# AVENUE™

## Signal Processing and Infrastructure Gear for Broadcast

# ENSEMBLE
DESIGNS

*Purveyors of Fine Video Gear—Loved by Engineers Worldwide*

## Who is Ensemble Designs?

### By Engineers, For Engineers

In 1989, a former television station engineer who loved designing and building video equipment, decided to start a new company. He relished the idea of taking an existing group of equipment and adding a few special pieces in order to create an even more elegant ensemble. So, he designed and built his first product and the company was born.

### Focused On What You Need

As the company has grown, more former TV station engineers have joined Ensemble Designs and this wealth of practical
experience fuels the company's innovation. Everyone at the company is focused on providing the very equipment you need to complete your ensemble of video and audio gear. We offer those special pieces that tie everything together so that when combined, the whole ensemble is exactly what you need.

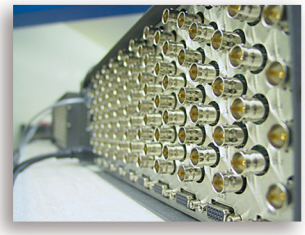
### Notably Great Service for You

We listen to you – just tell us what you need and we'll do our best to build it. We are completely focused on you and the equipment you need. Being privately held means we don't have to worry about a big board of directors or anything else that might take attention away from real business. And, you can be sure that when you call a real person will answer the phone. We love this business and we're here to stay.

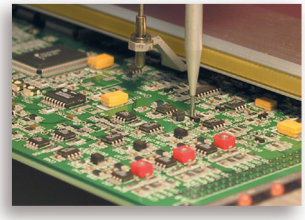
### Bricks and Mortar of Your Facility

The bricks and mortar of a facility include pieces like video converters, up/downconverters, audio embedders, switchers, routers, protection switches, multiviewers and SPGs for SD, HD and 3Gb/s. That's what we're focused on, that's all we do – we make proven and reliable signal processing and infrastructure gear for video facilities worldwide, for you.

**And consider our BrightEye product line when you need palm-sized video and audio processing.**



**Avenue video and audio converters, routers, keyers, and audio embedders are used worldwide in broadcast, mobile, production, and post. Reliable and easy to use.**



**Everything is made at Ensemble Designs in Nevada City, California.**

**Shipped with care to television broadcasters and video facilities all over the world.**

**Come on by and visit us.
Drop in for lunch and a tour!**

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# System Control Overview

## 3G, HD, SD, MPEG and Audio All In One Frame

### Features

- **Control and monitor all modules in the system from one or many locations—locally or worldwide**
- **Easily adjust video levels, timing, audio delay, and other parameters**
- **Customize module menus**
- **Alarm generation and log**
- **Download new module software—free for the life of the product!**
- **User Levels for security**
- **Module lockout for critical paths**
- **Use any combination of Control Panels and PCs for control and monitoring**
- **Avenue's user friendly protocol is available for interfacing to automation and other third-party control systems**
- **SNMP Monitoring and Control**

### Video and Audio Infrastructure

The Avenue system includes modules for up/down/cross conversion, audio embedding, synchronization, video conversion, routing, noise reduction, protection switches, test signal generators and more. Avenue signal processing modules are used worldwide in broadcast, mobile, satellite, cable, worship and post production facilities. Avenue is a tray-based signal integration system housed in a 3RU or 1RU frame. Any combination of 1.5 Gb/s HD, 3 Gb/s HD, SD, MPEG, analog video and audio processing modules can be used together in the same frame. All modules are hot swappable and because of the universal backplane no special rear connectors are needed.

For facilities using both fiber and coaxial cables, Avenue provides a complete and simple solution. The Avenue Intersection frame is just 1RU and holds 10 optical modules. It can be used independently or tied to an Avenue 3RU frame.

Built-in networking lets you tie your Avenue system together, streamlining control and monitoring. All frames and modules in the system can be accessed from multiple locations in a facility, including remote locations via the Internet. Comprehensive management and control is achieved by using any combination of Avenue Control Panels and/or Avenue PC software. Front edge or local controls are also available for each module.

### Frame Control

Modules can be configured locally or controlled and configured remotely with the optional Avenue Control Panels or the Avenue PC Control Application Software. Both remote control options require a System Control module in each remotely controlled frame. Some Avenue modules are configured and controlled via web browser interface built into the module. Any web browser enabled device can access and control these modules from virtually anywhere provided there is a TCP/IP network connection to the module.

### Local Frame Operation

Each Avenue frame can operate in stand-alone mode. Settings can be configured locally from the front edge controls of the modules. Parameters that have no local control will default to a standard setting. Modules used in local mode do not need a System Control module installed in the frame but will be unable to communicate with other Avenue frames. The Remote/Local switch must be set to Local on each module for the on-board settings to be enabled.

### Remote Frame Operation

Modules can be controlled and configured remotely using some or all of the optional remote control options: Avenue Touch Screens, Express Panel, Avenue PC Control Application Software and SNMP. Any number of frames may be linked together and controlled by a single control panel or a PC running the Avenue software. The number of control points is expandable to suit the needs of the facility. Our protocol is also available for interfacing to automation and other third-party control systems.

Once module parameters are set remotely, the information is stored on the module so it may be moved to a different cell or frame without losing configuration. It does not require a System Control module for operation after configuration. A System Control module must be installed in each frame to be part of the network and the Remote/Local switch on each module must be set to Remote to change settings on a module. PC control is available through a serial or Ethernet connection.

# System Control Overview

## System Control Modules: 5030 and 5035

When a System Control module is installed in each Avenue frame in the system, all frames can be connected together on a network. Frames can be daisy-chained together with AveNet (our proprietary Local Area Network communication), using simple twisted pair cable. Ethernet can be used instead of, or in conjunction with, AveNet.

Any combination of Avenue equipment including 3RU frames, 1RU frames, Intersection frames, Router Panels and Touch Screens can be used together on the network. The optional 5030 (3RU Frame) or 5035 (1RU Frame) System Control module provides the Serial, Ethernet and AveNet interface connections to an Avenue frame. The module is required for remotely controlling and configuring the frame modules from the Avenue remote control options which include the Touch Screen panels, Express Panel, and the Avenue PC Control Application Software. In addition, the System Control module provides the genlock reference input for the frame and distributes a master timing reference to all modules throughout the frame. The module is required for making adjustments on synchronizer module options when they are installed. A Status menu on the front of the module provides Ethernet, Serial and Reference communication indicators. Status menu functions also allow viewing of the current software version, viewing and setting of AveNet and IP Addresses and a Touch Screen reset function.

The 5030 System Control module installs in a dedicated cell to the right of the ten video and audio modules in a 3RU frame. It connects to the front door via a ribbon cable for controlling the Touch Screen Door, if installed. It interfaces to the frame backplane for controlling the serial communications port, the AveNet LAN connection between frames and the 10BaseT Ethernet TCP/IP connection. The 5035 System Control module installs in a dedicated cell to the right of the three video and audio modules in a 1RU frame. It interfaces to the frame backplane for controlling the serial communications port, the AveNet LAN connection between other frames and the 10BaseT Ethernet TCP/IP connection.

The Intersection frame includes a 5070 System Control Module that is installed in a dedicated cell in the intersection frame. The 5070 interfaces to the frame backplane for controlling the serial communications port, the AveNet LAN connection between other frames and the 10BaseT Ethernet TCP/IP connection.

## Avenue Touch Screens

The Avenue Touch Screen options include a stand-alone Tabletop Touch Screen Control Panel and a Touch Screen installed in the front door of the 3RU frame. The Touch Screen menus provide the means to configure and monitor module and system parameters. All remote control features can be controlled by a Touch Screen. Each frame or one frame in a group of frames can have an integrated Touch Screen Door or Tabletop Control Panel to control any of the frames on the AveNet bus. This versatility can be useful when control of frames installed in different rooms is desired.

## Avenue Express Panel

The Express Panel is a 1RU control panel for configuring and monitoring module and system parameters. It can be used instead of or in conjunction with Avenue Touch Screens and Avenue PC. It is particularly well suited for ingest and remote applications as it has dedicated knobs for proc adjustments.

## Web Browser Control

Some Avenue modules, including the Avenue 9430 Flexible Matrix Router, the Avenue 9950 3G Up/Down/Cross Converter, and Avenue Multiviewers have a built-in web server for set up and control. This allows any web browser enabled device to configure and control the module from virtually anywhere via the Internet or LAN. The individual module is connected to a network via an RG-45 connector on a cable supplied with the module. Once connected to a network, an iPad, iPhone, Android, laptop or any other web browser device can connect via TCP/IP address and access all the operational control and engineering functions of the device. Each control point can be limited as to access or control via Administrator authorization on a point-by-point basis.

# System Control Overview

## Avenue PC Software

Using Avenue PC Software, modules can be controlled and configured remotely. Any number of frames may be linked together and controlled by a PC running the Avenue software, even from remote locations via the Internet. The number of control points is expandable to suit the needs of the facility. Our protocol is also available for interfacing to automation and other third-party control systems.

## Virtual Modules

You can create custom menus for Avenue PC and Touch Screens that combine functionality from any modules in the system. A custom menu could include controls from several different modules, such as an embedder module, a video converter module and an audio delay module. Alternately, a custom menu could include a subset of controls from one module. You can design module menus and parameters to suit your needs. Custom menus are authored using Avenue PC and downloaded to any control point on the network.

## Alarms, User Levels and Software Updates

Alarms can be created using Avenue PC. The Alarm menu offers choices specific to the module or frame you want to monitor. For example, you can set an alarm for loss of reference to a particular module or for power failure in a particular frame. If an alarm occurs, you can choose to have a log entry generated, an alarm sound on your PC, an email sent out, or even a page sent. Email and pager choices require using the modem on your PC.

Touch Screens, the Express Panel, and Avenue PC have four user levels: Admin, Level1, Level2, and View Only. User levels can be protected by a four-digit pass code allowing level access to be assigned to different functional groups within your facility. Some groups may need more expert level access to certain parameters while others require read-only access. Critical modules can also be locked out entirely or set so only a single control point has access.

## Free Software Updates

Software updates for modules are posted on the Ensemble Designs web site and are available to customers at no charge. After downloading the software, Avenue PC is used to upload the new software into a module. The latest version is always available to you.

## Typical Ethernet Configuration

Avenue frames and control panels can be networked over Ethernet. The diagram below illustrates the most commonly used approach when Ethernet ports are available in each Avenue frame location.

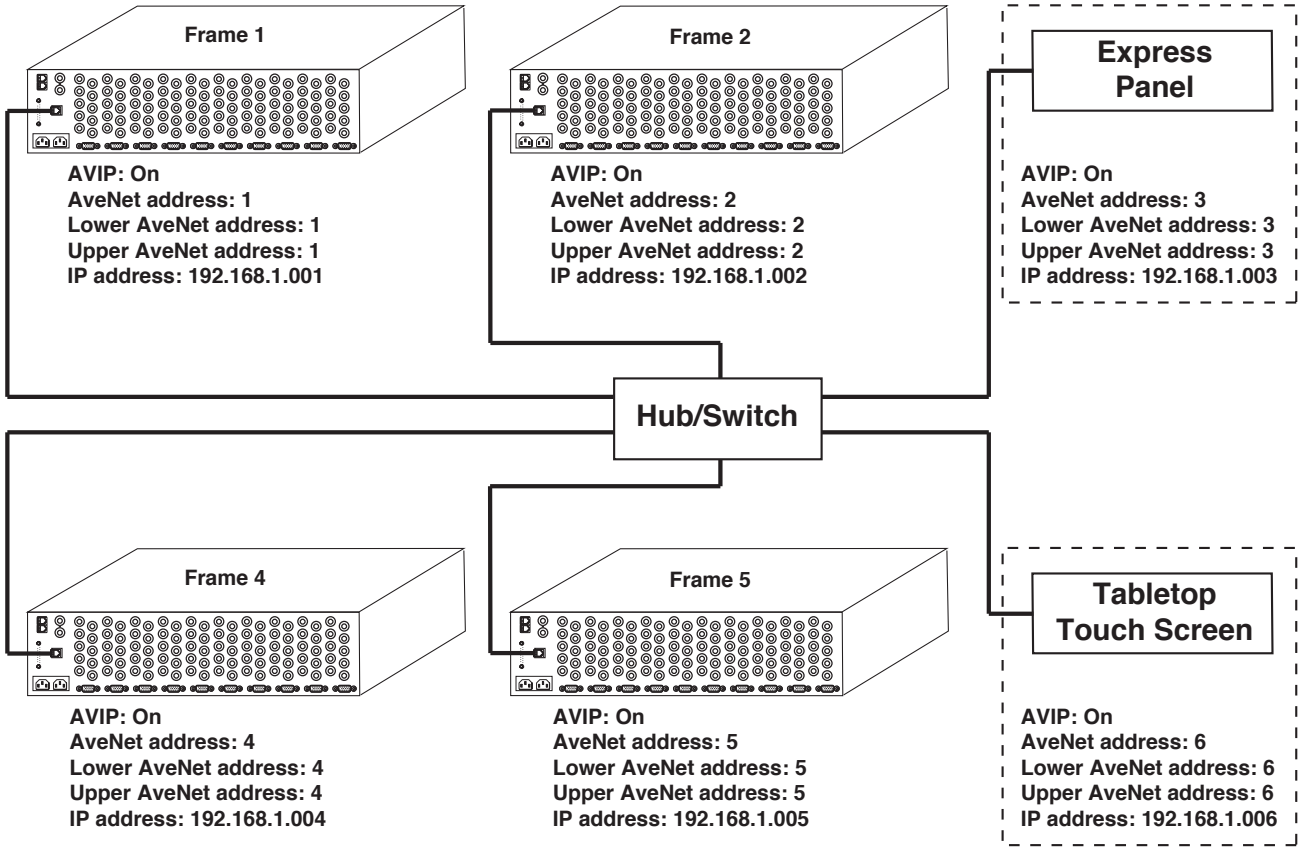
An Ethernet cable from the hub or switch is connected directly to the Ethernet port of each frame or Control Panel, creating a star configuration. AVIP (AveNet over IP) is enabled on the Control module installed in each frame using the module's local configuration controls or through a Touch Screen option if installed. AVIP is also enabled for each Control Panel. AVIP enables frames to send and receive AveNet information through the Ethernet ports. For this type of configuration, the AveNet ports are not used. All network connectivity is going through the Ethernet ports.

In the example shown below, the Avenue frames and Control Panels are assigned sequential AveNet addresses, using numbers 1 through 6. Each frame with an Ethernet connection is given a unique IP address. IP addresses can be set from a Touch Screen or directly on the 5030 or 5035 system control module.

## SNMP

An SNMP manager can be used to monitor and control Avenue modules. The Avenue MIB provides detailed information about how the manager can interface with the modules. An SNMP client is built into the Avenue system Control module.

*Typical Avenue System Using Ethernet Star Configuration*



# Avenue Frames

## 3RU Frame

The 3RU frame is a full-featured chassis that accommodates any ten Avenue modules. Modules plug into a universal motherboard so that rear modules are not needed. In addition to the ten module slots, there is a dedicated slot for the optional 5030 System Control module. One universal power supply comes with each frame. Redundant supply is optional and does not take up a slot in the frame. Touch Screen front door or plain front door are available. Plastic overlays for each module type are provided and slip over the corresponding BNCs on the backplane to identify the input and output designations on each type of module. In addition to the ten audio and video modules, the optional 5030 System Control Module adds a variety of control capabilities. Please refer to System Control Overview for more information.

## Features

- **Use with 3 Gb/s, HD, SD, MPEG and Audio modules**
- **Universal backplane**
- **Optional System Control module provides Ethernet, AveNet and serial interface**
- **Network all frames together for streamlined control**
- **SNMP monitoring and control**

*Avenue 3RU Frame with Touch Screen*

*Avenue 3RU Frame with plain door*

## 5020 Power Supply

Each Avenue 3RU frame comes with one 5020 Power Supply module installed. An optional redundant power supply is available if desired to provide backup. Power is provided to all modules in the frame, the front door fan and optional Touch Screen Panel.

## Frame Specifications

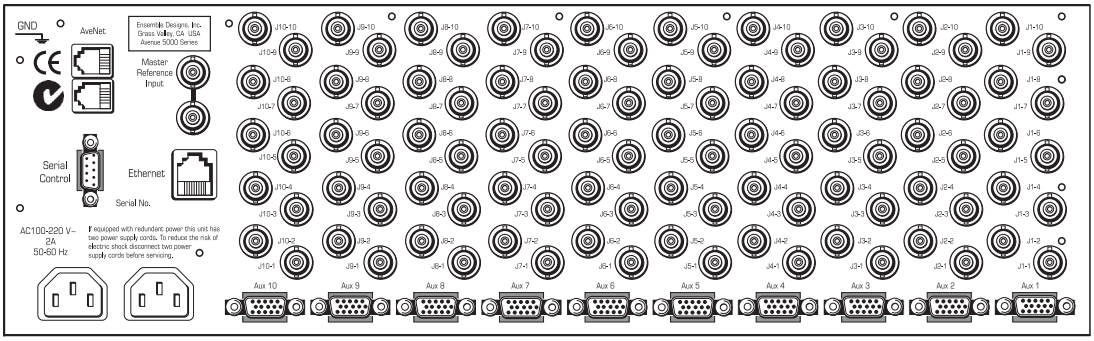
The Avenue 3RU (5.25 inches) frame fits in a standard 19-inch rack. Any number of frames may be stacked together in any combination.

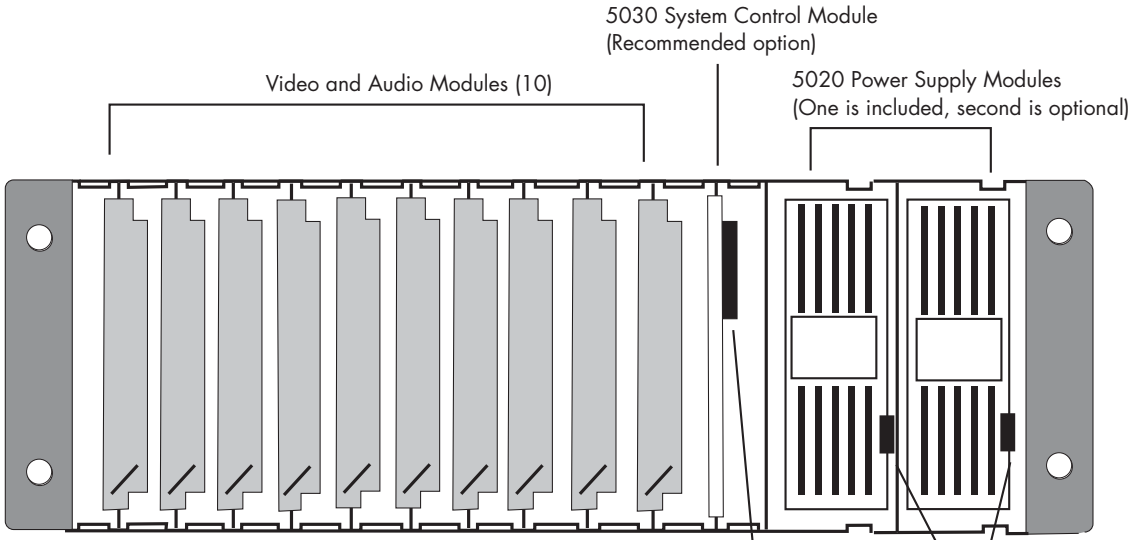
A fan in the front door of each 3RU frame provides the necessary cooling for the frame. The fan is temperature-sensitive and adjusts its speed accordingly. Should the fan fail, a red LED will light on the front panel. If using a remote control option, an alarm can be set to alert the user of fan failure. All critical components such as fuses, filter and fan are accessible from the front of the unit.

***Avenue 3RU Frame Dimensions and Architecture***

| Frame Dimensions: | Height | Width | Depth | Weight (no module) |
|---|---|---|---|---|
| 3RU | 5.25”/133.4 mm | 19”/482.6 mm | 15.1”/383.6 mm | 26.5 lbs/12.1 kg |

Frame Part Number: 3RUFRM, Touch Screen Door Part Number: 5050, Plain Front Door Part Number: 5040
Power required: 150 watt maximum
Front door projects 0.875”/23 mm. Allow minimum additional depth of 2.5”/65 mm for cabling



# Avenue Frames

## 1RU Frame

The 1RU Avenue frame accommodates any mix of up to three audio or video modules (except for certain expanded 2-slot modules). Modules plug into a universal motherboard; no special rear connectors are needed. In addition to the three module slots, there is a dedicated slot for the optional 5035 System Control module. A universal in-line power supply is provided with each frame.

Video and audio modules for conversion, distribution and synchronization plug into a universal frame motherboard. Plastic overlays for each module type are provided and slip over the corresponding BNCs on the backplane to identify the input and output designations on each type of module. As with the 3RU Frame, the 1RU also can add an optional System Control Module for additional features and capabilities. Please refer to System Control Overview for more information.

## Features

- **Use with 3 Gb/s, HD, SD, MPEG and Audio modules**
- **Universal backplane**
- **Optional System Control module provides Ethernet, AveNet and serial interface**
- **Network all frames together for streamlined control**
- **SNMP monitoring and control**

*Avenue 1RU Frame*

## 5010 Power Supply

Each Avenue 1RU frame includes a single 5010 Power Supply module. It installs in the upper right slot of the frame. Power is provided to all modules in the frame where it is regulated to the required voltages for the module.

The Avenue 1RU frame uses an external in-line power supply. There is a single point of connection on the frame for power.

For customers who want a redundant power solution, Ensemble offers an external in-line dual power supply with two line cords. This optional power supply auto-switches.

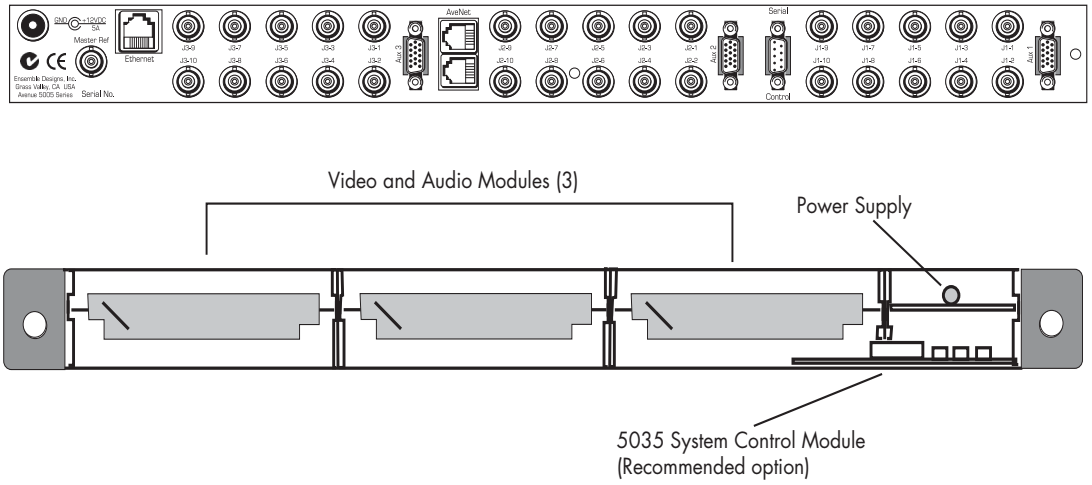
## Frame Specifications

The Avenue 1RU (1.75 inches) frame fits in a standard 19-inch rack. Any number of frames may be stacked together in any combination. All critical components such as fuses, filter and fan are accessible from the front of the unit.

***Avenue 1RU Frame Dimensions and Architecture***

| Frame Dimensions: | Height | Width | Depth | Weight (no modules) |
|---|---|---|---|---|
| 1RU | 1.75”/44.5 mm | 19”/482.6 mm | 13”/330 mm | 11.2 lbs/5.1 kg |

Part Number: 1RUFRM
Power required: 40 watt maximum



# Avenue Frames

## Intersection Frame

The compact 1RU Avenue Intersection Frame is high density and holds ten fiber optic modules. This frame can be used in conjunction with the Avenue 3RU Frame or can be used as an independent optical product, depending on the application.

The front of the frame has LED status indication for power, input signal presence and laser fault. The rear of the frame has one Ethernet connector and two AveNet connectors for the Avenue control interface.

The 3750 IS electrical to optical module or the 3760 IS optical to electrical module can be used in the Intersection frame. BNCs and LC optical connector are on the modules, not on the frame. Modules plug into the frame from the rear.

## Features

- **Use with Optical/Electrical Converter modules**
- **Use with 3 Gb/s, HD and SD modules**
- **System Control module provides Ethernet and AveNet interface**
- **SNMP monitoring and control**

*Avenue Intersection Frame*

## Integration

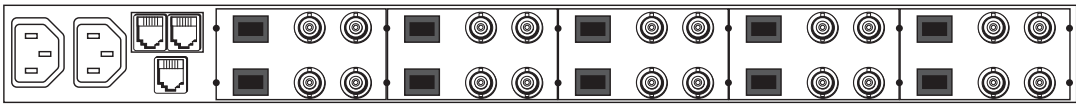
The Avenue Intersection Frame includes a 5070 system control module option that enables the frame to tie into the Avenue Control System, just like any other frame or control surface. The Avenue Intersection Frame appears as its "own" entity in the Avenue Control System. Control and status in the optical frame are presented to the user through the existing Avenue Control System, through Avenue PC or an Avenue Control Panel.

Redundant power is optional and there are two AC line connectors. Redundant power part number is 5065.

*Avenue Intersection Frame Dimensions and Architecture*

| Frame Dimensions: | Height | Width | Depth | Weight (no modules) |
|---|---|---|---|---|
| 1RU | 1.75"/44.5 mm | 19"/482.6 mm | 15.1"/383.6 mm | 11 lbs/5 kg |

Part Number: ISFRM
Power required: 50 watt maximum



# Touch Screen and Tabletop Control Panels

The Avenue Touch Screen Panels and Express Panel options offer remote control capability of any size network of Avenue frames. Any number of frames can be connected together through the AveNet interframe LAN bus to create an Avenue network. These networks can then communicate over Ethernet using the AveNet Over IP feature (AVIP). The frames can be controlled by a single Control Panel or any number of Control Panels installed in the network.

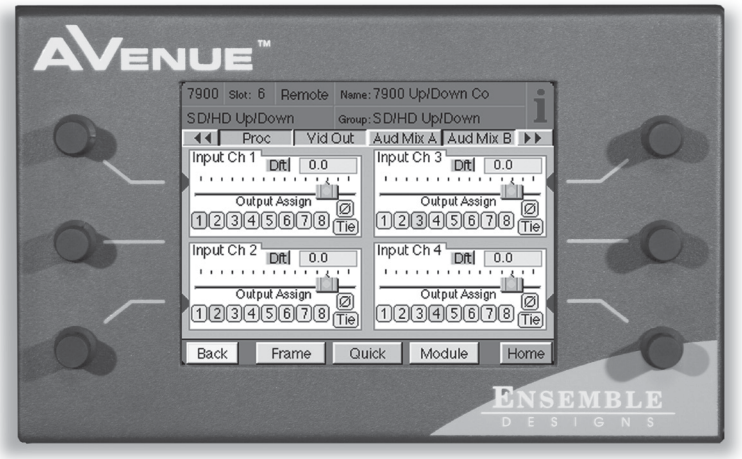
Remote control of Avenue frames is provided through a series of menus for system configuration and for setting parameters for each module installed in the frames. A series of menus allows you to set AveNet and IP addresses, enable AveNet Over IP (AVIP), name and monitor modules, frames and groups of frames and set module parameters in the system.

The Avenue Touch Screen Front Door option is installed in the front of the 3RU frame door. A single front door option can control an entire network or front doors can be installed in various frames for access from other rooms or locations.

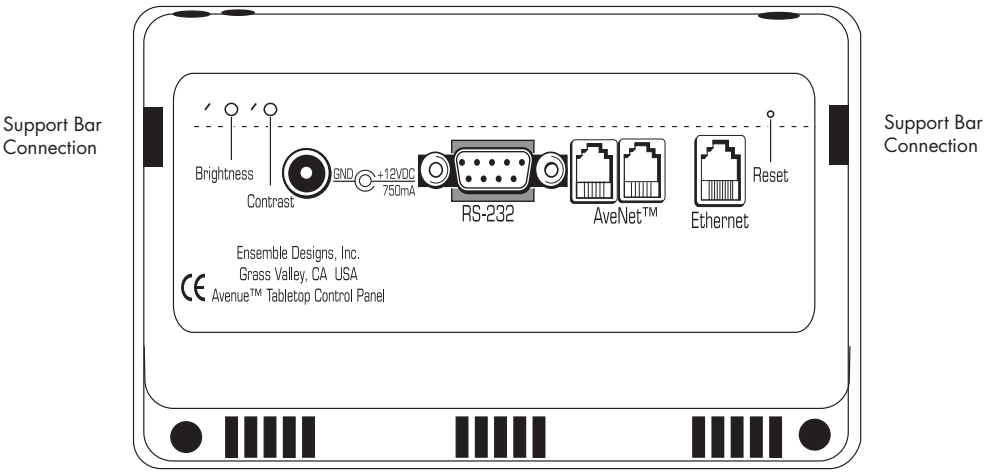
The Tabletop Touch Screen Control Panel offers intuitive remote control capability with both touch screen and dedicated knobs. Couple the full proc controls in the Avenue conversion modules with the six rotary controls to create a perfect QC station for live shading and adjustments. The small size is great for satellite receiving areas, QC and edit suites. Two configurations are possible: free-standing Tabletop or mounted directly into a standard 3RU half frame of a waveform monitor.

## Features

- **Control and monitor all modules in the system from one or many locations**
- **Easily adjust video levels, timing, audio delay and other parameters**
- **Customize menus with Virtual Modules**
- **User Levels for security**
- **Module lockout for critical paths**
- **Use any combination of Touch Screen Panels, Express Panels, and PCs for control and monitoring**




*Rear Connectors of Avenue Tabletop Control Panel*
*Each Tabletop Control Panel comes with a universal in-line power supply.*




Support Bar Not Shown

*Avenue Tabletop Control Panel Dimensions*

| | |
|---|---|
| Height | 5.25"/133.35 mm |
| Width | 8.375"/212.725 mm |
| Depth (stand collapsed,including knobs) | 2.75"/69.85 mm |
| (stand extended, including knobs) | 4.25"/107.95 mm |
| (stand collapsed, not including knobs) | 2.25"/57.15 mm |
| Weight | 3.5 lbs/1.6 kg |

Part Number: TBLTCP

# Express Control Panel

## The Express Control Panel is excellent for use in satellite receiving, ingest areas and remote trucks.

While it can be used with any Avenue module, the Express Panel really shines when used with Video Processing Frame Syncs and Up/Down/Cross Converters. With dedicated video, chroma, pedestal and hue knobs, live shading is easy. The continuous rotation, velocity-sensitive knobs are responsive and dependable. Audio levels for multiple groups are easily accessed as well. All other parameters, including timing and audio delay, are accessed through an intuitive menu interface.

One Express Panel can control every module in your Avenue system. Alternately, you can have as many Express Panels and Touch Screen Control Panels as you like in your Avenue system. Customize the control system for your needs. Remote control is provided through a series of menus for system configuration and for setting parameters for each module installed in the frames. These menus allow you to set AveNet and IP addresses, enable AveNet Over IP (AVIP), name and monitor modules, frames and groups of frames, and set module parameters in the system.

## Features

- **Elegant control for Avenue proc amps, frame syncs and up/down/cross converters**
- **Control all parameters of all Avenue modules**
- **Dedicated knobs for video, chroma, pedestal, hue**
- **Adjust audio levels for multiple groups**
- **Easily adjust video levels, timing, audio delay and other parameters**
- **Intuitive user interface**
- **Compact 1RU design**
- **Easy to install**
- **User Levels for security**
- **Module lockout for critical paths**
- **Use any combination of Express Panels, Touch Screens and PCs for control and monitoring**
- **Ethernet connectivity**

*Avenue Express Control Panel Dimensions*

| Frame Dimensions: | Height | Width (with ears) | Depth (including knobs) | Weight |
|---|---|---|---|---|
| 1RU | 1.75”/44.5 mm | 19”/482.6 mm | 8.25”/209.55 mm | 6.1 lbs/2.8 kg |

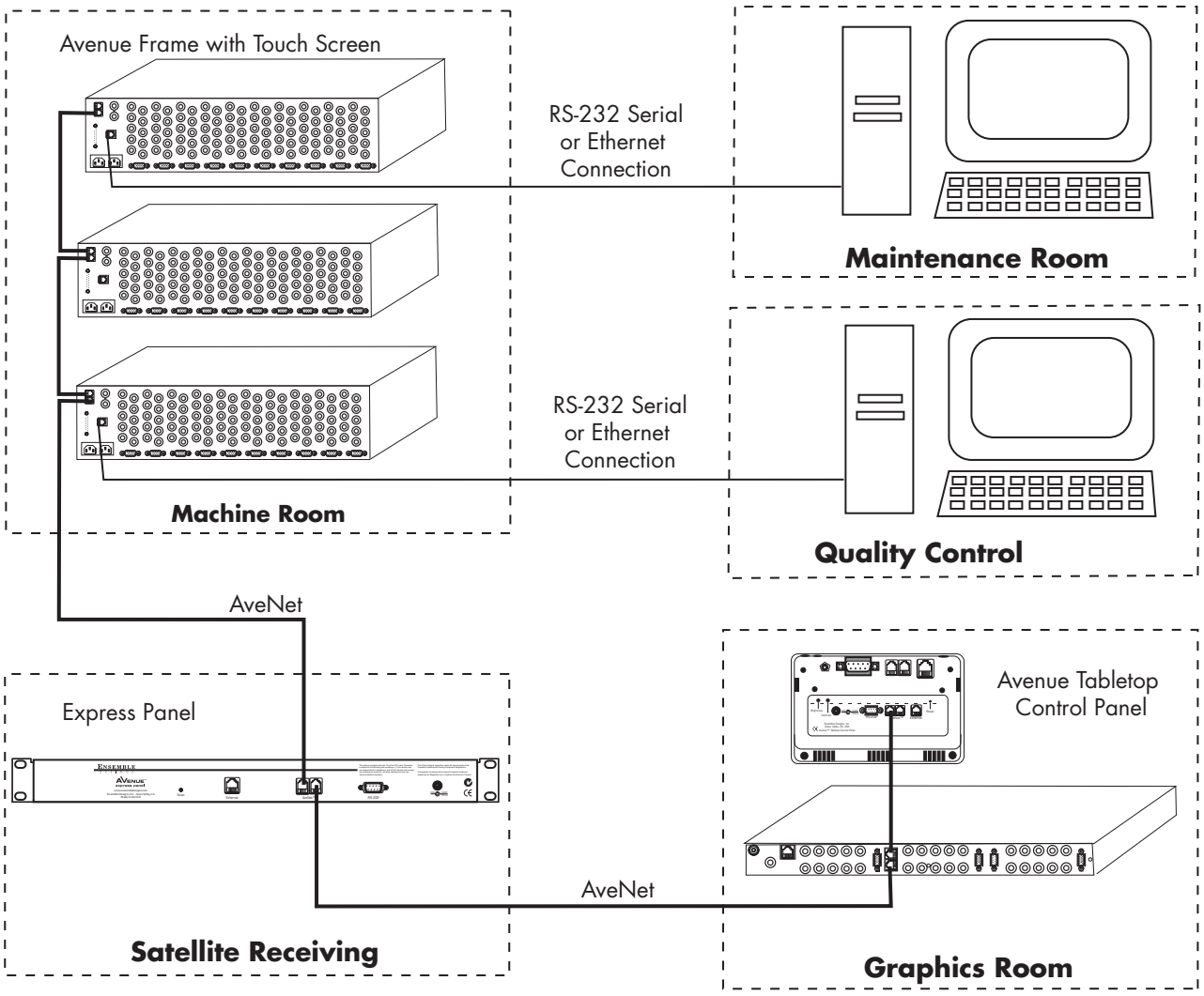
Part Number: EXPPNL
Power required: 90 watt maximum

*Avenue Express Control Panel*

# Avenue PC Control

## Example of an Avenue System Using Tabletop and PC Control

Any number of frames and Touch Screens, or Tabletop Control Panels can be connected via Ethernet or AveNet, which uses twisted pair cable. PCs connect to any frame serially or via Ethernet.



# Avenue PC Control

Avenue's remote control system gives your complete, efficient control of your video and audio signals. Module configuration is straight-forward and intuitive. Along with Avenue Touch Screens and Express Panel control, you can also access and control all frames and modules in the Avenue system with Avenue PC Control Software. The Avenue PC application comes on CD or can be downloaded from the Ensemble website.

The Avenue PC Control Application Software option is a PC-based remote control application which allows you to completely control, configure and monitor the modules in each of your Avenue frames. Avenue PC can be installed on a PC running all Windows operating systems. PC interface to the Avenue frames can be made through an RS-232 serial connection or through Ethernet.

Your PC can be connected to one of the Avenue frames (1RU, 3RU, or Intersection) through a PC serial port or via Ethernet on the back of the Avenue frames. Avenue PC only needs to connect to a single frame in an Avenue System. Regardless of the network topology, Avenue PC will have visibility and control over all of the modules.

## Features

- **Control and monitor modules in the system from one or many locations**
- **Easily adjust video levels, timing, audio delay and other parameters**
- **Store module configurations to another module of the same type**
- **Set user-defined alarms to alert you at any time when a fault condition has occurred and to maintain logs. Set email and pager alerts.**
- **Download new module software – free for the life of the product!**
- **Define access to each module parameter based on User Levels**
- **Define security User Levels protected by pass codes for locking out module changes on critical paths**
- **Customize module menus by creating Virtual Modules, custom groups of menus that combine functionality from any modules in the system**

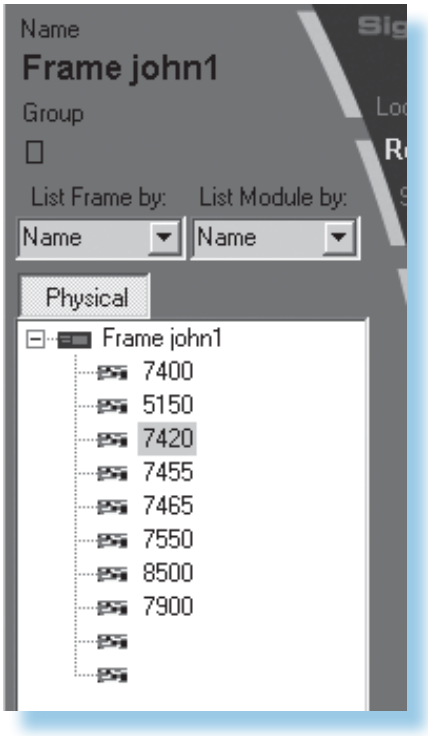
# Avenue PC Control

## Module Control

The Module Selection screen is illustrated at right. Available frames on the Avenue network will appear in the window. Expanding each frame will show the Avenue modules present in each frame.

As shown in the List Frame illustration at right, the frames can be listed by Name, Group and Address ID. The modules can be listed by Name, Group, Slot, Model, and Type.

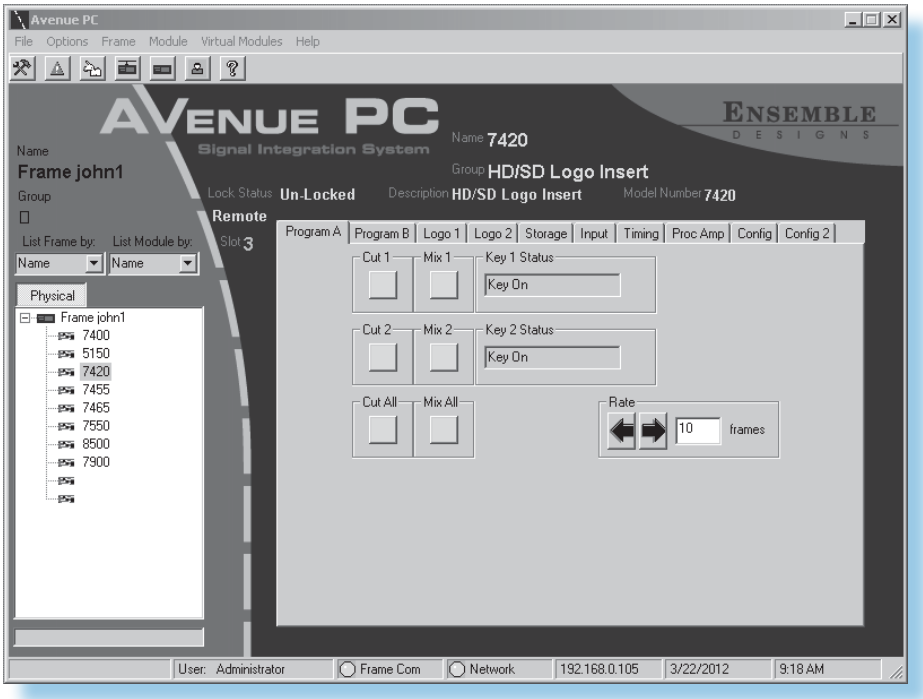
When you select a module from the list the setup menus available for that particular module will be displayed. Also displayed on the Mainscreen above the menus will be the Name and Description of the module, the Group, the Module number and whether the module is set to Remote or Local and if the module is Locked or Unlocked. Make sure the front panel switch on the module is set to Remote to allow it to be controlled by Avenue PC.




## Updating Avenue PC and Module Software

Free Avenue software updates can be periodically downloaded from the Ensemble Designs web site. The web site also provides technical bulletins, installation and release notes and frequently asked questions about Avenue PC. From the site you can update Avenue frame software, Avenue module software and PC application software. To download a newer software version, log on to the web site at www.ensembledesigns.com, select Support for Avenue and follow the instructions.

*Typical Mainscreen Display*



## Alarms

Avenue PC gives you the ability to set alarms on a frame or module basis. You can define Low and High Alarms and then set conditions on a frame or module to react with the defined alarms.

## Low and High Alarms

The control data from each frame module can be used to alert you when a module indicator becomes active or a module is missing. There are two alarm conditions, Low and High. You may define both types of alarms, making one a higher priority than the other or setting up a higher priority condition in one type of alarm.

Each alarm condition allows you to define the characteristics that will alert you when a module condition changes. Some of the alarm types include Visual Blinking and Audio which allows your PC to sound a Beep or Red Alert. You can also set up an alarm to send an email or page.

## Logging Alarms

The Alarms pulldown brings up the Alarms definition menu. To add an alarm, click on the Add Alarm box to bring up the Conditions entry screen. You can select the frame, then the module and choose the control data for the alarm given. You may also enable or disable the alarm with the Enable check box in the Conditions screen.

You can lock modules on Avenue PC and set Module User Levels. Modules in the Avenue system running v2.0 software or later have a User Level assigned to each adjustable control parameter. These levels are assigned to a default according to the type of adjustment. The User Levels of these parameters can be edited by an Administrator if desired using this menu.

## Set User Levels

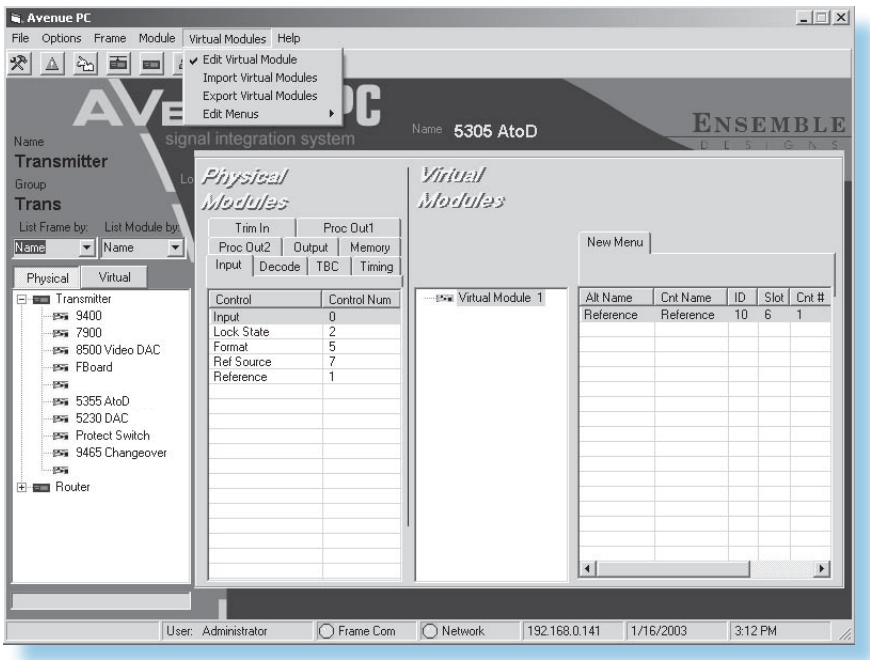
To edit Control User Levels, select an Avenue module from the frame list so its control parameters appear in the Edit Control User Level window. Select the individual Control in the list, then click on the User Level desired for this Control parameter. Select Done when finished to save and close the list.

## Save and Load Module Configurations

Save Module Configuration: This menu allows you to save a module configuration to a file. All module parameters will be stored and this file may be saved or downloaded to another module of the same type. Load Module Configuration: Selecting this function brings up a file location menu. The configuration from a stored file can be downloaded to another module of the same type.

## Virtual Modules

Virtual Modules are custom menus that combine functionality from any modules in the system. Use the Virtual Modules menu to create the combinations of controls from any modules. Virtual modules allow you to customize a module's menu to meet your facility's needs.



# Audio Adapters

Interfacing Avenue digital audio modules with existing twisted pair cabling is easy. Simply plug the appropriate interface adapter into the Avenue backplane and connect existing twisted pair cables to it. Several different adapters are available for conversion between balanced 110 ohm cabling and the unbalanced 75 ohm I/O on Avenue digital audio modules. The front of the interface has 3-position plug-in terminal blocks that make it simple to terminate the twisted pair cable and then plug it into the adapter. BNC connectors on the rear of the interface plug directly into the Avenue backplane.

### The 5080 is a 5 Port AES 110 Ohm Adapter for use with:

5150 as an AES DA
- Requires one per 5150 to provide 1 in/4 out
- Requires two per 5150 to provide 1 in/9 out

5155 as a Dual AES DA
- Requires two per 5155 to provide 2 x 1 in/4 out

### The 5082 is a 4 Port AES 110 Ohm Adapter for use with:

8500 with 8510 or 8415 Audio Sub modules when all four AES ports are desired
- Requires one per 8500

5330 with 6330 Audio Sub module when all four AES ports are desired
- Requires one per 5330

### The 5094T is a 5 Port AES 110 Ohm Adapter for use with:

6010 ADC providing two copies each of outputs 1/2 and 3/4. A fifth plug-in terminal block is provided for the AES reference input.

### The 5094S is a 4 Port AES 110 Ohm Adapter for use with:

6010 ADC providing two copies each of outputs 1/2 and 3/4. The 5094S is physically shorter than the 5094T, which allows the 6010's coaxial AES reference input to be used.

### The 5096 is a 2 Port AES 110 Ohm Adapter for use with:

6020 DAC providing for inputs 1/2 and 3/4

### The PHX15 Breakout Adapter with Phoenix Terminals for use with:

Any Avenue module that uses the HD15 Analog Audio Connector

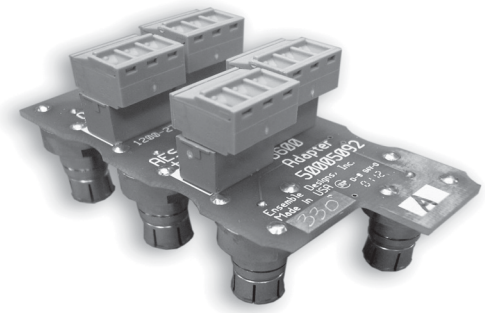
### BEAC Analog Audio Breakout Cable for use with:

Any Avenue module that uses the HD15 Analog Audio Connector. One end of this cable has an HD15 connector and the other end is pigtailed for use with your choice of connector (e.g. XLR.)

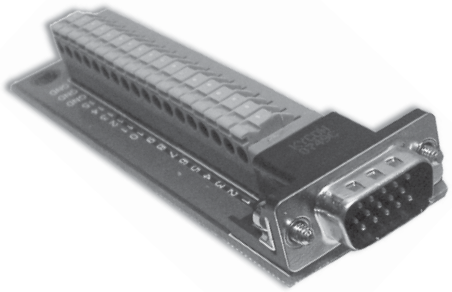
# Audio Adapters

**The 5084 is a 2 Port AES 110 Ohm Adapter for use with:**

8500 with 8510 or 8415 Audio Sub modules when only two AES ports are desired
(in order to allow access to four SDI outputs); Requires one per 8500
5330 with 6330 Audio Sub module when only two AES ports are desired
(in order to allow access to four SDI outputs); Requires one per 5330
5230 with 6230 Audio Sub module
Requires one per 5230
7600 HD Mux/Demux
Requires two per 7600 for full access to all four AES ports (just one for two ports)
7900 with 8415 Audio Sub module
Requires two per 7900 for full access to all four AES ports (just one for two ports)
7910 with 8415 Audio Sub module
Requires two per 7910 for full access to all four AES ports (just one for two ports)
7920 with 8415 Audio Sub module
Requires two per 7920 for full access to all four AES ports (just one for two ports)
7930 with 8415 Audio Sub module
Requires two per 7930 for full access to all four AES ports (just one for two ports)
7555 HD/SD Video Processing Frame Sync
Requires two per 7555 for full access to all four AES ports (just one for two ports)
7660 HD/SD Embedder, Disembedder and Data Inserter
Requires two per 7660 for full access to all four AES ports (just one for two ports)
9550 3G Video Processing Frame Sync
Requires two per 9550 for full access to all four AES ports (just one for two ports)
9600 3G Embedder, Disembedder and Data Inserter
Requires four per 9600 for full access to all eight AES ports (just one for two ports, two for four ports, three for six ports)



*5094 75 Ohm/110 Ohm Adapter*

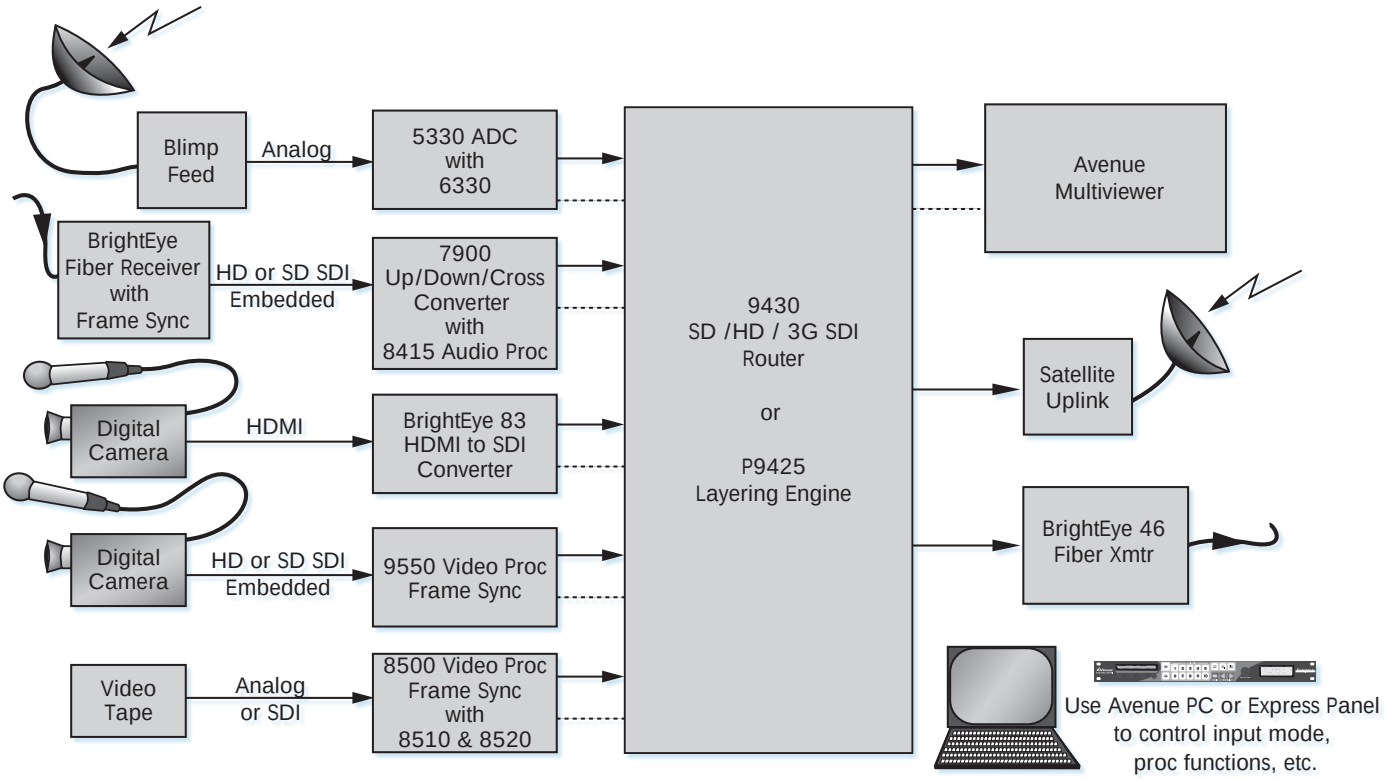


*PHX15 Breakout Adapter*

# Application Diagrams

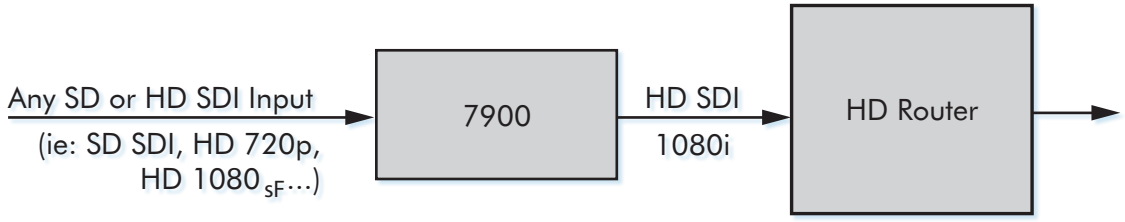
## A Complete Signal Chain for Broadcast and Mobile Use

Avenue provides convenience and flexibility for signal processing in broadcast applications, including remote trucks or OB vans. A complete signal chain, from ingest to transmit, is achieved with the Avenue and BrightEye product lines. The camera's HDMI output is converted to SDI and then fed into a router or production switcher. The Avenue Layering Engine provides background transitions and branding, with two layers of keying. The Avenue Express Panel is especially well suited for remote trucks and other live applications. The dedicated knobs for video and audio processing make it easy to adjust levels on the fly.




## Auto-Sensing Up/Down/Cross Conversion Application

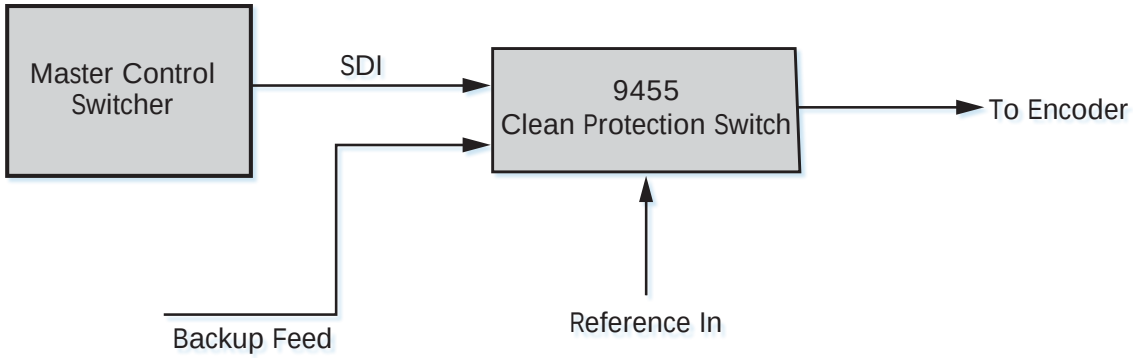
Use Avenue 7900 to bring any type of signal into your plant. Just set the output of the 7900 to whatever SDI standard you use in your facility, then feed any SDI input to the 7900 and the signal will automatically be upconverted, downconverted or cross converted as needed. In the example below, the facility standard is 1080i. If an SD signal is fed to the unit as shown, an upconversion will occur. If a 720p signal is fed to the 7900, a cross conversion will occur.



# Application Diagrams

## Fail-Safe Bypass Protection Switch for Critical Feeds

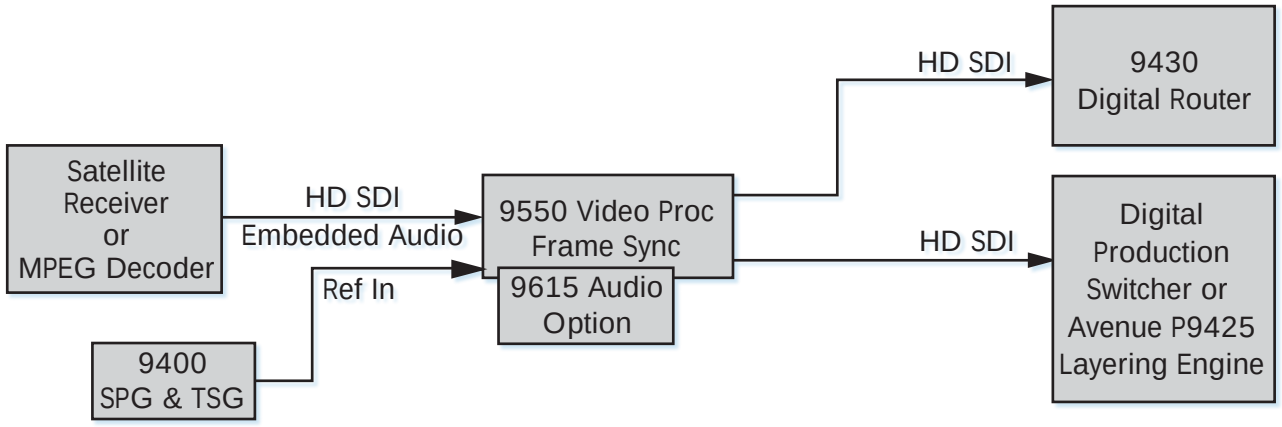
The best insurance for staying on-air is a smart, fail-safe protection switch. The 9455 module is a clean and quiet protection switch for critical broadcast and satellite feeds. It switches cleanly between asynchronous sources which means it can be used live to air. The module has a full video frame synchronizer, rather than a line delay, ensuring perfect alignment of mis-timed and non-synchronous SDI sources.




## Satellite or MPEG Ingest for SD and HD

As illustrated in the block diagram below, the 9550 accepts a digital feed from a serial digital receiver. HD, SD or 3 Gb/s SDI signals will now be locked to house and fully timeable.

Any timing or delay modifications to the video are tracked by the 9615 audio software key option, whether you wish to use disembedded audio or audio input from an analog or AES source. Properly timed audio from any of these sources is available directly when routed to the analog or AES outputs, or it can be re-embedded back onto the SDI video stream.

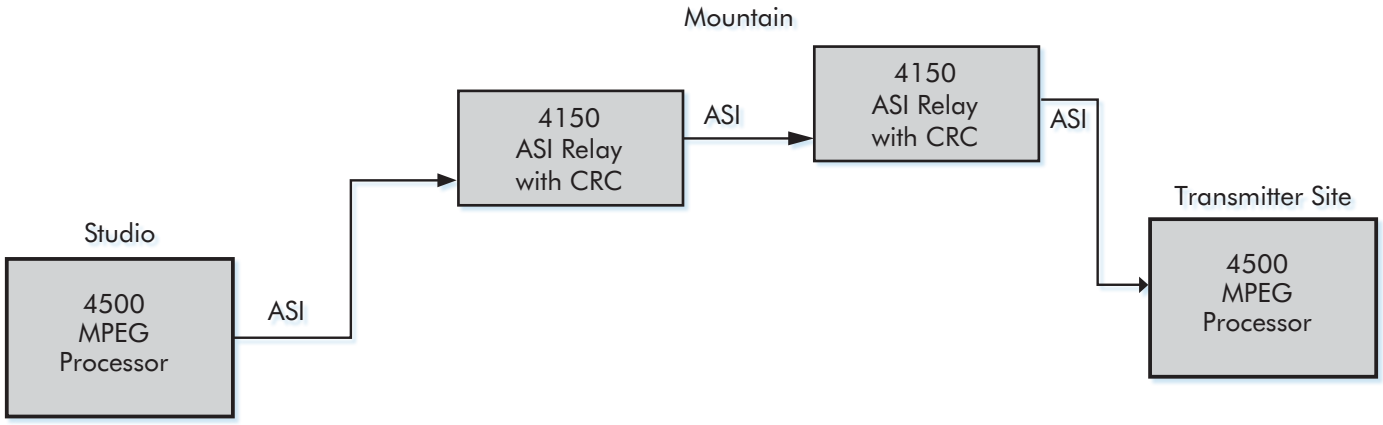


# Applications

## ASI Transport Stream Integrity Checking

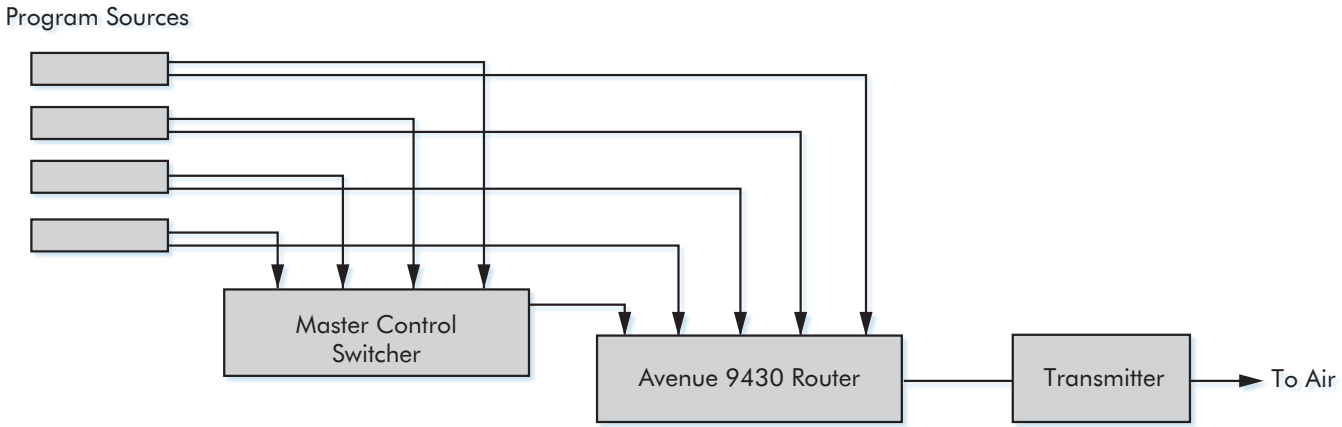
A 4500 is used at the studio origination point where the 4500 cleans up the ASI or 310M clock and reduces jitter. CRCs are inserted into the stream at this point, too. The relay points on the mountain each have a 4150 where the stream's CRCs are read and history is forwarded to the next hop. The transmitter site has another 4500 where the CRC history is read and evaluated for signal path integrity. If there is a problem in the signal path it will be revealed in the data. The 4500 then removes the CRCs from the signal prior to transmission.

If the 4150s are connected to the Avenue Control System then signal integrity can be reported at the relay points. If the 4150s do not have an Avenue Control System, the signal integrity can be read at the transmission path via the 4500 module. The history will indicate which hop had a fault, if any.



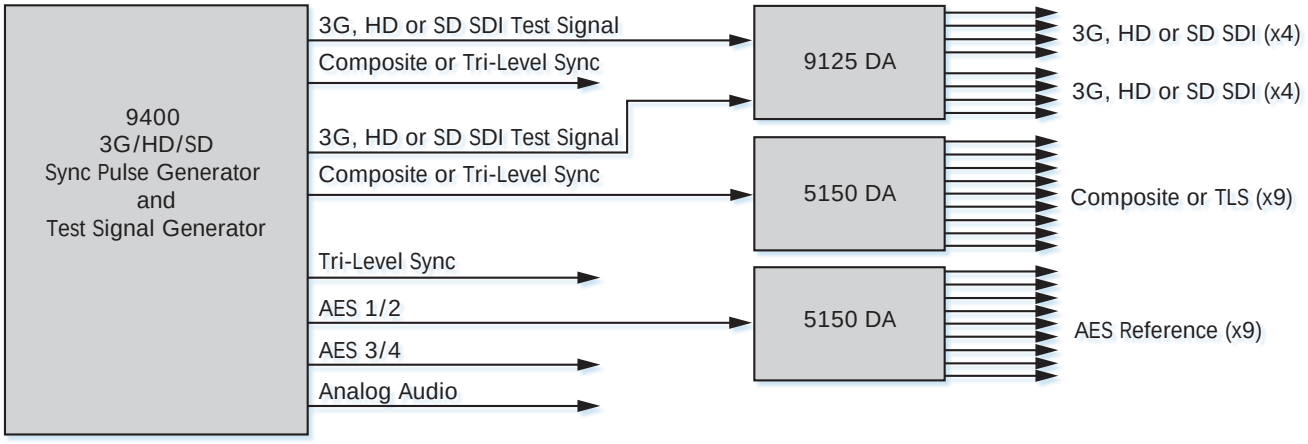

## Master Control Bypass

Use the 9430 router as a master control bypass switcher. The clean and silent switch option ensures your on-air signal is always there.



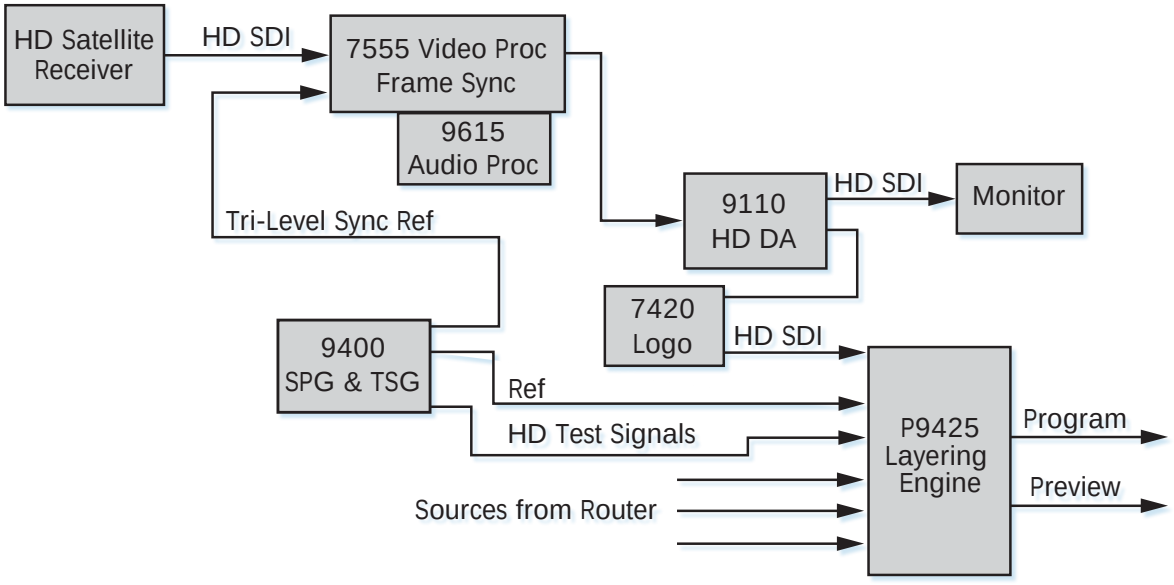
## Video and Audio Reference Generation and Distribution

The application shown below illustrates how the 9400 module provides digital, analog and audio reference outputs which can be distributed throughout a facility when combined with the 9125 Dual DA and the 5150 DA. Use the 9465 Sync Changeover module for a fully redundant SPG system.




## HD Ingest

The 7555 accepts either a high definition or standard definition signal for frame synchronization and signal processing. The 9615 option provides multi-channel audio processing including level adjustment and mixing.



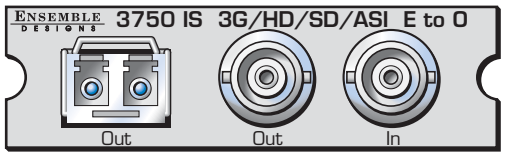
# 3750 IS

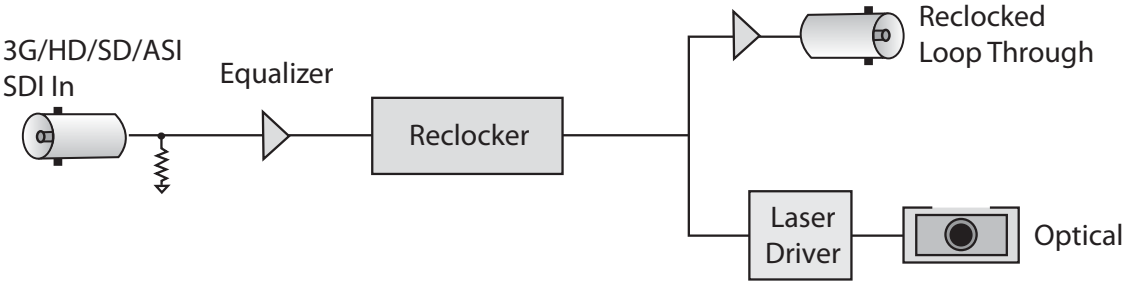
## 3G/HD/SD/ASI Electrical to Optical Converter

The Avenue 3750 IS module is an electrical to optical converter that can be used with 3 Gb/s and 1.5 Gb/s high definition signals, standard definition signals or ASI signals. The video input is converted to an optical signal and presented on an optical LC connector. This optical output can drive single mode fiber to a distance of 20 kilometers. With an optical launch power attenuator, multi-mode fiber can also be used. Passes embedded audio.

The 3750 IS and 3760 IS modules are used with the 1RU Intersection frame.

The Avenue Intersection Frame has a standard, built-in system control module that enables the frame to tie into the Avenue Control System, just like any other frame or control surface. The Avenue Intersection frame can be controlled in conjunction with a matched Avenue 3RU frame or it can be controlled as an independent fiber optic I/O unit.



## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | 270 Mb/s SD Serial Digital<br>SMPTE 259M or DVB-ASI at 270 Mb/s<br>1.485 Gb/s HD Serial Digital<br>SMPTE 274M, 292M or 296M<br>2.97 Gb/s HD Serial Digital<br>SMPTE 424M, 425M |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz<br>>10 dB to 2.97 GHz |
| Max Cable Length | 300 meters for 270 Mb/s Belden 1694A<br>100 meters for 1.485 Gb/s Belden 1694A<br>70 meters for 2.97 Gb/s Belden 1694A |

## Serial Digital Output

| | |
|---|---|
| Number | One, follows input |
| Signal Type | 270 Mb/s SD Serial Digital<br>SMPTE 259M or DVB-ASI at 270 Mb/s<br>1.485 Gb/s HD Serial Digital<br>SMPTE 274M, 292M or 296M<br>2.97 Gb/s HD Serial Digital<br>SMPTE 424M, 425M<br>Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz<br>>10 dB to 2.97 GHz |
| Output DC | None (AC coupled) |

## Optical Output

| | |
|---|---|
| Number | One |
| Signal Type | 3G/HD/SD/ASI<br>SMPTE 297M, optical equivalent of 259M or DVB-ASI at 270 Mb/s<br>SMPTE 274M, 292M or 296M<br>SMPTE 424M, 425M<br>Follows input |
| Wavelength | 1310 nm (non-CWDM)<br>Wavelengths 170 nm – 1610 nm at 20 nm CWDM spacing available. Call factory for price and specify part number 3750 IS-SP. |
| Power | -7 dBm |
| Max Cable Length | 20 km |
| Fiber Type | Single Mode<br>Multi-mode compatible with attenuation at transmit end |
| Connector | LC/UPC |

## General Specifications

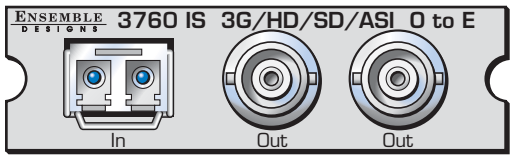
| | |
|---|---|
| Power Consumption | <5.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

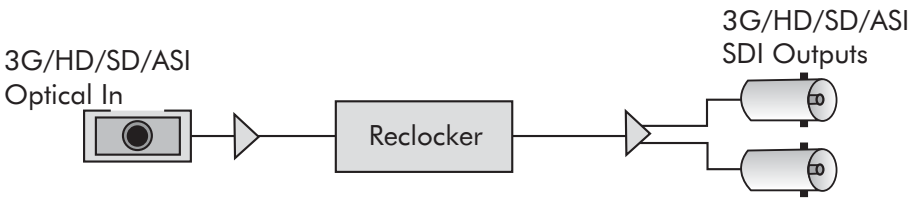
# 3760 IS

## 3G/HD/SD/ASI Optical to Electrical Converter

The Avenue 3760 IS module is an optical to electrical converter that supports 3 Gb/s HD, 1.5 HD, SD, and ASI data rates. The optical input is converted to electrical form and the resulting serial digital signal is reclocked and delivered to two BNC outputs. The 3760 IS passes embedded audio.

The 3760 IS module is used with the 1RU Intersection frame. The Avenue Intersection Frame has a standard, built-in system control module that enables the frame to tie into the Avenue Control System, just like any other frame or control surface. The Avenue Intersection frame can be controlled in conjunction with a matched Avenue 3RU frame or it can be controlled as an independent fiber optic I/O unit.



## Optical Input

| | |
|---|---|
| Number | One |
| Signal Type | 3G/HD/SD/ASI<br>SMPTE 297M, optical equivalent of 259M<br>DVB-ASI at 270 Mb/s<br>SMPTE 274M, 292M, 296M<br>SMPTE 424M, 425M |
| Wavelength | 830 to 1610 nm |
| Receiver Sensitivity | SD and ASI: -18 dBm<br>HD: -18 dBm |
| Max Cable Length | 20 km |
| Fiber Type | Single Mode<br>Multi-mode compatible with attenuation at transmit end |
| Connector | LC/UPC |

## Serial Digital Output

| | |
|---|---|
| Number | Two |
| Signal Type | 270 Mb/s SD Serial Digital<br>SMPTE 259M or DVB-ASI at 270 Mb/s<br>1.485 Gb/s HD Serial Digital<br>SMPTE 274M, 292M or 296M<br>2.97 Gb/s HD Serial Digital<br>SMPTE 424M, 425M<br>Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz<br>>10 dB to 2.97 GHz |
| Max Cable Length | 300 meters for 270 Mb/s Belden 1694A<br>100 meters for 1.485 Gb/s Belden 1694A<br>70 meters for 2.97 Gb/s Belden 1694A |

## General Specifications

| | |
|---|---|
| Power Consumption | <5.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

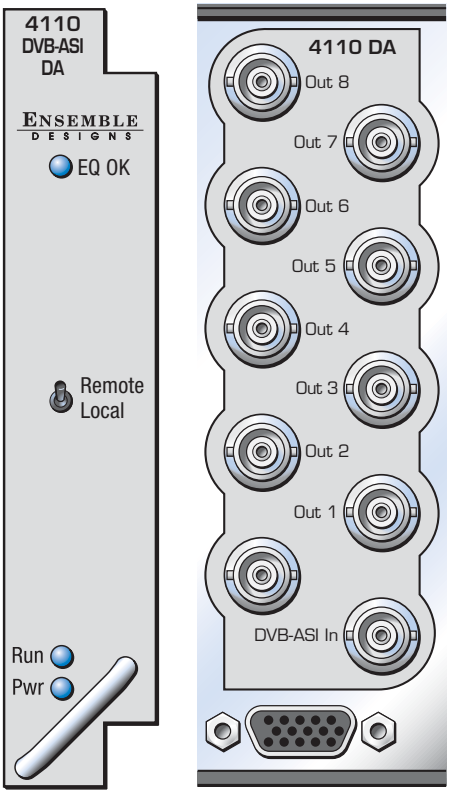
# 4110
## ASI/310M DA

The 4110 module is an ASI and SMPTE 310M distribution amplifier that handles data rates from 19.39 Mb/s to 270 Mb/s. Use the 4110 for distributing MPEG and ASI signals in your facility. Perfect for use with encoders, servers, and routers.

This module can be monitored locally and remotely. The remote control system is accessed using an Avenue Touch Screen, Avenue PC or your web browser. Modules can be updated with new software as new formats are supported. Software is updated with Avenue's built-in networking capability. Signal status can be monitored via an Avenue Control Panel, and Avenue PC Control Software.

### Features

- **Eight outputs**
- **Data rates from 19.39 Mb/s to 270 Mb/s**
- **Use with DVB-ASI**
- **SMPTE 310M signals**
- **Use with encoders, servers and other ASI compliant equipment**
- **Signal presence detection**
- **Local and remote monitoring**



## Input Signal

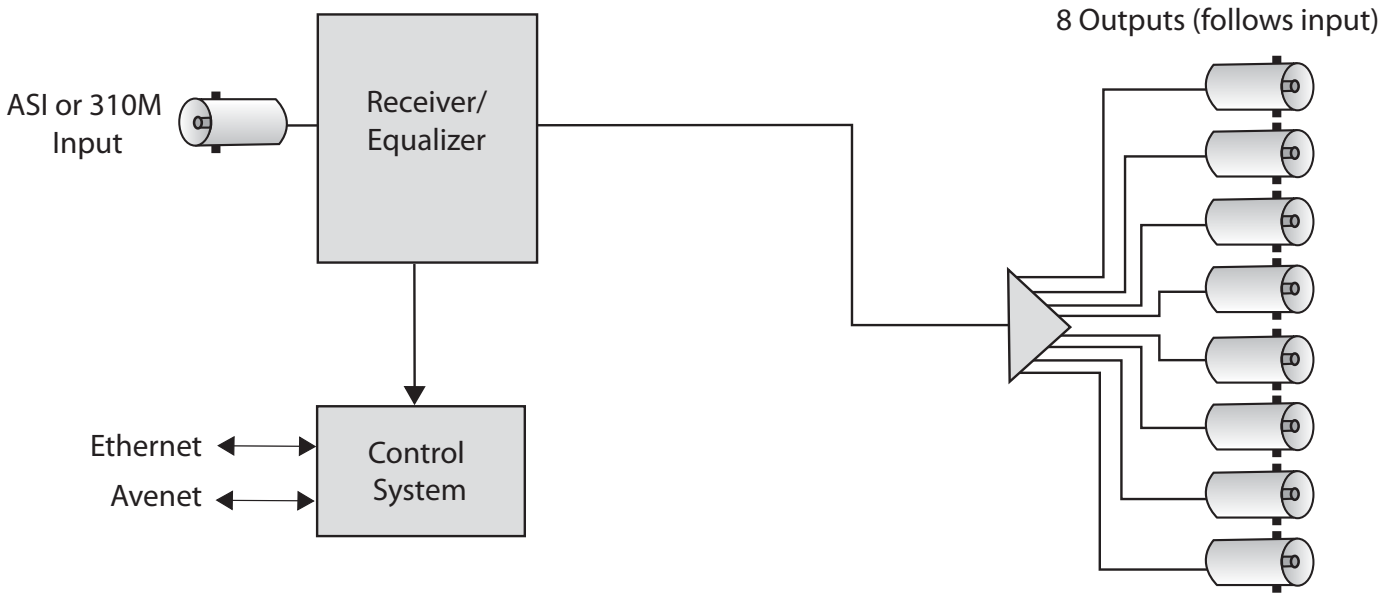
| | |
|---|---|
| Number | One |
| Signal Type | DVB-ASI at 270 Mb/s or SMPTE 310M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |
| Max Cable Length | 300 meters Belden 1694A |

## Output Signal

| | |
|---|---|
| Number | Eight |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |

## General Specifications

| | |
|---|---|
| Power Consumption | <2.5 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



# 4150
## ASI/310M Relay Point DA with CRC Support

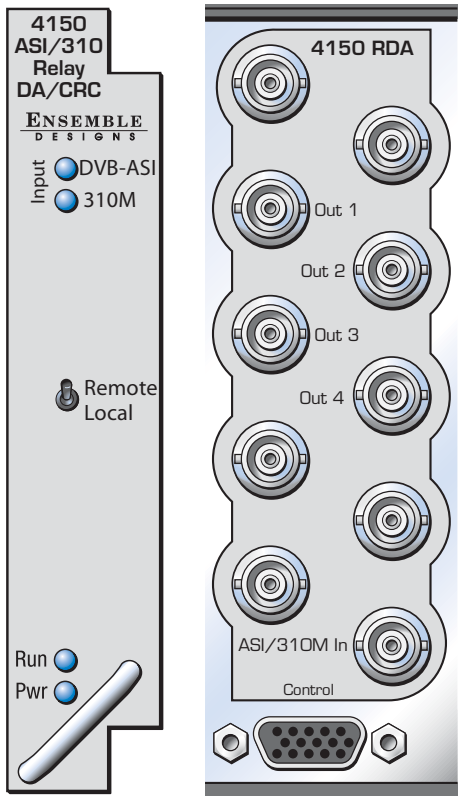
The 4150 module is for use in ASI and 310M broadcast and transmission applications and provides CRC insertion for checking data path integrity.

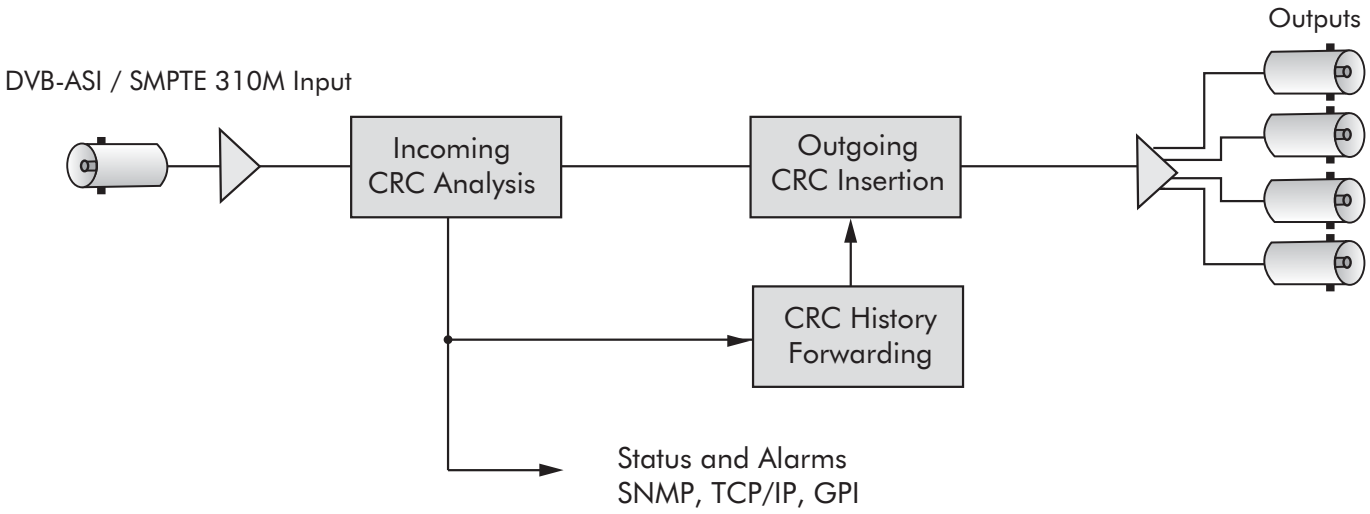
A CRC and Data Checksum packet can be seamlessly inserted into the stream by the 4150 to provide data path integrity testing at downstream points. Monitoring of these special packets can be performed by a second 4150 or an Avenue 4500 MPEG Processor or by one of the Avenue ASI/310M Protection Switches. Data integrity history is carried forward through the system to facilitate fault finding. These CRC packets provide an unequivocal test of data integrity on a transmission link by transmission link basis.

This is easier, more accurate, and less expensive than using a complex MPEG analysis tool to troubleshoot a data path problem.

The 4150 is often used in system that includes one or more Avenue 4500 MPEG Transport Stream Processor modules or an Avenue ASI/310M Protection Switch such as the 4450, 4455, or 7455.

Controls are easily accessed through an Avenue Control Panel, Avenue PC, GPIs, or front edge module controls. Alarms can be generated via SNMP, Avenue PC, and contact closure outputs.



# 4150
## ASI/310M Relay Point DA with CRC Support

### Features

- **CRC and Checksum insertion and integrity testing for ASI and 310M transmission paths**
- **CRC history forwarding to next hop on the transmission path**
- **Stream monitor alarms via TCP-IP, SNMP, RS-232 and GPI**
- **Remote control and monitoring**

### Input Signal

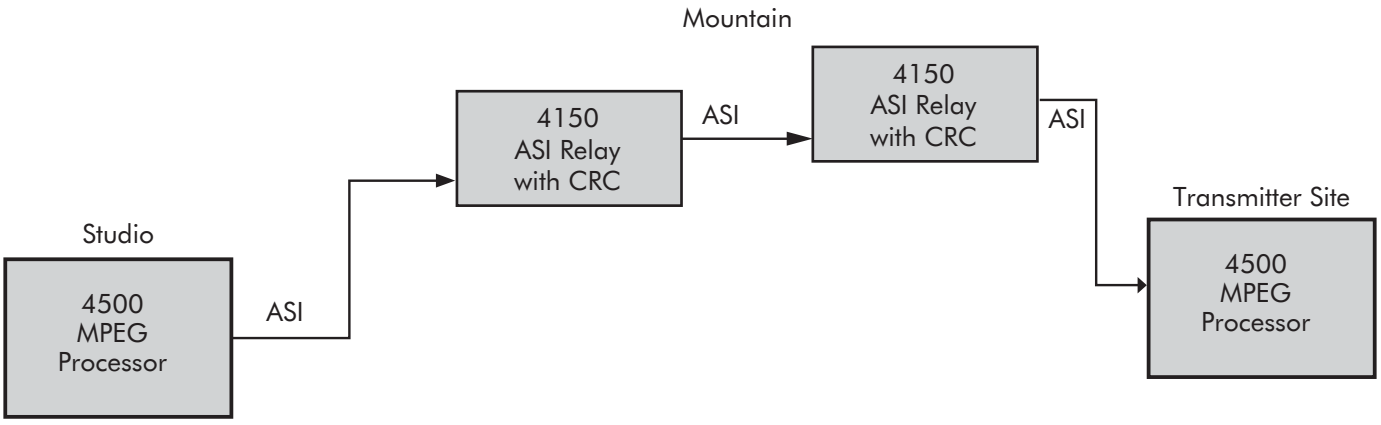
| | |
|---|---|
| Number | One |
| Signal Type | DVB-ASI at 270 Mb/s or SMPTE 310M |

### Output Signal

| | |
|---|---|
| Number | Four |
| Signal Type | Follows input |
| Impedance | 75 Ω |

### General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |




*Application Example*

A 4500 is used at the studio origination point where the 4500 cleans up the ASI or 310M clock and reduces jitter. CRCs are inserted into the stream at this point, too.

The relay points on the mountain each have a 4150 where the stream's CRCs are read and history is forwarded to the next hop.

The transmitter site has another 4500 where the CRC history is read and evaluated for signal path integrity. If there is a problem in the signal path it will be revealed in the data. The 4500 then removes the CRCs from the signal prior to transmission.

If the 4150s are connected to the Avenue Control System then signal integrity can be reported at the relay points. If the 4150s are not on the Avenue Control System, the signal integrity can be read at the transmission path via the 4500 module. The history will indicate which hop had a fault, if any.

# 4450
## SMPTE 310M Protection Switch

The 4450 module is a fail-safe, bypass protection switch for critical SMPTE 310M signals for broadcast or satellite applications. When a fault is detected in the primary input, and the secondary input is verified as good, the switch will activate causing the secondary input to be switched to the module's output. The 4450 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure.

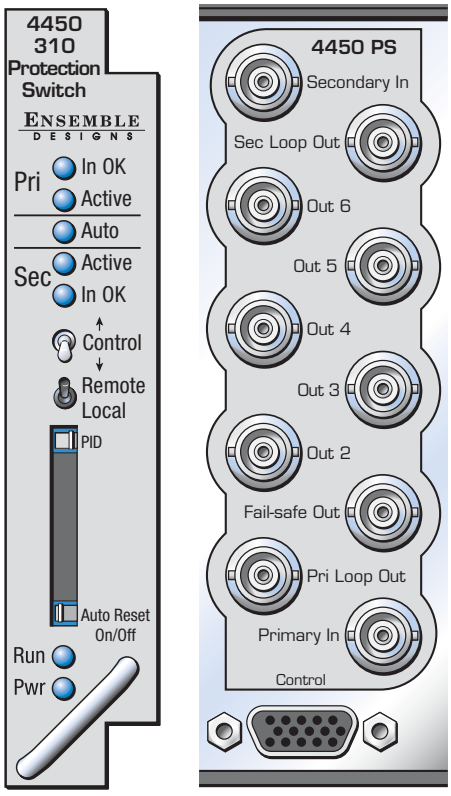
The health of a 310M signal is determined by monitoring digital clock lock, packet presence, and PID presence. The user can configure tests to define the minimum number of video packets and audio packets expected per second in a given service.

The switch can operate in two modes: automatic or nonresetting. In fully automatic mode, the 4450 will automatically switch back to the primary signal once it's been restored. In the nonresetting mode, the secondary input remains routed to the output, even after the primary input has recovered, until it's reset by the operator.

Controls are easily accessed through an Avenue Control Panel, Avenue PC, GPIs, or front edge module controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

## Features

- **Fail-Safe Bypass Protection Switch for SMPTE 310M signals**
- **Detects Signal Presence, Program Packets, PMT, PAT and PIDs with PID specific targeting**
- **Detection specifics are user-programmable**
- **Alarm generation**
- **Remote control and monitoring**



# 4450
## SMPTE 310M Protection Switch

### Input Signal

| | |
|---|---|
| Number | Two |
| Signal Type | SMPTE 310M |

### Loopback

| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

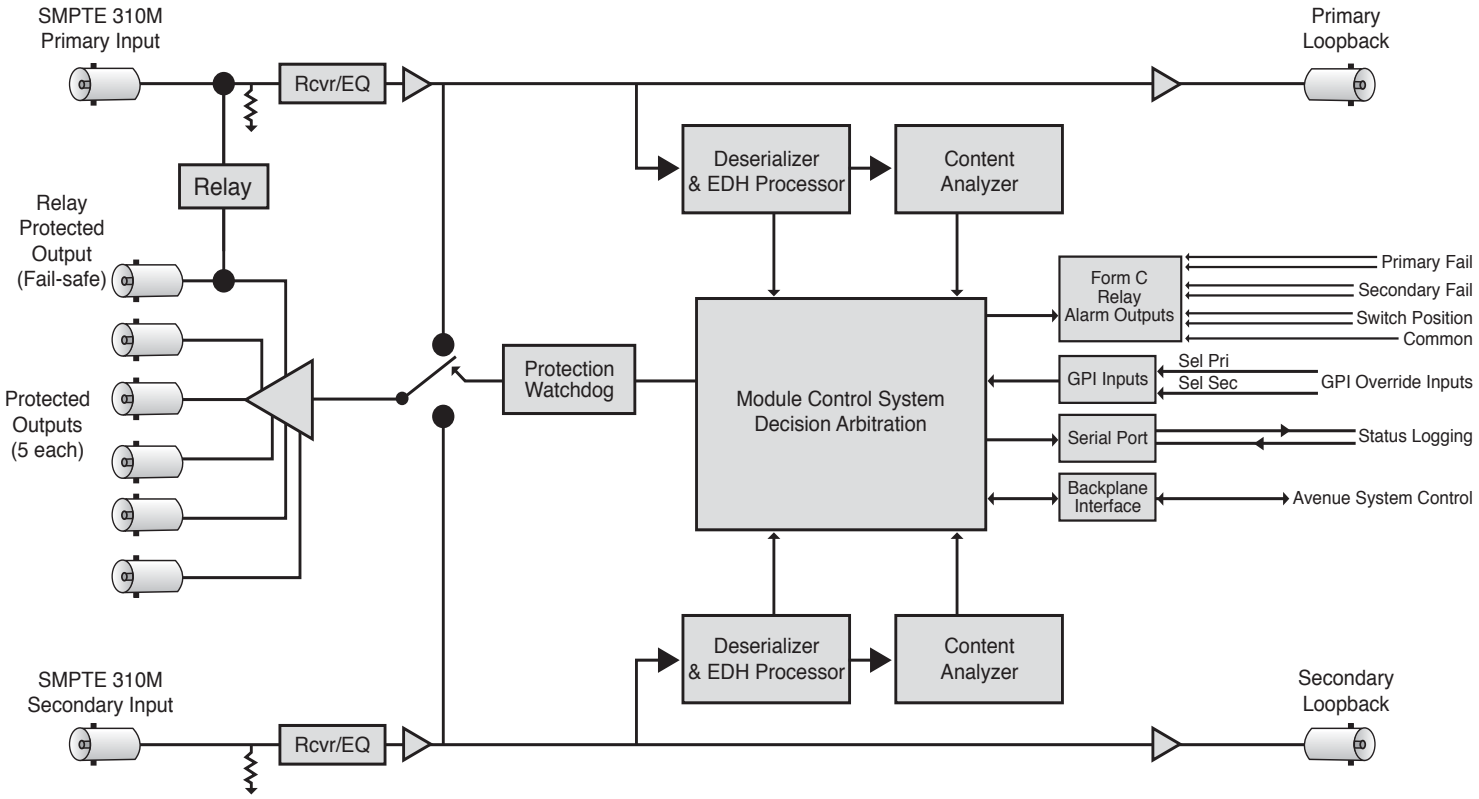
### Output Signal

| | |
|---|---|
| Number | Six total<br>One fail-safe bypass output<br>Five outputs |
| Signal Type | SMPTE 310M |
| Impedance | 75 Ω |

### General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 4 each 0.75 Amp PTC resettable fuse with each domain of the module independently regulated |

4450 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 4455
## ASI Protection Switch

The 4455 module is a fail-safe, bypass protection switch for critical ASI signals for broadcast or satellite applications. When a fault is detected in the primary input, and the secondary input is verified as good, the switch will activate, causing the secondary input to be switched to the module's output. The 4455 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure.

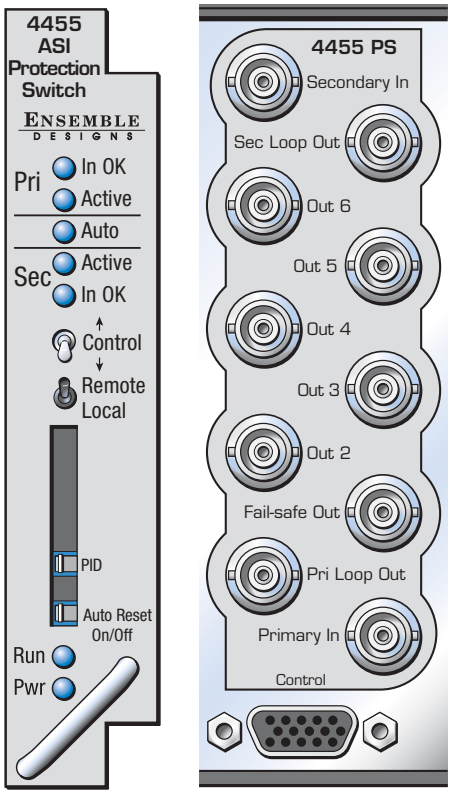
The health of an ASI signal is determined by monitoring digital clock lock, packet presence, and PID presence. The user can configure tests to define the minimum number of video packets and audio packets expected per second in a given service.

The switch can operate in two modes: automatic or nonresetting. In fully automatic mode, the 4455 will automatically switch back to the primary signal once it's been restored. In the nonresetting mode, the secondary input remains routed to the output, even after the primary input has recovered.

Controls are easily accessed through an Avenue Control Panel, Avenue PC software, GPIs, or front edge module controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

## Features

- **Fail-Safe Bypass Protection Switch for Critical ASI signals**
- **Detects Signal Presence, Program Packets, PMT, PAT and PIDs with PID specific targeting**
- **Detection specifics are user programmable**
- **Alarm generation**
- **Remote control and monitoring**



## Input Signal

| | |
|---|---|
| Number | Two |
| Signal Type | DVB-ASI at 270 Mb/s |

## Loopback

| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

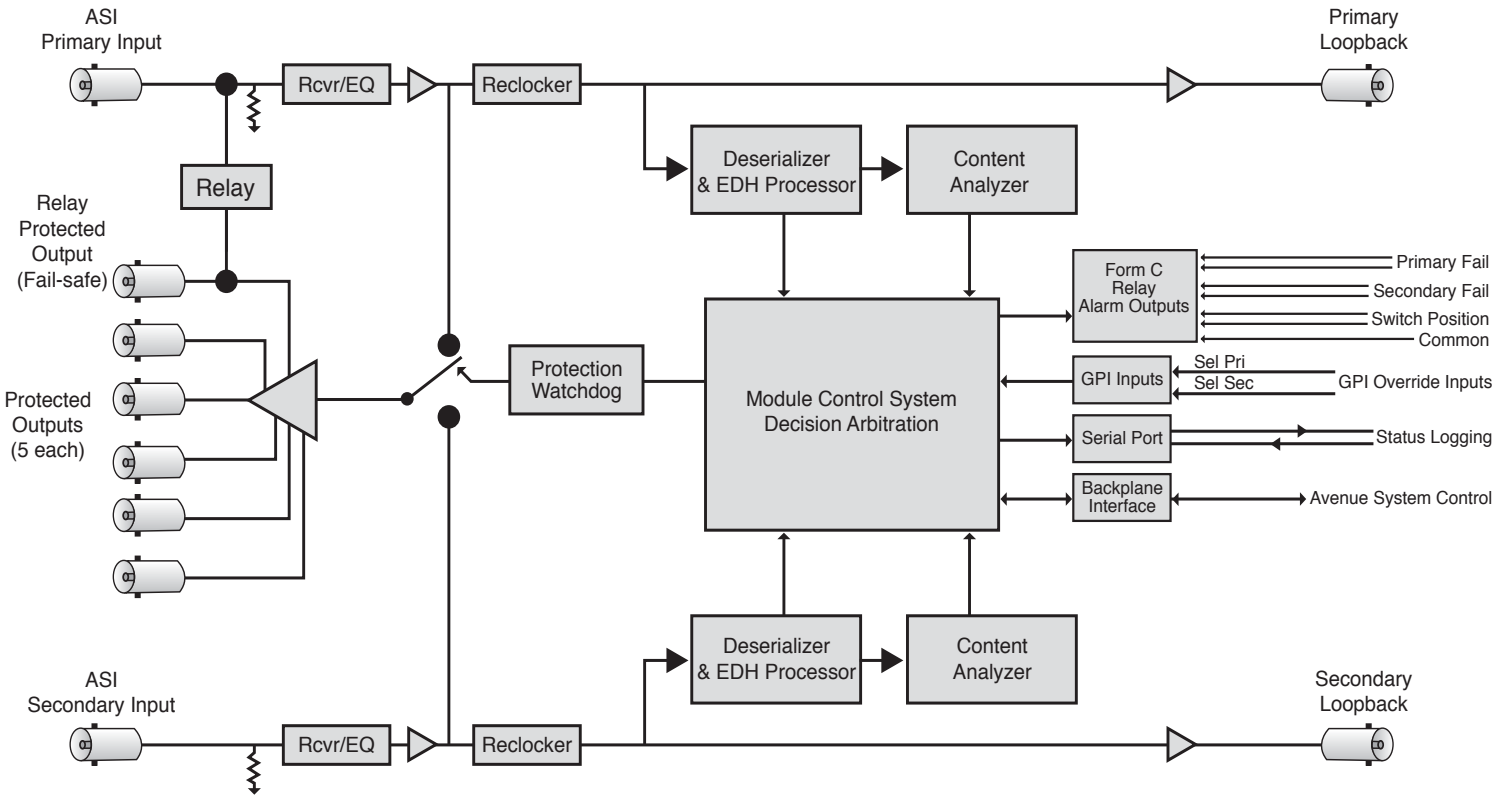
## Output Signal

| | |
|---|---|
| Number | Six total<br>One fail-safe bypass output<br>Five outputs |
| Signal Type | DVB-ASI |
| Impedance | 75 Ω |

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 4 each 0.75 Amp PTC resettable fuse with each domain of the module independently regulated |

4455 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 4500

## ASI and SMPTE 310M Converter and MPEG Transport Processor

The 4500 MPEG Transport Stream Processor works with both DVB-ASI and SMPTE 310M bitstreams. It provides stream content analysis with support for both Priority 1 and Priority 2 test protocols of the ETR 290 DVB measurement guidelines. As a converter, it can translate ASI to 310M or 310M to ASI. Using the reference input, the output bitstream can be synchronized to a video or 10 MHz reference signal.

The 4500 module is useful in broadcast and transmission applications. The built-in transport stream analyzer detects whether the input constitutes a valid signal by checking for PAT, PMT, and PID packets. In addition to the ETR 290 test protocols, analysis and data rate for elemental streams is performed. Alarms can be generated via SNMP, Avenue PC, and contact closure outputs.

The 4500 acts as a Time Base Corrector to remove jitter and adjust transport streams to the precise, desired bit rate. The reference input to the 4500 allows the use of either analog video or a 10 MHz signal to synchronize the output of the module. This is of particular importance in broadcast applications where the quality of the symbol clock – both jitter and accuracy – bears directly on the modulation process.

Reference to the 4500 can be supplied from an Avenue 7400 or 9400 SPG with GPS Option in order to provide the ultimate clock accuracy. In this configuration, the 4500 is an ideal solution to frequency coordination for multi-transmitter systems like Single Frequency Networks (SFN) and mobile/handheld transmission services.

A CRC and Data Checksum packet can be seamlessly inserted into the stream by the 4500 to provide data path integrity testing at downstream points. Monitoring of these special packets can be performed by a second 4500 or an Avenue 4450, 4455, or 7455 ASI/310M Protection Switch. Data Integrity history is carried forward through the system to facilitate fault finding. These CRC packets provide an unequivocal test of data integrity on a transmission link by transmission link basis. This is easier, more accurate, and less expensive than using a complex MPEG analysis tool to troubleshoot a data path problem.

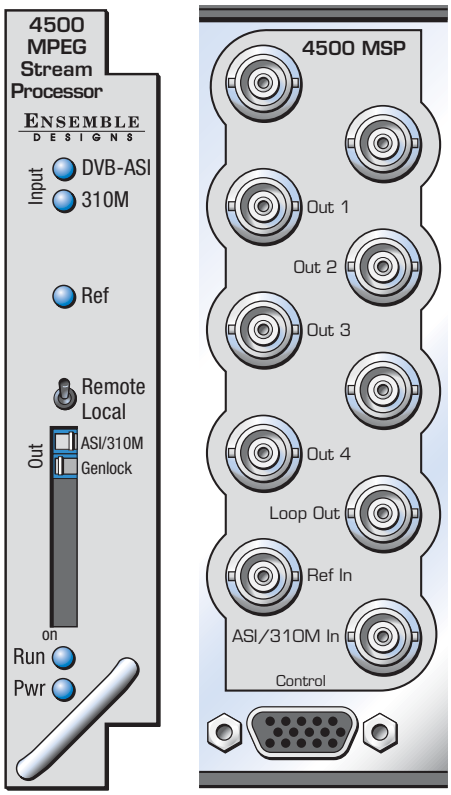
Set the output of the 4500 module to the desired signal type, either ASI or 310M. The module auto senses what type of signal is on the input and converts as needed. Advanced configuration in the Avenue Control System allows choosing which services on the input are passed on to the output.

Controls are easily accessed through an Avenue Control Panel, Avenue PC, GPIs, or front edge module controls.

For critical signals paths, consider using a 4450, 4455 or 7455 bypass protection switch.

### Features

- **Convert SMPTE 310M to ASI or ASI to SMPTE 310M for broadcast and transmission**
- **Built-in signal analyzer detects Signal Presence, Program Packets, PMT, PAT and PIDs**
- **Deliver a pristine signal to your transmitter for optimum transmitter performance**
- **Reference input used to correct the 310M symbol clock and remove jitter**
- **Clock management for Single Frequency Networks (SFN)**
- **CRC and Checksum data integrity testing**
- **ETR 290 Compliant for both Priority 1 and Priority 2**
- **Stream monitor alarms via TCP-IP, SNMP, RS-232 and GPI**
- **Remote control and monitoring**



## Input Signal

| | |
|---|---|
| Number | One |
| Signal Type | DVB-ASI at 270 Mb/s or SMPTE 310M |

## Loopback

| | |
|---|---|
| Number | One |
| Impedance | 75 Ω |

## Output Signal (processed)

| | |
|---|---|
| Number | Four |
| Signal Type | DVB-ASI at 270 Mb/s or SMPTE 310M, selectable |
| Impedance | 75 Ω |

## Reference Input

| | |
|---|---|
| Number | Two: External or Frame Master Reference |
| Signal Type | PAL or NTSC composite video or 10 MHz 1V P-P sine or square |
| Return Loss | >40 dB (applies to external ref input) |

## Signal Analysis

ETR 290 Compliant, Priority 1 and Priority 2
Data integrity CRC test

## Clock Accuracy

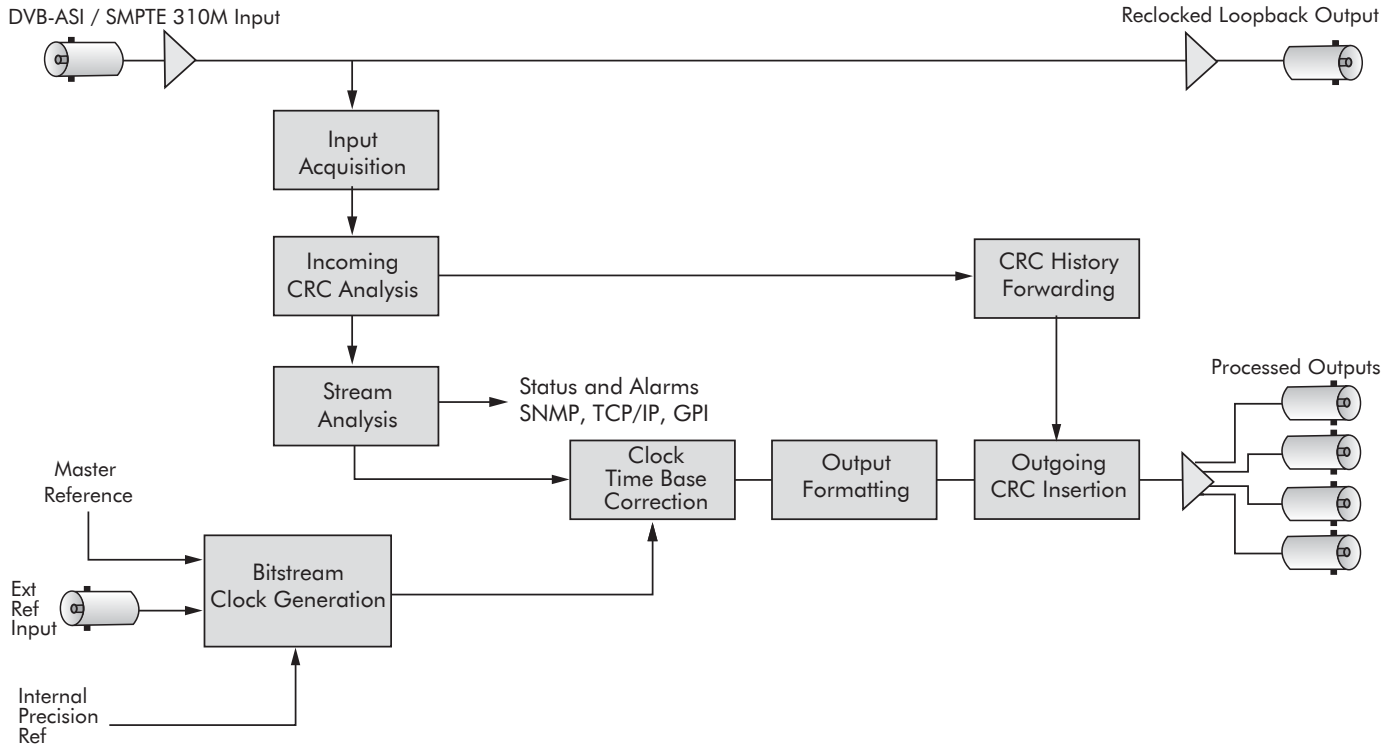
Internal Reference (TCXO)

| | |
|---|---|
| Freq Error | <0.1 ppm |
| | $<10^{-7}$ |

External reference follows Ref Source
$10^{-12}$ possible with GPS grade reference

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 4505
## Dual ASI and SMPTE 310M Converter MPEG Transport Processor

The 4505 is a two channel MPEG Transport Stream Processor that works with both DVB-ASI and SMPTE 310M bitstreams. Similar in architecture and functionality to the 4500 module, the 4505 has the additional capability of handling two streams of 310M or ASI.

The 4505 provides stream content analysis with support for both Priority 1 and Priority 2 test protocols of the ETR 290 DVB measurement guidelines. As a converter, it can translate ASI to 310M or 310M to ASI. Using the reference input, the output bitstream can be synchronized to a video or 10 MHz reference signal.

The 4505 module is useful in broadcast and transmission applications. Set the outputs of the 4505 module to the desired signal type, either ASI or 310M. The module auto senses what type of signal is on the input and converts as needed. Outputs can be configured independently so that one channel could convert ASI to 310M and the other channel could convert 310M to ASI. Advanced configuration in the Avenue Control System allows choosing which services on the input are passed on to the output.

The built-in transport stream analyzer detects whether the input constitutes a valid signal by checking for PAT, PMT, and PID packets. In addition to the ETR 290 test protocols, the user can configure tests to define the minimum number of video and audio packets expected per second in a given service. Alarms can be generated via SNMP, Avenue PC, and contact closure outputs.

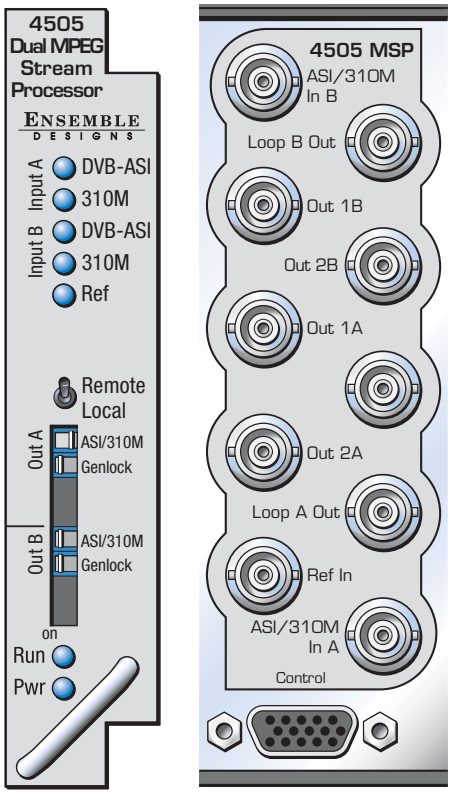
The 4505 brings the 310M symbol clock into the same precision as the transmitter which optimizes transmission performance. The 4505's output bitstreams can be synchronized to a video or 10 MHz reference signal. This is of particular importance in 310M applications where the symbol clock frequency acts directly in the transmitter modulation process. By using an Avenue 7400 SPG with the GPS reference option, the 4505 Stream Processor will ensure the highest possible accuracy in transmission.

Controls are easily accessed through an Avenue Control Panel, Avenue PC, GPIs, or front edge module controls.

For critical signals paths, consider using a 4450, 4455 or 7455 bypass protection switch.

### Features

- **Convert between SMPTE 310M and ASI signals or ASI to SMPTE 310M for broadcast and transmission**
- **Two channels on one module provide high density conversion**
- **Built-in signal analyzer detects Signal Presence, Program Packets, PMT, PAT and PIDs**
- **Deliver a pristine signal to your transmitter for optimum transmitter performance**
- **Reference input used to correct the 310M symbol clock and remove jitter**
- **Clock management for Single Frequency Networks (SFN)**
- **CRC and Checksum data integrity testing**
- **ETR 290 Compliant for both Priority 1 and Priority 2**
- **Stream monitor alarms via TCP-IP, SNMP, RS-232 and GPI**
- **Remote control and monitoring**



# Dual ASI and SMPTE 310M Converter MPEG Transport Processor

## Input Signal

| | |
|---|---|
| Number | Two (one per channel) |
| Signal Type | DVB-ASI at 270 Mb/s or SMPTE 310M |

## Loopback

| | |
|---|---|
| Number | Two (one per channel) |
| Impedance | 75 Ω |

## Output Signal (processed)

| | |
|---|---|
| Number | Four (two per channel) |
| Signal Type | DVB-ASI at 270 Mb/s or SMPTE 310M, selectable |
| Impedance | 75 Ω |

## Reference Input

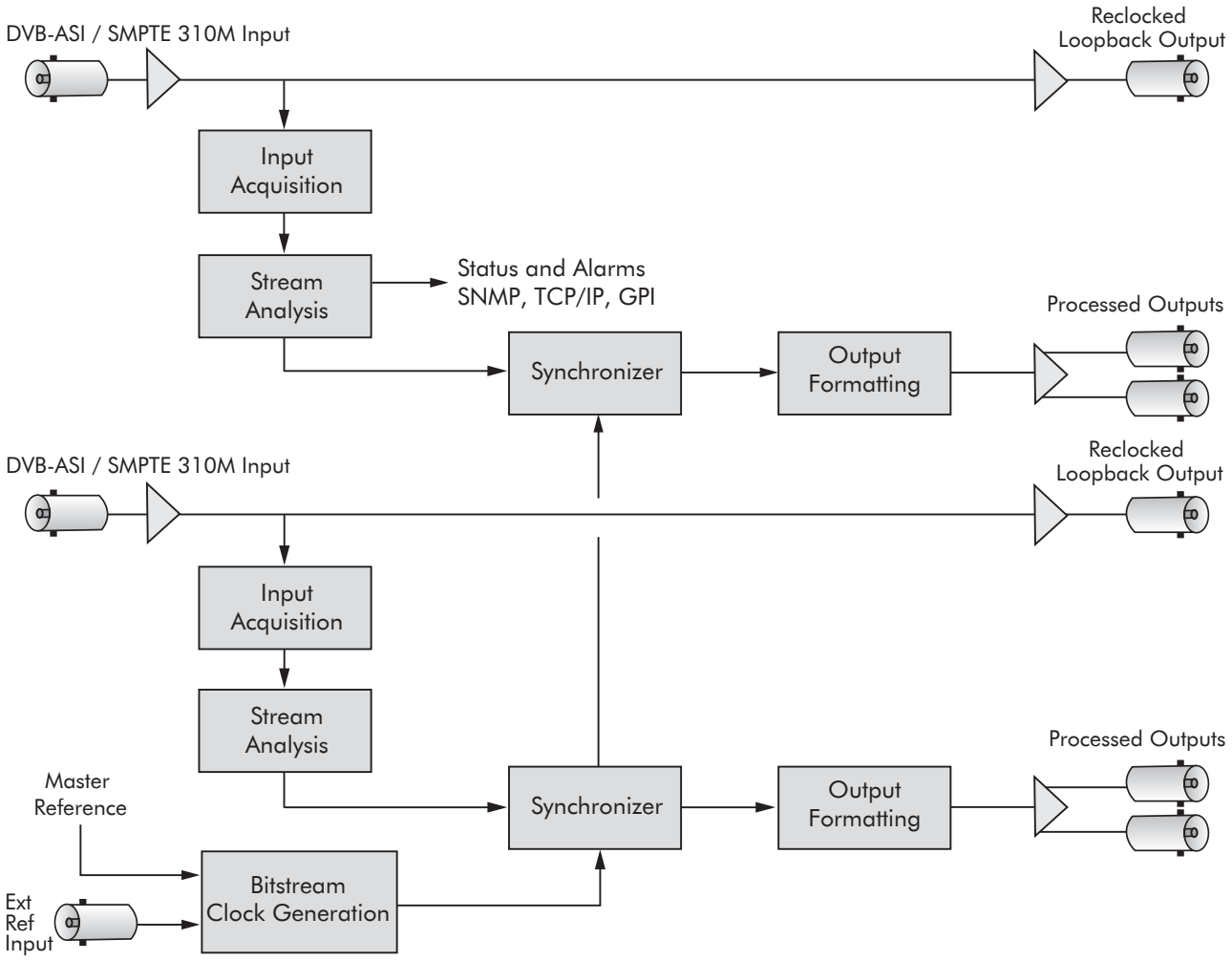
| | |
|---|---|
| Number | Two: External or Frame Master Reference |
| Signal Type | PAL or NTSC composite video or 10 MHz 1V P-P sine or square |
| Return Loss | >40 dB (applies to external ref input) |

## Signal Analysis

ETR 290 Compliant, Priority 1 and Priority 2

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 5120 and 5125
## Dual Digital Video DAs

The 5120 Dual Serial DA Module is a two channel digital video distribution amplifier with four outputs per channel. The 5125 is a Reclocking Dual Serial DA Module. Both modules offer cost-effective distribution as each does double duty.

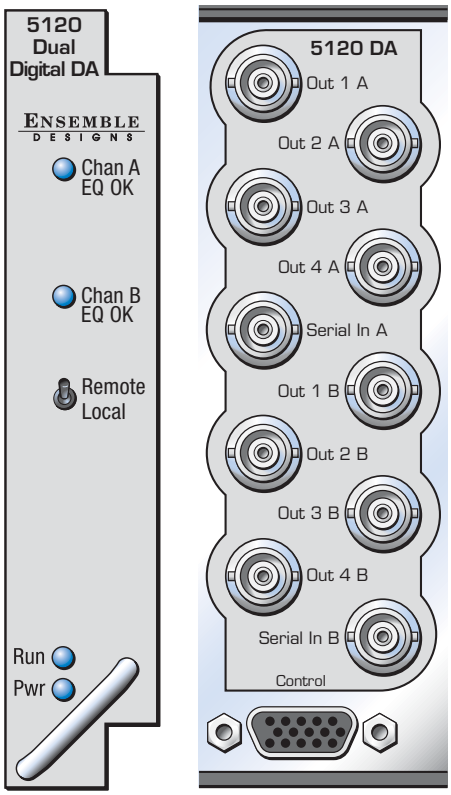
The 5120 is a nonprocessing DA with cable equalization and signal detection.

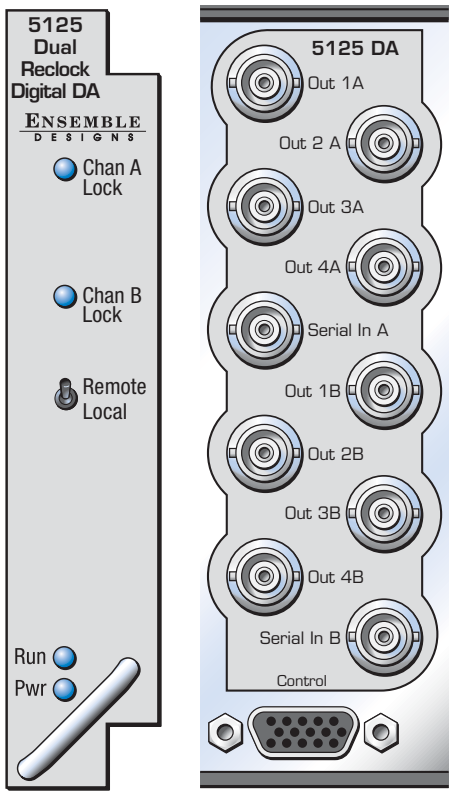
The 5125 reclocks the serial data stream, thereby improving jitter performance of the outputs where the input has jitter.

Both the 5120 and 5125 can be used to distribute any of the following data rates: 143 Mb/s, 177 Mb/s, 270 Mb/s, and 360 Mb/s. Both DA modules can be controlled through an Avenue Control Panel and through Avenue PC.

### Features

- **Two channels of distribution per module**
- **Two independent sets of four outputs**
- **Use with SD SDI, ASI and 310M signals**
- **EQ warning circuit**
- **User definable alarms**
- **5125 provides reclocking and jitter reduction**
- **Local and remote control of module settings**
- **Supports 143, 177, 270 and 360 Mb/s**
- **Passes embedded audio**
- **6 DAs in a 1RU Avenue frame**
- **20 DAs in a 3RU Avenue frame**



## Serial Input

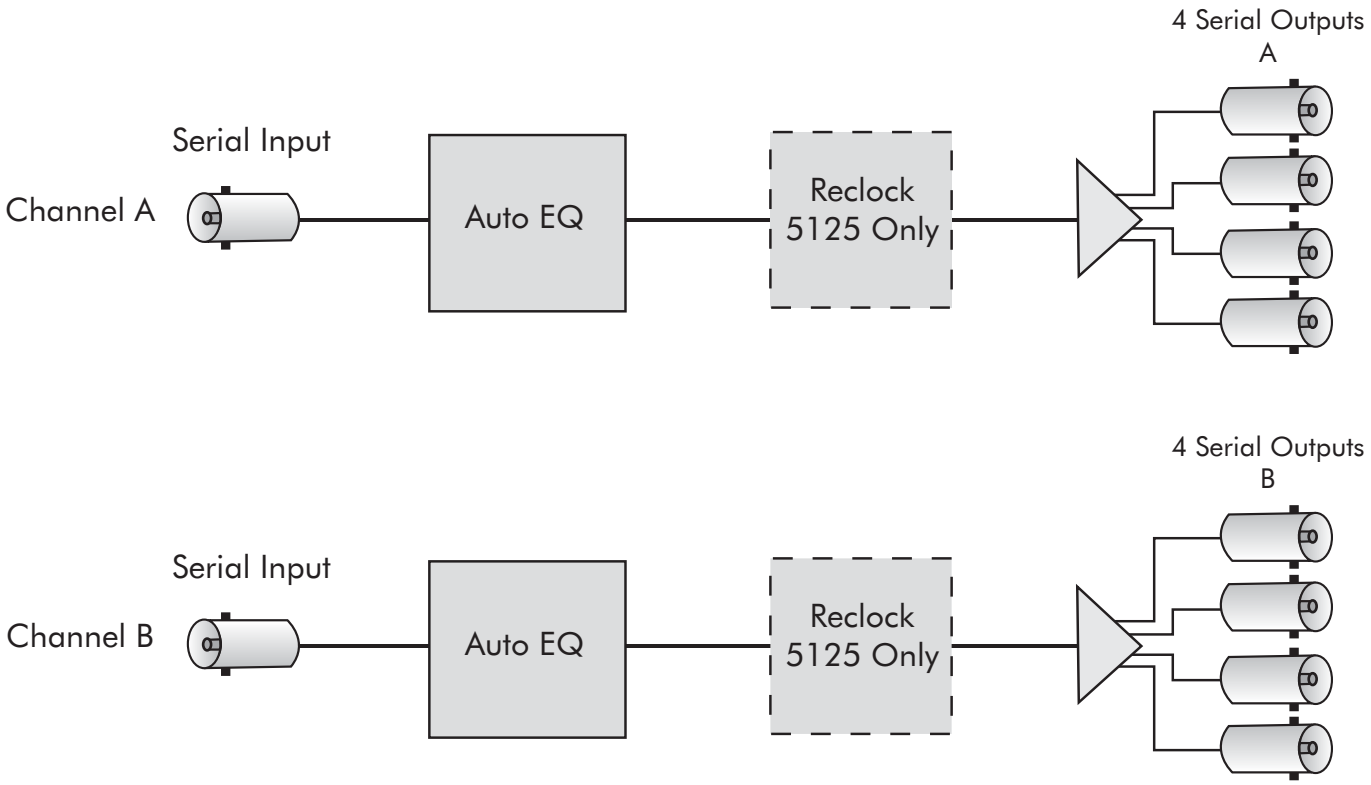
| | |
|---|---|
| Number | Two |
| Signal Type | Serial Digital SMPTE 259M<br>DVB-ASI<br>SMPTE 310M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 143, 177, 270 Mb/s, 300 meters<br>360 Mb/s, 200 meters<br>Belden 1694A |

## Output Signal

| | |
|---|---|
| Number | Four per channel |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |

## General Specifications

| | |
|---|---|
| Power Consumption | <4.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



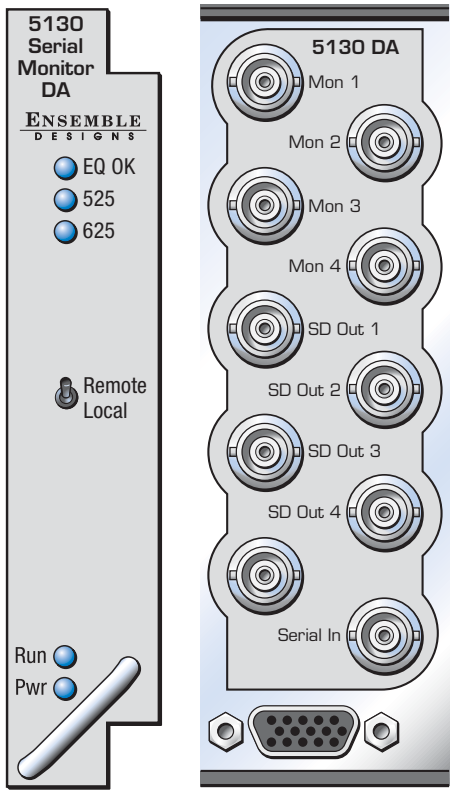
# 5130
## Reclocking Serial DA with Composite Monitor Outputs

Excellent for applications that need video distribution and signal monitoring, the 5130 module is both a serial digital DA and a digital-to-analog converter. The module has one serial digital input with four reclocked serial digital outputs and four composite monitor outputs.

Module status can be monitored through the Avenue Control Panels, Avenue PC and the LEDs located on the front edge of the module.

### Features

- **Both a DA and a converter**
- **Four serial digital outputs**
- **Four composite monitor outputs**
- **Reclocking and jitter reduction**
- **Front panel indicators and remote monitoring**
- **525 and 625 operation**
- **Excellent for facilities transitioning to digital**
- **Passes embedded audio and all ancillary data**



# 5130
## Reclocking Serial DA with Composite Monitor Outputs

### Input Signal

| | |
|---|---|
| Number | One |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |
| Max Cable Length | 300 meters Belden 1694A |

### Serial Output Signal

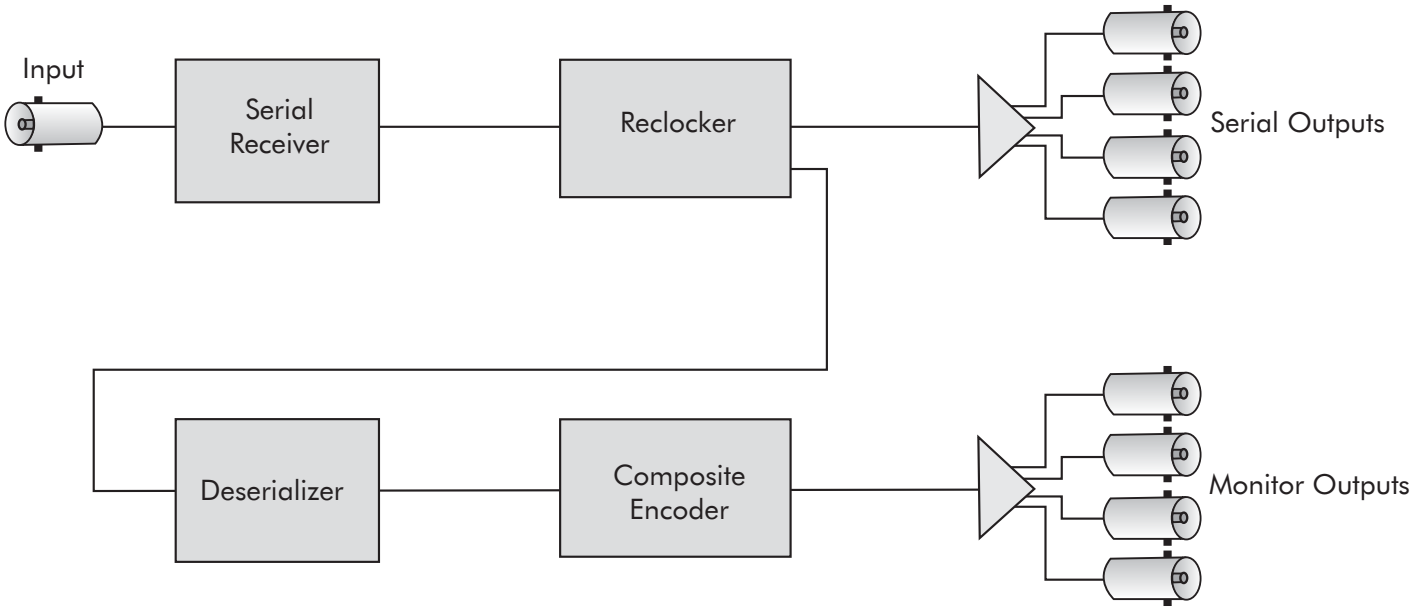
| | |
|---|---|
| Number | Four |
| Signal Type | Serial Digital SMPTE 259M<br>10 bit |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |
| Output DC | None (AC coupled) |
| Setup | User selectable |

### Composite Monitor Output

| | |
|---|---|
| Number | Four |
| Signal Type | NTSC/PAL |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <±200 mV |
| Response | ±0.25 dB, 10 kHz to 5.0 MHz |
| K Factors | <1.5% |
| Quantization | 9 bits |

### General Specifications

| | |
|---|---|
| Power Consumption | <5.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 5140
## Analog Video EQ DA

The 5140 provides analog distribution of NTSC and PAL composite video signals. It can equalize up to 1000 feet (300 meters) of coaxial cable. The purpose of equalization is to compensate for the losses that occur when a video signal travels through a length of coaxial cable. Due to their differing characteristics, different types of cable will require different equalization networks on the 5140. Cable type must be specified when the module is ordered.

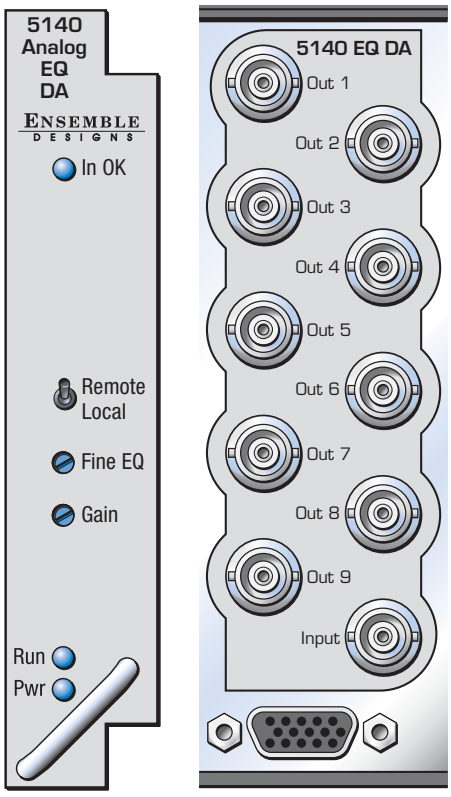
Input signal validity is displayed locally and can be monitored through the Avenue remote control options. Gain and EQ parameters can be adjusted locally as well as remotely. Remote control is accessed via the optional Avenue Touch Screen Control Panel and Avenue PC Control Application.

HumBlocker™ technology on the 5140 will automatically process the analog signal to remove power line hum and other types of interference. This is a superior solution to the problem of recovering analog signals in noisy environments or in the presence of groundloops.

Differential inputs can only provide their full benefit if the shield of the input signal is never connected to local ground. A simple patchbay or cable demarcation box can render differential inputs useless. The HumBlocker feature on the 5140 will actually identify and cancel power line interference within the video waveform itself. Because the HumBlocker system is designed specifically for analog composite video, it must be turned off if the module is being used to distribute other signals (AES, Tri-Level Sync, etc.).

### Features

- **Nine outputs**
- **Equalization up to 1000 feet (300 meters)**
- **HumBlocker™ circuitry provides a superior solution to differential inputs**
- **Local and remote control**



## Input Signal

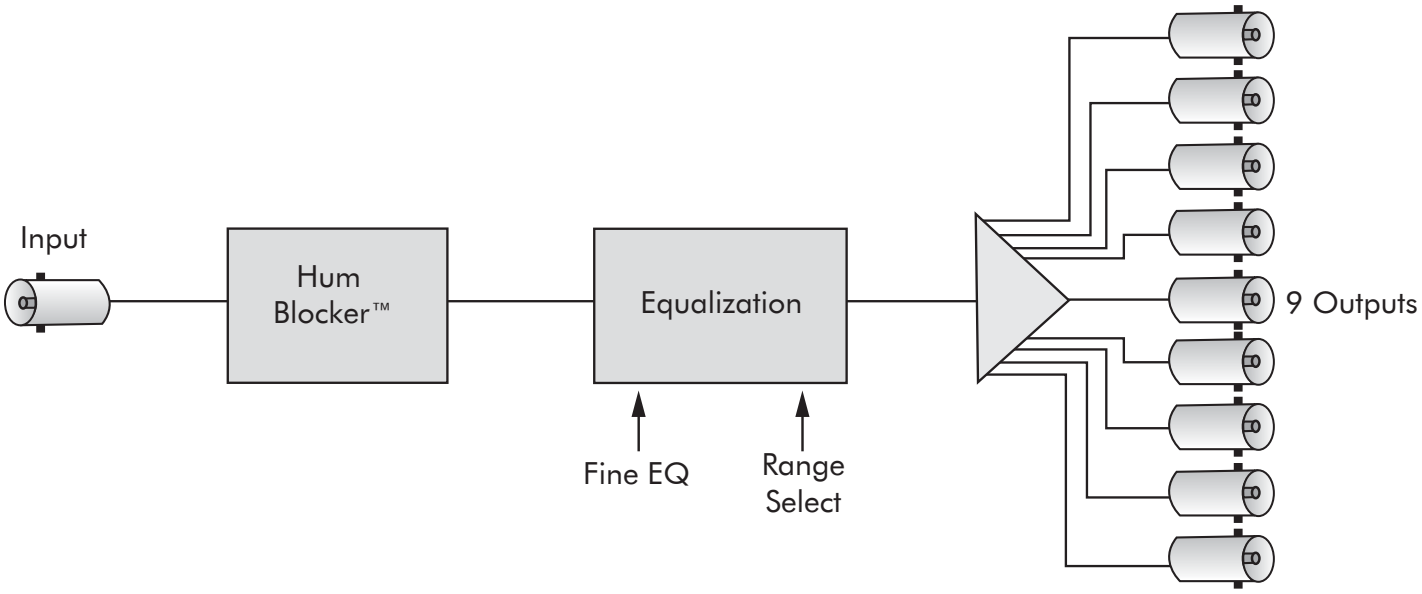
| | |
|---|---|
| Number | One, terminating |
| Signal Type | NTSC/525, PAL/625 |
| | Composite Video |
| Cable Type | Belden 1694A |
| | others upon request |
| Impedance | 75 Ω |
| Return Loss | >40 dB to 5 MHz |

## Output Signal

| | |
|---|---|
| Number | Nine |
| Signal Type | Follows Input |
| Impedance | 75 Ω |
| Return Loss | >40 dB to 5 MHz |
| DC Offset | Follows Input ±50 mV |
| Delay | 10 nsec (14° NTSC, 17° PAL) |

## General Specifications

| | |
|---|---|
| Frequency Response | ±0.1 dB |
| | 0 to 5.5 MHz |
| Signal to Noise | 68 dB |
| K Factor, 2T Pulse | <0.25% |
| Differential Phase | 10-90% APL <0.1 degree |
| Differential Gain | 10-90% APL <0.15% |
| Gain Stability | <0.1 dB variation over operating temp |
| Power Consumption | <3.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



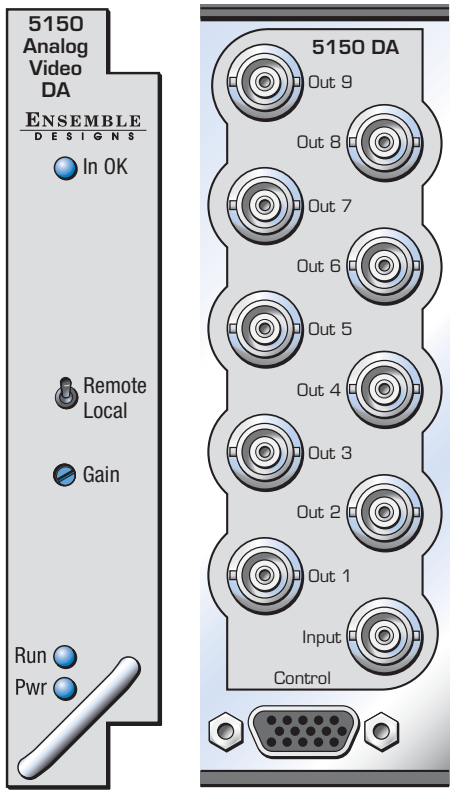
# 5150
## DA for Analog Video, AES and Tri-Level Sync

The 5150 module provides analog distribution of composite video signals, PAL or NTSC, AES audio and Tri-Level Sync. The 5150 provides one composite video input and nine buffered composite video outputs.

Input signal detection is displayed locally and through the Avenue remote control system. Gain can be adjusted locally as well as remotely. Remote control is accessed via the Avenue Control Panels and the Avenue PC Control Application.

### Features

- **Nine outputs**
- **Gain adjustment range of ±10%**
- **Supports PAL and NTSC signals**
- **AES digital audio distribution**
- **Tri-Level Sync distribution**
- **Use with LTC and word clock**
- **Special order for use with 10 MHz**
- **Local and remote control**



# 5150
## DA for Analog Video, AES and Tri-Level Sync

### Input Signal

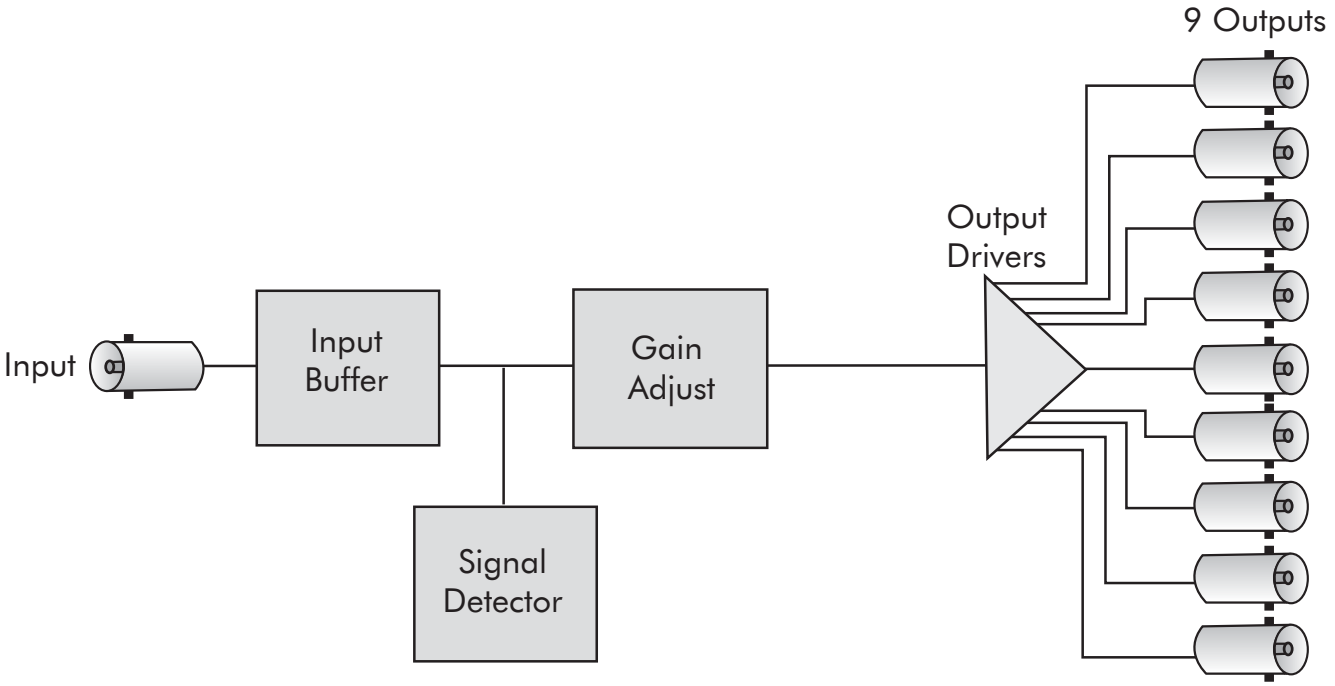
| | |
|---|---|
| Number | One, terminating |
| Signal Type | NTSC/525, PAL/625<br>composite video, AES digital audio<br>Tri-Level Sync |
| Impedance | 75 Ω |
| Return Loss | >40 dB to 5 MHz |

### Output Signal

| | |
|---|---|
| Number | Nine |
| Signal Type | Follows Input |
| Impedance | 75 Ω |
| Return Loss | >40 dB to 5 MHz |
| DC Offset | Follows Input ±50 mV |
| Delay | 10 ns (14° NTSC, 17° PAL) |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| Signal to Noise | 68 dB |
| K Factor, 2T Pulse | <0.25% |
| Differential Phase | 10-90% APL <0.1 degree |
| Differential Gain | 10-90% APL <0.15% |
| Gain Stability | <0.1 dB variation over operating temp |

### General Specifications

| | |
|---|---|
| Power Consumption | <3.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



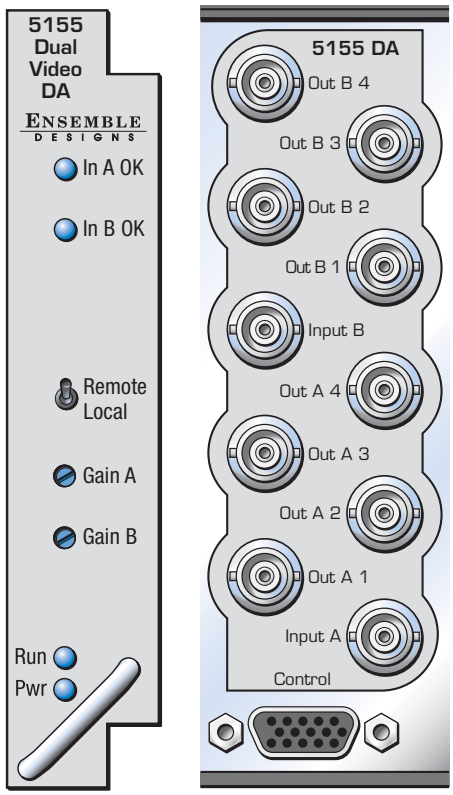
# 5155
## Dual DA for Analog Video, AES and Tri-Level Sync

The 5155 module provides analog distribution of composite video signals; NTSC and PAL; and AES audio. This dual distribution amplifier's two inputs are each distributed to four outputs.

Input signal validity is displayed locally and can be monitored through the Avenue remote control options. Gain can be adjusted locally as well as remotely. Remote control is accessed via the optional Avenue Control Panels and Avenue PC.

### Features

- **Two channels of distribution per module**
- **Supports PAL and NTSC signals**
- **AES audio distribution**
- **Tri-Level Sync distribution**
- **Use with LTC and word clock**
- **Special order for use with 10 MHz**
- **Local and remote control**



# 5155
## Dual DA for Analog Video, AES and Tri-Level Sync

### Input Signal

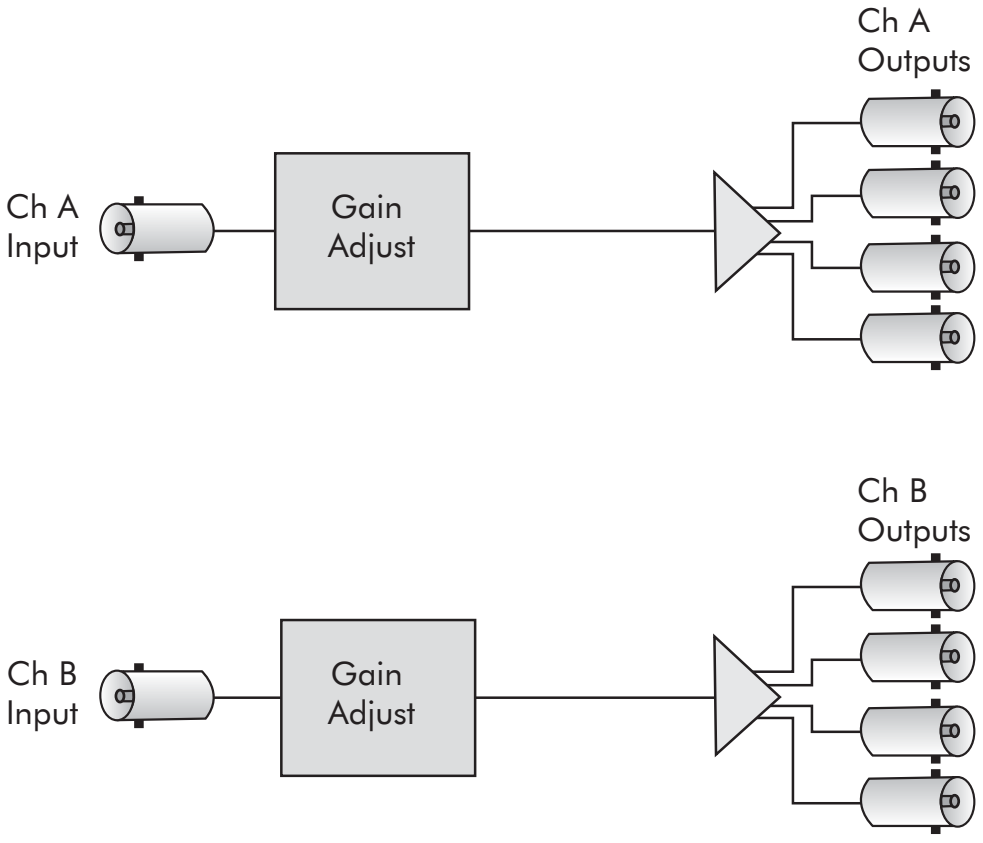
| | |
|---|---|
| Number | Two, terminating on module |
| Signal Type | NTSC/525, PAL/625<br>composite video,<br>AES digital audio,<br>Tri-Level Sync |
| Impedance | 75 Ω |
| Return Loss | 15 k–5 MHz >40 dB |

### Output Signal

| | |
|---|---|
| Number | Eight (four per input) |
| Signal Type | Follows Input |
| Impedance | 75 Ω |
| Return Loss | 15 k–5 MHz >40 dB |
| DC Offset | Follows Input ±50 mV |
| Delay | 10 nsec (14° NTSC, 17° PAL) |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor, 2T Pulse | < 0.25% |
| Differential Phase | 10–90% APL < 0.1 degree |
| Differential Gain | 10–90% APL < 0.15% |

### General Specifications

| | |
|---|---|
| Power Consumption | < 3.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



# 5160
## SD Protection Switch and DA

The 5160 Serial Digital Protection DA module is a fail-safe bypass protection switch for monitoring and switching critical digital paths. When a fault is detected in the Primary input, the switch will activate, causing the Secondary (backup) input to be switched to the module's distributed outputs. The switch can operate in two modes; automatic or nonresetting.

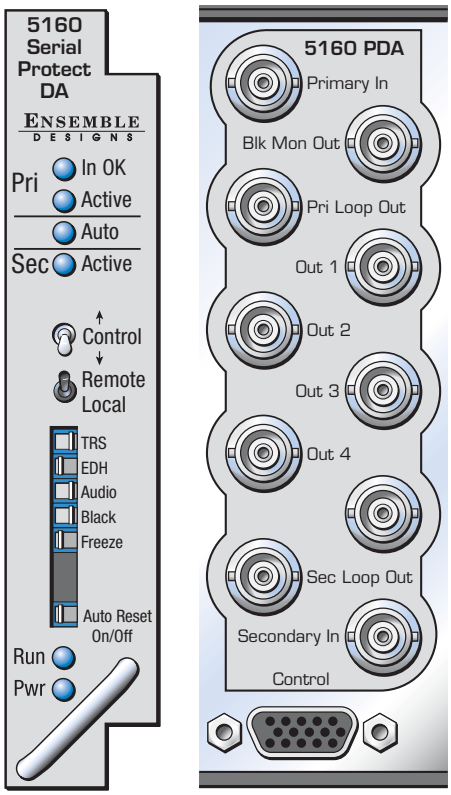
The 5160 monitors the integrity of the Primary serial digital input stream and analyzes the audio and video content. Signal health and fault detection is determined by monitoring any or all of the following parameters: Timing Reference Signal (TRS), Black, Embedded Audio, Error Detection and Handling (EDH), and Freeze.

A sophisticated Black detection system is employed to activate the switch in the event signal is lost. It allows the user to select not only the threshold and percentage of nonblack pixels, but also the portion of the picture to be considered.

The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 5160 to switch to the secondary input after a video freeze condition is detected in the primary input.

### Features

- **Two serial digital inputs, four serial digital outputs**
- **Detects TRS, EDH, Black, Silence and Freeze**
- **Embedded audio detection**
- **Passes embedded audio**
- **Alarm generation**
- **Remote control and monitoring**



## Input Signal

| | |
|---|---|
| Number | Two |
| Signal Type | Serial Digital SMPTE 259M |
| Standard | 525/60 or 625/50 auto detect |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 270 MHz |

## Serial Digital Loopback

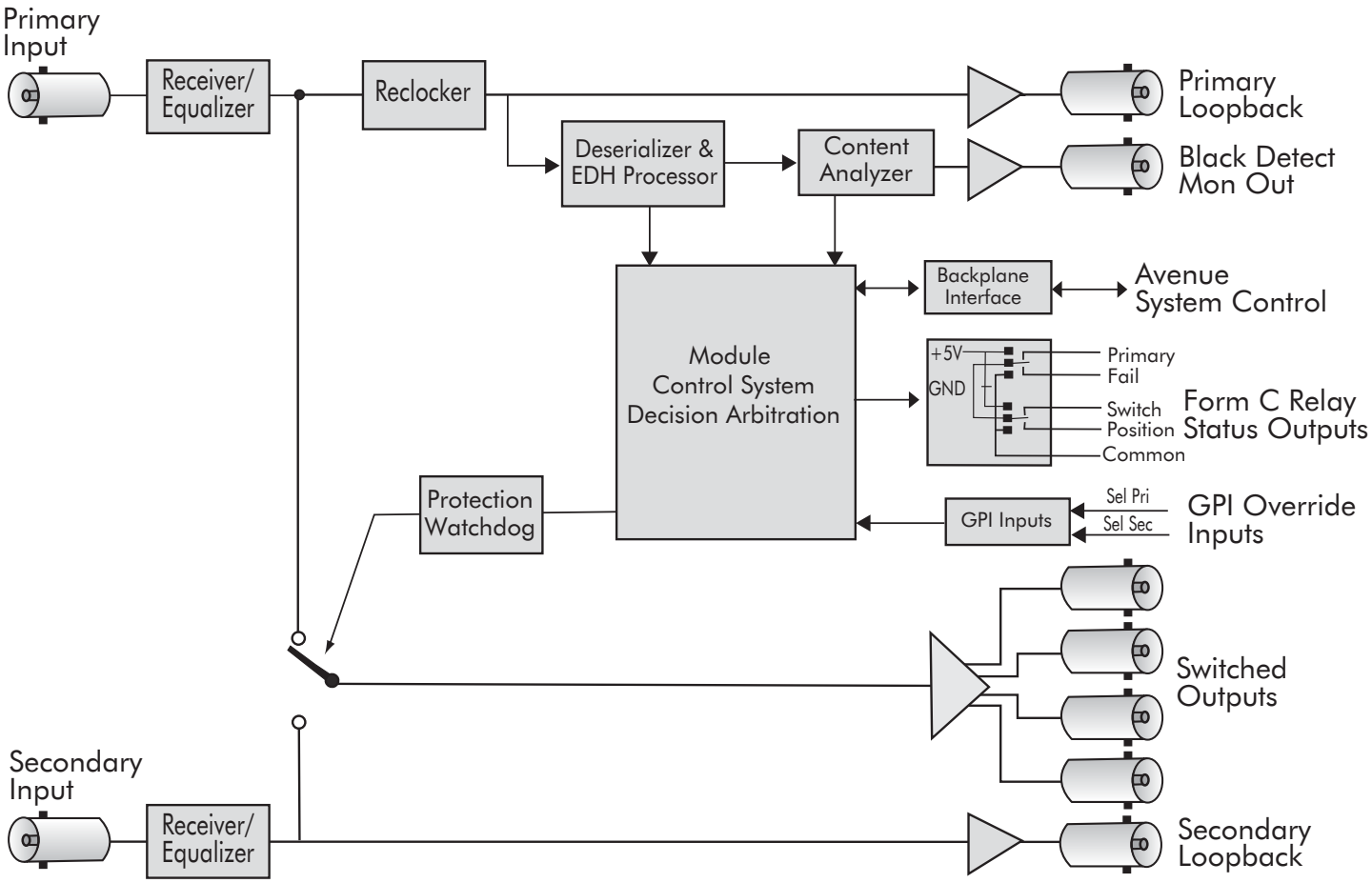
| | |
|---|---|
| Number | Two |
| Impedance | 75 Ω |

## Serial Output Signal

| | |
|---|---|
| Number | Four |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |

## General Specifications

| | |
|---|---|
| Connectors | BNC |
| Power Consumption | <5 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



# 5230 and 6230

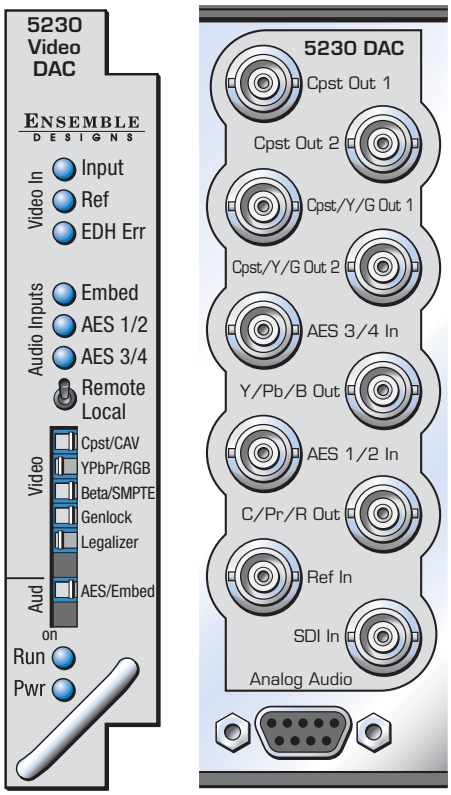
## SD Digital to Analog Video Converter and Disembedder

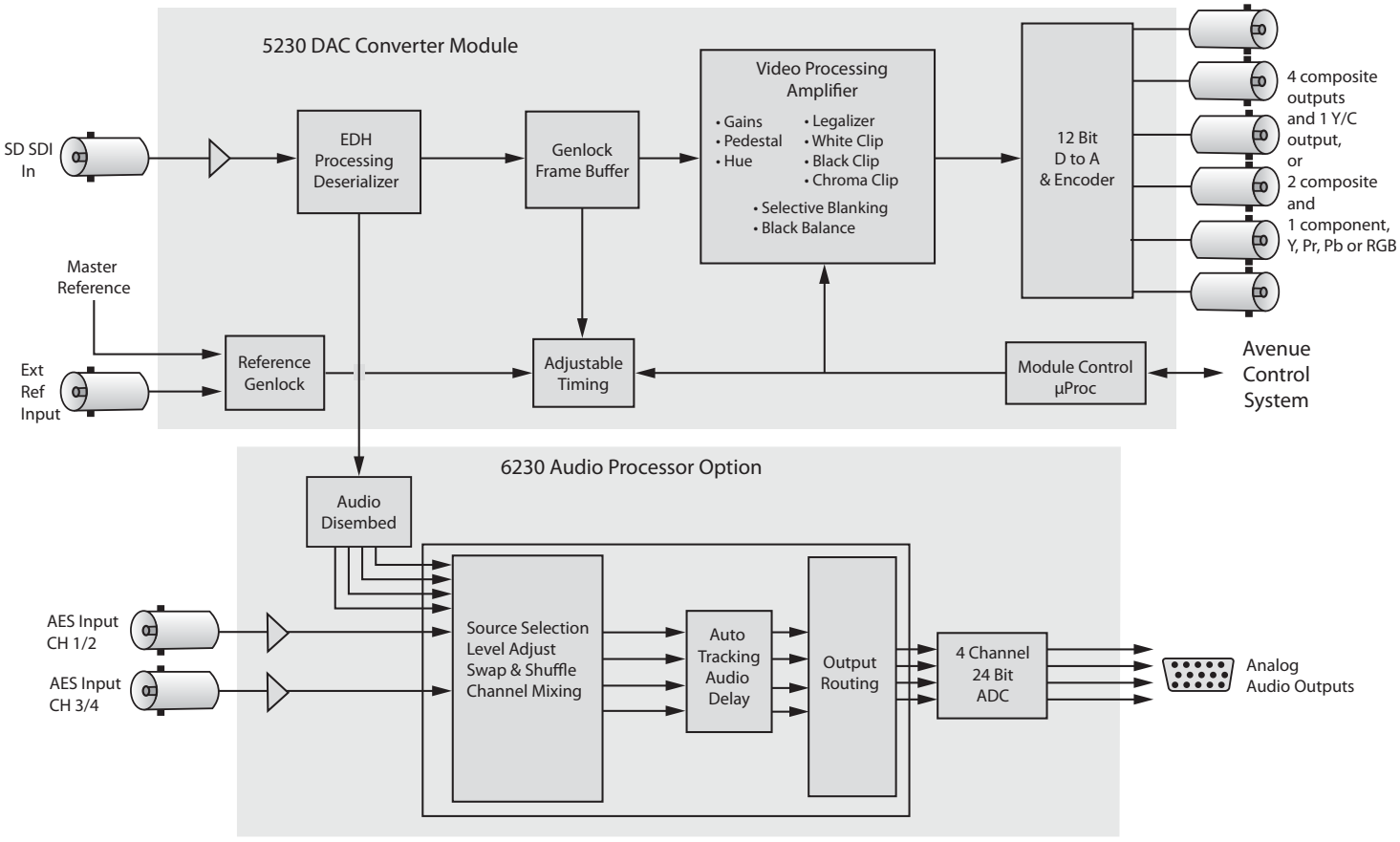
The 5230 converts serial digital component video into either composite or component analog outputs. Its 8 x oversampling and 12 bit processing ensure high quality conversion for use in the most demanding applications.

The 5230 has a full-featured Proc Amp for adjustment of every signal parameter. Proc controls include Video and Chroma Gain, NTSC-style hue rotation, Black Balance, and pedestal. Module parameters can be monitored and controlled locally and remotely.

The 5230 provides fully adjustable output timing relative to the reference input signal. Composite outputs can be precisely color timed and will also track color framing of the reference signal. Incorporating a full-frame synchronizer, the 5230 accepts serial inputs that are asynchronous to the reference. On loss of input, the output can mute to black or freeze on the last good frame of video.

The 6230 is an optional sub module for converting AES inputs or embedded audio content to analog. There is a four channel audio mixer for level controls, audio shuffling, and phase inversion. The 6230 also has automatic tracking delay and bulk delay to keep lip sync correct.



# 5230 and 6230

## SD Digital to Analog Video Converter and Disembedder

### Features

- **Component or composite or Y/C (S-Video) outputs**
- **12 bit conversion**
- **8:8:8 video reconstruction with 8 x oversampling**
- **Proc Amp adjustments and SC/H timing controls**
- **Line selectable toothed blanking**
- **Clips and Chroma limiting**
- **Composite legalizer**
- **Generates color bars**
- **Memory registers**
- **Genlock/Frame sync**
- **Automatic 525/625 switching**
- **Optional sub module for disembedding, audio shuffling and adjusting levels**
- **110 Ω option available**

### Serial Digital Input

| | |
|---|---|
| Signal Type | SMPTE 259 |
| EDH | Fully compliant |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 300 meters Belden 1694A |
| Automatic Cable Input Equalization | |

### Reference Input

| | |
|---|---|
| Number | Two:<br>One external (modules BNC)<br>One internal (frame master ref BNC) |
| Type | 1 V P-P Composite Video,<br>PAL or NTSC |
| Impedance | 75 Ω |
| Return Loss | >40 dB |

### Analog Output

| | |
|---|---|
| Type | PAL or NTSC<br>4 composite and 1 Y/C<br>or 2 composite and 1 component<br>Y, Pr, Pb or RGB |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <50 mV |
| Delay | 1 line, adjustable up to 1 frame |

### SDI to Analog Performance

| | |
|---|---|
| Bit Resolution | 12 bit output reconstruction<br>8 x oversampling |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| ScH Phase Error | <±2 degrees |
| Differential Phase | <1 degree |
| Differential Gain | <1% |
| Color Field Sequence | Locked to selected Ref |

### AES/EBU Digital Inputs (6230 sub module)

| | |
|---|---|
| Number | Two (total of four channels) |
| Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 or 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

### Embedded Inputs (6230)

| | |
|---|---|
| Number | One (from SDI video input) |
| Type | SMPTE 274M compliant<br>Selectable to any of 4 groups |
| Channels | Four |
| Bit Depth | 20 and 24 bit |

### Analog Audio Output (6230)

| | |
|---|---|
| Analog Output | Four, Balanced Pair |
| Processing | 24 Bits |
| Analog Output Z | 30 Ω, balanced, transformerless |
| Max Output level | +24 dBu |
| Dynamic Range | >106 dB |

### General Specifications

| | |
|---|---|
| Power Consumption | 10 watts (with both options installed) |
| Temperature | 0 to 40°C, ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

# 5330 and 6330

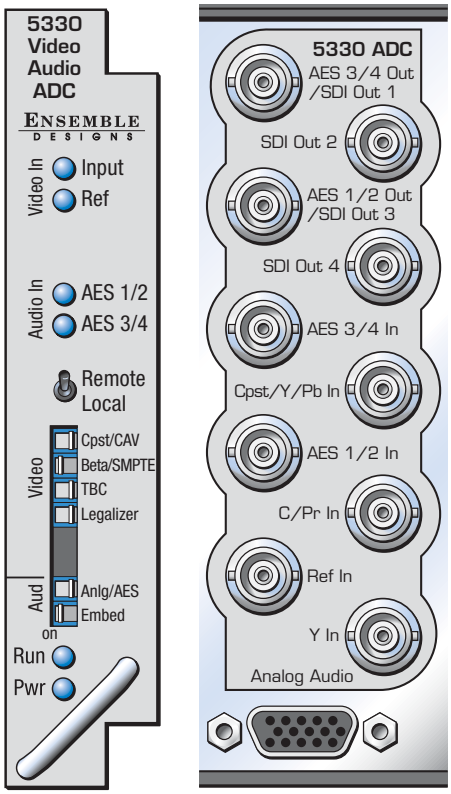
## Analog to SD Digital Video Converter and Embedder

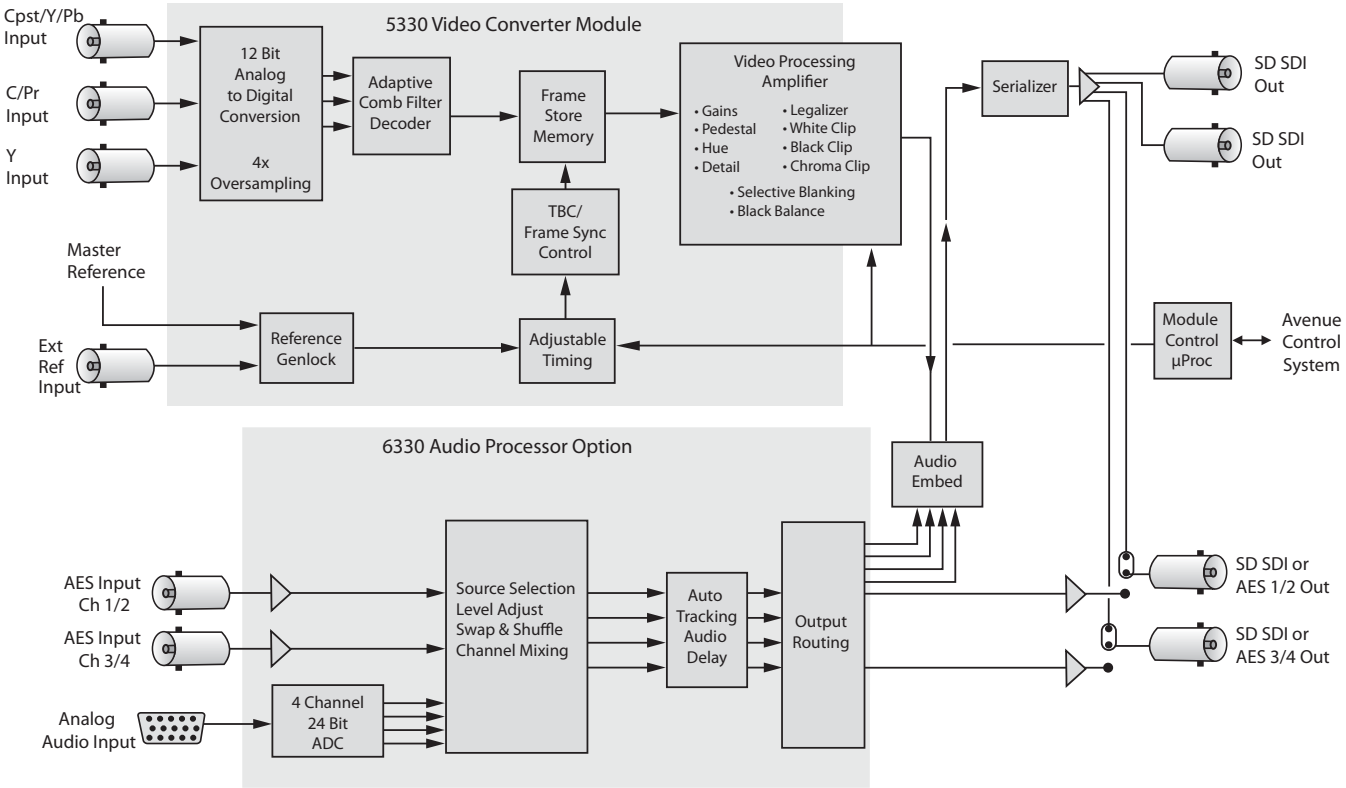
The 5330 converts a composite or component analog video signal to serial digital component. Its 12 bit processing and 4 x oversampling ensure clean signals that can be used in the most demanding applications. Composite signals are decoded using an adaptive comb filter. An infinitely adjustable timing system genlocks to your house reference.

The built-in time base corrector/frame synchronizer allows for removal of time base error present in the composite input. The 5330 accepts asynchronous inputs and delivers serial outputs locked and timed to house reference. Robust signal handling ensures proper time base correction for virtually any source, even a consumer VHS machine. On loss of input, the output can mute to black or freeze on the last good frame of video.

A Detail Enhancer recovers information that has been lost due to poor frequency response in upstream systems. The Predictive Composite Clipper mode identifies picture elements that would be illegal in analog composite, and limits color saturation and luminance excursions. Proc controls are also provided.

The optional 6330 sub module provides embedding of analog or AES audio. Analog inputs are digitized at 24 bits of resolution. Two AES inputs provide four channels of digital audio to the input selector. Sample rate converters can be selected in the AES input path, allowing the use of asynchronous digital sources. A four channel audio mixer provides level control, phase inversion and channel shuffling. The 6330 also has automatic tracking delay and bulk delay.



# 5330 and 6330

## Analog to SD Digital Video Converter and Embedder

### Features

- **Converts Y, Pr, Pb composite or Y/C (S-Video) to serial digital component**
- **Two or four serial digital outputs**
- **12 bit internal processing, 4 x oversampling**
- **Complete proc amp adjustments**
- **Adaptive comb filter**
- **Automatic 525/625 switching**
- **Memory registers**
- **Line selectable toothed blanking**
- **EDH detection and insertion**
- **TBC/Frame Synchronizer**
- **Optional embedder, audio shuffler and tracking delay**
- **110 Ω option**

### Analog Inputs

| | |
|---|---|
| Signal Type | SMPTE Y/Cr/Cb |
| | Beta Y/Cr/Cb |
| | NTSC, PAL Composite |
| | NTSC, PAL S-Video (Y/C) |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Input | ±1 volt DC |
| Input Hum | <100 mV |

### Reference Input

| | |
|---|---|
| Number | Two: |
| | One external |
| | One internal Master Timing Ref |
| Type | 1 V P-P Composite Video |
| | PAL or NTSC |
| Impedance | 75 Ω |
| Return Loss | >40 dB |

### Analog to SDI Performance

| | |
|---|---|
| Bit Resolution | 12 bit input quantization |
| | 4 x oversampling |
| Signal to Noise | >62 dB, weighted |
| Frequency Response | |
| Composite, Y | ±0.1 dB, 0 to 5.5 MHz |
| Cr, Cb | ±0.1 dB, 0 to 2.75 MHz |

### Serial Output

| | |
|---|---|
| Number | Two or Four (selectable) |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | 1 line, adjustable up to 1 frame |

### Analog Audio Input (6330 sub module)

| | |
|---|---|
| Analog Inputs | Four, Balanced Pair |
| Processing | 24 bits |
| Analog Input Z | >15 k Ω, balanced, transformerless |
| CMRR | >60 dB, 20 Hz to 10 kHz |

### AES Input (6330)

| | |
|---|---|
| Number | Two AES |
| Channels | Four total |
| Signal Type | AES Coaxial |
| | 20 or 24 bit |
| Impedance | 75 Ω |

### AES Outputs (6330)

| | |
|---|---|
| Number | Two AES or none (selectable) |
| Channels | Four total |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

### General Specifications

| | |
|---|---|
| Power Consumption | 10 watts (with both options installed) |
| Temperature | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

# 5350 and 5355

## 4 Channel Analog to SD Digital Video Converters

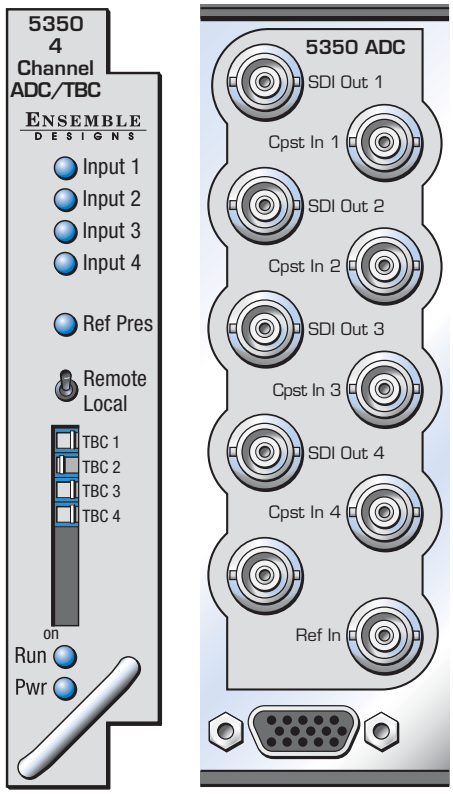
The Avenue 5350 and 5355 modules are four channel analog composite to serial digital video converters. Use these modules with routers, switchers, remote trucks or any application that requires many channels of high quality conversion.

12 bit analog to digital conversion, digital decoding of the composite input, and adaptive comb filtering ensure superior output signals. Proc amp functions allow adjustment of video, chroma, setup and hue.

5350 also has a genlock reference input and a TBC/Frame Sync for each of the four conversion channels. The 5350 can accept noisy inputs and is well suited for feeds from remote trucks and satellite receivers. Additionally, the 5350's outputs are independently timeable.

### Features

- **4 channels of conversion on one module**
- **4 analog inputs, four SDI outputs**
- **12 bit processing, 4 x oversampling**
- **PAL/NTSC auto detect**
- **Adaptive comb filter**
- **Proc amp**
- **5350 has TBC/Frame Sync, independently timeable outputs**
- **5350 accepts noisy inputs**
- **5350 has an internal color bar generator**



# 5350 and 5355

## 4 Channel Analog to SD Digital Video Converters

### Analog Video Inputs (4 each)

| | |
|---|---|
| Signal Type | Composite, NTSC or PAL |
| Impedance | 75 Ω |
| Return Loss | >40 dB DC to 5.5 MHz |
| Input DC | ±1 volt DC |
| Input Hum | <100 mV |

### Reference Input (5350 only)

| | |
|---|---|
| Signal Type | 1 V P-P Composite Video, PAL or NTSC |
| Impedance | 75 Ω |
| Return Loss | >40 dB |

### Serial Digital Outputs (4 each)

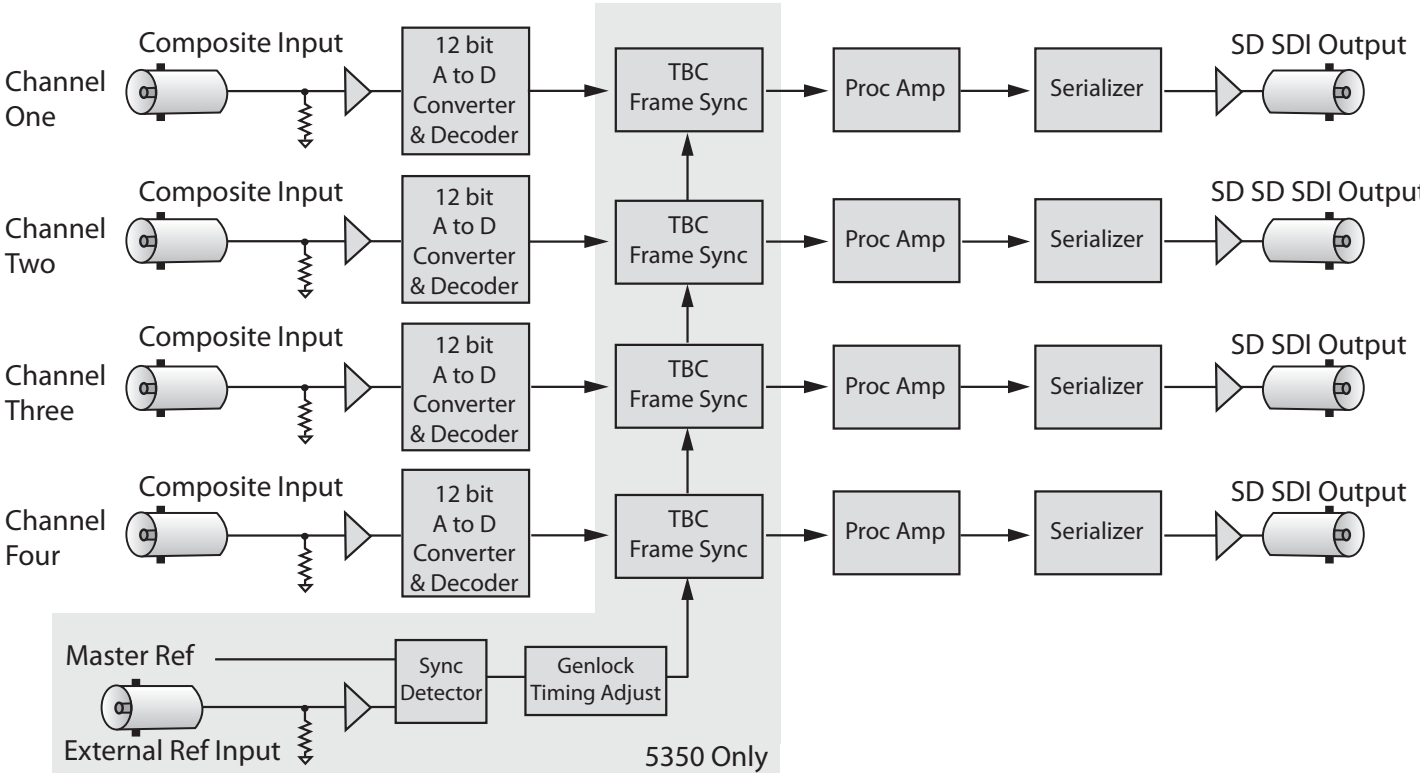
| | |
|---|---|
| Signal Type | SMPTE 259 |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | 5350: 1 line, adjustable up to 1 frame<br>5355: 1 line |

### Analog Video to SDI Performance

| | |
|---|---|
| Bit Resolution | 12 bit input quantization, 4 x oversampling |
| Decoding | Adaptive Comb Filter, 3 or 5 line selectable |
| Signal to Noise | >62 dB, weighted |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |

### General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 5360 and 5365

## 4 Channel Analog to SD Digital Video Converters and Embedders

The Avenue 5360 and 5365 modules convert four channels of analog video and audio to four streams of SD SDI with embedded audio. Use these modules with routers, switchers, remote trucks or any application that requires many channels of high quality video and conversion. This is a perfect solution for satellite installations that need to feed a large number of analog signals from IRDs into a monitor wall.

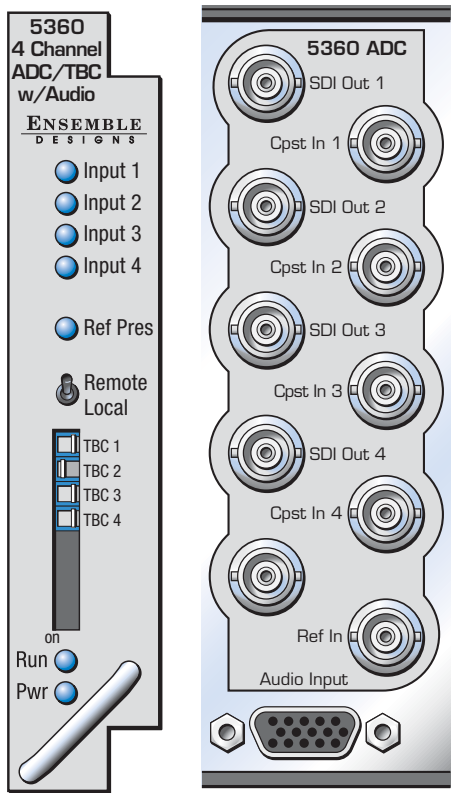
12 bit analog to digital conversion, digital decoding of the composite input, and adaptive comb filtering ensure superior output signals. Proc amp functions allow adjustment of video, chroma, setup and hue.

Analog audio inputs are digitized at 24 bits of resolution and then embedded into the associated video signal.

5360 also has a genlock reference input and a TBC/Frame Sync for each of the four conversion channels. The 5360 can accept noisy inputs and is well suited for feeds from remote trucks and satellite receivers. Additionally, the 5360's outputs are independently timeable.

### Features

- **Four channels of conversion and audio embedding on one module**
- **Four analog video inputs, four SDI outputs**
- **12 bit processing, 4 x oversampling**
- **Analog audio inputs, 1 stereo pair per video input**
- **24 bit, 256 x oversampled audio processing**
- **PAL/NTSC auto detect**
- **Adaptive comb filter**
- **Proc amp**
- **5360 has TBC/Frame Sync, independently timeable outputs**
- **5360 accepts noisy inputs**
- **5360 has an internal color bar generator**




### Analog Video Inputs (4 each)

| | |
|---|---|
| Signal Type | Composite, NTSC or PAL |
| Impedance | 75 Ω |
| Return Loss | >40 dB DC to 5.5 MHz |
| Input DC | ±1 volt DC |
| Input Hum | <100 mV |

### Reference Input (5360 only)

| | |
|---|---|
| Signal Type | 1 V P-P Composite Video, PAL or NTSC |
| Impedance | 75 Ω |
| Return Loss | >40 dB |

### Serial Digital Outputs (4 each)

| | |
|---|---|
| Signal Type | SMPTE 259 |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | 5360: 1 line, adjustable up to 1 frame |
| | 5365: 1 line |

### Analog Audio Input (2 per video input)

| | |
|---|---|
| Analog Inputs | Eight, unbalanced pair |
| Processing | 24 bits |
| Analog Input Z | >15 k Ω, unbalanced, transformerless |

# 5360 and 5365

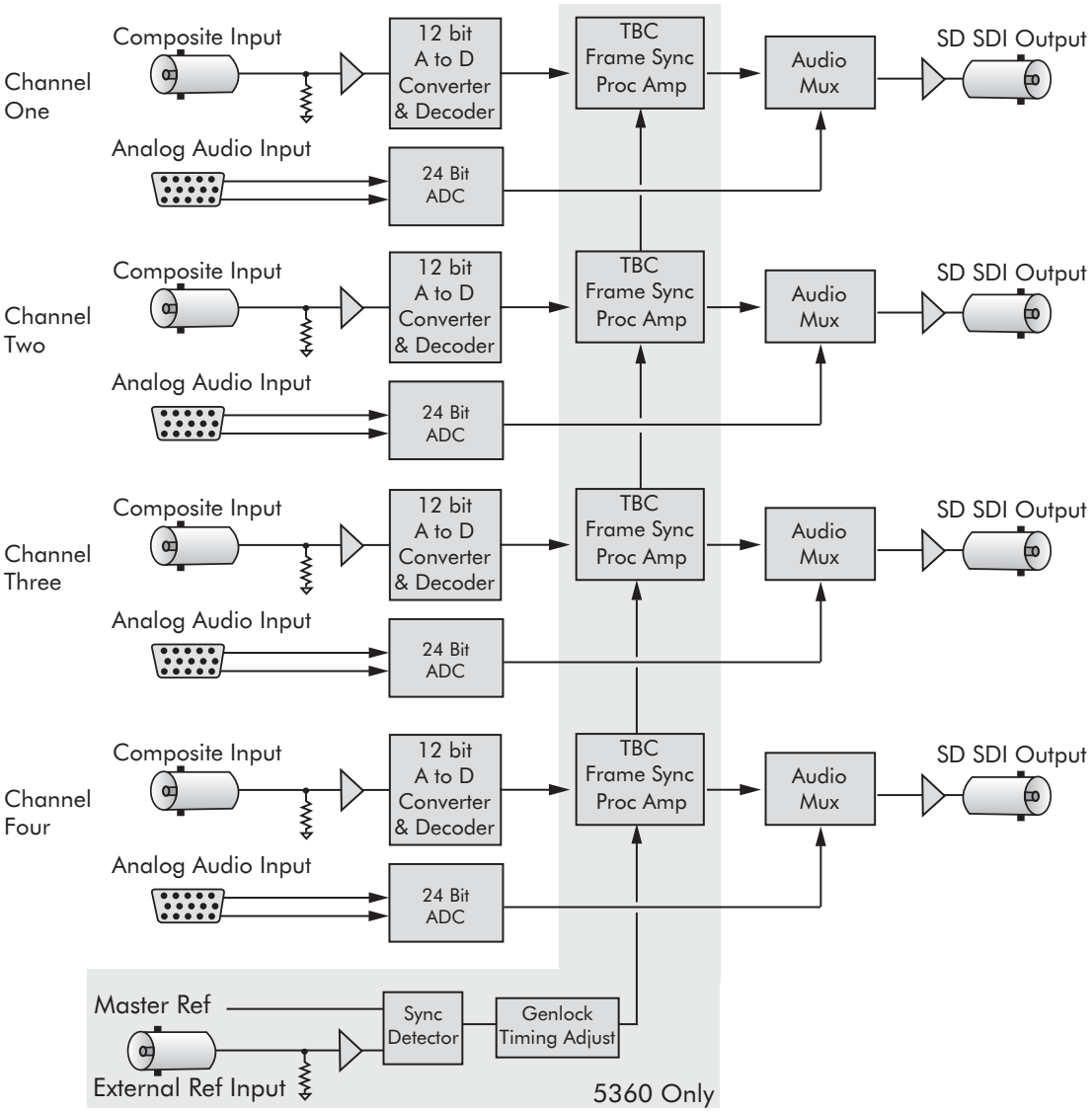
## 4 Channel Analog to SD Digital Video Converters and Embedders

### Analog Video to SDI Performance

| | |
|---|---|
| Bit Resolution | 12 bit input quantization, 4 x oversampling |
| Decoding | Adaptive Comb Filter, 3 or 5 line selectable |
| Signal to Noise | >62 dB, weighted |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |

### General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 5385
## Analog Composite to SD Digital Converter

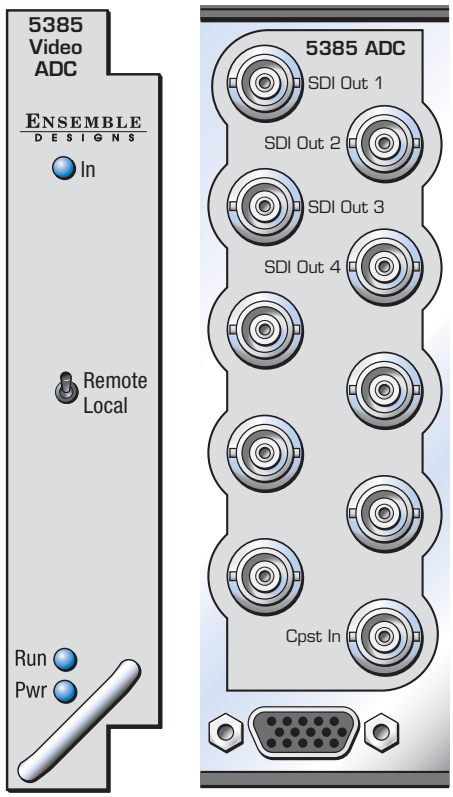
The 5385 module converts analog composite video to serial digital component. Its 12 bit processing and 4 x oversampling ensure clean signals that can be used in the most demanding applications.

The analog input is digitally decoded with sophisticated filtering to cleanly separate chroma and luminance content. The user selectable adaptive comb filter can be set to 3 line or 5 line mode. Complete proc controls provide adjustment for video, chroma, setup and hue. The SDI output is synchronous with respect to the analog video input.

Module parameters can be monitored and controlled both locally and remotely. Remote control is accessed with an Avenue Control Panel or through Avenue PC Software.

### Features

- **Converts composite to serial digital component**
- **Four serial digital outputs**
- **12 bit processing, 4 x oversampling**
- **Complete proc amp adjustments**
- **Adaptive comb filtering**
- **Memory registers**
- **Auto-senses PAL/NTSC**
- **Local and remote control**



# 5385
## Analog Composite to SD Digital Converter

### Analog Video Input

| | |
|---|---|
| Signal Type | Composite, NTSC or PAL |
| Impedance | 75 Ω |
| Return Loss | >40 dB DC to 5.5 MHz |
| Input DC | ±1 volt DC |
| Input Hum | <100 mV |

### Serial Digital Output

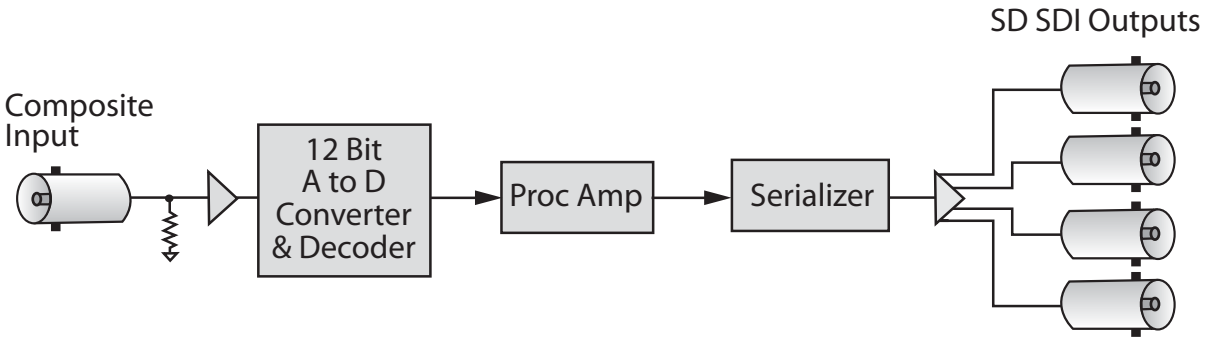
| | |
|---|---|
| Number | Four |
| Type | SMPTE 259 |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | 1 line |

### Analog Video to SDI Performance

| | |
|---|---|
| Bit Resolution | 12 bit input quantization, 4 x oversampling |
| Decoding | Adaptive Comb Filter, 3 or 5 line selectable |
| Signal to Noise | >62 dB, weighted |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |

### General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

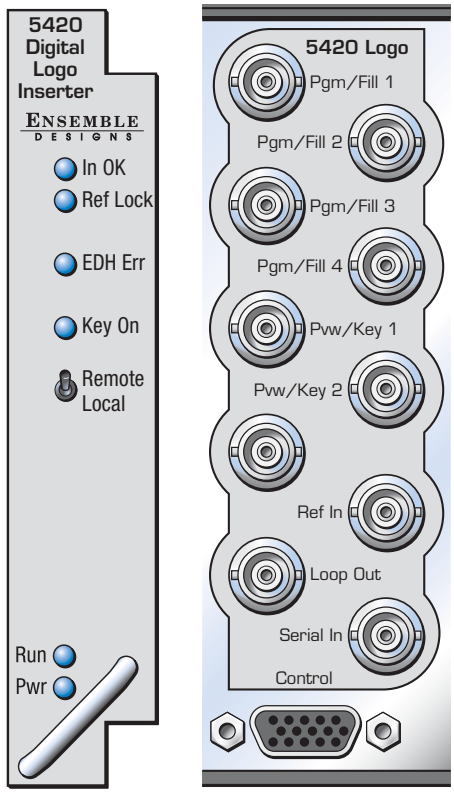


# 5420
## SD Logo Inserter

The 5420 Logo Inserter module keys a still logo or an animation over program material. Alternately the 5420 can supply separate fill and key to a production switcher. This module can be used in an Avenue 3RU or 1RU frame.

Generate logos and animations in your favorite graphics software and then upload them into the 5420's nonvolatile flash memory. Multiple logos and animations of varying sizes can be stored.

Logo position and logo density can be adjusted from the Avenue Control System, using an Avenue Touch Screen or Avenue PC, GPIs, serial interface and Ethernet are also available for control. Sequences of logos, animations and transitions can be programmed.




## Features

- **Key still logos and animations**
- **User upload of logos over serial or Ethernet**
- **Store multiple logo and animations of varying sizes**
- **Logo H and V positioning**
- **Density (Transparency) control of logo**
- **Fade or cut keys on/off**
- **Digital linear additive keying**
- **Program and preview outputs or key and fill outputs**
- **10 bit uncompressed logo storage in flash memory**
- **Full 10 bit keying and processing**
- **Includes software for logo management**
- **Program sequences of logos, animations and transitions**
- **Control through RS-232 serial, Ethernet, GPI triggers (8), or the Avenue Control System**
- **User defined input failure logo**
- **EDH monitoring and insertion**
- **Passes embedded audio**
- **525 and 625 operation**

## Serial Input

| | |
|---|---|
| Number | One |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |
| Max Cable Length | 300 meters Belden 1694A |

## Serial Output

| | |
|---|---|
| Number | Two Program/Fill, Two Pvw/Key |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |
| Output DC | None (AC coupled) |
| Delay | <740 µSec |

## Serial Loop Thru Output

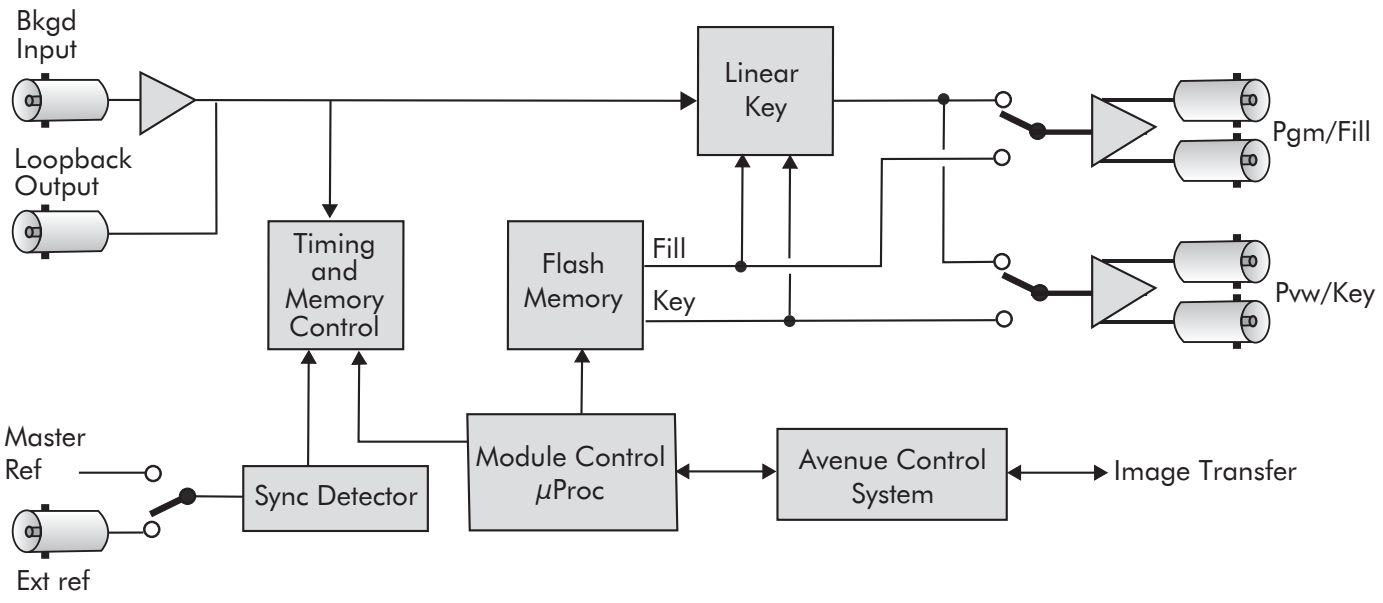
| | |
|---|---|
| Number | One, reclocked |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |

## Memory and File Specifications

Nonvolatile flash memory
2 million pixels (approximately 5 frames)
Any size/mix of targa stills and animations
(i.e.: 200 logos that are 100 x 100 pixels)

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40 °C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 5455
## SD Protection Switch

The 5455 module is a fail-safe, bypass protection switch for critical standard definition serial digital paths for broadcast or satellite applications. When a fault is detected in the primary input, and the secondary input is verified as good, the switch will activate causing the secondary input to be switched to the module's output. The 5455 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure.

The health of the video signal is determined by monitoring crucial parameters in order of increasing complexity: Timing Reference Signal (TRS), or a persistent loss of digital sync is tested first. Black, Embedded Audio and Freeze are also evaluated. Each test can be configured by the user. For example, the sophisticated Black Detector includes configurable parameters for black level threshold, pixel count, and duration time.

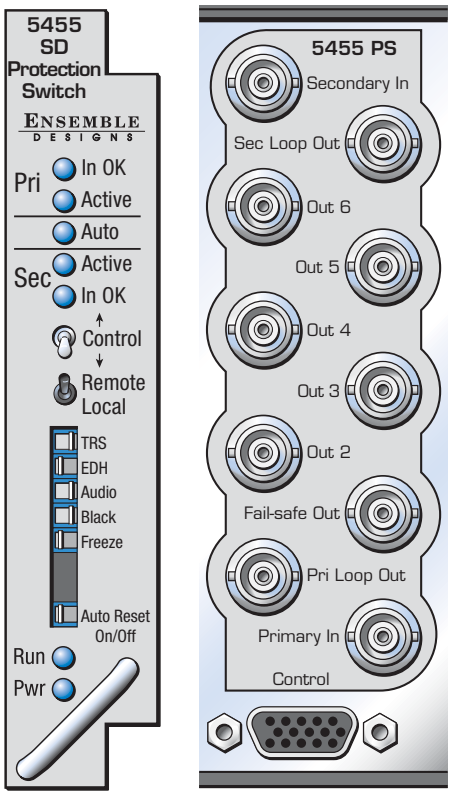
The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 5455 to switch to the secondary input after a video freeze condition is detected in the primary input.

The switch can operate in two modes; automatic or nonresetting. In fully automatic mode, the 5455 will automatically switch back to the primary signal once it's been restored. In the nonresetting mode, the secondary input remains routed to the output, even after the primary input has recovered.

Controls are easily accessed through an Avenue Control Panel, Avenue PC, GPIs, or front edge module controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

### Features

- **Fail-Safe Bypass Protection Switch for Critical SD SDI Signals**
- **Detects TRS, Black, Silence, and Freeze**
- **Detection specifics are user programmable**
- **Passes embedded audio**
- **Alarm generation**
- **Remote control and monitoring**



## Serial Digital Input

| | |
|---|---|
| Number | Two |
| Type | SD Serial Digital 270 Mb/s SMPTE 259M<br>625i 50 or 525i 59.94 |
| Automatic Cable Input Equalization | |

## Serial Digital Loopback

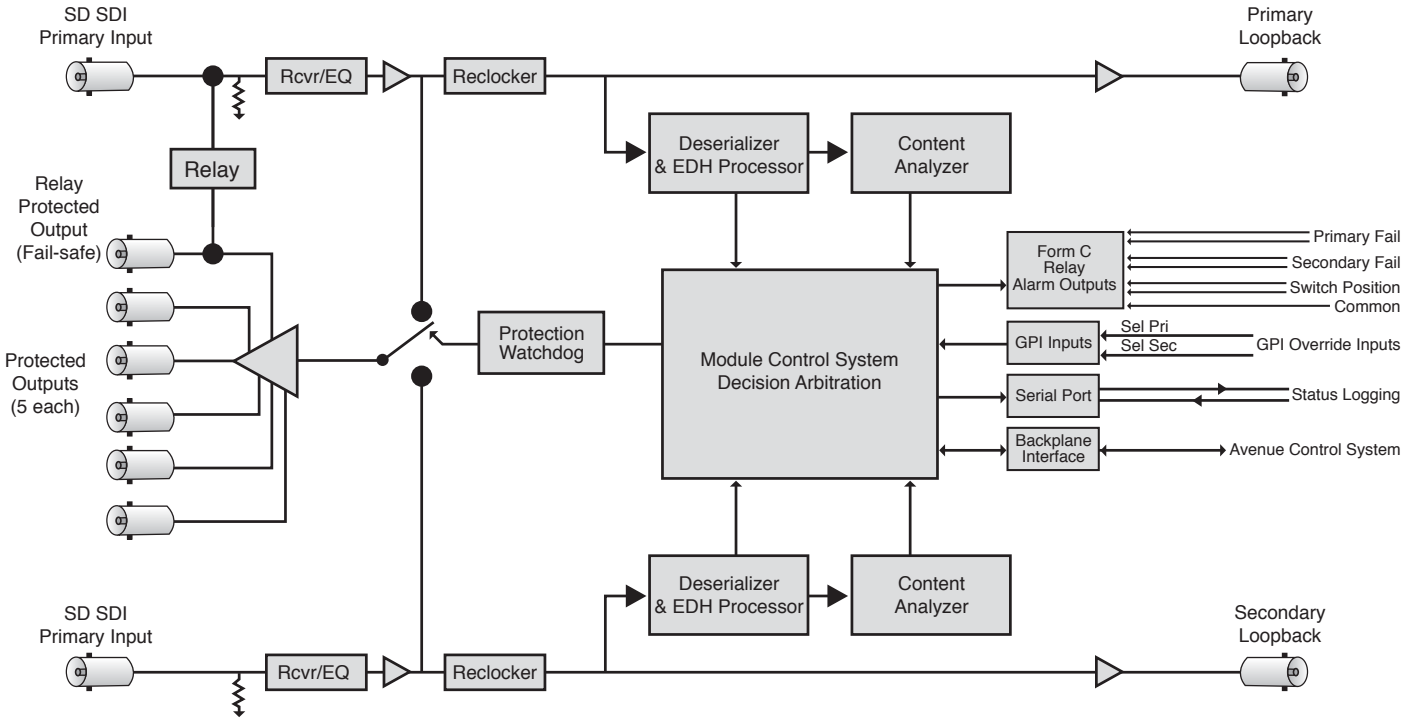
| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

## Serial Output Signal

| | |
|---|---|
| Number | Six total<br>One fail-safe bypass output<br>Five outputs |
| Signal Type | SD Serial Digital 270 Mb/s |
| Impedance | 75 Ω |

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 4 each 0.75 Amp PTC resettable fuse with each domain of the module independently regulated |



# 5470
## SD Proc Amp and Legalizer

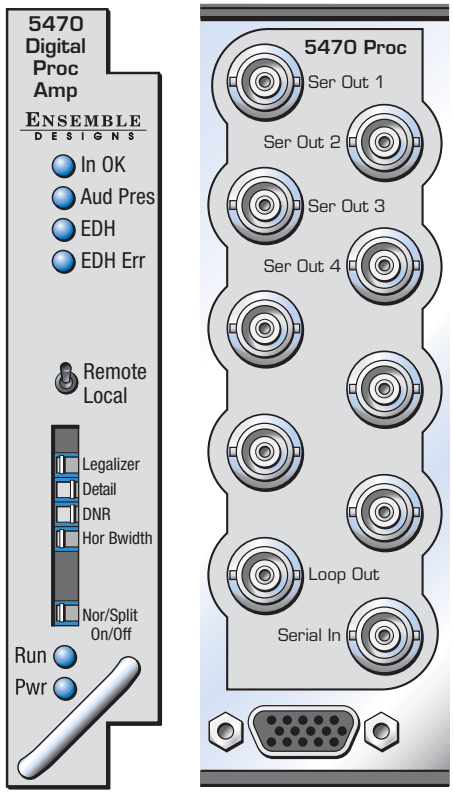
The 5470 is a full featured serial digital processing amplifier that is perfect for adjusting and legalizing SD SDI sources. All processing is done in the digital domain, ensuring a pristine output. When set to unity, the 5470 is completely transparent.

Proc controls include level adjustment, NTSC style hue rotation, along with video, chroma and setup. Black and White clips can be set as desired. The Detail Enhancer recovers information that has been lost due to poor frequency response in upstream systems. A Split Screen mode allows you to compare the processed output with the original nonprocessed input.

Certain values represented in serial digital component may be illegal in the PAL or NTSC domains. The 5470's Predictive Composite Clipper mode looks for and alters those values that would be illegal in analog composite, ensuring the output can be used for transmission.

Embedded audio and ancillary data are passed. If the video processing path has any delay, the embedded audio is delayed accordingly.

As with all Avenue modules, extensive remote control options are available with an Avenue Control Panel and Avenue PC.




## Features

- **Video, chroma, setup and hue controls**
- **Predictive Composite Clipper for legalizing signals**
- **Black and white clips, hard and soft**
- **Offset adjustments for Cr and Cb for black balance correction**
- **Split Screen comparison mode**
- **Sharpness filter for detail recovery**
- **10 bit processing**
- **Passes embedded audio**
- **Passes or strips ancillary data**
- **EDH monitoring and insertion**
- **Memory registers**
- **Auto 525/625 operation**
- **Remote control and card edge control**
- **Optional Digital Noise Reducer can be added**

## Serial Input

| | |
|---|---|
| Number | One |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 300 meters Belden 1694A |

## Serial Output

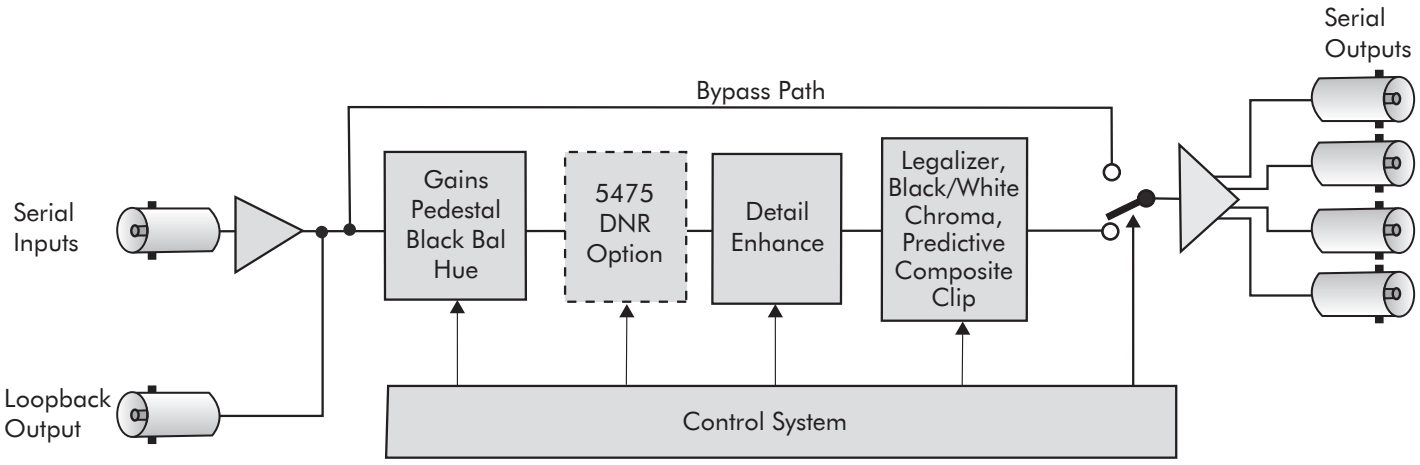
| | |
|---|---|
| Number | Four |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled)Delay<br>5470: <740 µSec<br>5475: No additional delay |

## Serial Loop Thru Output

| | |
|---|---|
| Number | One, reclocked |
| Signal Type | Serial Digital SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



# 5475
## Digital Noise Reducer

The 5475 Digital Video Noise Reducer is an optional sub module that can be added to the 5470 Digital Proc Amp module. The 5475 is motion and scene adaptive. It removes unwanted noise and artifacts, making it perfect for MPEG compression preprocessing and satellite feeds.

Several forms of noise reduction are employed to ensure the best possible performance. Horizontal Filtering is used to remove high frequency and impulse noise and to limit bandwidth for MPEG encoding. Recursive Temporal Noise filtering includes Simple Recursive, Motion Adaptive and Motion Adaptive with Impulse filter. Controls are provided for maximum signal-to-noise improvement and for noise threshold. These can be set manually or run in automatic mode.

Motion Adaptive Recursive Noise filtering works on a pixel-by-pixel basis, comparing the current frame to frames that have already been filtered. If the change that is detected is small, it is considered noise, while if it is large, it is considered motion or a scene change. The detection process uses an LMMSE (Linear Minimum Mean Square Error) filtering algorithm to evaluate the presence of motion. Combining this algorithm with recursive temporal filters preserves fine detail while reducing noise in the presence of motion, including rapidly moving objects and scene changes. Motion trails are minimized while avoiding hard-motion failures that some adaptive noise filters can exhibit.

User controls for the Motion Adaptive Recursive Filter include a Noise Threshold, based on how much noise is present in the incoming signal, and Maximum Signal to Noise Improvement, based on how much noise removal is desired. The threshold setting can be automatic or user-adjustable. When set to automatic, the noise level of the input signal is measured and the threshold is set accordingly. This simplifies the setup of the noise reducer and makes it responsive to varying input signal-to-noise levels. This minimizes the need for operator intervention to accommodate feeds of differing quality.

When the combined Motion Adaptive Recursive and Impulse Noise Filter is selected, temporal impulse noise filtering is used to remove high level, narrow noise impulses, without reducing fine stationary detail. Since the 5475 is used in conjunction with the 5470 Proc Amp, all the controls you need for level adjustments and clipping are included.

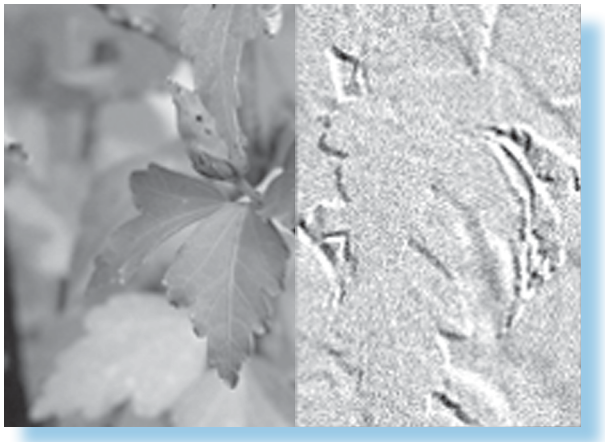
The Show Noise output mode displays what areas of the picture are being affected by the noise reducer. Noise is represented by white or black, while unaffected areas are represented in gray. This handy mode makes it easy to set optimum adjustments for the material being processed. The Split Screen mode lets you compare the processed output to the original signal.

### Features

- **Motion Adaptive Recursive and Horizontal filtering**
- **Frame based recursion**
- **Temporal Impulse Filtering**
- **Motion and Scene Adaptive**
- **Spatial and temporal modes**
- **Preprocessing for MPEG**
- **12 bit processing**
- **Minimal processing delay**
- **Automatic Noise Level sensing**
- **Automatic or Manual Reduction and Threshold setting**
- **Luma and Chroma Processing with separate controls**
- **Split Screen and Show Noise mode**
- **Luma Tie reduces cross-color artifacts**
- **Used in conjunction with 5470 Proc Amp – includes proc adjustments and detail enhancer**
- **Remote control and alarms**
- **Use with 525 or 625 signals**

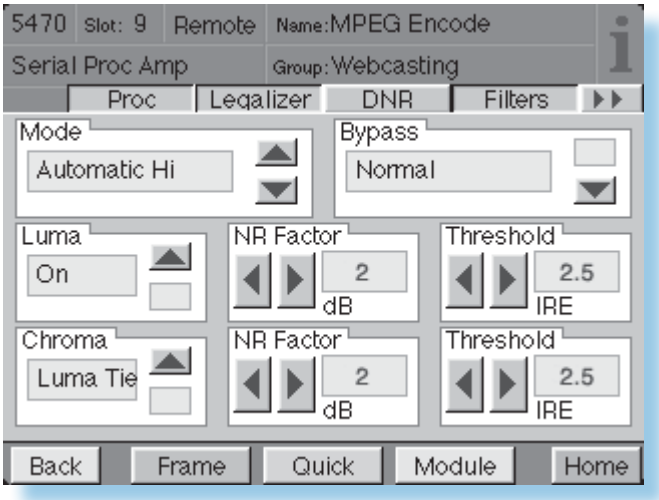
In addition to the 5475 motion-adaptive temporal filters, horizontal bandwidth filtering and luma chroma delay filters are provided. Sixteen tap 3/4, 1/2 and 1/4 luma bandwidth filters can be selected. Also sixteen tap 3/4 and 1/2 chroma bandwidth filters can be selected. These filters can be used to limit bandwidth before MPEG encoding. Simultaneously, the luma path delay can be adjusted relative to chroma path delay in approximately 2 nsec subpixel steps, providing the ability to correct luma-chroma delay errors in serial digital signals.

Since the 5475 is used in conjunction with the 5470 Proc Amp, all the controls you need for level adjustments and clipping are included.



*The Show Noise feature displays the detected noise and residual motion which will be removed from the video*

*Split Screen displays the noise-reduced output next to the original scene*




*Complete control over all DNR functions*

# 5820
## GPI/Serial Interface

The 5820 GPI/Serial Interface module extends the capability of the Avenue Control System enabling third party equipment to control Avenue modules. The 5820 provides General Purpose Interface control (GPI contact closure) over modules located anywhere in an Avenue system. It also provides RS-232/RS-422 serial interface access for use with show controllers and automation systems.

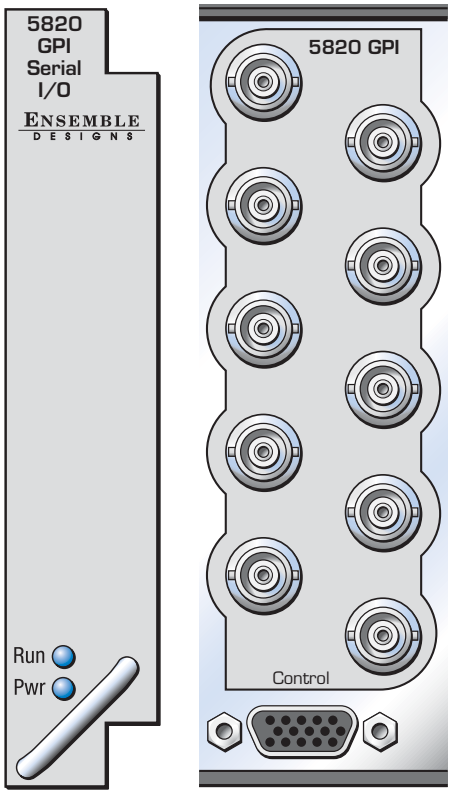
To use the 5820, just install it in any Avenue frame in the system and connect the 5820's GPIs or serial interface to your automation system or other third party device. Using the Avenue Control System, the 5820's GPIs and serial inputs can be mapped to any Avenue module in the system. When a GPI or serial command is received by the 5820, a message is sent to the corresponding Avenue module. That module then recalls the specified memory register.

The 5820 module takes full advantage of the Avenue Control System and is able to communicate with any other module located in any Avenue frame. Using M2M™ (Module To Module) communication, the 5820 acts on GPI contact closures, or serial commands, by sending configuration recall commands to another module. From the serial interface port of the 5820, an external device can also activate the same recall functions. Supporting both RS-232 and RS-422 interfaces, the simple ASCII-based protocol allows easy interconnection to any control system.

The 5815 is an optional 1RU control panel that serves as a shot box. It has eight illuminated status push buttons that can also be used for manual override and status in automated systems. Configuration and monitoring of the 5820 is also available through an Avenue Control Panel and Avenue PC software.

### Features

- **Enables third party equipment to recall memory registers of any Avenue module**
- **GPI and RS-232/RS-422 control of any Avenue module**
- **Eight GPI ports, each independently configurable**
- **Serial interface for use with show controllers and automation systems**
- **One 5820 module can serve multiple purposes, multiple modules**
- **Easily integrate Avenue into existing control systems**

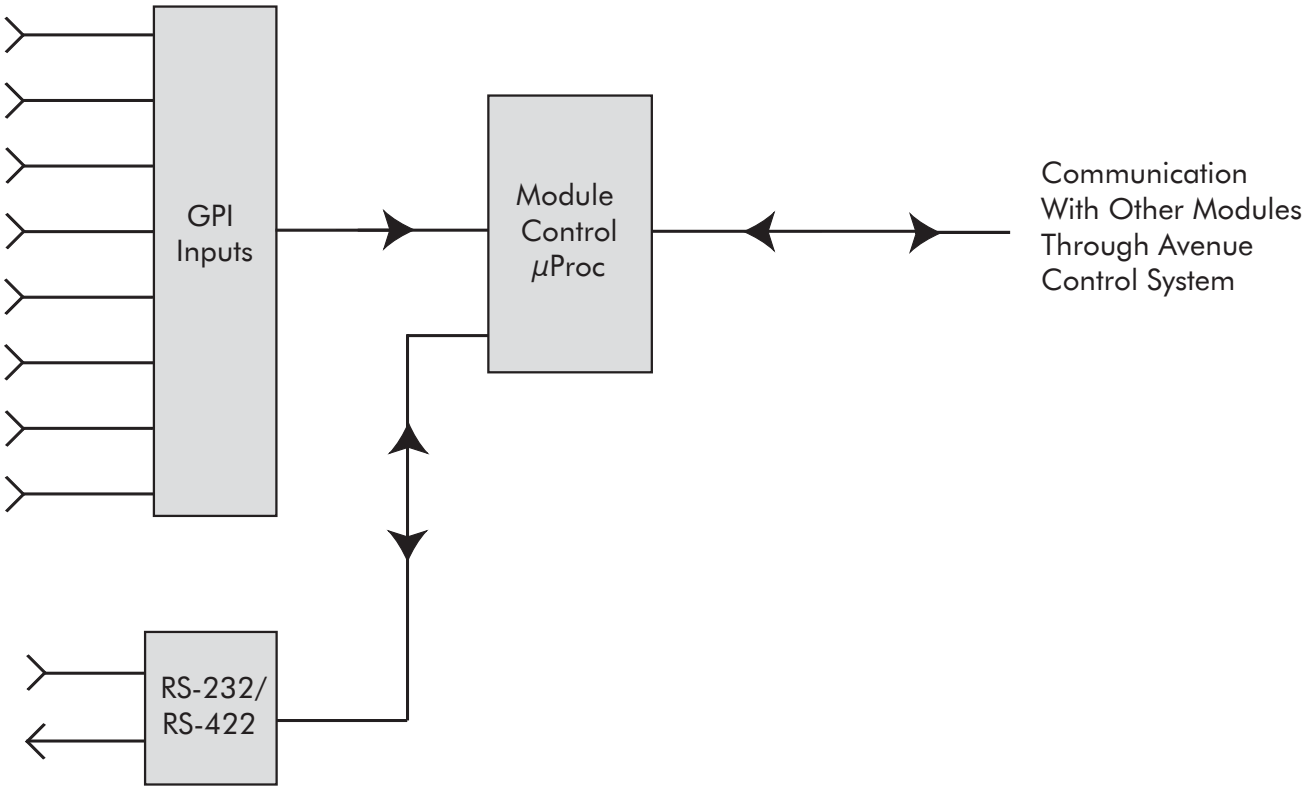


## Input Signal

| | |
|---|---|
| Number | Eight GPI,<br>One RS-232/RS-422 |

## General Specifications

| | |
|---|---|
| Power Consumption | <5.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



# 6010
## Analog to AES Converter

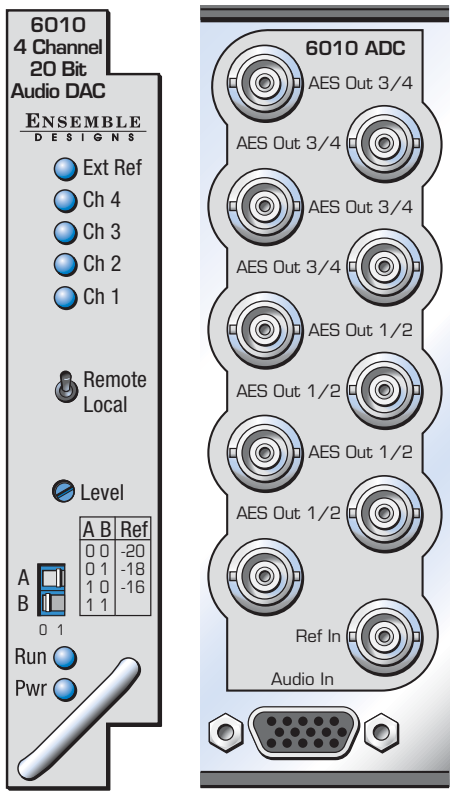
The 6010 module converts four channels of analog audio to two AES digital audio streams. Analog to digital conversion is performed with 24 bit precision for outstanding sonic performance. Use the 6010 to convert the audio outputs of your existing analog VTRs or any other high quality analog audio source. Like all modules in the Avenue series, the 6010 may be controlled either locally or remotely.

Four high impedance balanced analog inputs are provided on a high density 15-pin D connector. Two AES outputs (four copies of each) are provided on BNC connectors. The module has a built-in 48 kHz crystal-controlled sample rate clock, or it may be locked to an external AES3id reference. An LED is provided on the front of the module to indicate the presence of a valid external reference.

Four additional LEDs illuminate when the analog input signals reach reference digital output level. A dip switch allows reference digital output level to be set to -16, -18, or -20 dBFS. A rotary control is provided to set the gain of the analog input stages. All local controls and status indicators are available via the Avenue remote control system.

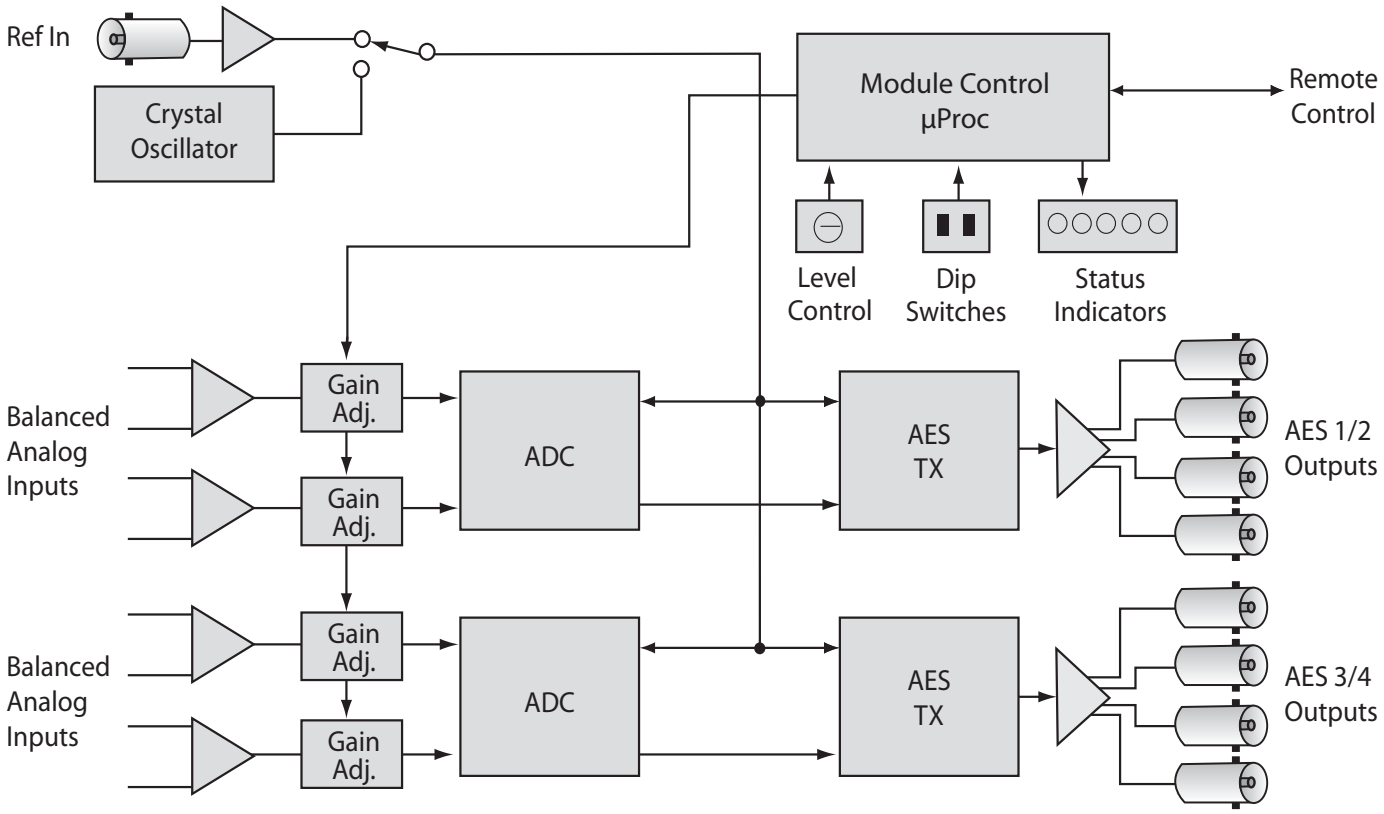
### Features

- **Four high impedance balanced analog inputs**
- **Two AES outputs (four copies of each)**
- **Selectable external AES reference or on-board crystal oscillator**
- **Gain trims on all four analog inputs**
- **Switch selectable digital reference level**
- **24 bit processing**
- **Local or remote control of all module settings**



## Specifications

| | |
|---|---|
| Analog input Z | >15 k Ω, balanced, transformerless |
| CMRR | >60 dB, 20 Hz – 10 kHz |
| Input gain range | -10 dBu to +8 dBu for -16, -18, -20 dBFS output |
| AES3id reference input | 1 V P-P, terminated in 75 Ω |
| AES3id outputs | 1 V P-P, 75 Ω source terminated |
| Sample rate | 48 kHz |
| Frequency response | +0/-0.1 dB, 20 Hz – 20 kHz |
| Crosstalk | <-84 dB, 20 Hz – 20 kHz |
| Dynamic range | 95 dB |



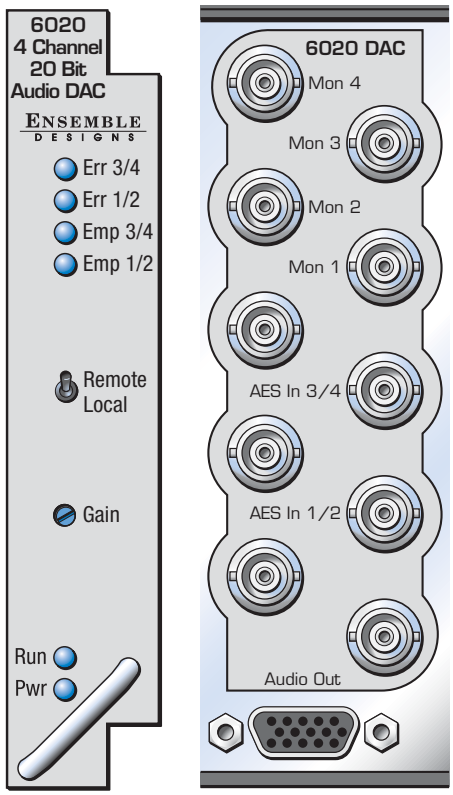
# 6020
## AES to Analog Converter

The 6020 module converts two AES digital audio streams to four channels of analog audio. Digital to analog conversion is performed with 24 bit precision for outstanding sonic performance. Use the 6020 to input digital audio signals to your existing analog VTRs or for any other application where digital audio signals must be fed to equipment with analog inputs. Like all modules in the Avenue series, the 6020 may be controlled either locally or remotely.

Two AES inputs are provided on BNC connectors. Four low impedance balanced analog outputs are provided on a high density 15-pin D connector. Two LED indicators are provided on the front of the module to indicate the presence of a valid AES input signal. Two additional LEDs indicate whether the emphasis flag is set on either of the digital inputs. If the emphasis flag is set, de-emphasis is automatically applied. A rotary control is provided to set the level of the analog outputs. All local controls and status indicators are available via the Avenue remote control system.

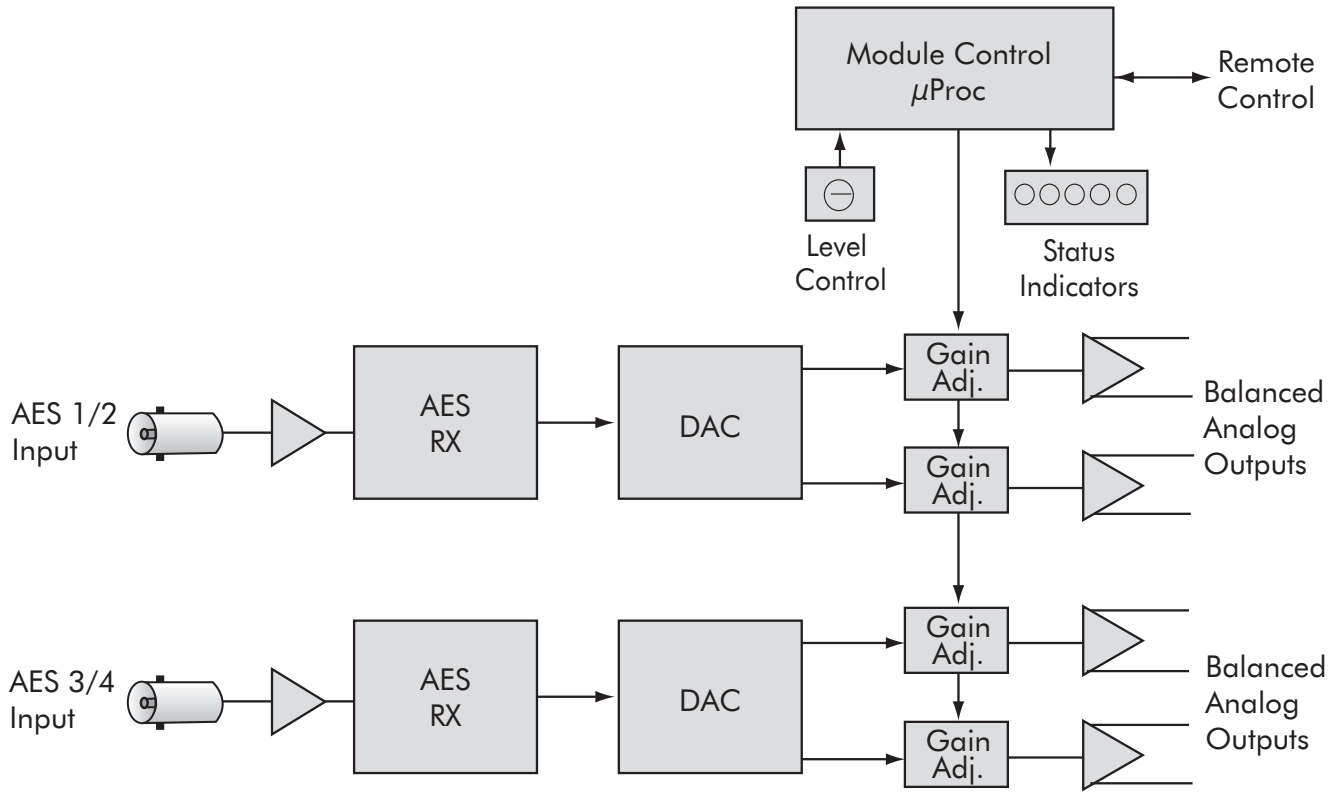
### Features

- **Two AES3id inputs**
- **Four balanced low impedance analog outputs**
- **Gain trims on all four analog outputs**
- **Operates with any sample rate from 30 to 50 kHz**
- **Detection and indication of input signal errors**
- **Detection and indication of input signals with the emphasis flag set**
- **24 bit processing**
- **Local or remote control of all module settings**



## Specifications

| | |
|---|---|
| AES inputs | 1 V P-P, terminated in 75 Ω |
| Sample rate | 30 kHz - 50 kHz |
| Analog output Z | 30 Ω, balanced |
| Output level | Adjustable from -10 dBu to +8 dBu for -20 or -18 dBFS input |
| Max output level | +24 dBu (bridging load), +22 dBu (600 Ω level) |
| Frequency response | +0/-0.2 dB, 20 Hz - 20 kHz |
| Crosstalk | <-84 dB, 20 Hz - 20 kHz |
| Dynamic range | 95 dB |



# 6600 Series

## Analog Audio DAs and Frame – Models 6601, 6601R and Frame 6600

The 6601 module is a high performance audio distribution amplifier for the broadcast and recording industry. Exceptional performance features include excellent response, noise and distortion specifications.

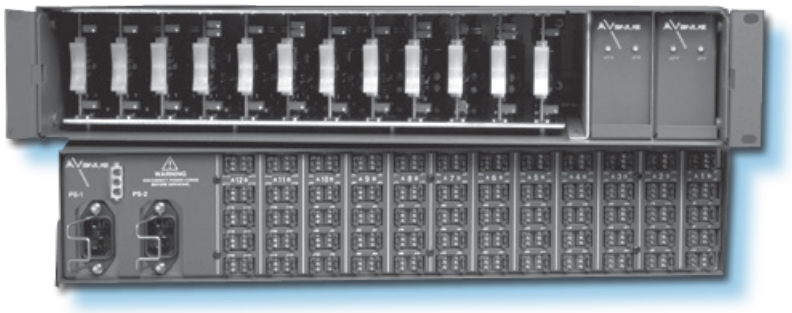
The 6601R module has all the capability of the 6601 plus selectable remote gain control. The amplifier offers a ±20 dB remotely controlled audio gain, which is selectable to either remote or local.

Both DA modules can be configured as mono or stereo with 8 balanced outputs (mono) or 4 balanced outputs per channel (stereo). Mode selected with a jumper on the module.

Up to twelve 6601 or 6601R audio amplifiers can be mounted in the 2RU Avenue 6600 frame. The 6600 frame is dedicated to audio distribution and pluggable terminal strips are standard on every frame. There is no need for rear modules or special adapters. Redundant power is an option. Power supplies are accessed from the front of the frame. This is a simple device and it does not tie into the Avenue Control System.

### Features

- **High performance analog audio distribution amplifiers**
- **8 mono outputs or 4 stereo outputs, jumper selectable**
- **Remote Gain Control available from rear of each module**
- **2RU frame with plugable terminal strip connectors**
- **Optional redundant power**



## Model 6601

### Input

| | |
|---|---|
| Impedance | >30 k Ω, balanced |
| Maximum level | +30 dBu (66 Ω), +24 dBm (600 Ω) |
| Common Mode Range | ±20 V |
| Common Mode Rejection (CMRR) | >90 dB @ 60 Hz, >60 dB @ 20 kHz |

### Outputs

| | |
|---|---|
| Channels | 1 (mono) or 2 (stereo) |
| Outputs per channel | 8 (mono) or 4 (stereo) |
| Output impedance | 66 Ω or 600 Ω balanced |
| Output isolation | >70 dB, 20 Hz to 20 kHz |
| Maximum level | +30 dBu (66 Ω),<br>+24 dBu (600 Ω) by special request |

### Performance

| | |
|---|---|
| Gain Range | -6 dB to +33 dB<br>(±6 dB on pot, 0, +9, +18,<br>+27 dB on jumpers) |
| Frequency response | <±0.05 dB, 20 Hz to 20 kHz, relative<br>to 1 kHz, up to +30 dBu (66 Ω),<br>+24 dBm (600 Ω) |
| Total Harmonic Distortion | <0.001%, 20 Hz to 20 kHz @<br>+30 dBu (66 Ω), +24 dBm (600 Ω) |
| S/N ratio | >100 dB @ unity gain<br>20 Hz to 20 kHz,<br>relative to +8 dBu, unweighted |
| Intermodulation distortion | <0.02% SMPTE @ +18 dBu (66 Ω) |
| Isolation between modules | >100 dB, 20 Hz to 20 kHz |
| Performance temperature | 5 – 40°C |
| Max operating temp range | 0 – 50°C |
| Power dissipation | <2 W |

## Frame 6600

### Audio DA Mounting Frame Specifications

| | |
|---|---|
| Number of modules | 12 (maximum) |
| Dimensions | 3.5 in x 19 in x 12 in |
| Nominal weight (with modules) | Approximately 16 lbs |
| Power Supply | Input voltage 90–260 VAC,<br>automatic selection |
| Frequency | 50/60 Hz |
| Power dissipation | 40 W |
| DC output | ±24 V |

## Power Supply 6600R

Redundant Power supply is optional

## Model 6601R

### Input

| | |
|---|---|
| Impedance | >30 k Ω, balanced |
| Maximum level | +30 dBu (66 Ω), +24 dBm (600 Ω) |
| Common Mode Range | ±20 V |
| Common Mode Rejection (CMRR) | >90 dB @ 60 Hz, >60 dB @ 20 kHz |

### Remote Gain

| | |
|---|---|
| Control | Local/remote, switch selectable<br>Accessed from rear of module |
| Type | DC control |
| Range | ±20 dB |

### Outputs

| | |
|---|---|
| Channels | 1 (mono) or 4 (stereo) |
| Outputs per channel | 8 (mono) or 3 (stereo) |
| Output impedance | 66 Ω or 600 Ω balanced |
| Output isolation >70 dB, 20 Hz to 20 kHz | |
| Maximum level | +30 dBu (66 Ω), +24 dBm (600 Ω) |

### Performance

| | |
|---|---|
| Gain range | ±20 dB |
| Frequency response | <±0.05 dB, 20 Hz to 20 kHz, relative<br>to 1 kHz, any level up to +30 dBu<br>(66 Ω), +24 dBm (600 Ω) |
| Total Harmonic Distortion | <0.001%, 20 Hz to 20 kHz @<br>+30 dBu (66 Ω), +24 dBm (600 Ω) |
| S/N ratio | >80 dB @ unity gain 20 Hz to 20 kHz,<br>relative to +8 dBu, unweighted |
| Intermodulation distortion | <0.02% SMPTE @ +18 dBu (66 Ω) |
| Isolation between modules | >100 dB, 20 Hz to 20 kHz |
| Performance temperature | 5 – 40°C |
| Max operating temp range | 0 – 50°C |
| Power dissipation | 2.5 W |

# 7130
## HD DA and Downconverter

The 7130 module has an HD SDI input with HD SDI, SD SDI and composite outputs, serving as both a downconverter and a distribution amplifier. If an SD SDI signal is input to the 7130, SD will pass to the outputs.

The 7130 performs automatic color space and gamma conversion to accommodate the differences between HD and SD. Output aspect ratio is selectable.

### Audio Handling

Four channels of analog audio output are provided for monitoring. Any of the sixteen embedded channels can be mapped and mixed to form these outputs.

Embedded audio is safely bypassed around the video with the lip sync preserved. Sixteen channels of embedded audio are supported. Audio processing is performed at 24 bit resolution.

### Control

The 7130 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock out, and customizable menus are just some of the tools included in the Avenue Control System.

### Metadata

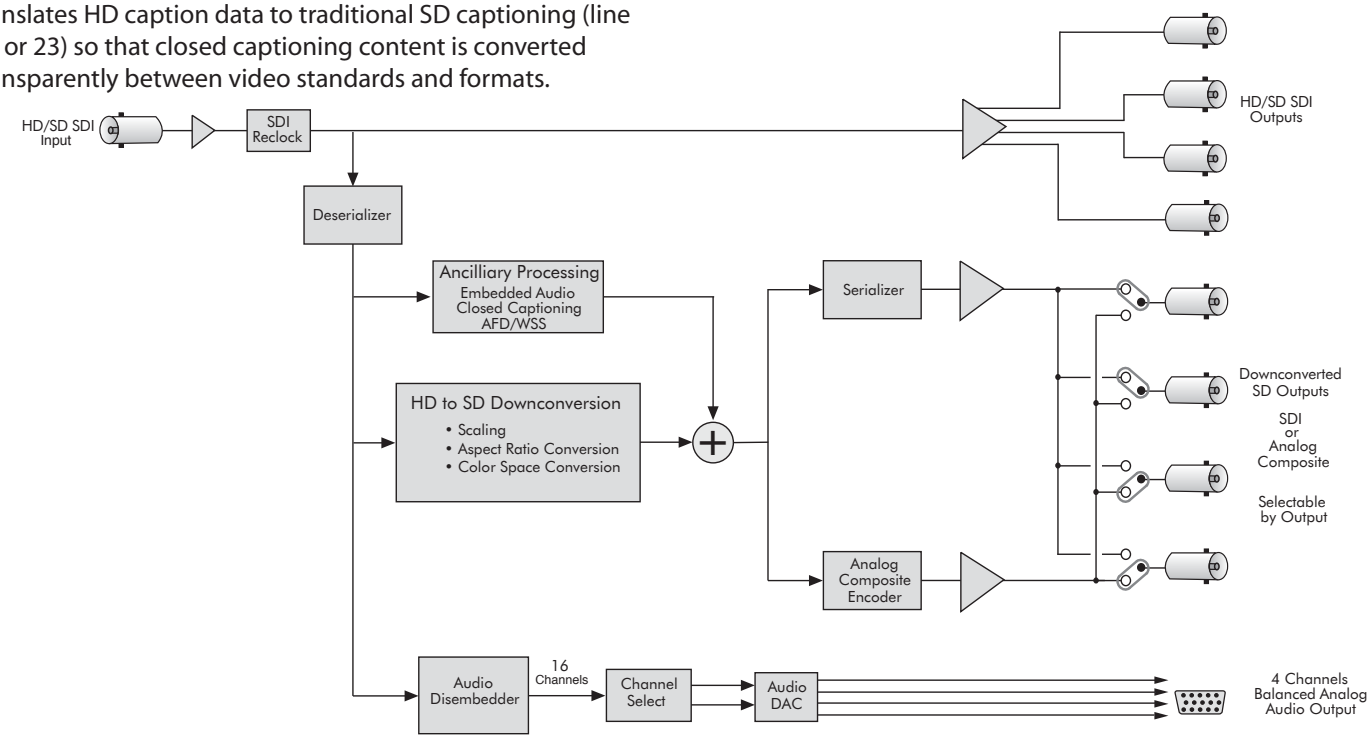
HD closed captioning is carried in data packets in the vertical interval ancillary data space. The 7130 properly translates HD caption data to traditional SD captioning (line 21 or 23) so that closed captioning content is converted transparently between video standards and formats.

### Automatic Aspect Ratio Conversion

The 7130 uses AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are read at the input of the module.

## Features

- **HD Downconverter and Distribution Amplifier**
- **Up to four processed SD SDI outputs**
- **Four SDI DA outputs**
- **Up to four composite outputs**
- **Downconverts HD 720p or 1080i to SD**
- **Distribution Amplifier for any HD or SD signal**
- **Supports AFD**
- **Translates HD closed captioning to SD closed captioning**
- **Passes 16 channels of embedded audio**
- **4 channels of analog audio for monitoring**
- **Auto detection of input standard and frame rate**
- **Local and remote control**



## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M (Both 525 and 625 SD standards) |
| Impedance | 75 Ω, BNC |
| Return Loss | >15 dB |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |

Automatic Cable Input Equalization

## Standards Supported

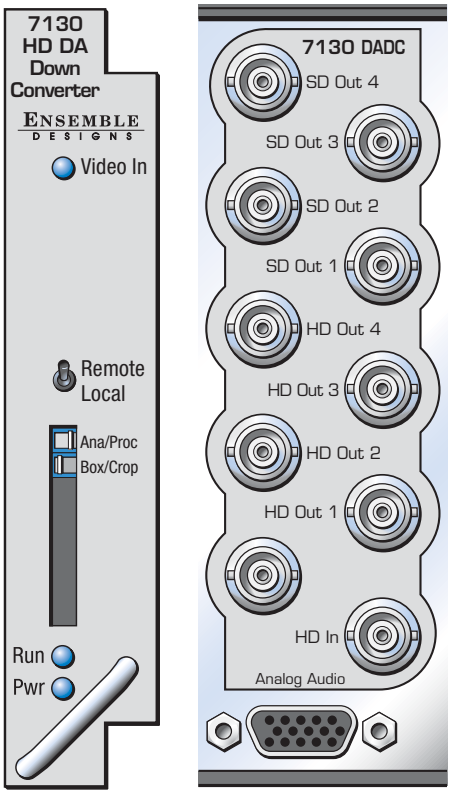
1080i 50, 59.94 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 Hz , SMPTE 296M -1,2,3
525i 59.94, 625i 50

## Conversion Directions

Downconversion from
1080i/59.94 or 720p/59.94 to 525 (NTSC) and
1080i/50 or 720p/50 to 625 (PAL)

## Serial Digital DA Outputs (unprocessed)

| | |
|---|---|
| Number | Four |
| Signal Type | HD or SD, follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | None |




## SD Serial Digital Outputs (processed)

| | |
|---|---|
| Number | Four max<br>Zero to four, jumper selectable<br>BNCs shared with composite outputs |
| Signal Type | SD Serial Digital 270 Mb/s SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | Downconverted output in vertical time with input |

## Analog Video Output

| | |
|---|---|
| Number | Up to four<br>Zero to four, jumper selectable<br>BNCs shared with SD SDI outputs |
| Signal Type | Composite, PAL or NTSC |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <50 mV |
| Resolution | 12+ bit processing |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| ScH Phase error | <±2 degrees |
| Differential Phase | <1 degree |
| Differential Gain | <1% |
| Delay | Downconverted output in vertical time with input |

## Analog Audio Output

| | |
|---|---|
| Number | Four (selectable from sixteen) |
| Signal Type | Balanced, transformerless |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x Oversampled |
| Reference Level | -10 dBu to +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 kHz |
| Crosstalk | <102 dB |
| Dynamic Range | >106 dB |

## Embedded Output

Support for all four groups (16 channels) from input to output

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

# 7160
## HD/SD Protection Switch and DA

The 7160 Serial Digital Protection DA module is a fail-safe bypass protection switch for monitoring and switching critical SD and HD paths in broadcast and satellite applications. When a fault is detected in the Primary input, the switch will activate, causing the Secondary (backup) input to be switched to the module's distributed outputs. The switch can operate in two modes; automatic or nonresetting.

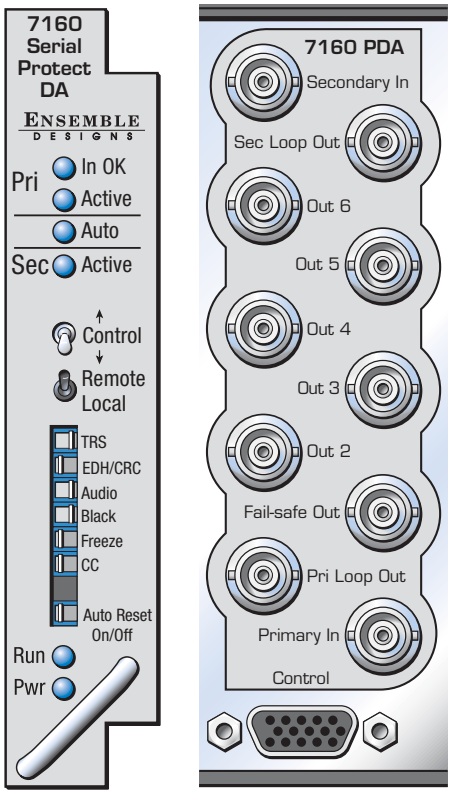
The 7160 monitors the integrity of the Primary serial digital input stream and analyzes the audio and video content. Signal health and fault detection is determined by monitoring any or all of the following parameters: Closed Caption Data, Timing Reference Signal (TRS), Black, Embedded Audio, Error Detection and Handling (EDH), CRCs, and Freeze.

A sophisticated Black detection system is employed to activate the switch in the event signal is lost. It allows the user to select not only the threshold and percentage of non-black pixels, but also the portion of the picture to be considered.

The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 7160 to switch to the secondary input after a video freeze condition is detected in the primary input.

### Features

- **Use for critical paths in broadcast and transmission to ensure staying on-air incase of primary signal fault**
- **Two serial digital inputs, four serial digital outputs**
- **Accepts SD and HD SDI inputs**
- **Detects TRS, CRCs, EDH, Black, Silence and Freeze**
- **Embedded audio detection**
- **Passes embedded audio**
- **Alarm generation**
- **Remote control and monitoring**



## Input Signal

| | |
|---|---|
| Number | Two |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M or SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |

Automatic Cable Input Equalization

## Standards Supported (auto-detected)

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50
525i 59.94

## Serial Digital Loopback

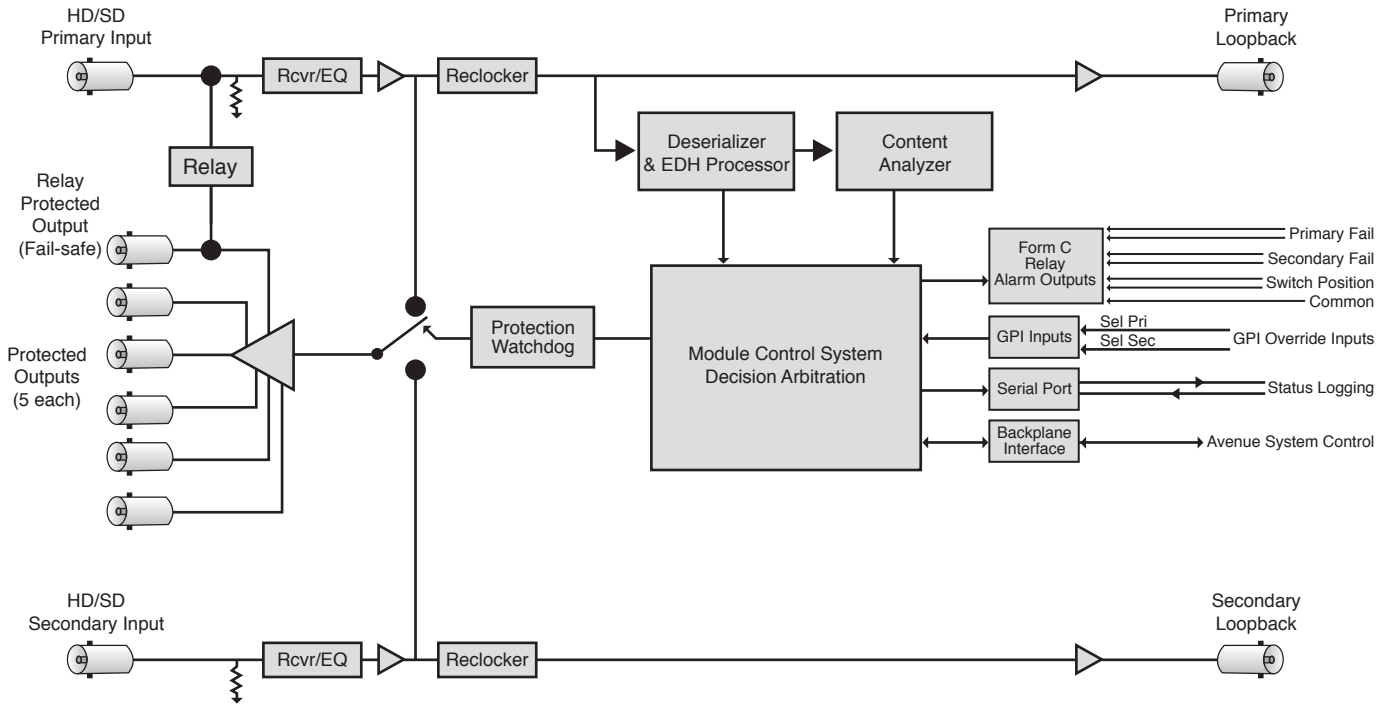
| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Signal Type | Follows input |
| Impedance | 75 Ω |

## Serial Output Signal

| | |
|---|---|
| Number | Six<br>Includes One Fail-Safe bypass output |
| Signal Type | Follows selected input |
| Impedance | 75 Ω |

## General Specifications

| | |
|---|---|
| Connectors | BNC |
| Power Consumption | <5 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |



# 7400
## HD/SD Sync Pulse Generator and Test Signal Generator

### 7400 SPG/TSG – Reliable and Easy-To-Use

The 7400 HD/SD Sync Generator and Test Signal Generator is a stable timing source that is perfect for local reference generation in broadcast, remote trucks and post. HD SDI, SD SDI, analog composite, Tri-Level Sync, timecode, AES audio and analog audio reference outputs are generated.

The 7400 can operate from an internal precision frequency reference as a stand-alone Master Sync Generator or lock to a video reference or 10 MHz precision reference. Alternately, the 7400-GPS option can be used. If the external reference is lost, the 7400's softlock provides a graceful transition to the internal TCXO, ensuring consistent reference output.

The 7400 can output multiple formats of Tri-Level Sync, HD SDI test signals, SD SDI and composite test signals, and color black reference. The 7400 can simultaneously deliver both 525 (NTSC) and 625 (PAL) based signals. Color framing tracks the reference signal. All of the video outputs are derived from the same time base and can be timed with respect to each other. The 7400 has two identical generators, Generator A and Generator B, each with a variety of outputs. Each set of outputs can be timed with respect to the reference to any point in the television frame. All of the outputs from a particular generator must be selected within the same frame rate family.

The Avenue Frame features a retainer bar to ensure that modules remain properly seated even in the most demanding mobile environments.

### Favorite Test Patterns

There are over 30 test signals including: Full and Split Field Bars at 75% and 100% with Pluge; Black; Flat Field; Pulse and Window; Ramp; Crosshatch; Safe Title; Blanking Markers; Cosite; Checkfield, Pathogenic, and 5 Step. The Cyclops feature adds a motion element to the selected video test signal to assist in locating a signal that might be frozen in a frame sync somewhere in the signal chain. An ID slate with user programmable text can overlay the test pattern.

### Customizable Test Patterns

In addition to the standard suite of test patterns, users can create custom test patterns on a computer. Simply transfer test patterns to the included Secure Digital flash memory card using Avenue Logo software and a standard SD card reader, then insert the memory card into the 7400. Custom test patterns can also include motion.

### Audio Generators

The 7400 provides extensive support for analog and digital audio. Because all of the video outputs can be locked to a common time base, the AES digital audio outputs are always synchronous with all of the video outputs – regardless of format. Multiple tone generators make it easy to identify multi-channel content. This bitstream will be included in the set of signals that can be embedded into the test signal outputs.

The audio section of each generator supports sixteen audio channels. The content of each channel is independently programmable. Choices include adjustable frequency tone generators, tone sweeps, silence and timecode. Left/Right Channel ID that synchronizes to the Cyclops feature can also be selected.

All sixteen of these channels can be embedded in the SDI outputs. Each AES output can select from any of the 8 pairs that make up these 16 channels. Similarly, the stereo analog output of each generator can be driven from any of these audio signal pairs.

### Multiple Timecode Generators

Multiple timecode generators make the 7400 convenient for post applications. Timecode is delivered as LTC both 75 Ohm BNC and 110 Ohm Balanced), VITC, and DVITC. One generator can be configured to produce 525/59.94 drop frame timecode while the other generator is making 1080sF/23.98.

### 7400-GPS Option for the Ultimate Precision Reference

For the ultimate in precision, the 7400-GPS option can be used with the 7400 module. The purpose of this GPS option is to provide an extremely precise frequency reference. The oscillator on the 7400-GPS is more accurate than a typical internal precision standard and is equivalent in accuracy to an atomic standard. Increased frequency accuracy makes it possible to frame synchronize signals between different facilities with virtually no dropped or doubled frames. The GPS option also provides precise time of day information, which can be used to drive the 7400 module's internal timecode generators.

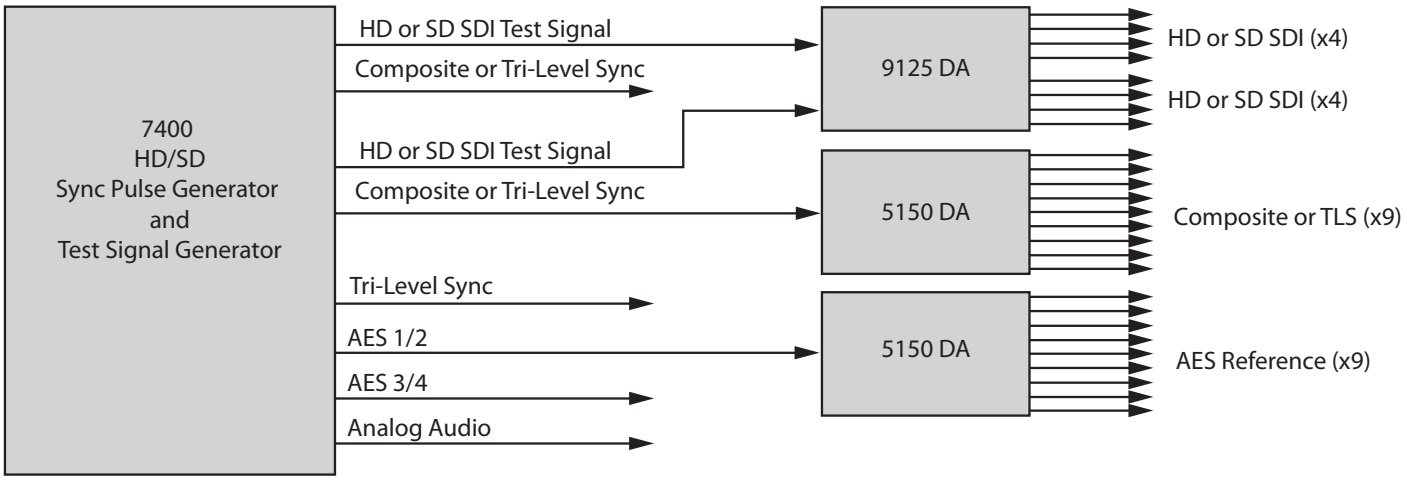
The 7400-GPS option seamlessly integrates into the Avenue system by plugging directly onto the 7400 module. It can be easily installed in the field. The 7400-GPS option consists of a compact, weatherproof antenna (with internal high-gain pre-amp) and a receiver sub module which mounts directly to the 7400 module. The included GPS antenna mounts onto standard 3/4" threaded pipe, metal or plastic. Connection from the F-style coaxial fitting on the antenna to the appropriate BNC on the Avenue Frame can be made with customer supplied standard 75 ohm cable. The coax cable can be routed through the center of the pipe for a completely waterproof installation. When low loss cable such as Belden 1694A is used, the antenna can be placed up to 200 feet (60 meters) from the frame. Ideally, the antenna is mounted outdoors where it has an unobstructed view of the sky.

## A Complete SPG and TSG System

The 7400 can be combined with other Avenue modules to create a complete sync pulse and test signal chain. The 7410 is a four channel Tri-Level Sync generator that can output four different types of Tri-Level Sync simultaneously and is very useful in post and hybrid facilities. The 5150 distribution amplifier can be used to distribute multiple copies of AES audio, Tri-Level Sync or composite black signals as needed. For HD test signal and black distribution, either the 9110 DA or 9125 DA are a good fit.

## Features

- **Use as Master Sync Gen or lock to external reference or GPS**
- **Can output SD SDI, HD SDI, composite, timecode and audio simultaneously**
- **Softlock provides graceful transition to internal TCXO if external reference is lost, ensuring consistent reference output**
- **Outputs can be independently timed**
- **Generates 30+ test signals**
- **Generates closed caption test sequence to test for compliance**
- **Dual Link test patterns**
- **Flash memory card for making custom test patterns**
- **Packages available for ease of ordering**



# 7400
## HD/SD Sync Pulse Generator and Test Signal Generator

*Description of Outputs*

### Generator A

**SDI Out A –** Outputs HD or SD test signals. Select frame rate family for all of Generator A; 59.94, 50 or 60. Output can include 16 channels of embedded audio. The embedded audio can be any combination of the following: tone, silence, external audio. Can also include DVITC.

**Programmable Out 1A –** Outputs analog composite black, composite 100% bars, or Tri-Level Sync from TLS Gen 1. When SDI Out A is a SD test pattern, this BNC can also output a composite version of that test pattern. Composite output can include VITC.

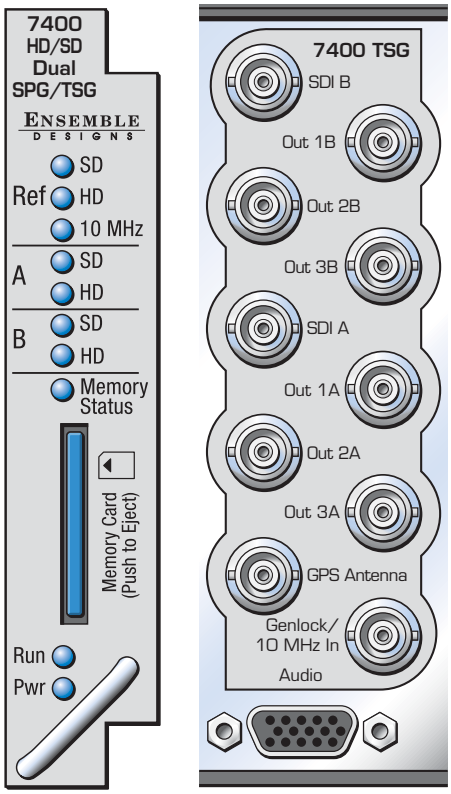
**Programmable Out 2A –** Outputs one of the following: Tri-Level Sync from TLS Gen 2 (can be different from Out 1A), LTC, AES (any of 8 pairs), AES silence, Word Clock, 6 Hz pulse, 10 MHz (only if locked to internal or GPS reference).

**Programmable Out 3A –** Outputs one of the following: Tri-Level Sync from TLS Gen 2 (same as Out 2A), LTC, AES (any of 8 pairs), AES silence, Word Clock, 6 Hz pulse, 10 MHz (only if locked to internal or GPS reference).

**Analog Audio –** Stereo output, 1 of 8 pairs from the audio generator.

### Generator B

Has the same outputs as noted for Generator A. Generator B is completely independent from Generator A. Generator B can operate in a different frame rate family and its set of outputs can be timed independently.




### Order Info

| | |
|---|---|
| 7400 | SPG/TSG Module |
| 7400-GPS | GPS receiver option that plugs onto 7400 module. (Does not take up a slot in Avenue frame) Includes weatherproof antenna. Antenna mounts onto standard 3/4" pipe. Customer to provide 75 Ω 1694A coax up to 60 m/200 ft with F connector for antenna connection and BNC for Avenue frame connection. |
| P74001 | HD/SD Sync Gen Package |
| P74012 | HD/SD Sync Gen Package with GPS |
| P74023 | Full Suite HD/SD Sync Gen Package with GPS |
| P74034 | Redundant HD/SD Sync Gen Package with Changeover |
| P74045 | Redundant HD/SD Sync Gen Package with GPS and Changeover |
| P74056 | Redundant Full Suite HD/SD Sync Gen Package with GPS and Changeovers |

## Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94
Composite PAL, NTSC

## Frame Rate Families

Each 7400 has 2 identical Generators, each with a variety of outputs.
All of the outputs from a particular Generator must be selected within the same frame rate family.
50 Hz (625) Derived Family: 1080i/50, 720p/50, 1080p/25, 1080sF/25, 625i/50
59.94 Hz (525) Derived Family: 1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98, 525i/59.94
60 Hz Derived Family: 1080i/60, 720p/60, 1080p/24, 1080sF/24

## Reference Input

| | |
|---|---|
| Number | Two |
| | One external (modules BNC) |
| | One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or |
| | Tri-Level Sync or |
| | 10 MHz 1V P-P sine or square |
| Return Loss | >40 dB (applies to external ref input) |

## Serial Digital Outputs

| | |
|---|---|
| Type | HD Serial Digital 1.485 Gb/s |
| | SMPTE 274M, 292M or 296M or |
| | SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 300 meters for SD 270 Mb/s Belden 1694A |
| | 100 meters for HD 1.485 Gb/s Belden 1694A |

## Tri-Level Sync Outputs

| | |
|---|---|
| Signal Type | Tri-Level Sync |
| Output DC | ±50 mV |
| Return Loss | >30 dB to 30 MHz |

## Composite Outputs

| | |
|---|---|
| Signal Type | NTSC/PAL |
| Impedance | 75 Ω |
| Return Loss | >40 dB DC to 5.5 MHz |
| Frequency Response | ±0.1 dB 0 to 5.0 MHz |
| Output DC | ±50 mV |
| K Factor | <1.0% |
| Differential Phase | <1.0 degree |
| SCH Phase | ±2 degrees |
| Delay | adjustable over full frame in sub degree steps |
| Color Framing | Tracks reference |

## Accuracy

| | |
|---|---|
| Internal Reference (TCXO) | |
| Freq Error | $<10^{-7}$ |
| | $< \pm 1$ Hz $F_{sc}$ |
| GPS Option | |
| Freq Error | $<10^{-12}$ |

## Stability

| | |
|---|---|
| Analog Jitter | <1 ns |
| Digital Jitter | <0.2 UI (0.13 UI typical) |
| AES Jitter | <1 ns |

## AES Audio Outputs

| | |
|---|---|
| Type | AES3id tone, 300 Hz to 1.6 KHz, or silent |
| Resolution | 24 bit |

## Analog Audio Outputs

| | |
|---|---|
| Number | Two stereo pairs or four mono |
| Type | tone, 300 Hz to 1.6 KHz, or silent |
| Impedance | 30 Ω, balanced |
| Reference Level | -10 to + 4 dBu, selectable |

## Additional Output Choices

| | |
|---|---|
| Timecode | DVITC on the SDI outputs |
| | VITC on the composite outputs |
| | LTC on BNC prgm 2/3 unbalanced or on HD-15 balanced, 1 V P-P |
| | drop or non-drop for NTSC |
| 6 Hz Pulse | |
| Word Clock | |
| 10 MHz | when locked to internal or GPS reference |

## Flash Memory

| | |
|---|---|
| Number | One |
| Type | Secure Digital SD Flash Memory Card |
| Size | 2 GB card included |

## File Type

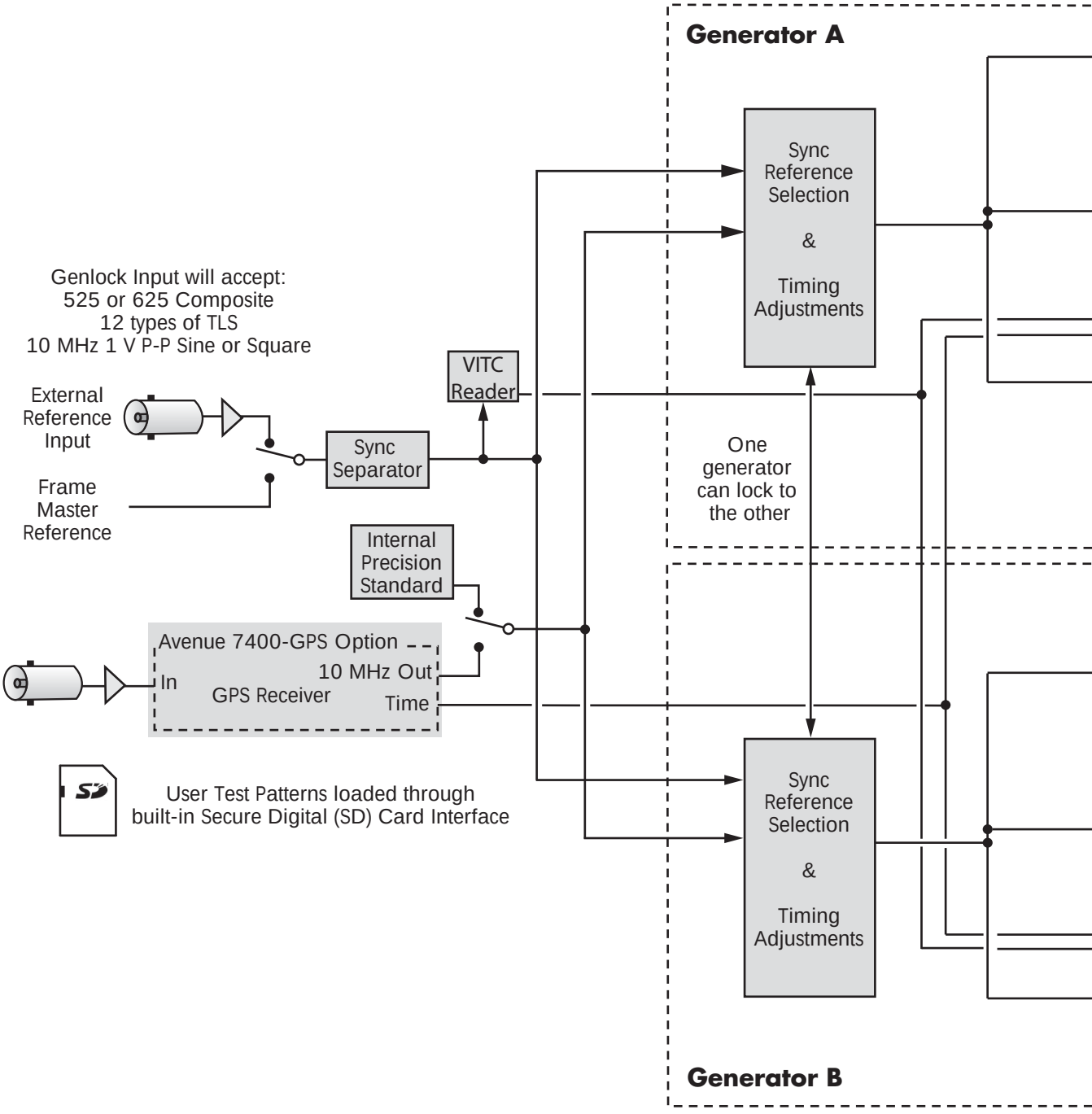
| | |
|---|---|
| Video | .tga |

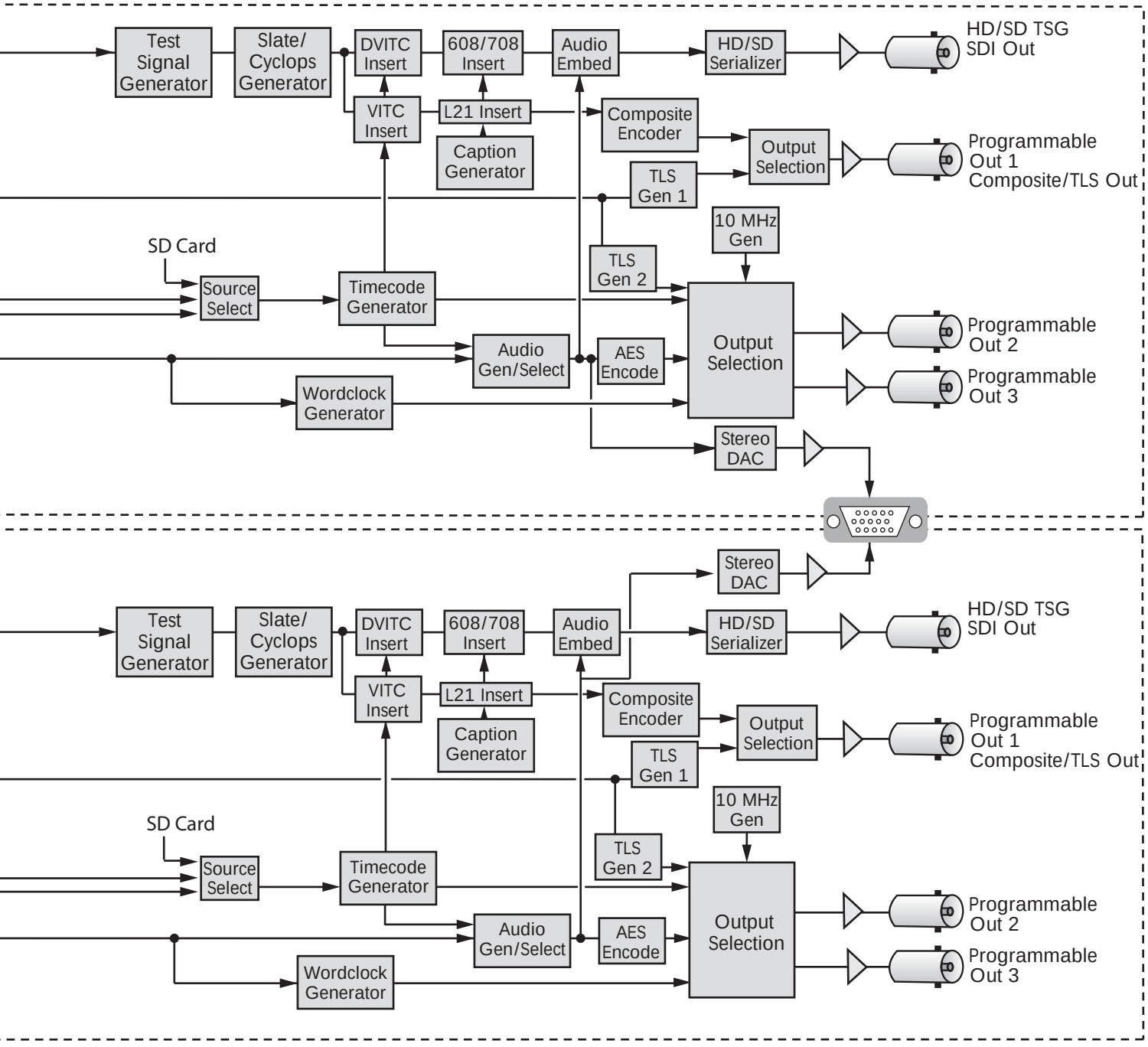
## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts for 7400 |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

7400 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed

# 7400
## HD/SD Sync Pulse Generator and Test Signal Generator




Test Signal Generator
Slate/ Cyclops Generator
DVITC Insert
608/708 Insert
Audio Embed
HD/SD Serializer
HD/SD TSG SDI Out
VITC Insert
L21 Insert
Caption Generator
Composite Encoder
Output Selection
Programmable Out 1 Composite/TLS Out
TLS Gen 1
10 MHz Gen
SD Card
Source Select
Timecode Generator
TLS Gen 2
Audio Gen/Select
AES Encode
Output Selection
Programmable Out 2
Programmable Out 3
Wordclock Generator
Stereo DAC
Test Signal Generator
Slate/ Cyclops Generator
DVITC Insert
608/708 Insert
Audio Embed
Stereo DAC
HD/SD Serializer
HD/SD TSG SDI Out
VITC Insert
L21 Insert
Caption Generator
Composite Encoder
Output Selection
Programmable Out 1 Composite/TLS Out
TLS Gen 1
10 MHz Gen
SD Card
Source Select
Timecode Generator
TLS Gen 2
Audio Gen/Select
AES Encode
Output Selection
Programmable Out 2
Programmable Out 3
Wordclock Generator

# 7410
## Quad Tri-Level Sync Generator

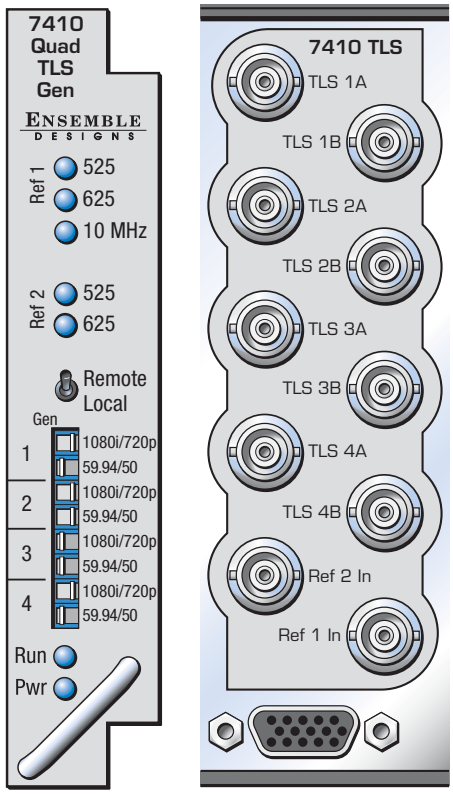
The 7410 Quad Tri-Level Sync Generator is for use in high definition television and post applications. Two reference inputs allow the module to lock to any two PAL, NTSC, or 10 MHz references. The 7410 can also operate as a stand-alone master generator.

Each of the four outputs is independent and can be set to output a different Tri-Level Sync signal. The timing of each generator can be set independently. A variety of user-selectable formats are supported including: 1080i, 720p, 1080p and 1080sF. The 7410 is well suited for facilities that need the flexibility of having simultaneous 720 and 1080 Tri-Level Sync outputs.

Use this module in conjunction with the 7400 SPG/TSG for a complete reference solution.

### Features

- **Eight Tri-Level Sync outputs**
- **Simultaneously outputs four different Tri-Level signals**
- **Can provide 50 Hz and 60 Hz outputs simultaneously**
- **Locks to two references or can be a master generator**



## Reference Input

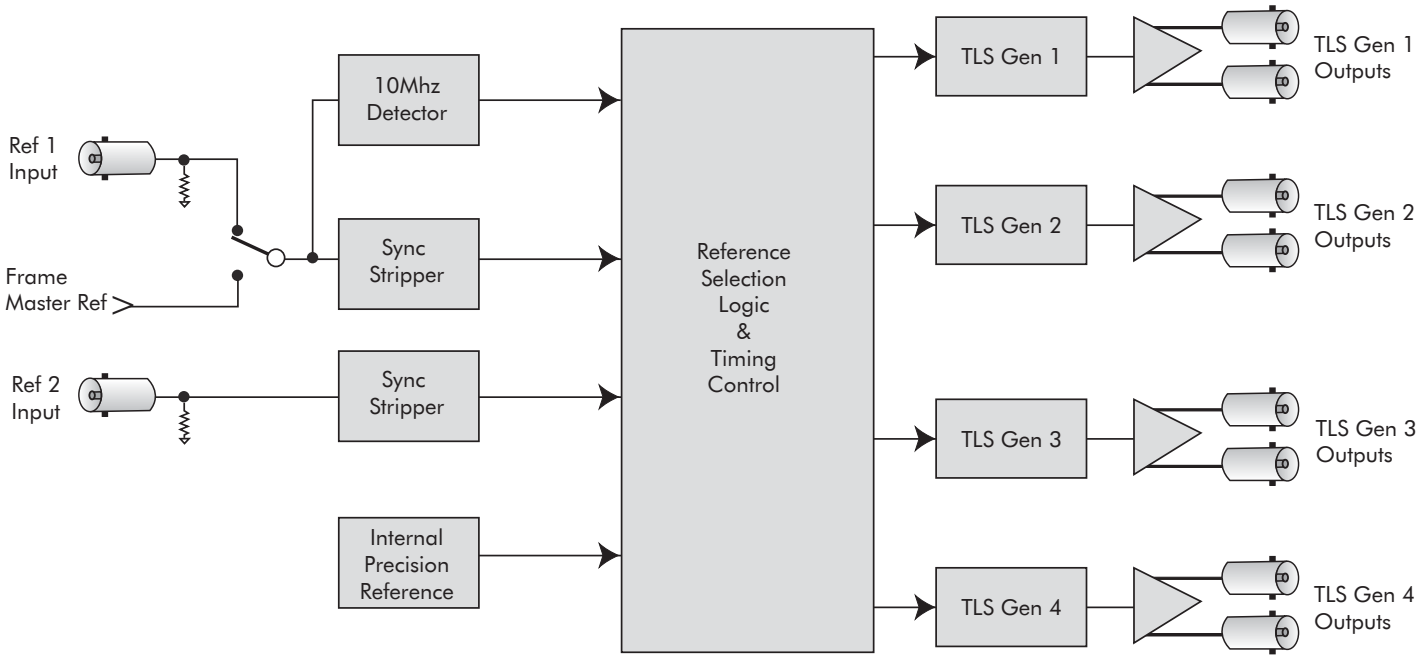
| | |
|---|---|
| Number | Two on module (and one alternate: Frame Master Reference) |
| Signal Type | 1 V P-P PAL, NTSC, or 10 MHz |
| Return Loss | >40 dB DC to 5.5 MHz |

## Tri-Level Sync Output

| | |
|---|---|
| Number | Eight, 75 Ω |
| Signal Type | 1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6<br>720p 50, 59.94 or 60 Hz SMPTE 296M -1,2,3<br>1080p 23.98, 24, 25 Hz SMPTE 274M -9,10,11<br>1080sF 23.98, 24, 25 Hz RP211 -14,15,16 |
| Output DC | ±50 mV |
| Return Loss | >30 dB to 30 MHz |

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 7420
## HD/SD Logo Inserter

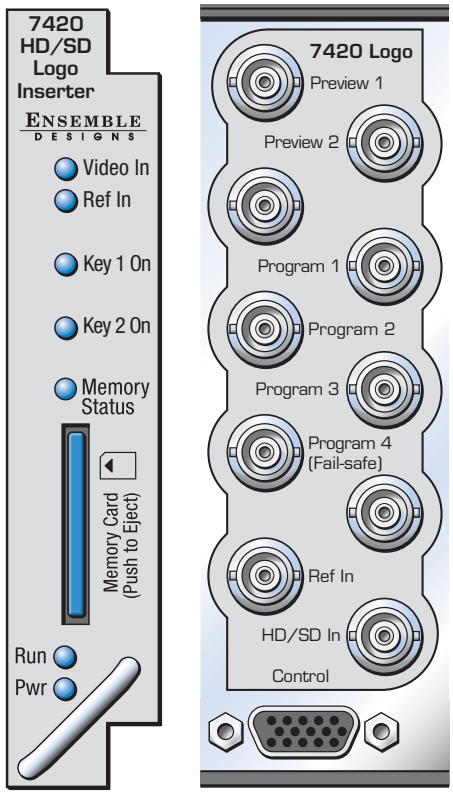
### HD and SD Logo Insertion and Branding

The 7420 is a dual rate logo inserter that can accept either an SD or HD video input and key still logos and animations over program material. The logo insertion capability can be used to add letterbox framing. It can also be used to key sports or event logos, or to source a virtual set background. The on-board memory can play back almost a minute of uncompressed video. Alternately, the 7420 can supply separate fill and key outputs to a production switcher for keying there.

### Handy Flash Memory

The 7420 is fitted with a Secure Digital flash memory card in order to provide an extremely fast and easy way to transfer material. This is a particularly convenient method for pre-building material off-line. Simply transfer logos and animations to a Secure Digital flash memory card using a standard card reader, then insert into the 7420.

The 7420's flash memory card can be removed and reinstalled without interrupting logo playback. The flash memory card is used for transfer while the actual logo and animation playback comes from the 7420's DDR2 memory.




### Linear Keying

The 7420 provides two cascaded, full linear keyers with transparency and a programmable transition rate. Each keyer is independently controllable and each has independent access to up to 2 GB of stored video and sound files. Standard configuration is Keyer 1 and 2 each populated with 1 GB of DDR2 (SODIMM) memory. Users can upgrade to 2 GB of DDR2.

### Audio Support

Sound and voice-overs can be associated with logos and clips. Each keying channel can playback a stereo sound file simultaneously with video. Audio is mixed into the user-selected output channel.

### Avenue Logo Authoring Environment

The Avenue Logo authoring environment provides a means to import graphics, animations and sound files. Logo and animation files are converted to the appropriate SD or HD color space, adjusted for proper aspect ratio, and organized in a form suitable to download into the 7420. Lossless compression ensures logos, animations and clips look as good in the program output as when they were created. The authoring system allows importing sound files which can be associated with one or more still or animated logos. Video and audio files are associated through the Avenue Logo authoring software. Avenue Logo software can be provided to your clients so they can build sports or event logos off-line.

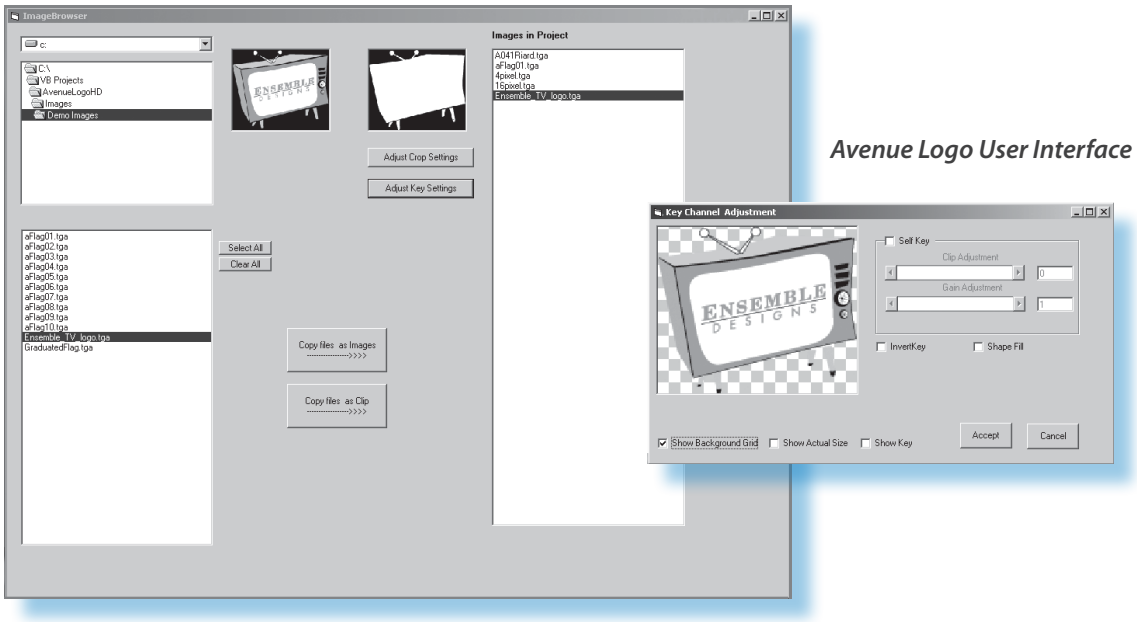
### Control

Playback of sequences can be issued through a variety of methods. All Avenue modules can be accessed via Ethernet with Avenue PC software, or through third-party support using TCP/IP or SNMP protocols.

Automation interfaces can be made through a simple ASCII protocol via the RS-232 port specific to the module. Single GPI contact closures can be used to initiate logo sequences.

## Features

- Key still logos and animations
- HD and SD operation
- Fail-Safe bypass in case of power failure
- Flash memory card for transferring logos
- Includes Avenue Logo Authoring and Management software
- Control through Avenue Control System and 8 GPI triggers
- 16 channel audio support, passes embedded audio
- Program/Preview outputs or Key/Fill outputs
- Full 10 bit linear keying and processing




*Avenue Logo User Interface*

# 7420
## HD/SD Logo Inserter

### Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M or SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |

Automatic Cable Input Equalization

### Serial Digital Output

| | |
|---|---|
| Number | Four Program /Fill (includes one fail-safe bypass)<br>Two Preview/Key |
| Signal Type | Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | 4 µSec |

### Standards Supported

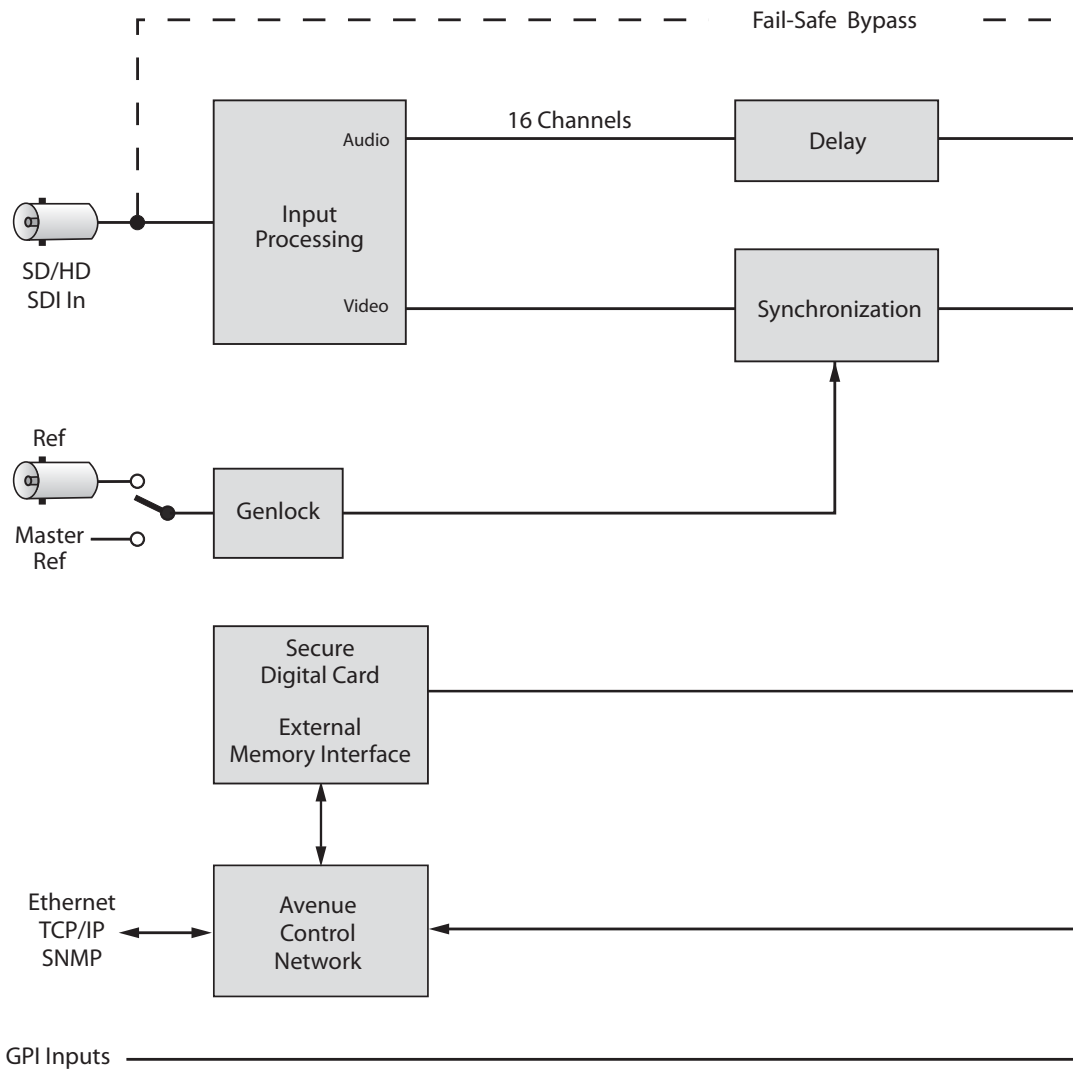
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94

### Reference Input

| | |
|---|---|
| Number | One external (module's BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

### Flash Memory

| | |
|---|---|
| Number | One |
| Type | Secure Digital SD Flash Memory Card |
| Size | 2 GB card included |



## Memory Capacity with 2 GB DDR2 Installed

One or a combination of the following:

| | |
|---|---|
| 8.5 sec | HD video |
| 53 sec | SD video |
| 256 | HD full screen image |
| 1595 | SD full screen images |
| 768+ | HD lower thirds |
| 4785+ | SD lower thirds |
| 3600+ | HD still corner bug 300x300 px |
| 18,000+ | SD still corner bug 300x300 px |
| 120+ sec | HD animated corner bug 300x300 px |
| 600+ sec | SD animated corner bug 300x300 px |

Capacity numbers above calculated at 60 Hz frame rate.

Any combination of logos, animations and audio files can be stored.

## Playback/Keyer Memory

Comes standard with 1 GB in Keyer 1 and Keyer 2 positions. Must install equal amount of memory in both Keyer positions.

| | |
|---|---|
| Number | Two positions max |
| Type | DDR2 SODIMM, 200 pin Type PC4200 or faster |

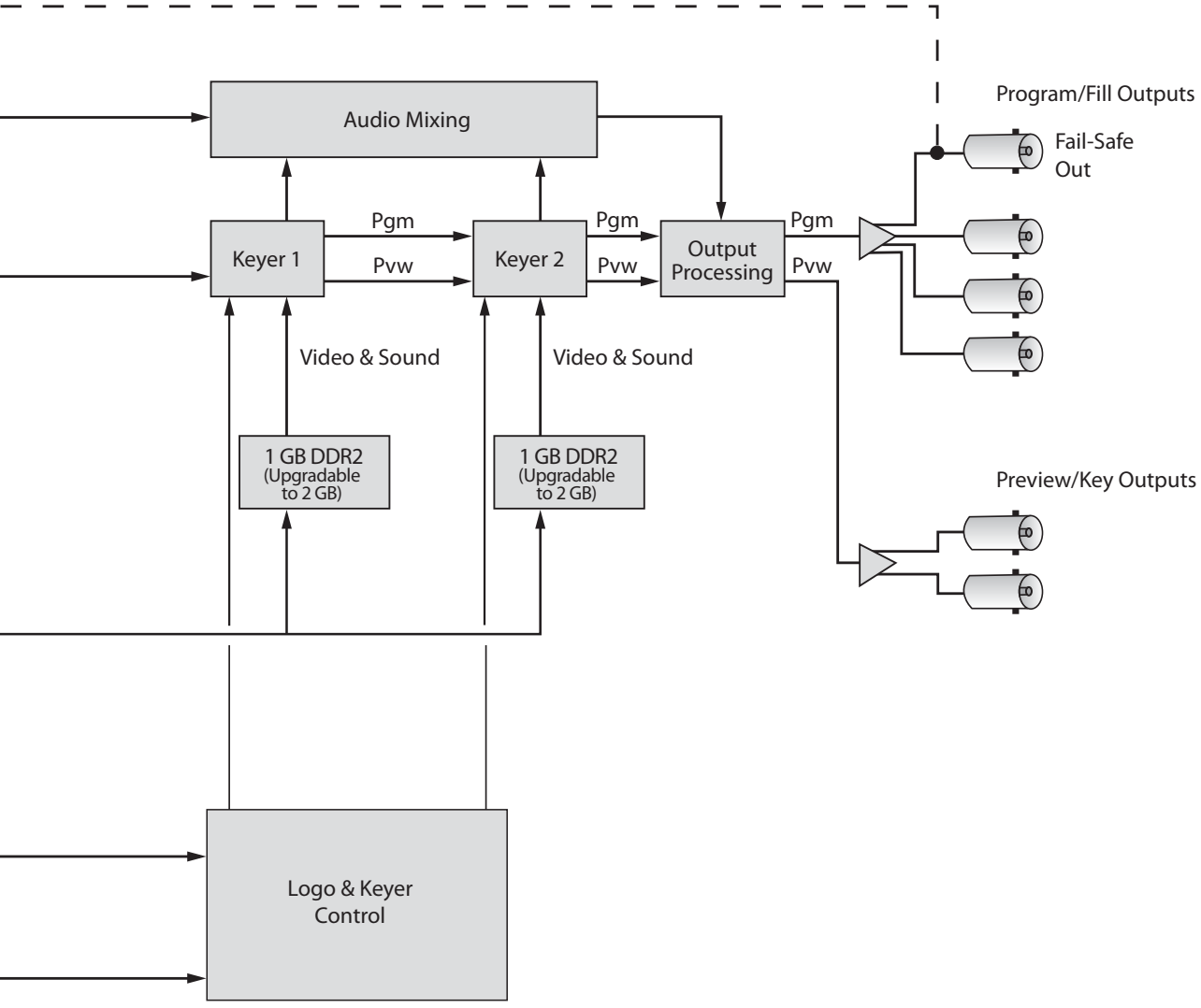
## File type

| | |
|---|---|
| Image | .tga |
| Animation | ###.tga |
| Audio | .wav |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

7420 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 7435
## HD/SD Clean and Quiet Protection Switch

### A Clean Switch That's Glitch-Free

The 7435 module is a clean and quiet protection switch for critical broadcast and satellite feeds. It switches cleanly between asynchronous sources which means it can be used live to air. The module has a full video frame synchronizer, rather than a line delay, ensuring perfect alignment of mis-timed and non-synchronous SDI sources.

Clean and quiet switching between sources requires that they be synchronous and precisely timed to each other. The 7435 accomplishes this automatically, with integral frame synchronization of the inputs, allowing operation with both synchronous and asynchronous (wild) sources. This frame synchronization feature not only means that the output of the 7435 will always be stable and glitch-free, but it also means that in the event of a total loss of both inputs, consistently timed color black will still be output.

These internal frame synchronizers can be genlocked to an external reference signal so that the output of the 7435 is synchronous to local sources. Alternately, in teleports, headends, and other multi-service facilities, where there is no logical common reference, the 7435 will internally generate an accurate reference.

The delay through the 7435 can be adjusted from one to eight frames, with independent control for the Primary and Secondary input paths. By operating with several frames of delay, the fault detection algorithms are given enough time to detect a failure in an input signal and switch to the backup before the fault has actually appeared on-air.

### Features

- **Clean and quiet switch for SD and HD SDI signals**
- **Use for clean switching of asynchronous sources for critical, live feeds**
- **Full frame synchronizer with adjustable delay**
- **Quiet audio switching**
- **Passes embedded audio**
- **External genlock reference input**
- **GPIs and TCP/IP for automation control**
- **Fail-safe bypass in case of power failure**
- **Local and remote control**
- **Memory Registers**

### Perfect Audio

Glitch-free, quiet switching of embedded audio signals is achieved with the 7435's precise synchronization and alignment of audio sources. Digital audio is de-embedded, and if it is linear PCM, sample rate converted, switched, and re-embedded. Encoded audio streams such as Dolby™ E are de-embedded and re-embedded but not processed in any way. PCM audio is supported with asynchronous sources, operation of encoded audio requires all sources to be synchronous, but not necessarily in time.

### Switch Logic

When a fault is detected in the primary input to the 7435, and the secondary input is verified as good, the switch will activate, causing the secondary input to be switched to the module's output. The 7435 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure. The module can be set to automatically switch back to the primary after the fault condition clears. If both the primary and the secondary inputs signals are faulted, no switch occurs.

The health of a high definition or standard definition video signal is determined by monitoring crucial parameters in order of increasing complexity; Timing Reference Signal (TRS), or a persistent loss of digital sync is tested first. Black, Embedded Audio and Freeze are also evaluated. Each test can be configured by the user. For example, the sophisticated Black Detector includes configurable parameters for black level threshold, pixel count, and duration time.

The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 7435 to switch to the secondary input after a video freeze condition is detected in the primary input.

### Control and Alarms

Module controls are easily accessed through an Avenue Control Panel, Avenue PC software, GPIs, or the module's front edge controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

# 7435
## HD/SD Clean and Quiet Protection Switch

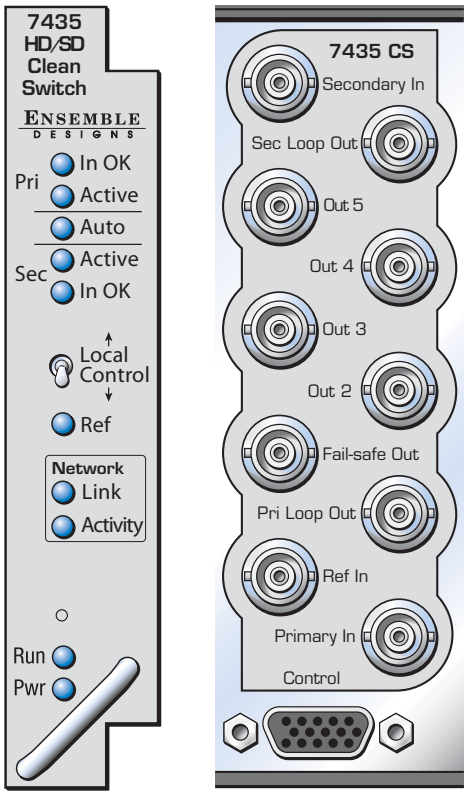
### Input

| | |
|---|---|
| Number | Two |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M Data, SMPTE 337M |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.5 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |

Automatic Cable Input Equalization

### Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50




### Serial Digital Loopback

| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

### Output

| | |
|---|---|
| Number | Six (includes one fail-safe bypass) |
| Signal Type | HD or SD Serial Digital, follows input |
| Delay | Adjustable up to 8 frames |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

### Reference Input

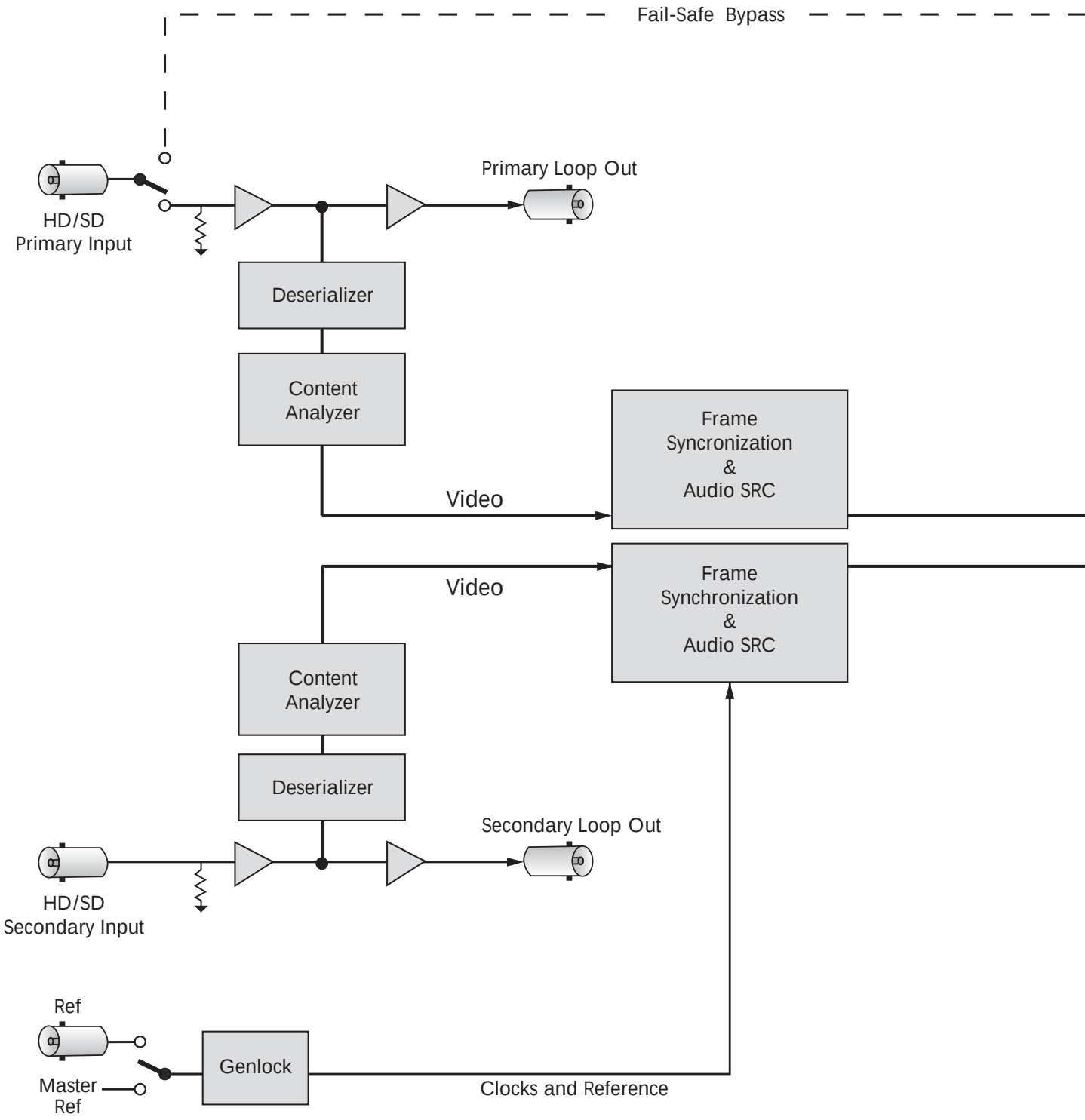
| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB |

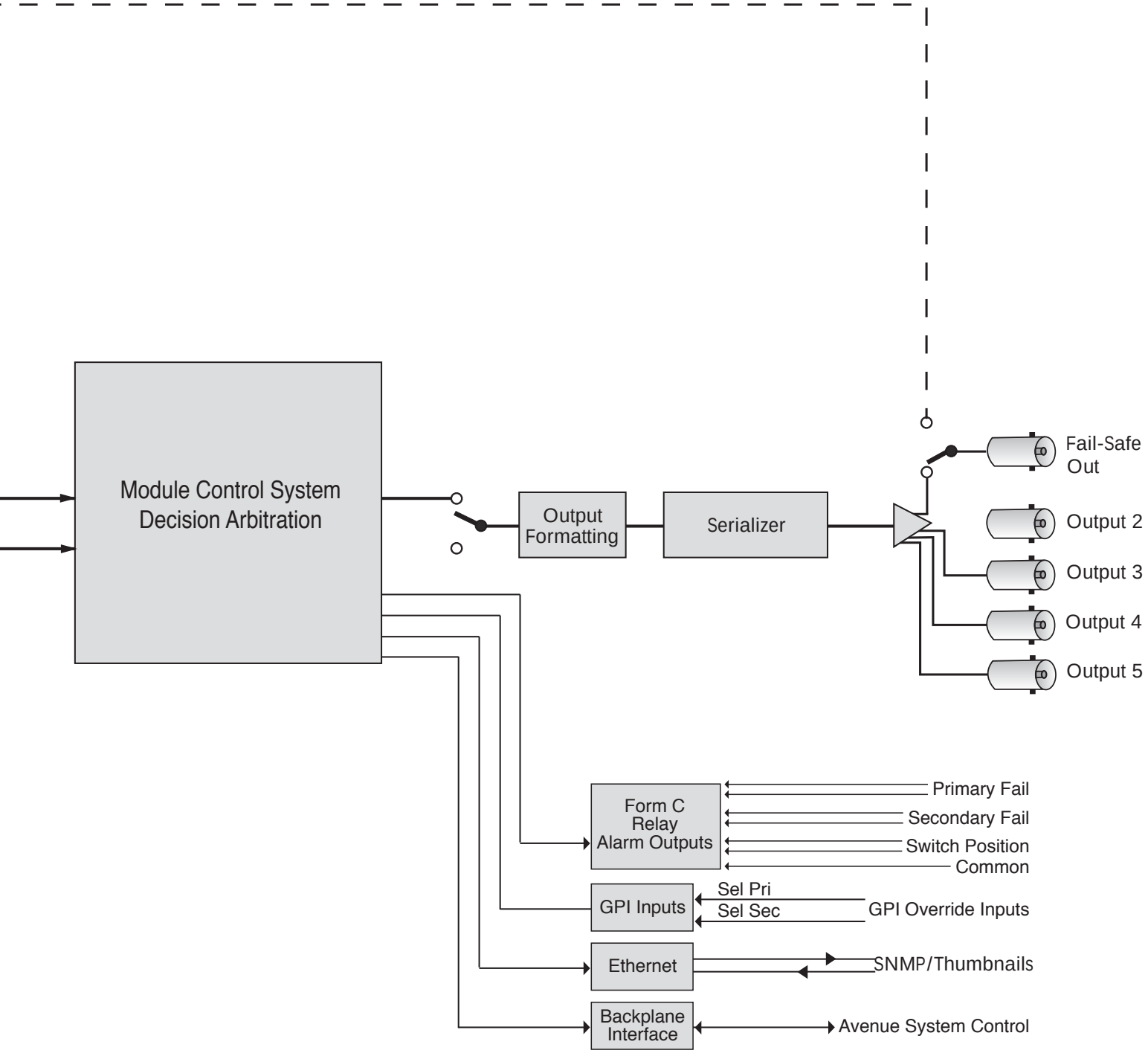
### General Specifications

| | |
|---|---|
| Power Consumption | 12 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

7435 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed

# 7435
## HD/SD Clean and Quiet Protection Switch




Module Control System
Decision Arbitration
Output
Formatting
Serializer
Fail-Safe
Out
Output 2
Output 3
Output 4
Output 5
Form C
Relay
Alarm Outputs
Primary Fail
Secondary Fail
Switch Position
Common
GPI Inputs
Sel Pri
Sel Sec
GPI Override Inputs
Ethernet
SNMP/Thumbnails
Backplane
Interface
Avenue System Control

# 7450
## HD Protection Switch

The 7450 module is a fail-safe, bypass protection switch for critical digital paths for broadcast or satellite applications. When a fault is detected in the primary input, and the secondary input is verified as good, the switch will activate, causing the secondary input to be switched to the module's output. The 7450 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure.

The 7450 supports HD SDI signals. Different types of signal testing (vetting) can be enabled on the 7450 and it will apply the tests automatically and independently for the Primary and Secondary inputs.

The health of a high definition video signal is determined by monitoring crucial parameters in order of increasing complexity; Timing Reference Signal (TRS), or a persistent loss of digital sync is tested first. Black, Embedded Audio and Freeze are also evaluated. Each test can be configured by the user. For example, the sophisticated Black Detector includes configurable parameters for black level threshold, pixel count, and duration time.

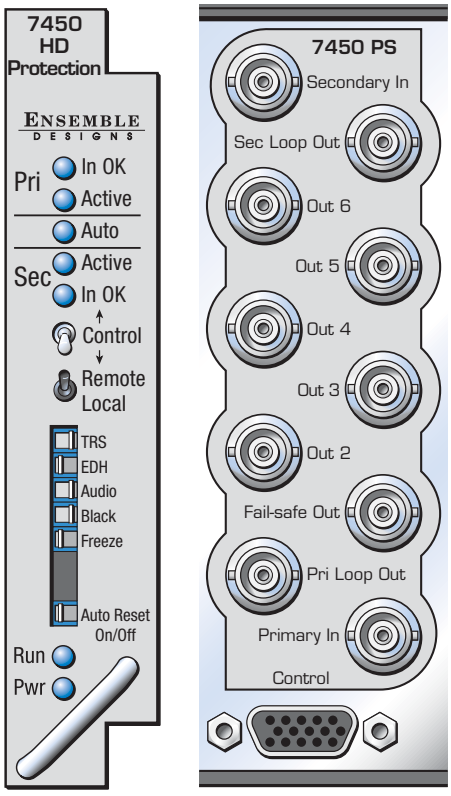
The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 7450 to switch to the secondary input after a video freeze condition is detected in the primary input.

The switch can operate in two modes: automatic or non-resetting. In fully automatic mode, the 7450 will automatically switch back to the primary signal once it's been restored. In the non-resetting mode, the secondary input remains routed to the output, even after the primary input has recovered.

Controls are easily accessed through an Avenue Control Panel, Avenue PC software, GPIs, or front edge module controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

## Features

- **Fail-Safe Bypass Protection Switch for Critical Signal Paths**
- **Use with HD SDI signals**
- **Detects TRS, Black, Silence, Freeze**
- **Detection specifics are user programmable**
- **Passes embedded audio**
- **Alarm generation**
- **Remote control and monitoring**



## Serial Digital Input

| | |
|---|---|
| Number | Two |
| Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M |
| Max Cable Length | 100 meters Belden 1694A |

Automatic Cable Input Equalization

## HD Standards Supported:

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4, 5, 6
720p 59.94 or 60 Hz, SMPTE 296M -1, 2, 3
1080p 23.98, 24, 25 Hz, SMPTE 274M -9, 10, 11
1080sF 23.98, 24, 25 Hz, RP211 -14, 15, 16

## Serial Digital Loopback

| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

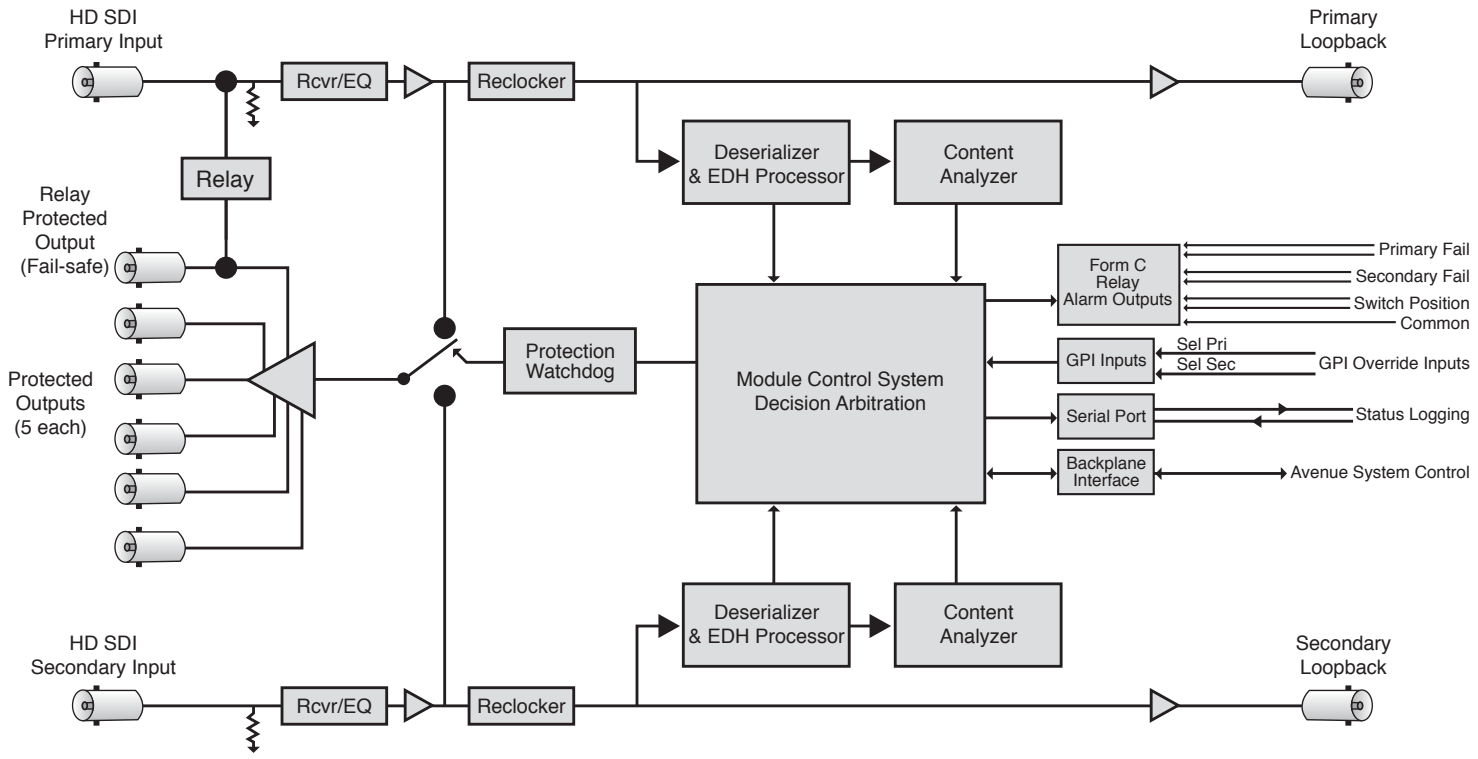
## Serial Output Signal

| | |
|---|---|
| Number | Six total<br>One Fail-Safe bypass output<br>Five DA outputs |
| Signal Type | HD Serial Digital<br>Follows input |
| Impedance | 75 Ω |

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40° C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 4 each 0.75 Amp PTC resettable fuse with each domain of the module independently regulated. |

7450 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 7455
## HD/SD/ASI/310M Protection Switch

The 7455 module is a fail-safe, bypass protection switch for critical digital paths for broadcast or satellite applications. When a fault is detected in the primary input, and the secondary input is verified as good, the switch will activate, causing the secondary input to be switched to the module's output. The 7455 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure.

The 7455 supports SD SDI, HD SDI, SMPTE 310M and DVB-ASI signals. Different types of signal testing (vetting) can be enabled on the 7455 and it will apply the tests according to the type of input that is present. This happens automatically and independently for the primary and secondary inputs. This means that the primary input of the module could be HD SDI while the secondary input is SD SDI. It is also possible to mix SDI, ASI and 310M signals, or receive the same standard on both the primary and secondary inputs.

The health of a high definition or standard definition video signal is determined by monitoring crucial parameters in order of increasing complexity; Timing Reference Signal (TRS), or a persistent loss of digital sync is tested first. Black, Embedded Audio and Freeze are also evaluated. Each test can be configured by the user. For example, the sophisticated Black Detector includes configurable parameters for black level threshold, pixel count, and duration time.

The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 7455 to switch to the secondary input after a video freeze condition is detected in the primary input.

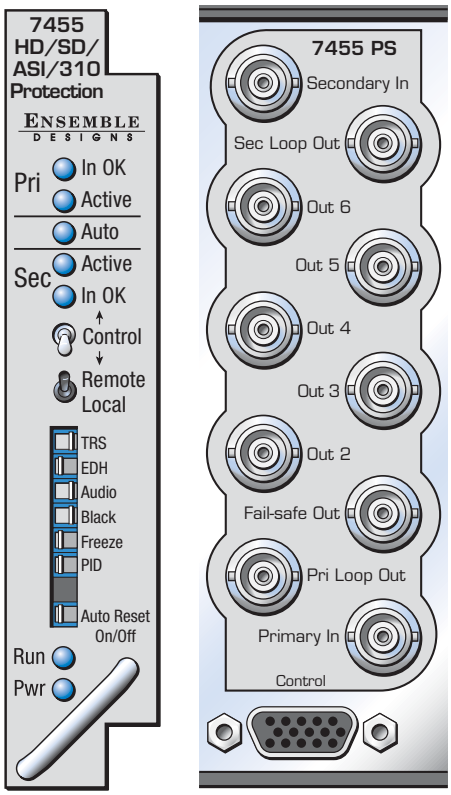
The health of an ASI or 310M signal is determined by monitoring digital clock lock, packet presence, and PID presence. The user can configure tests to define the minimum number of video packets and audio packets expected per second in a given service.

The switch can operate in two modes: automatic or nonresetting. In fully automatic mode, the 7455 will automatically switch back to the primary signal once it's been restored. In the nonresetting mode, the secondary input remains routed to the output, even after the primary input has recovered.

Controls are easily accessed through an Avenue Control Panel, Avenue PC software, GPIs, or front edge module controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

## Features

- **Bypass Protection Switch for Critical Signal Paths**
- **Use with HD, SD, ASI and 310M signals**
- **Detects TRS, Black, Silence, Freeze for HD and SD Signals**
- **Detects Signal Presence, Program Packets, PMT, PAT and PIDs for ASI and 310M signals**
- **PID specific targeting and analysis**
- **Detection specifics are user-programmable**
- **Passes embedded audio**
- **Fail-safe bypass in case of power failure**
- **Alarm generation**
- **Remote control and monitoring**



## Serial Digital Input

| | |
|---|---|
| Number | Two |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M or DVB-ASI 270 Mb/s or<br>SMPTE 310M |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |

Automatic Cable Input Equalization

## Standards Supported (auto-detected)

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50
525i 59.94
DVB-ASI
SMPTE 310M

## Serial Digital Loopback

| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

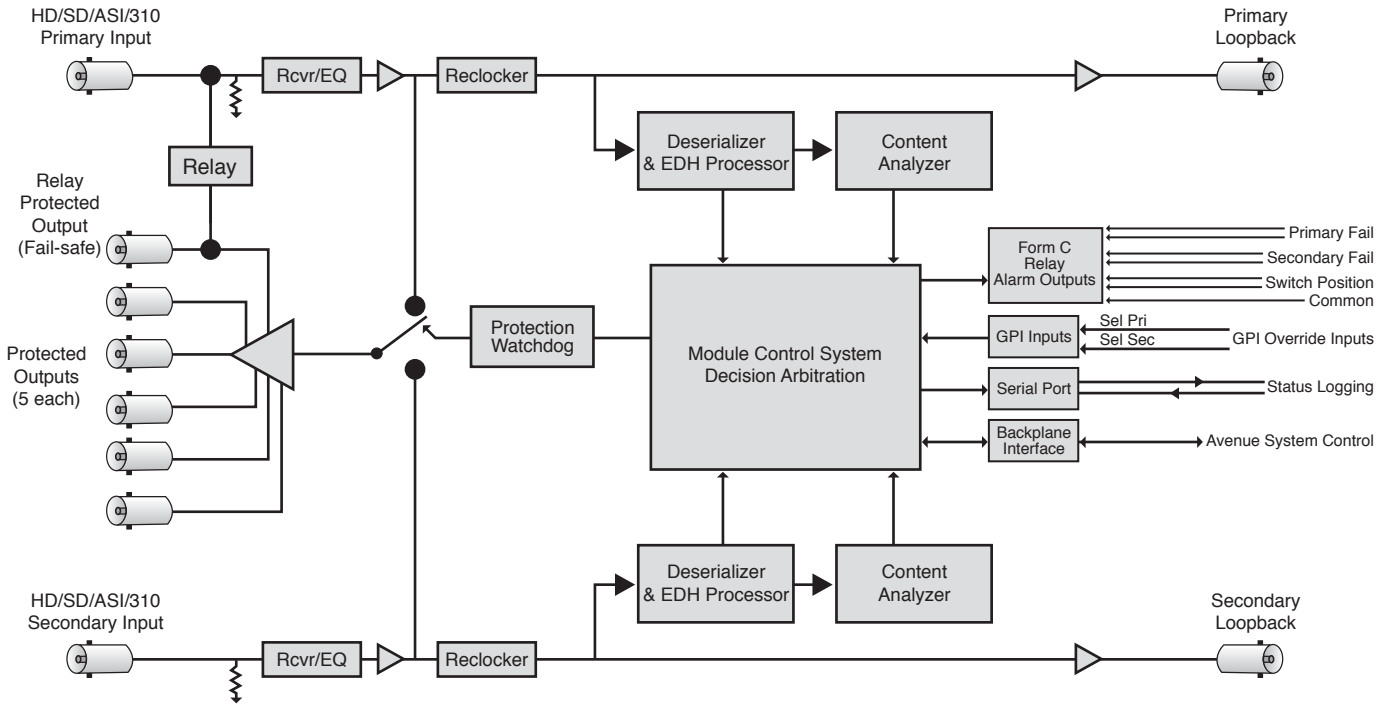
## Serial Output Signal

| | |
|---|---|
| Number | Six total<br>One fail-safe bypass output<br>Five DA outputs |
| Signal Type | Follows selected input |
| Impedance | 75 Ω |

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 4 each 0.75 Amp PTC resettable fuse with each domain of the module independently regulated |

7455 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 7465
## Sync Changeover

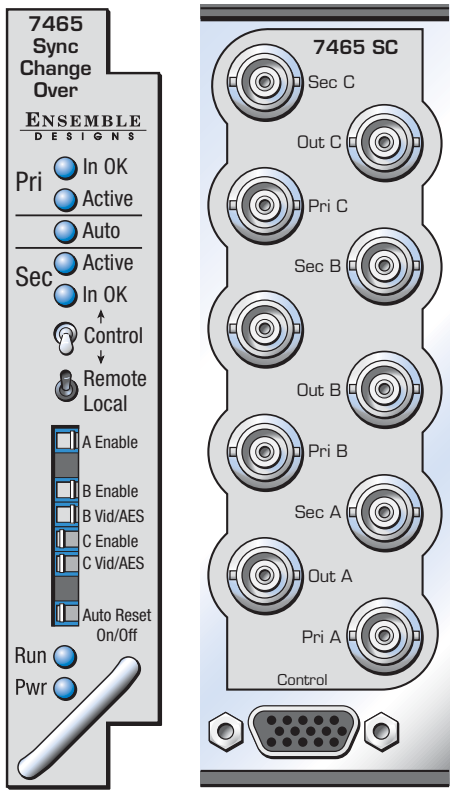
The 7465 Sync Changeover switch module can be used with Avenue's 7400 SPG module or with third party sync pulse generators. In the event of a failure of the primary sync source, the 7465 changes to the secondary source.

There are three poles or sections on the 7465. One pole tests for HD SDI, SD SDI, ASI and SMPTE 310M signals. The other two poles test for AES audio, Composite video, Bi-Level Sync and Tri-Level Sync. A drop in signal amplitude below a predetermined auto threshold will trigger the switch.

Multiple changeover switches can be ganged together through the control system. Depending on the application, two or more 7465s may be required to handle all signals that need to be protected.

### Features

- **3 poles for signal testing**
- **Use with HD SDI, SD SDI, analog composite, AES audio, LTC, DVB–ASI, SMPTE 310M, Bi-Level Sync and Tri-Level Sync signals**
- **Gang multiple 7465s together as needed**
- **Passes embedded audio**
- **Passive design**
- **GPI inputs for remote manual override**
- **GPI outputs to indicate signal status and switch position**



# 7465
## Sync Changeover

### Input Signals

| | |
|---|---|
| Number | Six |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>Analog Composite,<br>DVB-ASI, SMPTE 310M<br>AES Digital Audio, LTC<br>Bi-Level Sync or Tri-Level Sync, selectable |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.485 Gb/s |

Automatic Cable Input Equalization

### HD Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16

### Output Signals

| | |
|---|---|
| Number | Three |
| Signal Type | Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 270 MHz |

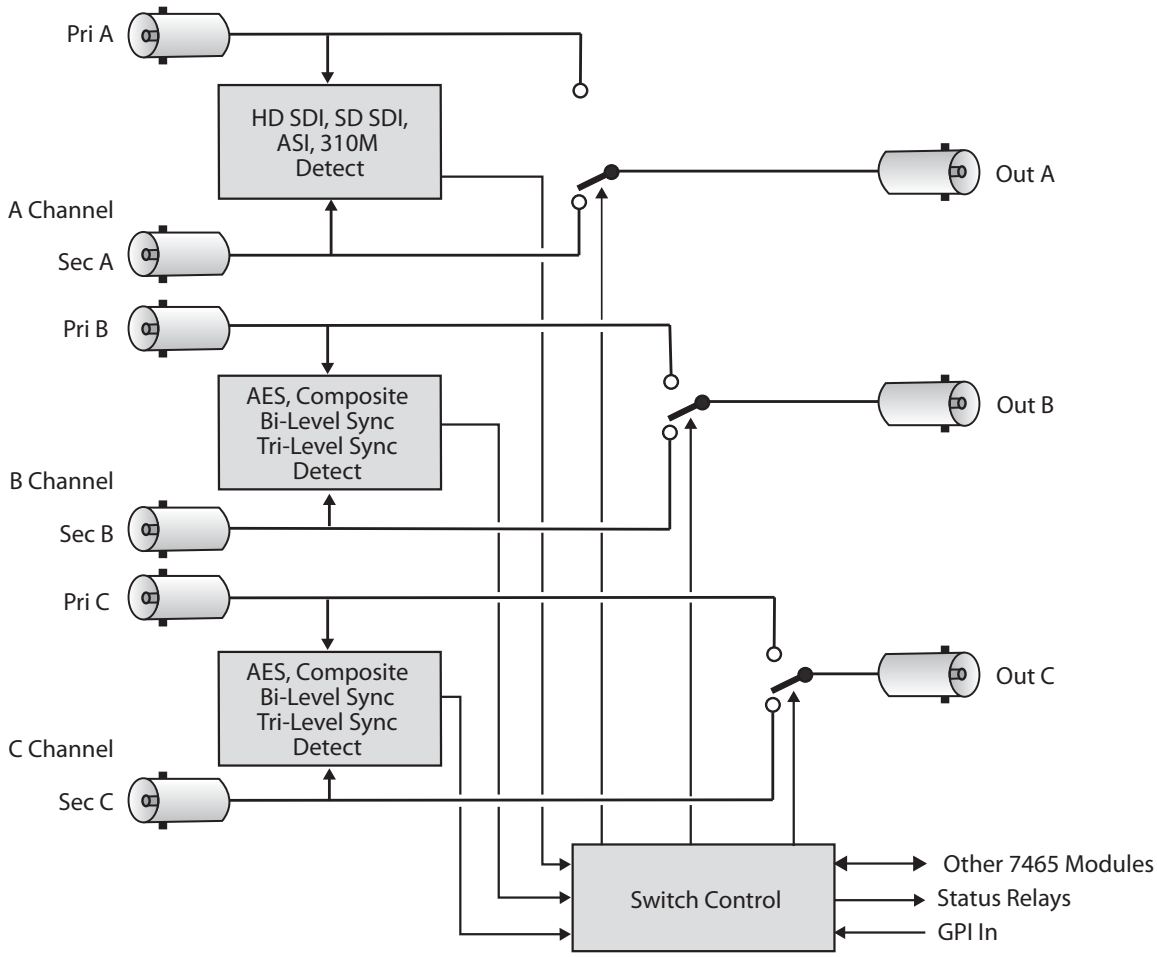
### Switcher Characteristics

| | |
|---|---|
| Type | 75 Ω RF Relay |
| Insertion Loss | <0.5 dB |

### General Specifications

| | |
|---|---|
| Connectors | BNC |
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |

7465 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 7550
## HD Legalizer

### Legalizer
The 7550 module is an HD Legalizer that supports high definition or standard definition digital video. When the Legalizer is enabled, the picture is processed on a pixel by pixel basis to be within legal limits for RGB requirements. Alternatively, the Y, Cr, Cb legalizer provides controls for white clip, and black clip and chroma limiting.

### Flexible Synchronization
An infinitely adjustable timing system genlocks to your house reference. The 7550 genlocks to either composite video (PAL or NTSC) or to Tri-Level Sync. The module can lock to the frame's master reference or reference can be connected directly to the module's external reference BNC. The serial output timing can be set anywhere within a frame of the selected input reference, which can be the module's external BNC reference or the frame's master timing reference.

Upon loss of signal, the 7550 provides freeze frame or black until the signal is recovered.

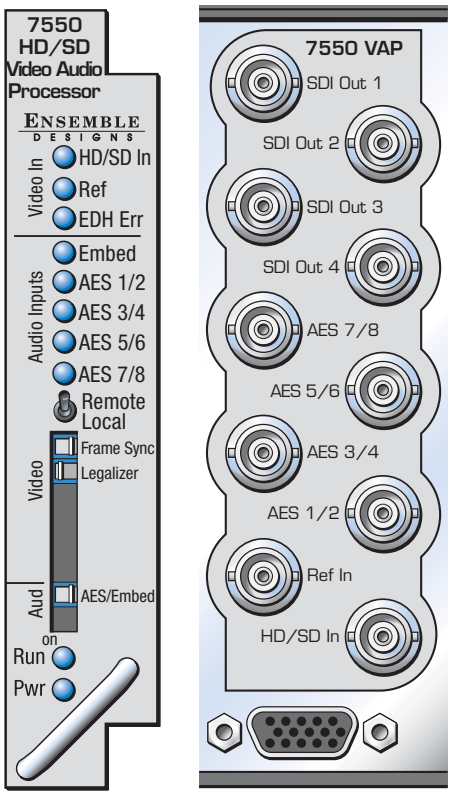
### Uncompromised Pictures
The HD or SD SDI input is carried at full, uncompressed bandwidth throughout the entire module, and EDH monitoring of the digital input alerts you to any incoming problem. EDH detection, monitoring and insertion are standard on the 7550. Flags are reported through Avenue PC.

### Complete Proc Amp Functions
The 7550 has a full-featured Proc Amp for adjustment of every signal parameter. Proc controls include Video and Chroma Gain, NTSC-style hue rotation, Black Balance, and Pedestal.

### Audio Tracking
The 8415 Audio Processing option can be added to the 7550 module. The 8415 is an eight-channel processor that has been designed to provide superior handling of embedded audio. Embedded audio is safely bypassed around the video framestore with the lip sync properly preserved.

### Total Control
Every function and parameter on the 7550 and 8415 can be controlled from an Express Panel, Avenue Touch Panel, or the Avenue PC Control Application. Memory registers can be used to save the complete configuration of the module, making it easy to change instantly between different configurations.

## Features
- **Legalizer**
- **HD or SD SDI I/O**
- **Full-featured Frame Synchronizer**
- **Comprehensive Proc Amp controls**
- **External genlock reference input**
- **EDH detection and insertion**
- **Internal Color Bar Generator**
- **Memory Registers**
- **Passes embedded audio**
- **Accepts the 8415 Audio Processor option for tracking audio delay, audio mixing, shuffling**
- **Audio Automatic Gain Control optional**



## Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

Automatic Cable Input Equalization

## Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50

## Output

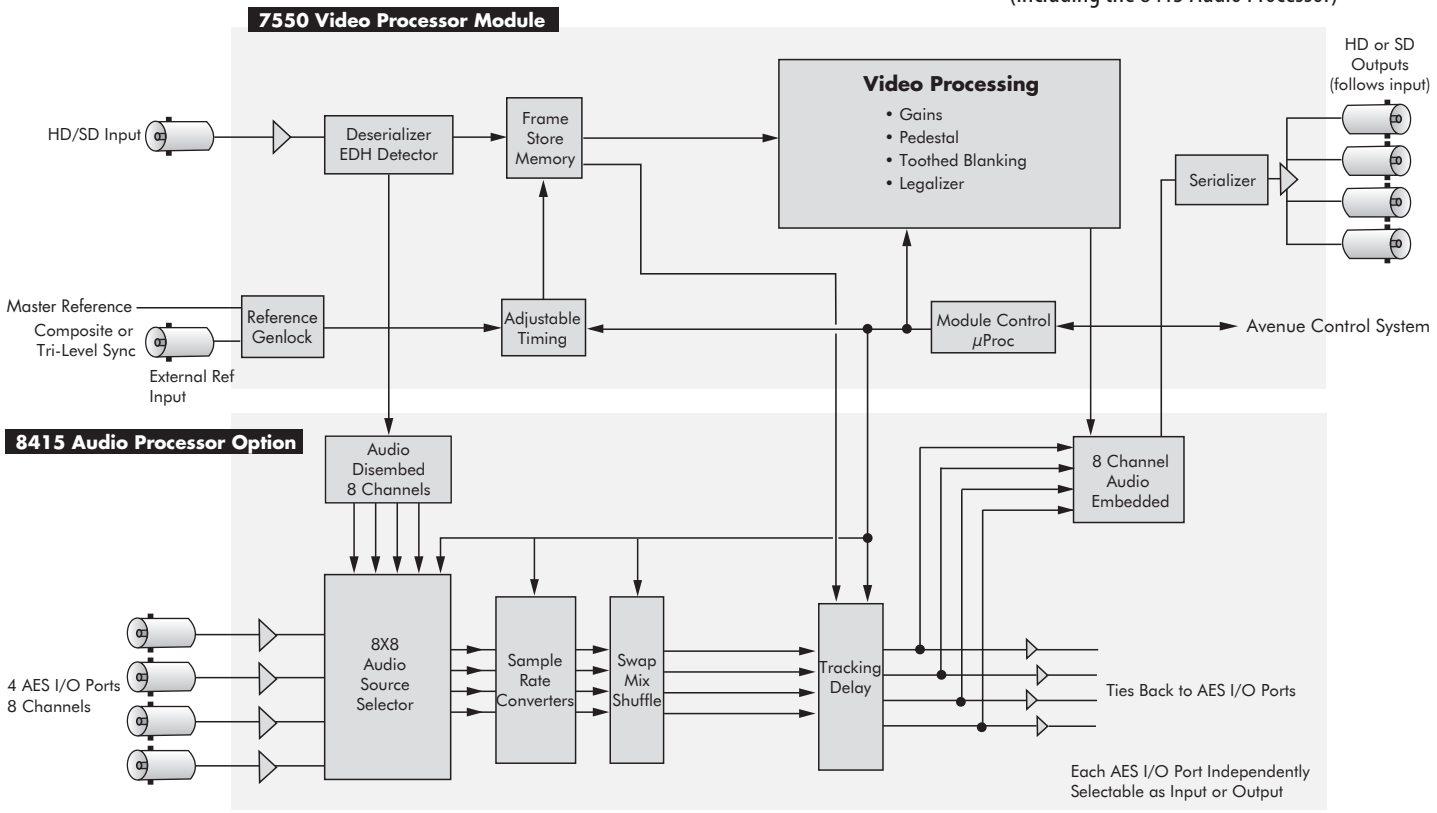
| | |
|---|---|
| Number | Four |
| Signal Type | HD or SD Serial Digital, follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |
| Delay | Adjustable from 10 µSec to 4 frames |

## Reference Input

| | |
|---|---|
| Number | Two<br>One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts (with both options installed) |
| Temperature | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Size | Standard Avenue Module<br>Occupies one slot in 3RU or 1RU Frame (including the 8415 Audio Processor) |



# 7555
## HD/SD Video Processing Frame Sync

The 7555 HD Processing Frame Sync accepts a 1.5 Gb/s high definition video or standard definition video signal for processing, synchronization and timing.

### Flexible Synchronization

An infinitely adjustable timing system genlocks to your house reference. The 7555 genlocks to either composite video (PAL or NTSC) or to Tri-Level Sync. The module can lock to the frame's master reference or reference can be connected directly to the module's external reference BNC. The serial output timing can be set anywhere within a frame of the selected input reference, which can be the module's external BNC reference or the frame's master timing reference.

Upon loss of signal, the 7555 provides freeze frame or black until the signal is recovered.

### Uncompromised Pictures

The HD or SD SDI input is carried at full, uncompressed bandwidth throughout the entire module.

### Complete Proc Amp Functions

The 7555 has a full-featured Proc Amp for adjustment of every signal parameter. Proc controls include Video and Chroma Gain, NTSC-style hue rotation, Black Balance, and Pedestal.

### Audio Support

The 7555 includes a full-featured, sixteen-channel audio mixer. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources. Delay is adjustable up to one second. The audio mixer can be used for embedded audio and for audio sourced from the AES or analog inputs. The 9615 AES and analog audio I/O software key option is required if you want to use the AES or analog inputs and outputs. The 9615 provides four AES input/output ports for eight channels of I/O and also provides four channels of analog audio I/O.

### Dolby and AC-3

The 7555 can be fitted with Dolby™ and AC-3 encoding and decoding options. The 7615 decoding option can be fed from either an AES input or an AES stream disembedded from the incoming SDI signal. The resulting discrete surround signals are then selectable as inputs to the sixteen channel mixer/shuffler.

The 7630 Dolby encoder is fed from selected outputs of the sixteen channel mixer/shuffler. The resulting encoded bitstream can be output both on an AES output and embedded into the SDI output.

### LevelTrack™ AGC and Compliance Options

The 9670 LevelTrack™ Audio Automatic Gain Control software key can be added as an option. LevelTrack provides control for keeping audio levels consistent in program material.

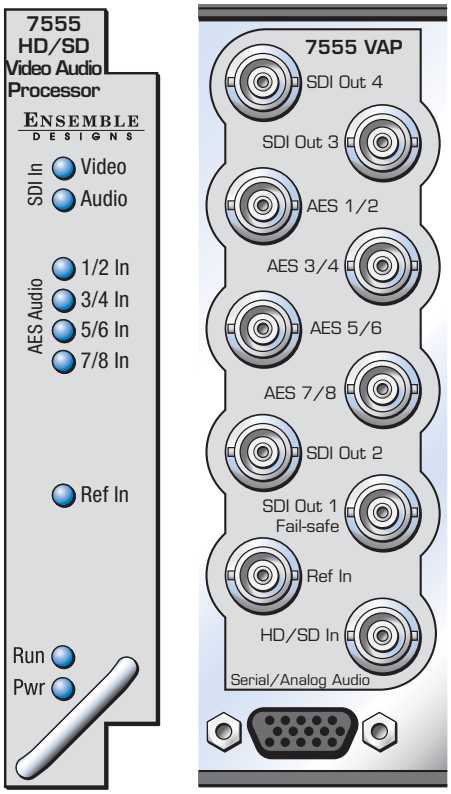
The 9690 Audio Compliance and Monitoring Software can be added for compliance verification and archiving.

### Total Control

Every function and parameter on the 7555 can be controlled from an Avenue Touch Panel or the Avenue PC Control Application. Memory registers can be used to save the complete configuration of the module, making it easy to change instantly between different configurations.

## Features

- **HD or SD SDI I/O**
- **Full-featured Frame Synchronizer with adjustable delay**
- **Comprehensive Proc Amp controls**
- **External genlock reference input**
- **Internal Color Bar Generator**
- **Fail-safe bypass in case of power failure**
- **Passes embedded audio**
- **AES option for 4 streams/8 channels**
- **Analog audio I/O option**
- **Data mux and demux as per SMPTE 337M**
- **Dolby encoding and decoding options**
- **Audio Loudness Control AGC option**
- **Memory registers**




## Order Info

| | |
|---|---|
| 7555 | HD/SD Video Processor module |
| 7615 | Dolby E, Dolby D, AC-3 Decoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7630 | Dolby E Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7635 | Dolby D/AC-3 Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 9615 | AES, analog audio, and data I/O software key option |
| 9670 | LevelTrack Audio Loudness Control AGC software key option |
| 9690 | Audio Compliance and Monitoring Software |

# 7555
## HD/SD Video Processing Frame Sync

### Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M or SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |

Automatic Cable Input Equalization

### Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
525i 59.94, 625i 50
Data, SMPTE 337M

### Output

| | |
|---|---|
| Number | Two (one fail-safe bypass) |
| Signal Type | HD or SD Serial Digital, follows input |
| Delay | Adjustable up to 8 frames |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

### Reference Input

| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

### AES/EBU Digital Inputs (requires 9615 option)

| | |
|---|---|
| Number | Four (total of eight channels selectable as inputs or outputs) |
| Type | AES3id or data (SMPTE 337) |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |

### AES/EBU Digital Outputs (requires 9615 option)

| | |
|---|---|
| Number | Four (total of eight channels) selectable as inputs or outputs |
| Type | AES3id or data |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

### Analog Audio Inputs (requires 9615 option)

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced |
| Connector | 15 pin D |
| Impedance | >15K Ω |
| Maximum Input Level | 24 dBu |
| CMRR | >60 dB, 20 Hz to 10 KHz |
| Quantization | 24 bits, 128 x oversampled |
| Sample Rate | 48 KHz |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Analog Audio Outputs (requires 9615 option)

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced, transformerless |
| Connector | 15 pin D |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x oversampled |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ± 0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Dolby Metadata Inputs/Outputs (requires 9615 option)

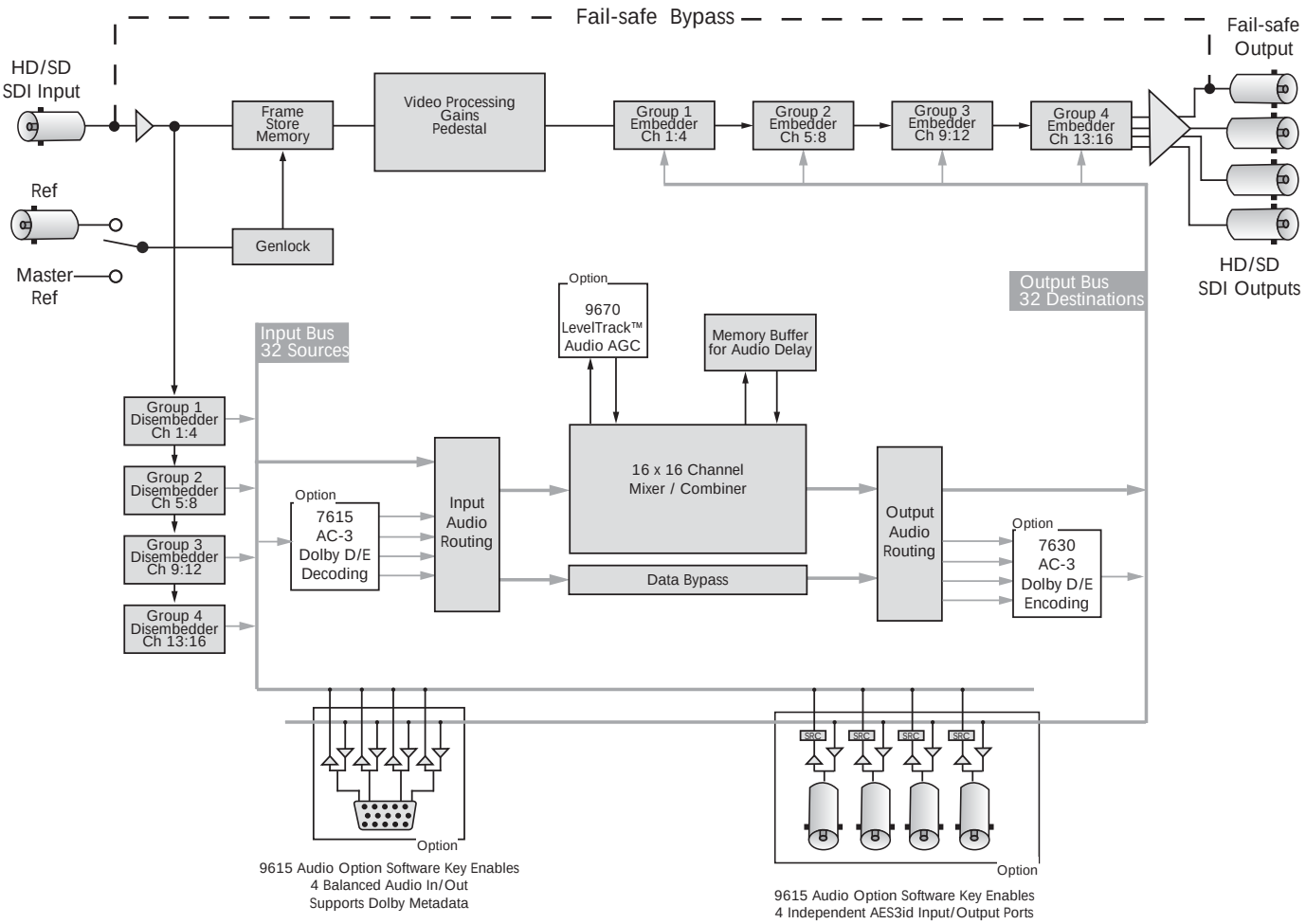
| | |
|---|---|
| Signal Type | Dolby metadata, RS-422, RS-485 |
| Number | Four, selectable as inputs or outputs, share with analog audio I/O |
| Connector | HD-15, balanced |

### Embedded Output (In SDI Outputs)

| | |
|---|---|
| Group Assign | Cascade or replace |
| Channels | Sixteen |
| Bit Depth | 24 Bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 7600
## HD/SD Embedder and Disembedder

The 7600 module is a dual rate eight-channel audio embedder or disembedder for 1.5 Gb/s high definition video signals or for 270 Mb/s standard definition signals. Four AES ports automatically configure as inputs or outputs depending on if the module is configured as mux or demux.

### Configurable Mux or Demux

When configured as a multiplexer, the 7600 has one serial digital video input and four AES audio inputs. These four AES streams are embedded into the video stream. AES inputs are sample rate-converted, allowing the use of asynchronous audio. The output of the module is a digital stream that contains the original video signal and four AES pairs.

When configured as a demultiplexer, audio signals present in the incoming video signal are extracted and delivered as standard AES digital audio streams.

The 7600 includes a full-featured, eight-channel audio mixer. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources. All audio processing is performed at full 24 bit resolution by a digital signal processor (DSP). Delay is adjustable up to one second.

### In-Line Shuffler

Because the 7600 has simultaneous disembedding and embedding, it is an in-line processor for embedded audio. It can take embedded content, adjust levels and remap channels, and deliver it to the output as an embedded signal.

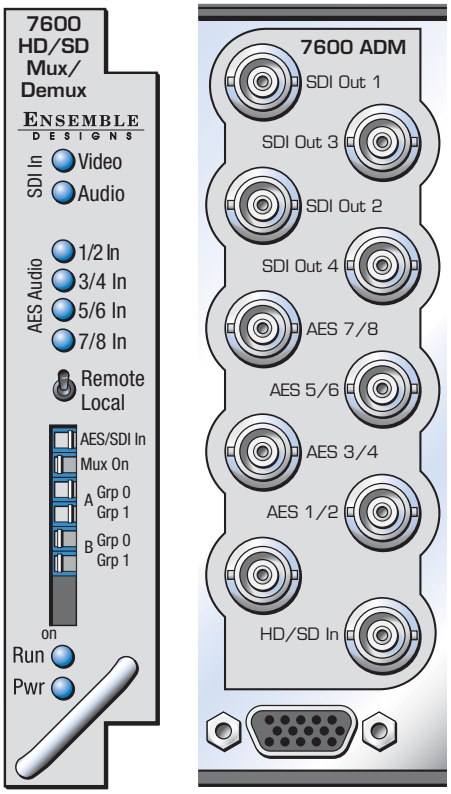
The 7600 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lockout, and customizable menus are just some of the tools included in the Avenue Control System.

### Automatic Gain Control Option

The 9670 Audio Automatic Gain Control software key can be added as an option. This option provides control for keeping audio levels consistent in program material.

### Features

- **Audio embedder or disembedder for HD or SD signals**
- **Handles 4 AES streams/8 channels**
- **Up to one second of delay**
- **In-line processor for embedded audio**
- **Supports Dolby E and AC-3 data**
- **Audio Automatic Gain Control option**
- **Built-in audio mixer**
- **Phase inversion selectable on a channel basis**
- **Built-in sample rate converter accepts asynchronous inputs**
- **26 bit processing resolution**
- **Memory registers**
- **Local and remote control**



## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 100 meters Belden 1694A |

Automatic Cable Input Equalization

## Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50

## Serial Digital Output

| | |
|---|---|
| Number | Four |
| Signal Type | Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | <2 µSec |

## AES/EBU Digital Inputs

| | |
|---|---|
| Number | Four (total of eight channels) |
| Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | Four AES Streams (from video input)<br>Eight channels from any two of four groups |
| Channels | Eight |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

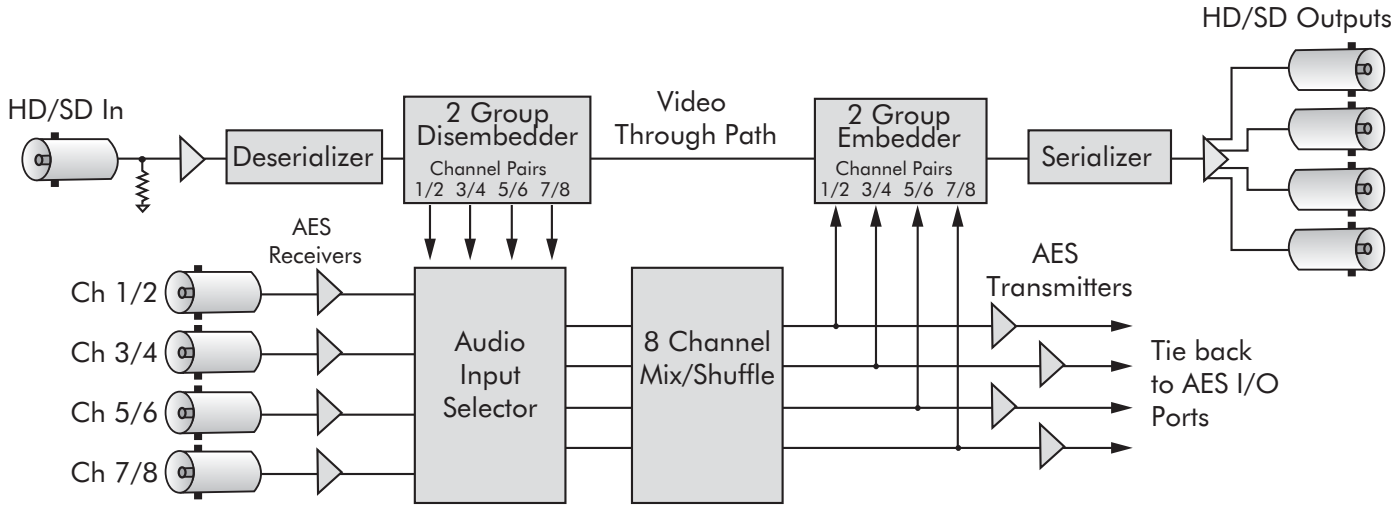
| | |
|---|---|
| Number | Four (total of 8 channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz<br>Synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output (In SDI Outputs)

| | |
|---|---|
| Group Assign | Cascade or replace any two of four groups |
| Channels | Eight |
| Bit Depth | 24 Bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 7610

## 8 Channel Audio Processor sub module for 7900 Series without AES I/O

### Audio Processing

The 7610 is an eight-channel sub module for use with the Avenue 7900 Series Up/Down/Cross Converters. It provides processing for signals with embedded audio. No audio I/O is provided. Audio is disembedded, delayed and then reembedded into the video stream. All audio processing is performed at full 24 bit resolution by a digital signal processor (DSP).

### Lip Sync Preservation

The 7610 has been designed to provide superior handling of embedded audio. The disembedder on the input side follows the timing of the video input, even if that input is asynchronous to the house reference. The embedder on the output side is synchronous to house. This allows embedded audio to be safely bypassed around the video framestore with lip sync properly preserved.

| Avenue Module | Compatible Audio sub module |
|---|---|
| 7550 | 8415 |
| 7555<br>7660 | 7615, 7630, 7635 |
| 7900<br>7910<br>7920<br>7930<br>7940 | 7610, 8415 |
| 8500 | 8415, 8510 |
| 9550<br>9660 | 7615, 7630, 7635 |

# 7615

## Dolby™ E, Dolby D and AC-3 Decoder sub module and Software Key Option

The 7615 Decoder sub module option supports Dolby D, Dolby E and AC-3 signals. The 7615 fits onto Avenue modules that benefit from comprehensive audio handling. In addition to the hardware sub module, a unique software key is provided for activation.

The 7615 decoding option can be fed from either an AES input or an AES stream disembedded from the main module's incoming SDI signal. The resulting discrete surround signals are then selectable as inputs to the main module's channel mixer and shuffler.

The 7615 is for use with the following modules:

7555 HD/SD Video Processing Frame Synchronizer
7660 HD/SD Embedder, Disembedder and Data Inserter
9550 3G/HD/SD Video Processing Frame Synchronizer
9600 3G/HD/SD Embedder, Disembedder and Data Inserter

The 7555 or 9550 are recommended for use with the 7615, 7630 and 7630 due to the 1 frame delay in the Dolby processors.

For complete audio processing, these modules can be fitted with both the 7615 Decoder and the 7630 or 7635 Encoder at the same time. One analog audio channel per encoder/decoder is used for data. Both Dolby E and AC-3/Dolby D modes are supported.

# 7630 and 7635

## Dolby E, Dolby D and AC-3 Encoder sub module and Software Key Option

The 7630 Encoder sub module option supports Dolby E signals. The 7635 Encoder sub module option supports Dolby D and AC-3 signals. The 7630 or 7635 fits onto Avenue modules that benefit from comprehensive audio handling. In addition to the hardware sub module, a unique software key is provided for activation.

The 7630 or 7635 Encoder is fed from selected outputs of the main module's channel mixer and shuffler. The resulting encoded bitstream can be output both on an AES output and embedded into the SDI output.

The 7630 and 7635 are for use with the following modules:

7555 HD/SD Video Processing Frame Synchronizer
7660 HD/SD Embedder, Disembedder and Data Inserter
9550 3G/HD/SD Video Processing Frame Synchronizer
9600 3G/HD/SD Embedder, Disembedder and Data Inserter

The 7555 or 9550 are recommended for use with the 7615, 7630 and 7635 due to the 1 frame delay in the Dolby processors.

For complete audio processing, these modules can be fitted with both the 7615 Decoder and the 7630 or 7635 Encoder at the same time. One analog audio channel per encoder/decoder is used for data.

# 7660
## HD/SD Embedder, Disembedder and Data Inserter

The 7660 module is an eight-channel audio embedder or disembedder for 1.5 high definition or 270 Mb/s standard definition signals. Four AES ports automatically configure as inputs or outputs depending on if the module is configured as mux or demux. Additionally, four channels of analog audio are supported.

### Configurable Mux or Demux

When configured as a multiplexer, the 7660 has one serial digital video input and four AES audio inputs. These four AES streams are embedded into the video stream. AES inputs are sample rate-converted, allowing the use of asynchronous audio. The output of the module is a digital stream that contains the original video signal and four AES pairs, or eight channels.

When configured as a demultiplexer, audio signals present in the incoming video signal are extracted and delivered as standard AES digital audio streams.

The 7660 includes a full-featured, sixteen-channel audio mixer. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources. Delay is adjustable up to one second.

### In-Line Shuffler

Because the 7660 has simultaneous disembedding and embedding, it is an in-line processor for embedded audio. It can take embedded content, adjust levels and remap channels, and deliver it to the output as an embedded signal.

### Dolby and AC-3

The 7660 can be fitted with Dolby and AC-3 encoding and decoding options. The 7615 decoding option can be fed from either an AES input or an AES stream disembedded from the incoming SDI signal. The resulting discrete surround signals are then selectable as inputs to the sixteen channel mixer/shuffler.

The 7630 Dolby encoder is fed from selected outputs of the sixteen channel mixer/shuffler. The resulting encoded bitstream can be output both on an AES output and embedded into the SDI output.

Additionally, the 7660 fully supports embedding and disembedding of encoded multi-channel bitstreams such as AC-3 and Dolby E.

### LevelTrack™ Audio Loudness Control AGC Software and Compliance Options

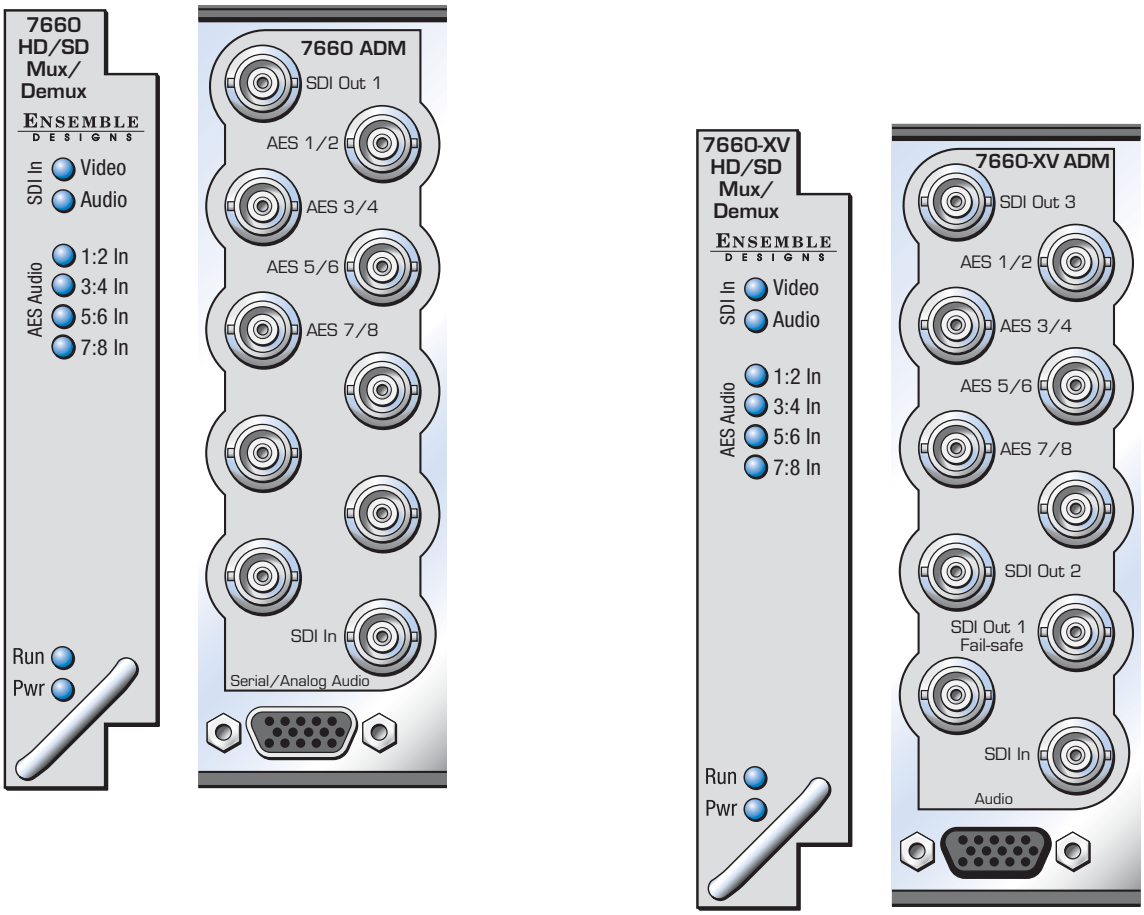
The 9670 LevelTrack Audio Loudness Control AGC software key can be added as an option. LevelTrack provides control for keeping audio levels consistent in program material.

The 9690 Audio Compliance and Monitoring Software can be added for compliance verification and archiving.

The 7660 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lockout, and customizable menus are just some of the tools included in the Avenue Control System.

### Features

- **Audio embedder or disembedder for HD or SD signals**
- **Handles 4 AES streams/8 channels**
- **Analog audio I/O**
- **Dolby encoding and decoding options**
- **Up to one second of delay**
- **In-line processor for embedded audio**
- **Audio Automatic Loudness Control AGC option**
- **Built-in audio mixer**
- **Phase inversion selectable on a channel basis**
- **Built-in sample rate converters accept asynchronous inputs**
- **26 bit processing resolution**
- **Data mux and demux as per SMPTE 337M**
- **Memory registers**




## Order Info

| | |
|---|---|
| 7660 | HD/SD Embedder, Disembedder and Data Inserter module |
| 7660-XV | HD/SD Embedder, Disembedder and Data Inserter module<br>XV configuration provides 3 SDI outputs |
| 7615 | Dolby E, Dolby D, AC-3 Decoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7630 | Dolby E Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7635 | Dolby D/AC-3 Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 9670 | LevelTrack Audio Automatic Gain Control software key option |
| 9690 | Audio Compliance and Monitoring Software |

# 7660
## HD/SD Embedder, Disembedder and Data Inserter

### Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s<br>SMPTE 274M, 292M or 296M<br>or SD Serial Digital 270 Mb/s SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |

Automatic Cable Input Equalization

### Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50
Data, SMPTE 337M

### Output

| | |
|---|---|
| Number | One |
| Signal Type | HD or SD Serial Digital, follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

### AES/EBU Digital Inputs

| | |
|---|---|
| Number | Four (total of eight channels)<br>selectable as inputs or outputs |
| Type | AES3id or data (SMPTE 337) |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |

### AES/EBU Digital Outputs

| | |
|---|---|
| Number | Four (total of eight channels)<br>selectable as inputs or outputs |
| Type | AES3id or data |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

### Analog Audio Inputs

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced |
| Connector | 15 pin D |
| Impedance | >15K Ω |
| Maximum Input Level | 24 dBu |
| CMRR | >60 dB, 20 Hz to 10 KHz |
| Quantization | 24 bits, 128 x oversampled |
| Sample Rate | 48 KHz |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Analog Audio Outputs

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced, transformerless |
| Connector | 15 pin D |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x oversampled |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ± 0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Dolby Metadata Inputs/Outputs

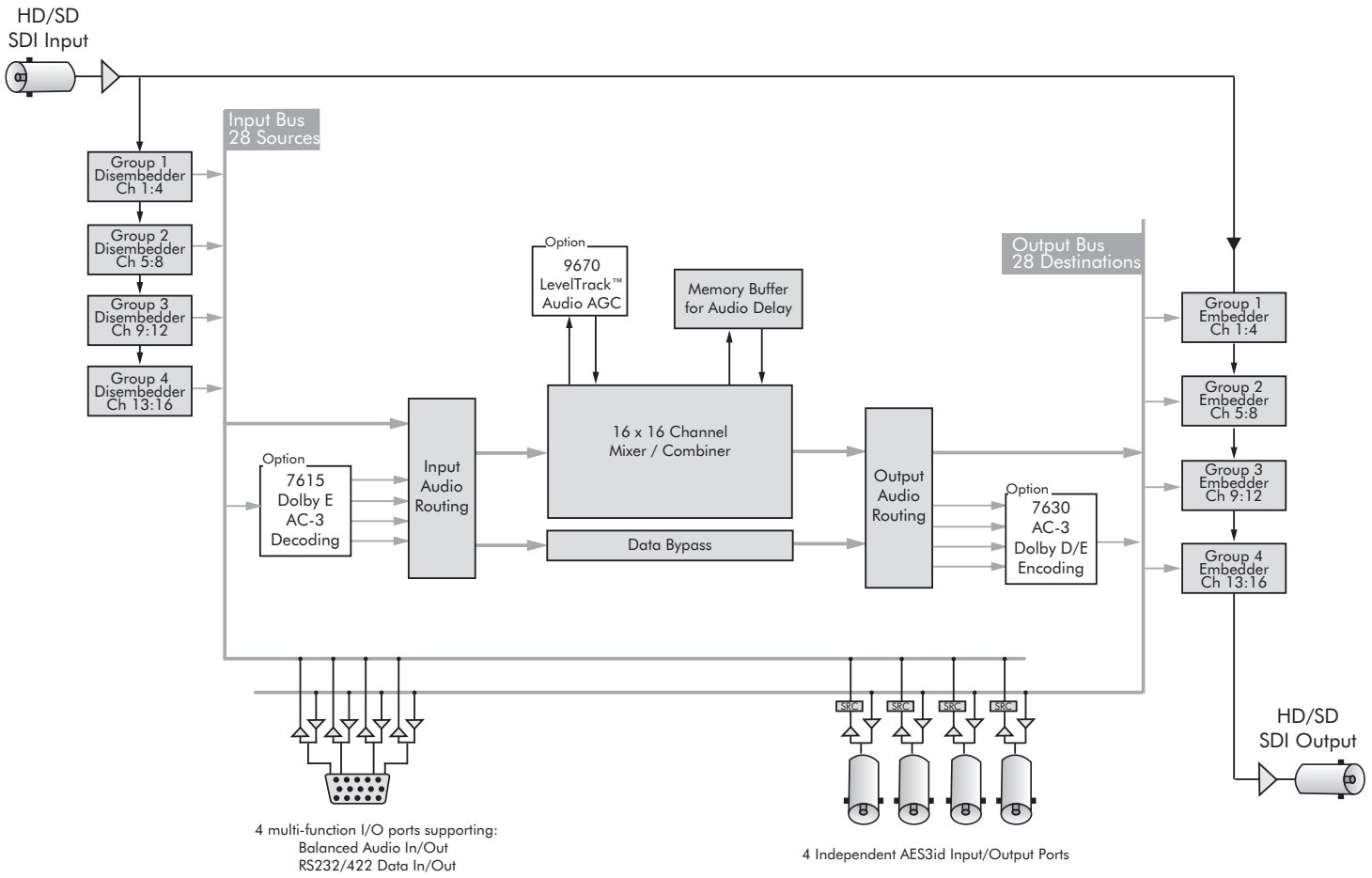
| | |
|---|---|
| Signal Type | Dolby metadata, RS-422, RS-485 |
| Number | Four, selectable as inputs or outputs, share with analog audio I/O |
| Connector | HD-15, balanced |

### Embedded Output (In SDI Outputs)

| | |
|---|---|
| Group Assign | Cascade or replace |
| Channels | Sixteen |
| Bit Depth | 24 Bit |

### General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |




*Above, block diagram for the 7660 HD/SD Embedder, Disembedder and Data Inserter module*

*Alternately, for 3 SDI outputs, order the 7660-XV HD/SD Embedder, Disembedder and Data Inserter module*

# 7900
## HD Up/Down/Cross Converter

### Do It All With One Module

The 7900 is a flexible, configurable Up and Downconverter for use in broadcast and post. It can process SD (Standard Definition) signals into HD, downconvert HD signals into standard definition, and perform Format and Aspect Ratio Conversion on both SD and HD signals. The 7900 and one of the optional audio sub modules together only occupy one slot in an Avenue frame – now that's efficient use of space.

### It's Smart – No Need for Configuration

The 7900 can be configured to continually output your facility's preferred HD format. Just connect any HD or SD signal to the input and the 7900 will convert it to the appropriate format for output. And, if the 8415 audio option is installed, the audio will have automatic delay compensation.

### Upconversion

When configured as an upconverter, the 7900 has a standard definition SDI input and four HD SDI outputs. Excellent for on-air use, the 7900 is equally at home in an HD island, in a signal ingest installation, or in a production application.

The 7900 uses sophisticated Edge and Motion Adaptive Noise Reduction, ensuring delivery of a pristine output that is excellent for use in broadcast. All processing is performed on progressive signals at full bandwidth 4:4:4, for optimum signal quality. Signals are interlaced and deinterlaced as required with motion adaption and edge interpolation. Aspect ratio conversion choices include: Letterbox, Anamorphic, Crop and Zoom.

Input standard and frame rate are auto-detected. The 7900 automatically performs 16 bit SD and HD color space conversion. The built-in Proc Amp provides adjustment of signal parameters with controls for Video, Chroma, Setup and Hue. Vertical interval data is faithfully preserved and is passed from SD to HD. The upconverted output is timeable with respect to the reference input.

### Downconversion

When used as a downconverter, the 7900 has an HD SDI input and four outputs that can be configured as two SDI and two composite outputs, or four SDI outputs. Whether it's providing digital feeds to production switchers and routers, or analog monitoring – the 7900 handles it all.

The downconversion process includes Picture Detail Enhancement and Anti-Alias Filtering, which makes for a pristine SD output.

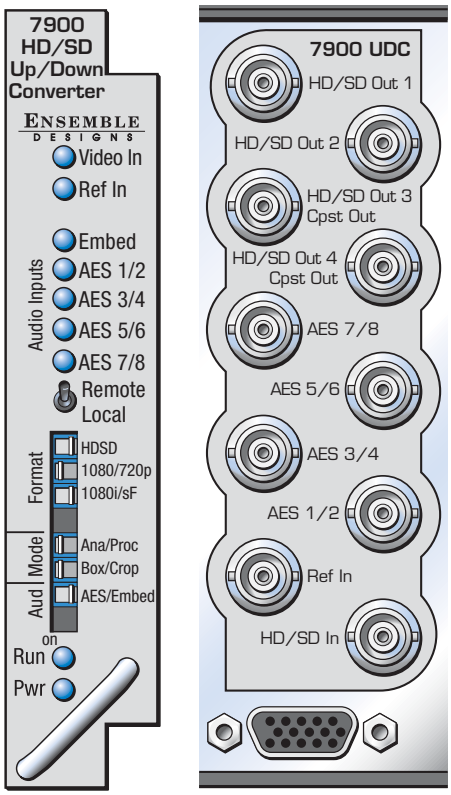
The Aspect Ratio Conversion process offers Resizing and Repositioning with choices for: Letterbox, Anamorphic, Crop and Zoom. The 7900 automatically adjusts between HD and SD color space and gamma. Proc amp controls are provided in the form of Video, Chroma, Setup and Hue.

Both the digital and analog outputs are timeable with respect to the reference input.

### Cross Conversion

The 7900 provides cross conversion between HD 1.5 Gb/s formats, processing all popular variations of 1080 and 720, making it simple for every facility to ingest any type of HD signal.

All popular variations of 720p, 1080i, 1080sF and 1080p are supported. The 7900 converts between any HD signals within the 59.94/23.98/29.97 family, within the 50/25 fps family, or within the 60/30 fps family. 3:2 pulldown is used when converting between 59.94 and 23.98. Film mode is automatically detected.



## Metadata

HD closed captioning is carried in data packets in the vertical interval ancillary data space. The 7900 properly translates between HD caption data and traditional SD captioning (line 21 or 23) so that closed captioning content is converted transparently between video standards and formats.

## Automatic Aspect Ratio Conversion

The 7900 supports AFD (Active Format Description)to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and downconversion process to adapt automatically to material that is already in letter or pillarbox form in order to produce the most appropriate conversion.

## Audio Options

When an audio sub module is installed, audio is automatically delayed as needed to compensate for the video processing in the 7900. For complete audio processing, choose from three different audio sub modules. Sub modules plug onto the 7900 board and do not take up a slot in the frame.

The 8415 is an eight-channel audio sub module with AES I/O that provides management of embedded audio in the processing path, or supports audio embedding/ disembedding alongside the video processing elements. Embedded audio is safely bypassed around the video frame store with the lip sync preserved. Level adjustments and channel shuffling are accessed through the built-in audio mixer. The 9670 Automatic Gain Control option can be added to the 8415. All audio processing is performed at full 24 bit resolution.

The 7610 sub module option provides carriage of up to eight channels of embedded audio through the format conversion process. Embedded audio in the input signal is delayed to match the video delay and preserve lip sync. The delayed content is reinserted in the video output. No level adjustment or channel swapping is provided.

## Complete Control System

The 7900 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock out, and customizable menus are just some of the tools included in the Avenue Control System.

## Features

- **Upconverter**
- **Downconverter**
- **Cross converter**
- **Aspect Ratio Converter**
- **Smart auto-config – set output, then feed any input**
- **Proc Amp and Frame Sync**
- **Audio Mux/Demux optional**
- **Audio Automatic Gain Control optional**
- **Add audio sub module option for delay and processing**
- **All internal processing performed on 4:4:4 progressive signals**
- **Accepts asynchronous signals**
- **Reference input – output is timeable**
- **Automatically adjusts between SD/HD color space and gamma**
- **16 bit processing**
- **Edge and Motion Adaptive Noise Reduction**
- **Picture Detail Enhancement**
- **Anti-Alias Filter**
- **Passes closed captioning**
- **Auto detection of input standard and frame rate**
- **3:2 pulldown**
- **Built-in test pattern and tone**
- **Local and remote control**

# 7900
## HD Up/Down/Cross Converter

### Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s<br>SMPTE 274M, 292M or 296M<br>or SD Serial Digital 270 Mb/s<br>SMPTE 259M<br>(Both 525 and 625 SD standards) |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |

Automatic Cable Input Equalization

### HD Standards Supported

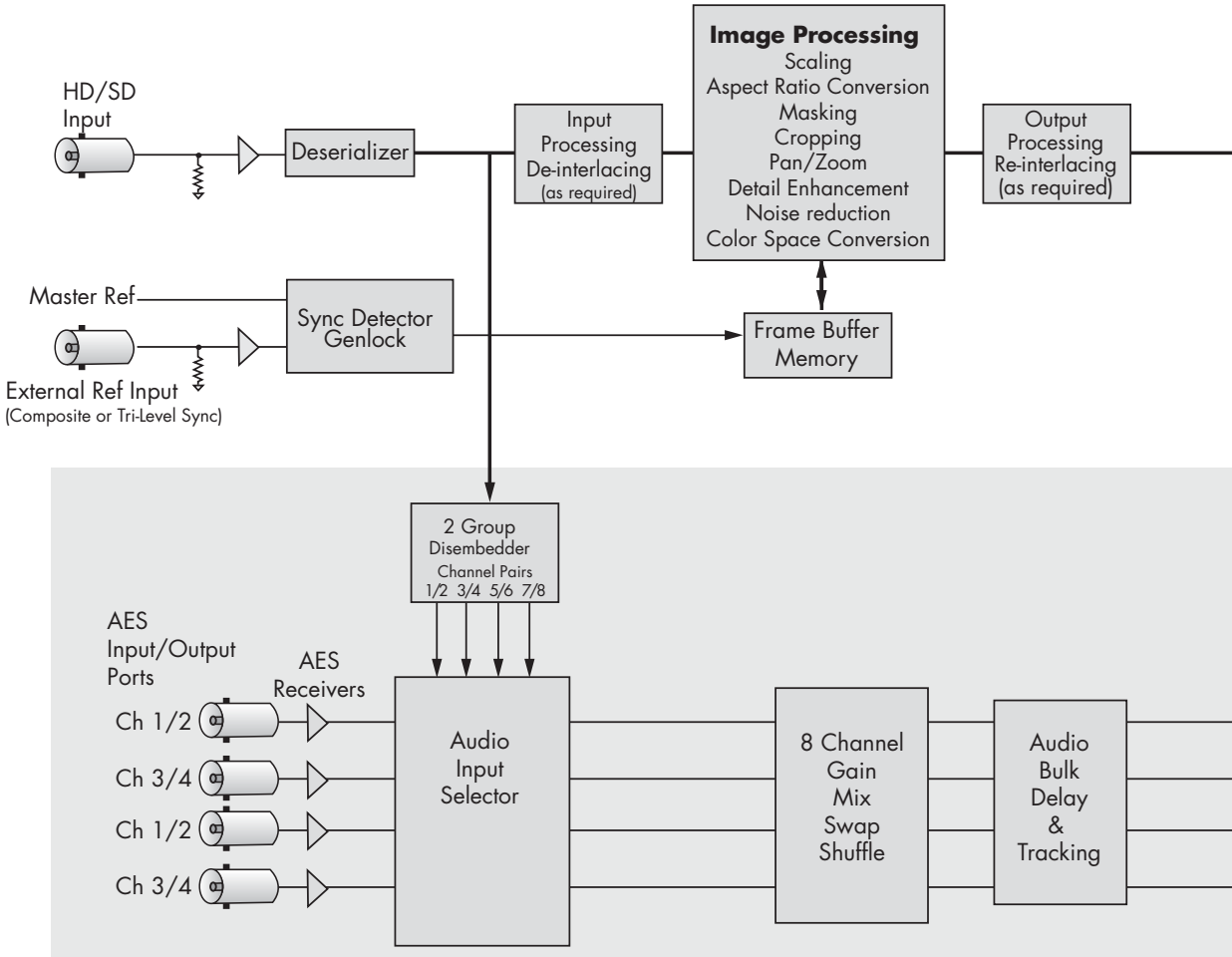
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50

### Serial Digital Output

| | |
|---|---|
| Number | Two, Three or Four Selectable |
| Signal Type | SMPTE 274M, 292M or 296M when HD<br>SMPTE 259M (525 or 625) when SD |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled)Delay<br>Adjustable from 1 field to 1 frame |

### Reference Input

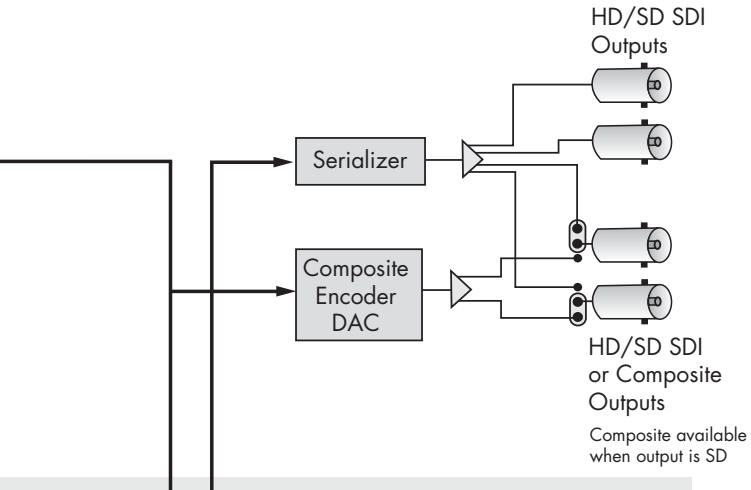
| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or<br>Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |




*Avenue 7900 HD Up/Down/Cross Converter*

## Analog Output (available when output is SD)

| | |
|---|---|
| Number | Two max<br>(BNCs shared with SD SDI outputs) |
| Signal Type | PAL or NTSC composite<br>Standard matches SDI output |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <50 mV |
| Bit Resolution | 12 bit output reconstruction<br>8 x oversampling |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| Differential Phase | <1 degree |
| Differential Gain | <1% |




**8415 8 Channel Audio Processing Option**

## Conversion Directions

Up/Down Conversion between
525 (NTSC) and 1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98
625 (PAL) and 1080i/50, 720p/50, 1080p/25, 1080sF/25
Cross Conversion within frame rate families
525 Derived Family: 1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98
625 Derived Family: 1080i/50, 720p/50, 1080p/25, 1080sF/25

## AES/EBU Digital Inputs (with 8415 sub module option)

| | |
|---|---|
| Number | Four (total of 8 channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | Four AES Streams (from video input)<br>Eight channels from any two of four groups<br>Selectable to any of four groups |
| Channels | Eight |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz Synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output

| | |
|---|---|
| Number | Four or two depending on configuration |
| Group Assign | Cascade or replace any two of four groups |
| Channels | Eight |
| Bit Depth | 24 bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

# 7910
## HD Upconverter and Cross Converter

The 7910 module accepts an SD or HD SDI input and has four HD SDI outputs. Excellent for on-air use, the 7910 is equally at home in an HD island, in a signal ingest installation, or in a production application. Since the 7910 functions as either an Upconverter or Cross Converter, it's useful on the output of a server when material may switch between HD programming and SD commercials. It's also convenient in a dual-rate master control environment.

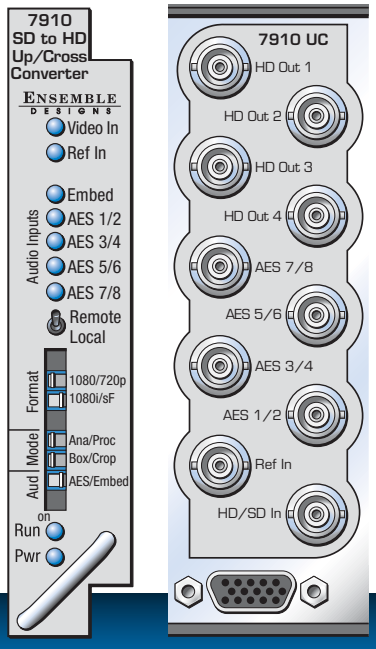
Sophisticated Adaptive Noise Reduction ensures delivery of a pristine output that is excellent for use in broadcast. Additionally, Picture Detail Enhancement is used to recover information that has been lost due to poor frequency response upstream. Aspect ratio conversion choices include: Letterbox, Anamorphic, Crop and Manual Zoom.

Input standard and frame rate are auto-detected. The 7910 automatically adjusts from SD to HD color space and gamma. The built-in Proc Amp provides adjustment of signal parameters with controls for Video, Chroma and Pedestal. The upconverted output is timeable with respect to the reference input. When converting to film rate (1080sF/23.98) formats, 3:2 pulldown cadence is automatically detected and backed out when present in the input.

The 7910 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock out, and customizable menus are just some of the tools included in the Avenue Control System.

### Metadata

HD closed captioning is carried in data packets in the vertical interval ancillary data space. The 7910 properly translates between traditional SD captioning (line 21 or 23) and HD caption data so that closed-captioning content is converted transparently between video standards and formats.




### Automatic Aspect Ratio Conversion

The 7910 supports AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and downconversion process to adapt automatically to material that is already in letterbox or pillarbox form in order to produce the most appropriate conversion.

### Audio Options

When an audio sub module is installed, audio is automatically delayed as needed to compensate for the video processing in the 7910. For complete audio processing, choose from three different audio sub modules. Sub modules plug onto the 7910 board and do not take up a slot in the frame.

The 8415 is an eight-channel audio sub module with AES I/O that provides management of embedded audio in the processing path, or supports audio embedding/disembedding alongside the video processing elements. Embedded audio is safely bypassed around the video frame store with the lip sync preserved. Level adjustments and channel shuffling are accessed through the built-in audio mixer. The 9670 Automatic Gain Control option can be added to the 8415. All audio processing is performed at full 24 bit resolution.

The 7610 sub module option provides carriage of up to eight channels of embedded audio through the format conversion process. Embedded audio in the input signal is delayed to match the video delay and preserve lip sync. The delayed content is reinserted in the video output. No level adjustment or channel swapping is provided.

### Features

- **Upconverter and Cross Converter**
- **Proc Amp and Frame Sync**
- **16 bit processing**
- **Accepts asynchronous signals**
- **Reference input – output is timeable**
- **Automatically adjusts between SD/HD color space and gamma**
- **Adaptive Noise Reduction and Picture Detail Enhancement**
- **All processing performed in progressive**
- **Auto-detection of input standard and frame rate**
- **Built-in test pattern and tone**
- **Audio Mux/Demux optional**
- **Audio Automatic Gain Control optional**
- **Add audio sub module for delay and processing**

## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s,<br>SMPTE 274M, 292M or 296M<br>or SD Serial Digital 270 Mb/s, SMPTE 259M<br>(Both 525 and 625 SD standards) |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A |
| Automatic Cable Input Equalization | |

## HD Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50

## Serial Digital Output

| | |
|---|---|
| Number | Four |
| Signal Type | HD Serial Digital 1.485 Gb/s<br>SMPTE 274M or 296M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled)Delay<br>Adjustable from 1 field to 1 frame |

## Reference Input

| | |
|---|---|
| Number | One external (module's BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or<br>Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

## Conversion Directions

Upconversion from
525 (NTSC) to 1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98, and
625 (PAL) to 1080i/50, 720p/50, 1080p/25, 1080sF/25
Cross Conversion within frame rate families
525 Derived Family: 1080i/59.94, 720p/59.94, 1080p/23.98, and 1080sF/23.98
625 Derived Family: 1080i/50, 720p/50, 1080p/25, 1080sF/25

## AES/EBU Digital Inputs (with 8415 sub module option)

| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted<br>internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | Four AES Streams (from video input)<br>Eight channels from any two of<br>four groups<br>Selectable to any of four groups |
| Channels | Eight |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

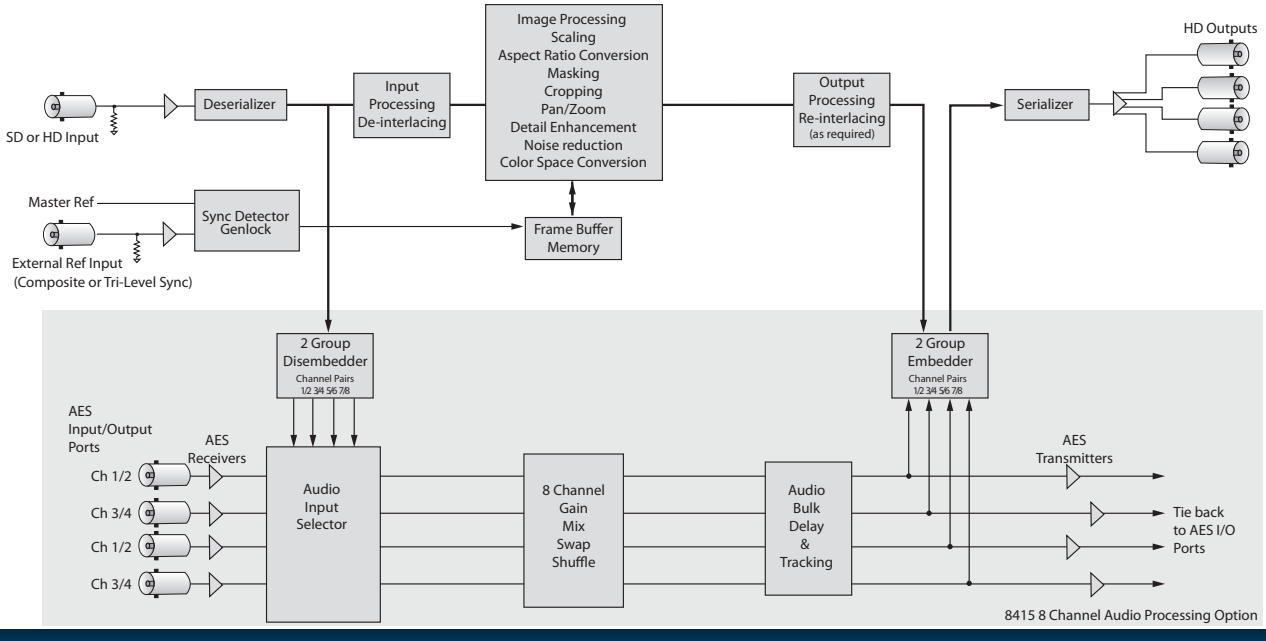
| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output

| | |
|---|---|
| Number | Four or two depending on configuration |
| Group Assign | Cascade or replace any two of four groups |
| Channels | Eight |
| Bit Depth | 24 bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 7920
## HD Downconverter

The 7920 module has an HD SDI input and four outputs that can be configured as two SDI and two composite outputs, or four SDI outputs. Whether it's providing digital feeds to production switchers and routers or analog monitoring, the 7920 is right at home.

The Downconversion process includes Picture Detail Enhancement and Anti-Alias Filtering, which make for a pristine SD output. The Aspect Ratio Conversion process offers Resizing and Repositioning with choices for: Letterbox, Anamorphic, Crop and Zoom. The 7920 automatically adjusts from HD to SD color space and gamma. Proc amp controls are provided in the form of Video, Chroma and Pedestal.

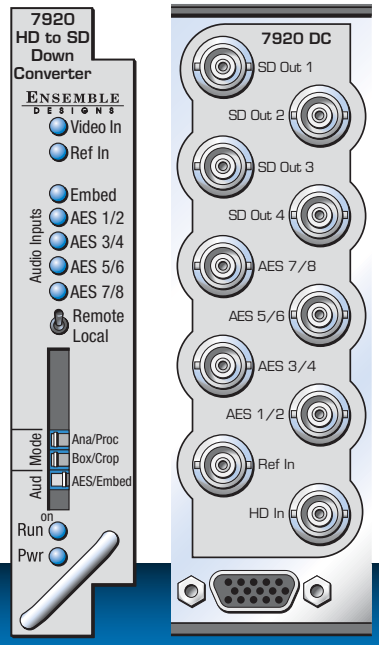
The 7920 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock out, and customizable menus are just some of the tools included in the Avenue Control System.

### Metadata

HD closed captioning is carried in data packets in the vertical interval ancillary data space. The 7920 properly translates between HD caption data and traditional SD captioning (line 21 or 23) so that closed captioning content is converted transparently between video standards and formats.

### Automatic Aspect Ratio Conversion

The 7920 supports AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and down conversion process to adapt automatically to material that is already in letterbox or pillarbox form in order to produce the most appropriate conversion.




### Audio Options

When an audio sub module is installed, audio is automatically delayed as needed to compensate for the video processing in the 7920. For complete audio processing, choose from three different audio sub modules. Sub modules plug onto the 7920 board and do not take up a slot in the frame.

The 8415 is an eight-channel audio sub module with AES I/O that provides management of embedded audio in the processing path, or supports audio embedding and disembedding alongside the video processing elements. Embedded audio is safely bypassed around the video frame store with the lip sync preserved. Level adjustments and channel shuffling are accessed through the built-in audio mixer. The 9670 Automatic Gain Control option can be added to the 8415. All audio processing is performed at full 24 bit resolution.

The 7610 sub module option provides carriage of up to eight channels of embedded audio through the format conversion process. Embedded audio in the input signal is delayed to match the video delay and preserve lip sync. The delayed content is reinserted in the video output. No level adjustment or channel swapping is provided.

### Features

- **Downconverter for 720p, 1080i, 1080sF and 1080p**
- **Proc Amp and Frame Sync**
- **16 bit processing**
- **Accepts asynchronous signals**
- **Reference input – output is timeable**
- **Automatically adjusts between SD/HD color space and gamma**
- **Anti-Alias Filter and Picture Detail Enhancement**
- **All processing performed in progressive**
- **Passes closed captioning**
- **Auto detection of input standard and frame rate**
- **3:2 pulldown**
- **Built-in test pattern and tone**
- **Audio Mux/Demux optional**
- **Audio Automatic Gain Control optional**
- **Add audio sub module for delay and processing**

## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M |
| Impedance | 75 Ω, BNC |
| Return Loss | >15 dB |
| Max Cable Length | 1.485 Gb/s 100 meters |
| Automatic Cable Input Equalization | |

## HD Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16

## Serial Digital Output

| | |
|---|---|
| Number | Four max |
| Signal Type | SD Serial Digital 270 Mb/s, SMPTE 259M (Both 525 and 625 SD standards) |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled)Delay Adjustable from 1 field to 1 frame |

## Reference Input

| | |
|---|---|
| Number | Two:<br>One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

## Analog Output

| | |
|---|---|
| Number | Two max (BNCs shared with SD SDI outputs) |
| Signal Type | PAL or NTSC composite<br>Standard matches SDI output |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <50 mV |
| Bit Resolution | 12 bit output reconstruction<br>8 x oversampling |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| Differential Phase | <1 degree |
| Differential Gain | <1% |

## Conversion Directions

Downconversion from
1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98 to 525 (NTSC) or
1080i/50, 720p/50, 1080p/25, 1080sF/25 to 625 (PAL)

## AES/EBU Digital Inputs (with 8415 sub module option)

| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | Four AES Streams (from video input)<br>Eight channels from any two of four groups<br>Selectable to any of four groups |
| Channels | Eight |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

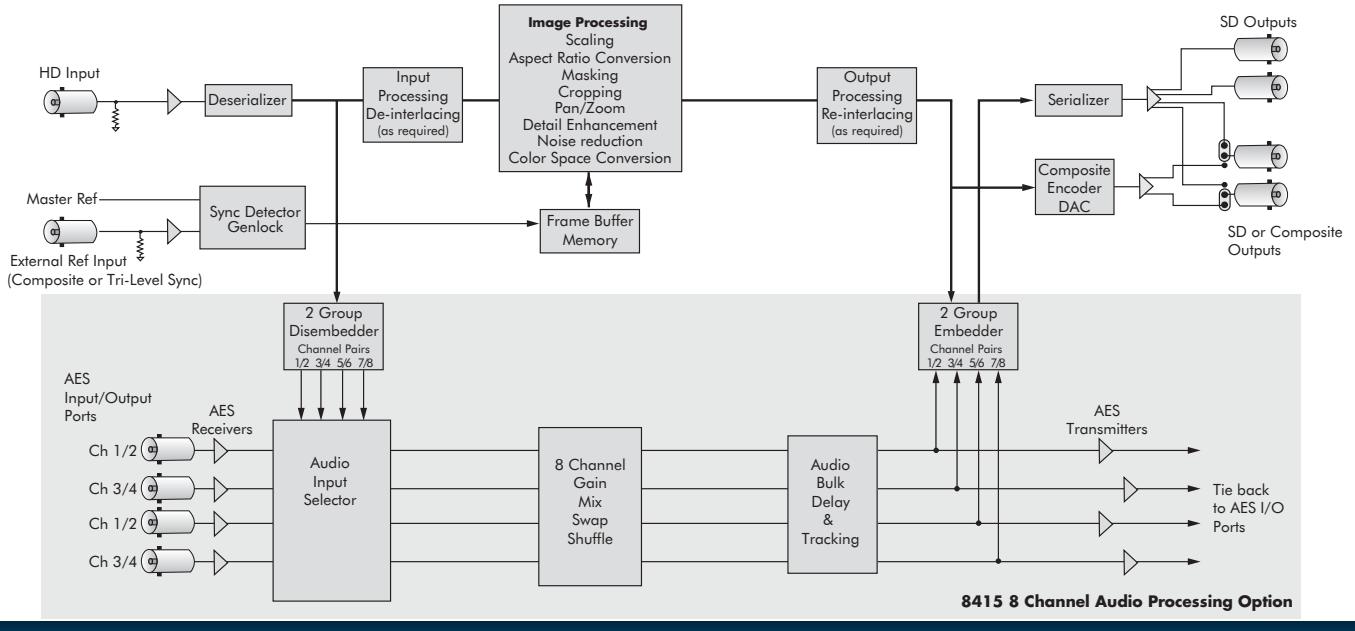
| | |
|---|---|
| Number | Four (total of 8 channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to Video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output

| | |
|---|---|
| Number | Four or two depending on configuration |
| Group Assign | Cascade or Replace any two of four groups |
| Channels | Eight |
| Bit Depth | 24 bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



# 7925
## Dual HD Downconverter

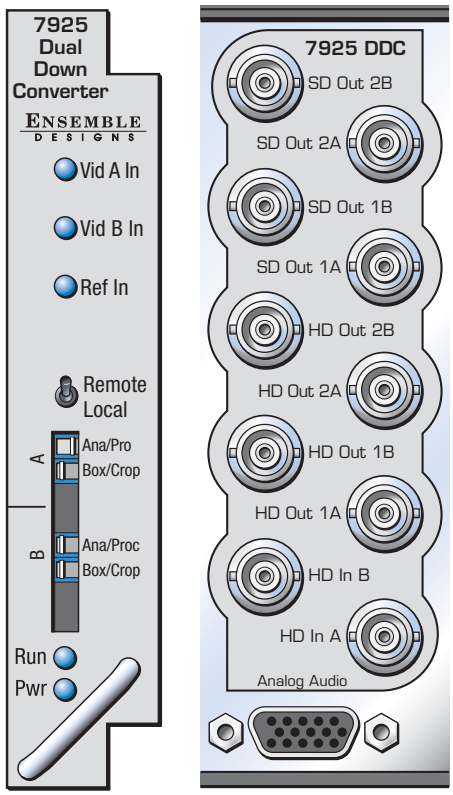
The 7925 module is a two-channel, dual downconverter with HD and SD outputs that can be used in the most demanding broadcast applications. With two downconverters on one module, the 7925 provides high efficiency with excellent picture quality. The downconverted outputs are timeable with respect to the reference input and can feed production switchers and routers.

The 7925 accepts 720p, 1080i, 1080sF and 1080p inputs that are synchronous or asynchronous. If an SD SDI input is received, SD is passed to the output.

Motion-adaptive deinterlacing of the video signal enables all internal processing to occur in progressive.

The 7925 performs automatic color space and gamma conversion to accommodate the differences between HD and SD. The Aspect Ratio Conversion process offers resizing and repositioning with choices for: Letterbox, Anamorphic, Crop and Zoom.

Proc amp controls are provided in the form of Video, Chroma and Pedestal. Video outputs can be timed with respect to the reference input.




## Audio Handling

The 7925 supports 16 channels of embedded audio (without the need for any sub module). Embedded audio in the input is safely bypassed around the video processing, delayed to preserve lip sync, and reembedded in the SD SDI output. Any two of those audio channels can be selected for conversion to analog form. These balanced outputs can be used with the composite video output to feed analog equipment, or for signal monitoring. All audio processing and conversion is performed at full 24 bit resolution.

## Control

The 7925 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock-out, and customizable menus are just some of the tools included in the Avenue Control System.

## Metadata

HD closed captioning is carried in data packets in the vertical interval ancillary data space. The 7925 properly translates HD caption data to traditional SD captioning (line 21 or 23) so that closed captioning content is converted transparently between video standards and formats.

## Automatic Aspect Ratio Conversion

The 7925 uses AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are read at the input of the module to determine the type of Aspect Ratio Conversion to perform. Subsequently, these flags are properly updated in the output signal to reflect its format and presentation.

## Features

- Two HD downconverters on one module
- Accepts asynchronous HD inputs
- Each channel has SD SDI and/or composite outputs
- Reclocked DA'd outputs
- Downconverts 720p, 1080i, 1080sF or 1080p to SD
- Passes SD 525 or 625 if received on input
- Reference input
- Outputs can be locked and timed to reference for use with switchers and routers
- Internal processing in progressive
- Proc Amp and Frame Sync
- Built-in test pattern and tone
- Supports AFD
- Translates HD closed captioning to SD closed captioning
- Passes 16 channels of embedded audio
- 2 channels of analog audio for monitoring
- Auto detection of input standard and frame rate
- Local and remote control

# 7925
## Dual HD Downconverter

### Serial Digital Input

| | |
|---|---|
| Number | Two (one per channel) |
| Signal Type | HD Serial Digital 1.485 Gb/s,<br>SMPTE 274M, 292M or 296M |
| Impedance | 75 Ω, BNC |
| Return Loss | >15 dB |
| Max Cable Length | 100 meter |

Automatic Cable Input Equalization

### Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
525i 59.94, 625i 50

### Conversion Directions

Downconversion from
1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98 to 525 (NTSC), or
1080i/50, 720p/50, 1080p/25, 1080sF/25 to 625 (PAL)

### Reference Input

| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or<br>Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

### HD Serial Digital Output

| | |
|---|---|
| Number | Three<br>Ch A has two HD SDI reclocked DA'd outputs and<br>Ch B has one HD SDI reclocked DA'd output |
| Signal Type | HD Serial Digital 1.485 Gb/s,<br>SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>(Both 525 and 625 SD standards) |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | 0 for HD outputs |

### General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

### SD Serial Digital Output

| | |
|---|---|
| Number | Four max<br>Jumper selectable, BNCs shared with composite outputs<br>Each channel has two SD outputs, selectable as two SD SDI, or<br>two composite, or<br>one SD SDI and one composite |
| Signal Type | SD Serial Digital 270 Mb/s, SMPTE 259M<br>(Both 525 and 625 SD standards) |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | Adjustable from 1 field to 1 frame |

### Analog Video Output

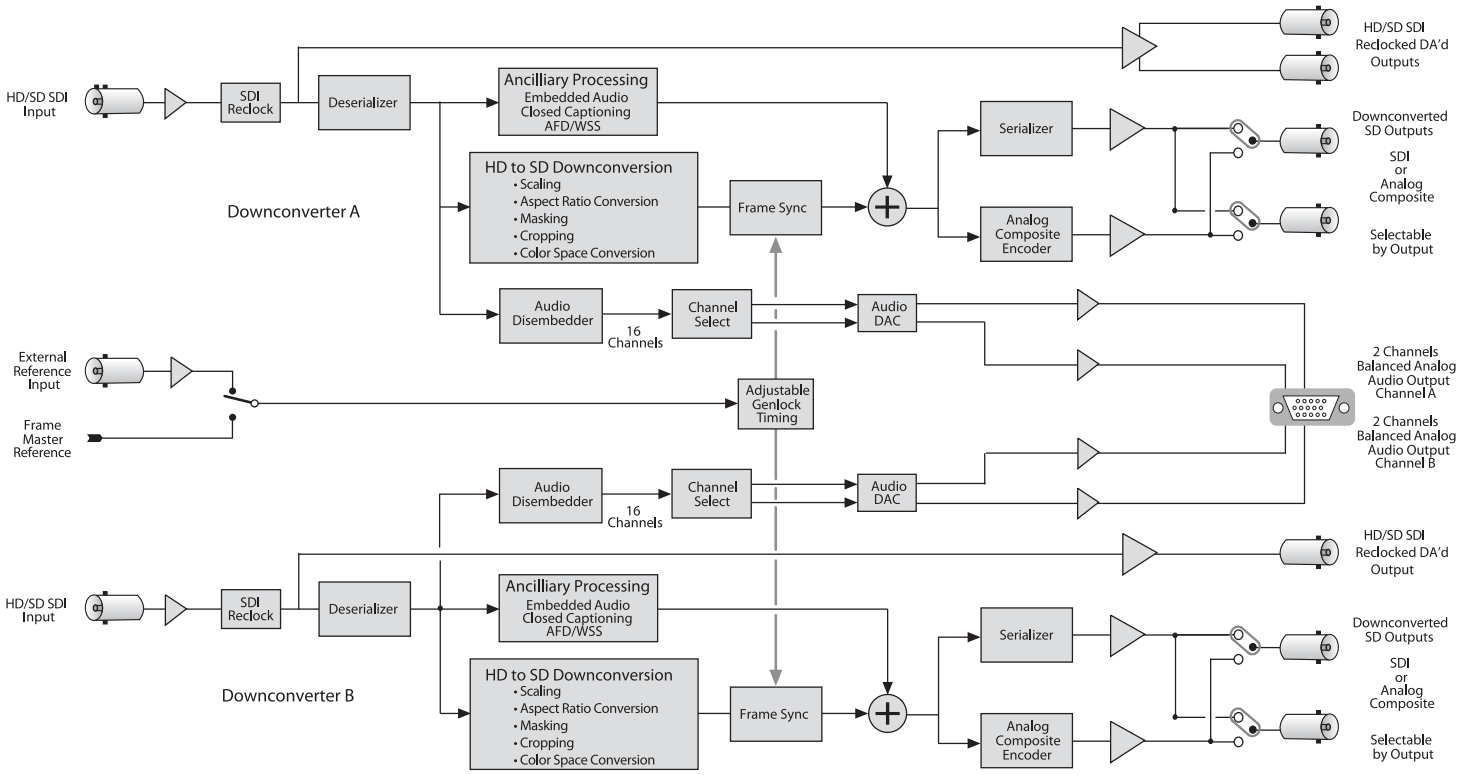
| | |
|---|---|
| Number | Four max<br>Jumper selectable, BNCs shared with SDI outputs<br>Each channel has two SD outputs, selectable as two SD SDI, or<br>two composite, or<br>one SD SDI and one composite |
| Signal Type | PAL or NTSC composite |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <50 mV |
| Resolution | 16 bit processing |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| Differential Phase | <1 degree |
| Differential Gain | <1% |
| Delay | Adjustable from 1 field to 1 frame |

### Analog Audio Output

| | |
|---|---|
| Number | Two (selectable from sixteen) |
| Signal Type | Balanced, transformerless |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x Oversampled |
| Reference Level | -10 dBu to +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 kHz |
| Crosstalk | <102 dB |
| Dynamic Range | >106 dB |
| Delay | Automatic to match video processing |

### Embedded Output

Support for all four groups (16 channels) from input to output.
Audio in SD output is delayed appropriately to compensate for conversion.


HD/SD SDI Input
SDI Reclock
Deserializer
Ancillary Processing
Embedded Audio
Closed Captioning
AFD/WSS
HD to SD Downconversion
• Scaling
• Aspect Ratio Conversion
• Masking
• Cropping
• Color Space Conversion
Frame Sync
Serializer
Analog Composite Encoder
HD/SD SDI Reclocked DA'd Outputs
Downconverted SD Outputs
SDI or Analog Composite
Selectable by Output
Downconverter A
Audio Disembedder
16 Channels
Channel Select
Audio DAC
External Reference Input
Frame Master Reference
Adjustable Genlock Timing
2 Channels Balanced Analog Audio Output Channel A
2 Channels Balanced Analog Audio Output Channel B
HD/SD SDI Input
SDI Reclock
Deserializer
Ancillary Processing
Embedded Audio
Closed Captioning
AFD/WSS
HD to SD Downconversion
• Scaling
• Aspect Ratio Conversion
• Masking
• Cropping
• Color Space Conversion
Frame Sync
Serializer
Analog Composite Encoder
HD/SD SDI Reclocked DA'd Output
Downconverted SD Outputs
SDI or Analog Composite
Selectable by Output
Downconverter B
Audio Disembedder
16 Channels
Channel Select
Audio DAC

# 7930
## HD Cross Converter

The 7930 module provides cross conversion between HD 1.5 Gb/s formats, processing all popular variations of 1080 and 720, making it simple for every facility to ingest any type of HD signal.

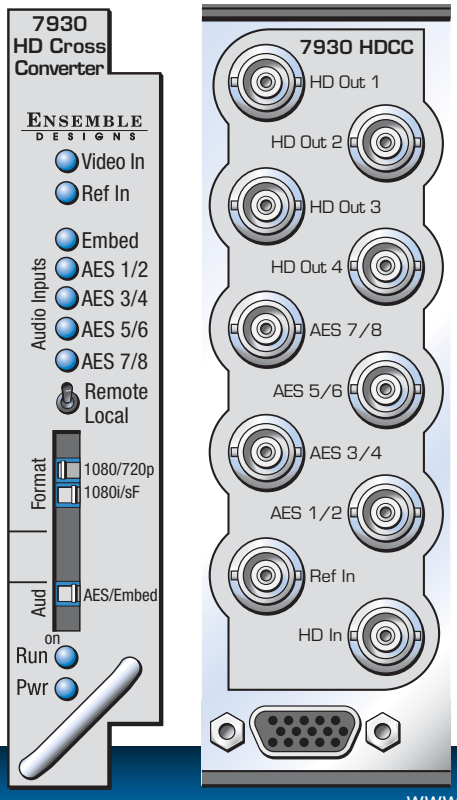
All popular variations of 720p, 1080i, 1080sF and 1080p are supported. The 7930 converts between any HD signals within the 59.94/23.98/29.97 family, within the 50/25 fps family, or within the 60/30 fps family. When converting from 59.94 to 23.98 formats, the 3:2 cadence of any existing film material in the input is automatically detected and backed out.

The 7930 can be configured to continually output your facility's preferred HD format. Just connect any HD signal to the input and the 7930 will cross convert it to the appropriate format for output. And, if the 8415 audio option is installed, the audio will automatically be processed as well.

The 7930 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock-out, and customizable menus are just some of the tools included in the Avenue Control System.

### Metadata

HD closed captioning is carried in data packets in the vertical interval ancillary data space. The 7930 converts this caption data transparently between video standards and formats.




### Automatic Aspect Ratio Conversion

The 7930 supports AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and downconversion process to adapt automatically to material that is already in letterbox or pillarbox form in order to produce the most appropriate conversion.

### Audio Options

When an audio sub module is installed, audio is automatically delayed as needed to compensate for the video processing in the 7930. For complete audio processing, choose from three different audio sub modules. Sub modules plug onto the 7930 board and do not take up a slot in the frame.

The 8415 is an eight-channel audio sub module with AES I/O that provides management of embedded audio in the processing path, or supports audio embedding/disembedding alongside the video processing elements. Embedded audio is safely bypassed around the video frame store with the lip sync preserved. Level adjustments and channel shuffling are accessed through the built-in audio mixer. The 9670 Automatic Gain Control option can be added to the 8415. All audio processing is performed at full 24 bit resolution.

The 7610 sub module option provides carriage of up to eight channels of embedded audio through the format conversion process. Embedded audio in the input signal is delayed to match the video delay and preserve lip sync. The delayed content is reinserted in the video output. No level adjustment or channel swapping is provided.

### Features

- **HD Cross Converter for 720p, 1080i, 1080sF, 1080p**
- **16 bit processing**
- **All processing performed in progressive**
- **Accepts asynchronous signals**
- **Reference input, output is timeable**
- **Auto detects input standard and frame rate**
- **Proc Amp**
- **Passes closed captioning**
- **Built-in test pattern and tone**
- **Audio Mux/Demux optional**
- **Audio Automatic Gain Control optional**
- **Add audio sub module for delay and processing**

## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 100 meters Belden 1694A |
| Automatic Cable Input Equalization | |

## HD Standards Supported

1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16

## Serial Digital Output

| | |
|---|---|
| Number | Four |
| Signal Type | HD Serial Digital 1.485 Gb/s, SMPTE 274M or 296M |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |
| Delay | Adjustable from 1 field to 1 frame |

## Reference Input

| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

## Conversion Directions

Cross Conversion within frame rate families
525 Derived Family: 1080i/59.94, 720p/59.94, 1080p/23.98, and 1080sF/23.98
625 Derived Family: 1080i/50, 720p/50, 1080p/25, 1080sF/25

## AES/EBU Digital Inputs (with 8415 sub module option)

| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | Four AES Streams (from video input)<br>Eight channels from any two of four groups<br>Selectable to any of four groups |
| Channels | Eight |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

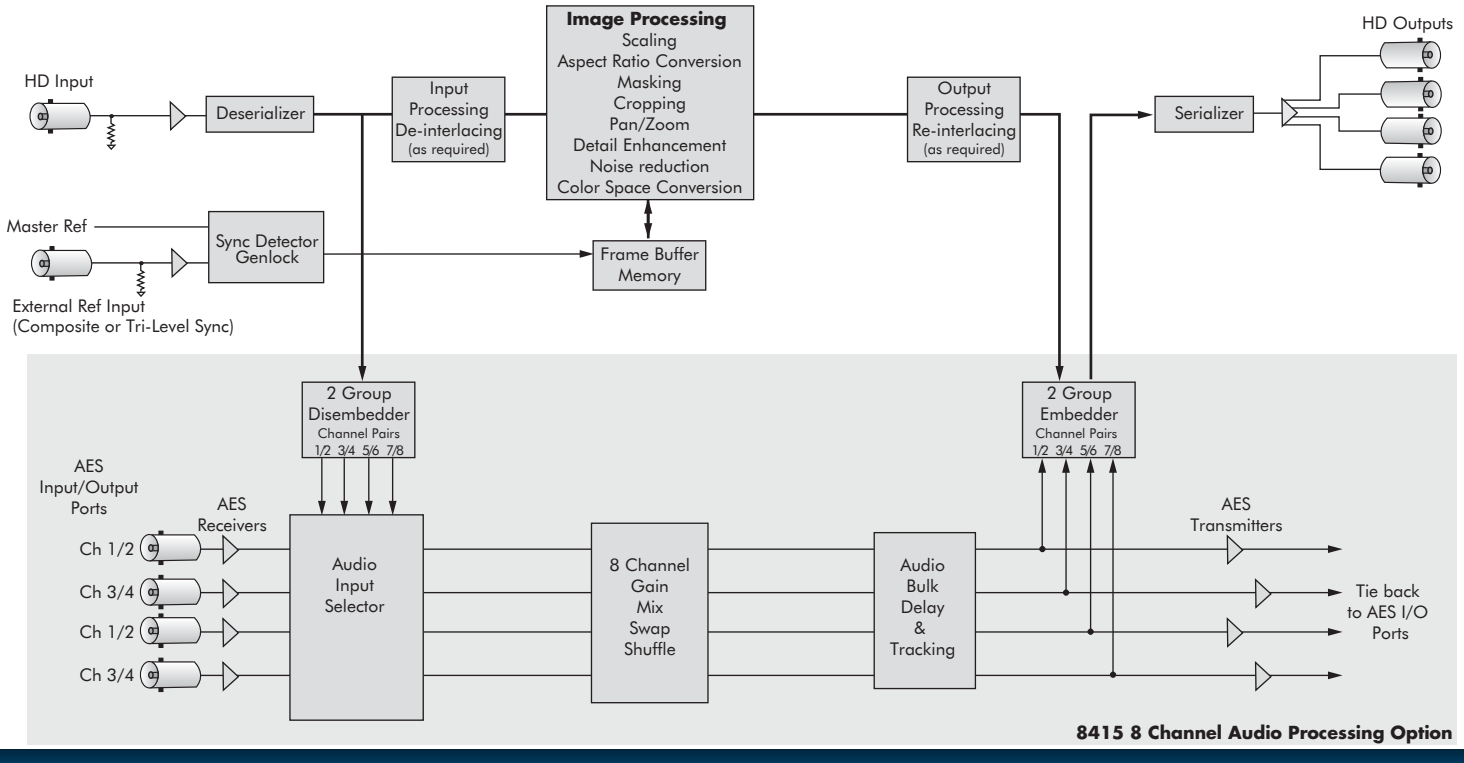
| | |
|---|---|
| Number | Four (total of 8 channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz Synchronous to Video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output

| | |
|---|---|
| Number | Four or two depending on configuration |
| Group Assign | Cascade or replace any two of four groups |
| Channels | Eight |
| Bit Depth | 24 bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |




**8415 8 Channel Audio Processing Option**

# 7940
## SD Aspect Ratio Converter

The 7940 is an aspect ratio converter for standard definition signals. Resizing and Repositioning includes choices for: Letterbox, Anamorphic, Crop and Zoom. Proc amp controls are provided in the form of Video, Chroma and Pedestal.

The 7940 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock out, and customizable menus are just some of the tools included in the Avenue Control System.

### Automatic Aspect Ratio Conversion

The 7940 supports AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and downconversion process to adapt automatically to material that is already in letterbox or pillarbox form in order to produce the most appropriate conversion.

### Audio Options

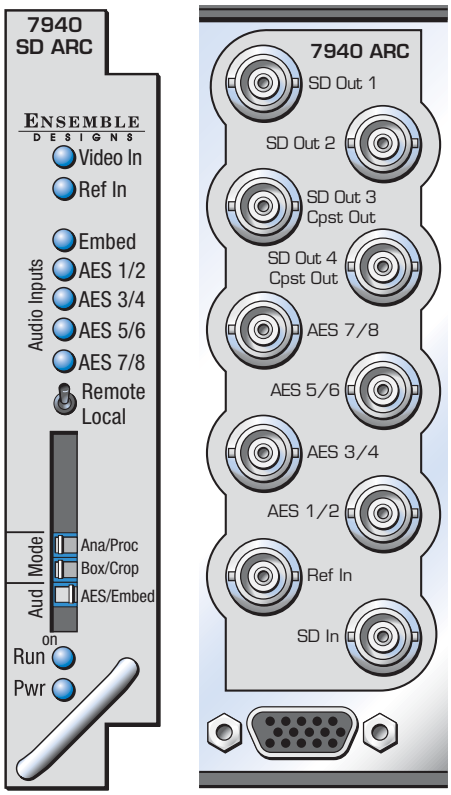
When an audio sub module is installed, audio is automatically delayed as needed to compensate for the video processing in the 7940. For complete audio processing, choose from three different audio sub modules. Sub modules plug onto the 7940 board and do not take up a slot in the frame.

The 8415 is an eight-channel audio sub module with AES I/O that provides management of embedded audio in the processing path, or supports audio embedding/ disembedding alongside the video processing elements. Embedded audio is safely bypassed around the video frame store with the lip sync preserved. Level adjustments and channel shuffling are accessed through the built-in audio mixer. The 9670 Automatic Gain Control option can be added to the 8415. All audio processing is performed at full 24 bit resolution.

The 7610 sub module option provides carriage of up to eight channels of embedded audio through the format conversion process. Embedded audio in the input signal is delayed to match the video delay and preserve lip sync. The delayed content is reinserted in the video output. No level adjustment or channel swapping is provided.

### Features

- **SD Aspect Ratio Converter**
- **16 bit processing**
- **Accepts asynchronous signals**
- **Reference input – output is timeable**
- **Auto-detects input standard and frame rate**
- **Passes closed captioning**
- **Proc Amp**
- **Built-in test pattern and tone**
- **Audio Mux/Demux optional**
- **Audio Automatic Gain Control optional**
- **Add audio sub module for delay and processing**



## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | SD Serial Digital 270 Mb/s, SMPTE 259 (both 525 and 625 SD standards) |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 300 meters Belden 1694A |
| Automatic Cable Input Equalization | |

## Serial Digital Output

| | |
|---|---|
| Number | Four max |
| Signal Type | SD Serial Digital 270 Mb/s SMPTE 259 |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |

## Reference Input

| | |
|---|---|
| Number | One external (module's BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video |
| Return Loss | >40 dB (applies to external ref input) |
| Delay | Adjustable from 1 field to 1 frame |

## Analog Output

| | |
|---|---|
| Number | Two max (BNCs shared with SD SDI outputs) |
| Signal Type | PAL or NTSC composite<br>Standard matches SDI output |
| Impedance | 75 Ω<br>Return Loss >40 dB |
| Output DC | <50 mV |
| Bit Resolution | 12 bit output reconstruction<br>8 x oversampling |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| Differential Phase | <1 degree |
| Differential Gain | <1% |

## AES/EBU Digital Inputs (with 8415 sub module option)

| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 KHz to 100 KHz (sample rate converted internally to 48 KHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | Four AES Streams (from video input)<br>Eight channels from any two of four groups<br>Selectable to any of four groups |
| Channels | Eight |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

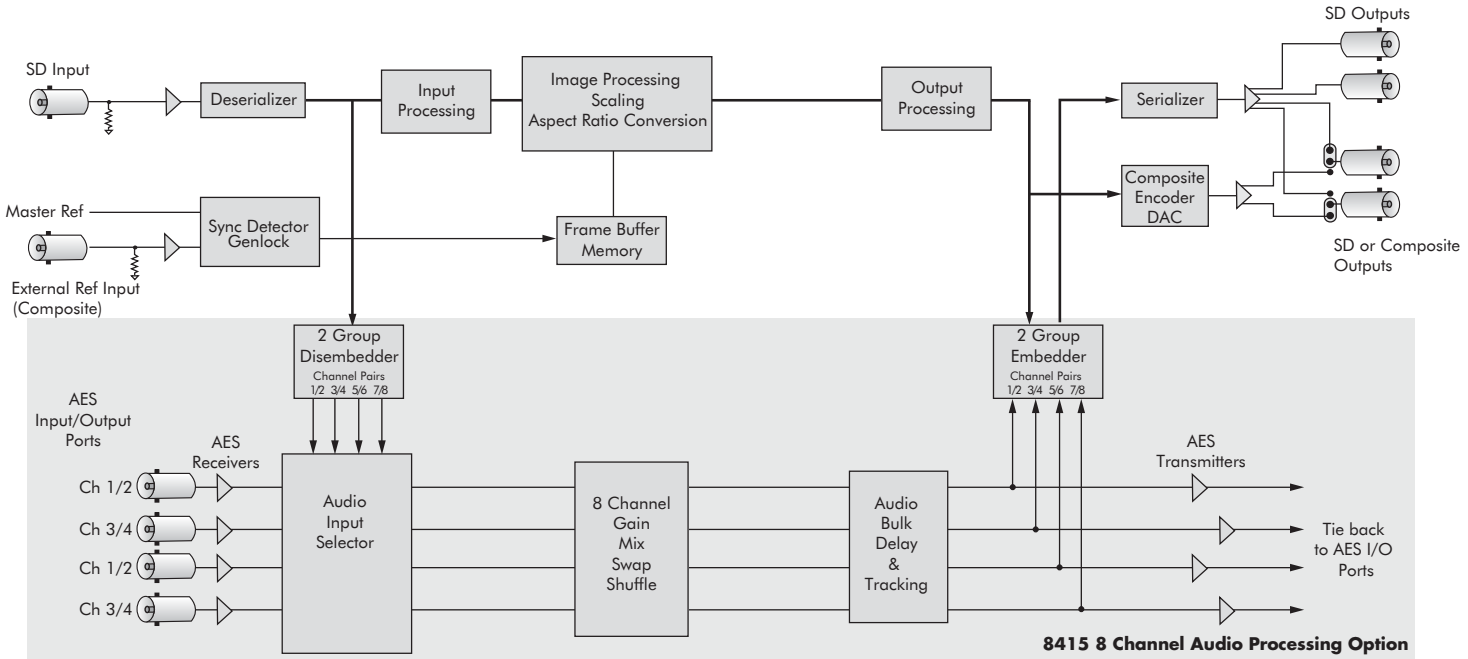
| | |
|---|---|
| Number | Four (total of eight channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 KHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output

| | |
|---|---|
| Number | Four or two depending on configuration |
| Group Assign | Cascade or replace any two of four groups |
| Channels | Eight |
| Bit Depth | 24 bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |



8415 8 Channel Audio Processing Option

# 8415

## 8 Channel Audio Processor sub module for 7550, 7900 Series and 8500

### Audio Processing

The 8415 is an eight-channel sub module for use with the Avenue 7550, 7900 Series and 8500 Video Processing Frame Syncs. The 8415's flexible architecture addresses a wide range of audio handling needs. All audio processing is performed at full 24 bit resolution by a digital signal processor (DSP).

### Mix, Swap and Shuffle

The 8415 is a full-featured, eight-channel audio mixer. With built-in disembedding from the SDI input of the Video Processor, and four AES I/O ports, the 8415 can handle any digital audio requirement. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. Because the 8415 has simultaneous disembedding and embedding, it is an in-line processor for embedded audio. It can take embedded content, adjust levels and remap channels, and deliver it to the output as an embedded signal.

### Lip Sync Preservation

The 8415 has been designed to provide superior handling of embedded audio. The disembedder on the input side follows the timing of the video input, even if that input is asynchronous to the house reference. The embedder on the output side is synchronous to house. This allows embedded audio to be safely bypassed around the video framestore with lip sync properly preserved.

### Automatic Gain Control Option

On the 7550 and 7900 series modules, Avenue 9670 Audio Automatic Gain Control software key can be added as an option. This option provides control for keeping audio levels consistent in program material.

### Features

- **8 channel audio processing**
- **AES I/O**
- **24 bit audio processing**
- **Embedded Audio Input (Eight Channels)**
- **Embedded Audio-Friendly Synchronization**
- **Resynchronize embedded audio content**
- **Fully adjustable audio levels**
- **Automatic Gain Control Option**
- **Complete shuffling and mixing among all channels**
- **Mix, shuffle, adjust levels of embedded audio**
- **Phase inversion selectable on a channel basis**
- **Tracking Audio Delay**
- **User-adjustable Bulk Audio Delay**
- **Automatic Gain Control option**
- **Built-in tone generator**
- **100 MHz DSP**
- **Use with 7550, 7900 Series and 8500**

# 8 Channel Audio Processor sub module for 7550, 7900 Series and 8500

## AES/EBU Digital Inputs

| | |
|---|---|
| Number | Four (total of 8 channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

## Embedded Inputs

| | |
|---|---|
| Number | One (from SDI video input) |
| Signal Type | SMPTE 274M compliant |
| | Selectable to any of 4 groups |
| Channels | Four |
| Bit Depth | 20 and 24 bit |

## AES/EBU Digital Outputs

| | |
|---|---|
| Number | Four (total of 8 channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

## Embedded Output

| | |
|---|---|
| Number | Two (or more, depending on main module) |
| Signal Type | SMPTE 274M compliant |
| Group Assign | Cascade or replace any two of four groups |
| Channels | Four |
| Bit Depth | 24 bit |

# 8500
## Composite/SD Legalizer and Video Processing Frame Sync

### Legalizer
The 8500 module is a composite Legalizer, Proc Amp, TBC and Frame Sync. The Legalizer is a predictive clipper which insures signal levels will not exceed those permitted in the composite domain. While the Legal setting automatically puts in values to insure signals will not exceed composite legal limits, selecting Custom allows the you to set a range of clip values.

### Noise Reducer Option
The optional 8520 Noise Reducer removes unwanted noise and artifacts with is motion- and scene-adaptive filtering. Several forms of noise reduction are employed to ensure the best possible performance. Recursive Temporal Noise filtering includes Simple Recursive, Motion Adaptive and Motion Adaptive with Impulse Filters. Controls are provided for maximum signal-to-noise improvement and for noise threshold. These can be set manually or run in automatic mode. The combination of the 8500 module and the 8520 noise reducer is perfect for MPEG compression preprocessing and satellite or ENG feeds.

### Uncompromised Pictures
Whether your input is standard definition SDI Digital Component, Analog Composite or Analog Component, the 8500 handles it with precision and accuracy. The SDI input is carried at full uncompressed bandwidth throughout the entire module, and EDH monitoring of the digital input alerts you to any incoming problem. Analog inputs are 4x oversampled at 12 bits of resolution. Composite signals are decoded using an adaptive comb filter. Complete control over signal levels is provided.

### Digital and Analog Outputs
With both SD SDI and 12 bit analog inputs (composite, component, or S-Video [Y/C] formats), the 8500 is easily integrated into any hybrid facility. The 8500 simultaneously outputs both SDI digital component and 12 bit analog composite.

Outputs are fully timed to your house reference, including the subcarrier and ScH phase of the composite output. The analog output is constructed at 8 x oversampling with 12 bits of quantizing resolution. On loss of input, the output can mute to black or freeze on the last good frame of video.

### Rock Steady TBC/Frame Synchronizer
Input video is synchronized to your house reference by an agile TBC/Frame Synchronizer. Even noisy and jittery analog sources are faithfully tracked to provide a steady, genlocked output. Robust signal handling ensures proper time base correction for virtually any source, even a consumer VHS machine. Select the SDI input and the 8500 is a serial digital frame sync.

### Complete Proc Amp Functions
The 8500 has a full-featured Proc Amp for adjustment of every signal parameter. Proc controls include Video and Chroma Gain, NTSC-style hue rotation, Black Balance, and pedestal. Black and White clips can be set to prevent excessive signal excursions.

A Detail Enhancer recovers information that has been lost due to poor frequency response in upstream systems. Certain values represented in serial digital component may be illegal in the PAL or NTSC composite domains. The Predictive Composite Clipper mode identifies picture elements that would be illegal in analog composite, and limits color saturation and luminance excursions. You can be confident that the work you're doing in digital component will look its best in composite.

Selective (toothed) vertical blanking lets you choose to pass or strip content in the vertical interval on a line-by-line and field-by-field basis. To help optimize the settings in the Proc Amp, a Split Screen mode allows you to compare the processed output with the original material.

### Audio Options
A four or eight channel audio sub module can be added to the main 8500 module. Either the 8415 or 8510 can be added to accommodate audio I/O, channel shuffling and mixing. The 8500 module passes embedded audio and Dolby without an audio sub module. The 9670 Audio AGC option handles loudness requirements.

### Total Control
Because the 8500 is an Avenue module, every function and parameter can be controlled from the Avenue Control System. Memory registers can be used to save the complete configuration of the module, making it easy to change instantly between different configurations. Any combination of Express Panels, Touch Screens and PCs can be used to control the 8500. The Express Panel is especially well suited for use with the 8500.

# 8500

## Composite/SD Legalizer and Video Processing Frame Sync

### Features

- **Video Legalizer**
- **Predictive Composite Clipper**
- **Black and White clips**
- **Excellent tracking of noisy inputs**
- **Adaptive Comb Filter decoder, sharpness filter**
- **Split Screen mode**
- **Outputs are fully timeable**
- **Composite, component, S-Video input**
- **A to D, and D to A, all in one module**
- **Full-featured TBC/Frame Synchronizer**
- **Comprehensive Proc Amp controls**
- **Passes embedded audio and Dolby**
- **12 bit, 8 x Oversampled analog output**
- **4x oversampled analog input**
- **SD SDI (Serial Digital) input**
- **Simultaneous SD SDI and analog composite outputs**
- **Line-Selectable toothed blanking**
- **Internal color bar generator**
- **Memory Registers**
- **4- or 8-channel audio options**
- **Noise Reducer option**
- **Audio Automatic Gain Control option**

### Analog Inputs

| | |
|---|---|
| Signal Type | SMPTE Y, Pr, Pb<br>Beta Y, Pr, Pb<br>NTSC, PAL Composite<br>NTSC, PAL S-Video (Y/C) |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Input DC | ±1 volt DC |
| Input Hum | <100 mV |

### Serial Digital Input

| | |
|---|---|
| Signal Type | SD Serial Digital 270 Mb/s, SMPTE 259M |
| EDH | Fully compliant |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Max Cable Length | 300 meters Belden 1694A |

Automatic Cable Input Equalization

### Reference Input

| | |
|---|---|
| Number | One external<br>One internal Master Timing Ref |
| Signal Type | 1 V P-P Composite Video, PAL or NTSC |
| Impedance | 75 Ω, BNC |
| Return Loss | >40 dB |

### Analog to SDI Performance

| | |
|---|---|
| Bit Resolution | 12 bit input quantization, 4 x oversampling |
| Signal to Noise | >62 dB, weighted |
| Frequency Response | |
| Composite and Y | ±0.1 dB, 0 to 5.5 MHz |
| Cr, Cb | ±0.1 dB, 0 to 2.75 MHz |
| Minimum Delay | 90 µSec |

### SDI to SDI Performance

Passes entire SDI signal from input to output, including embedded audio and all other ancillary data

### Analog Output

| | |
|---|---|
| Signal Type | PAL or NTSC Composite<br>Standard follows input |
| Impedance | 75 Ω |
| Return Loss | >40 dB |
| Output DC | <50 mV |

### Serial Digital Outputs

| | |
|---|---|
| Number | One, two or four (selectable) |
| Signal Type | SD Serial Digital 270 Mb/s, SMPTE 259M |
| EDH | Fully compliant |
| Impedance | 75 Ω |
| Return Loss | >15 dB |
| Output DC | None (AC coupled) |

### SDI to Analog Performance

| | |
|---|---|
| Bit Resolution | 12 bit output reconstruction<br>8 x oversampling |
| Signal to Noise | >65 dB |
| Frequency Response | ±0.1 dB, 0 to 5.5 MHz |
| K Factor | <1% |
| ScH Phase Error | <±2 degrees |
| Differential Phase | <1 degree |
| Differential Gain | <1% |
| Color Field Sequence | Locked to selected Ref |
| Minimum Delay | 25 µSec |

### General Specifications

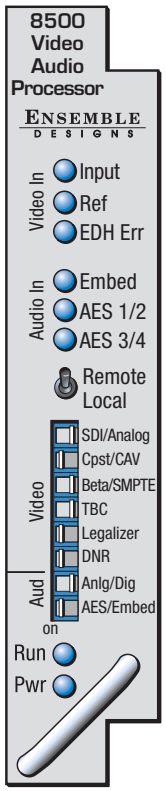
| | |
|---|---|
| Power Consumption | 10 watts (with 2 options installed) |
| Temperature | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Size | Occupies one slot in 3RU or 1RU Frame (including 1 audio and DNR sub module) |

# 8500

## Composite/SD Legalizer and Video Processing Frame Sync

### Features

- **Legalizer**
- **Digital Noise Reducer option**
- **Digital Proc Amp**
- **SD Analog and Digital Inputs**
- **SD Analog and Digital Outputs**
- **TBC/Frame Sync**
- **Passes embedded audio**
- **Embedded Audio Processing option**
- **4 or 8 channels**
- **Tracking Audio Delay**



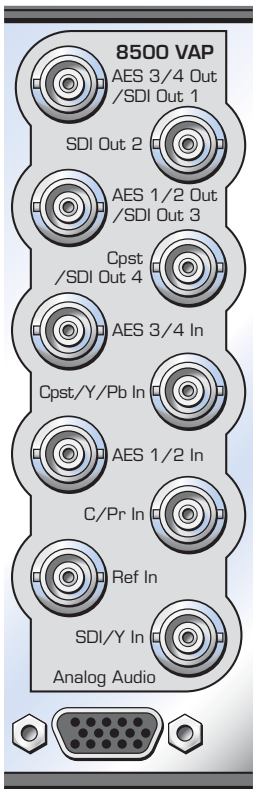



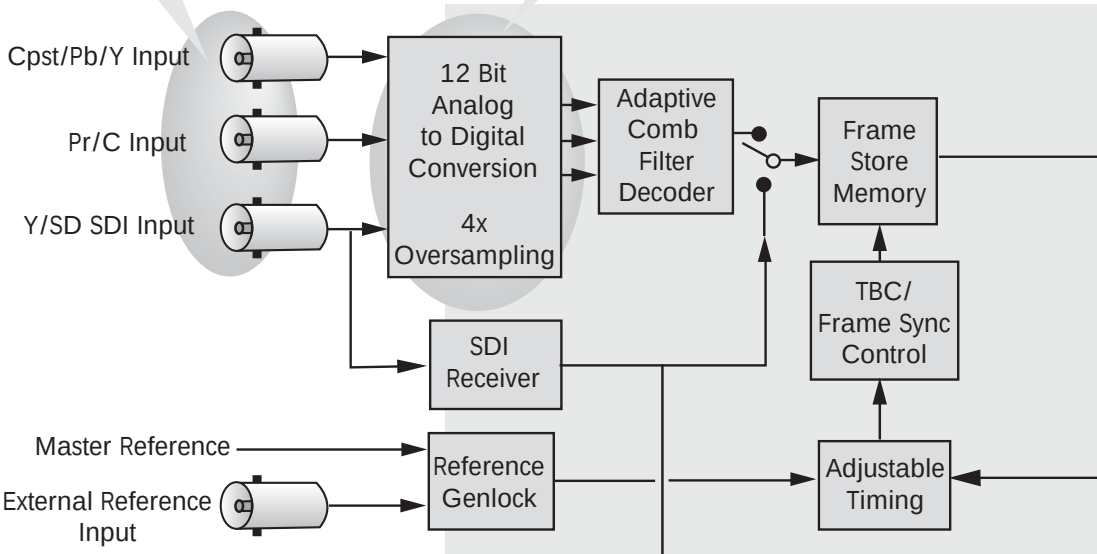

**Image Quality**

12 Bit Analog to Digital Conversion
4x Oversampling

**Input Flexibility**

Composite and S-Video
Component
SD SDI

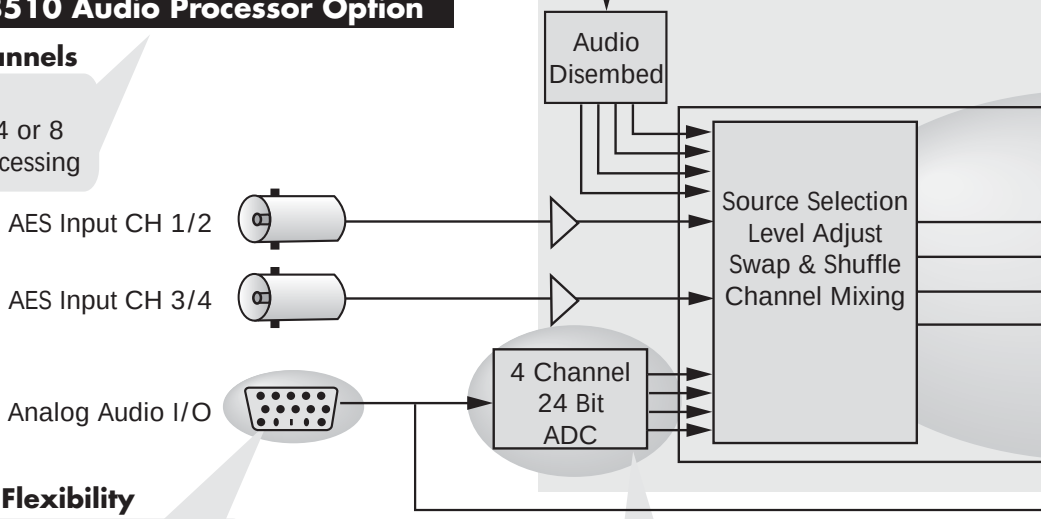
**8500 Video Processor Module**




**8510 Audio Processor Option**

**4 or 8 Channels**

Sub module
Choices for 4 or 8
Channel Processing

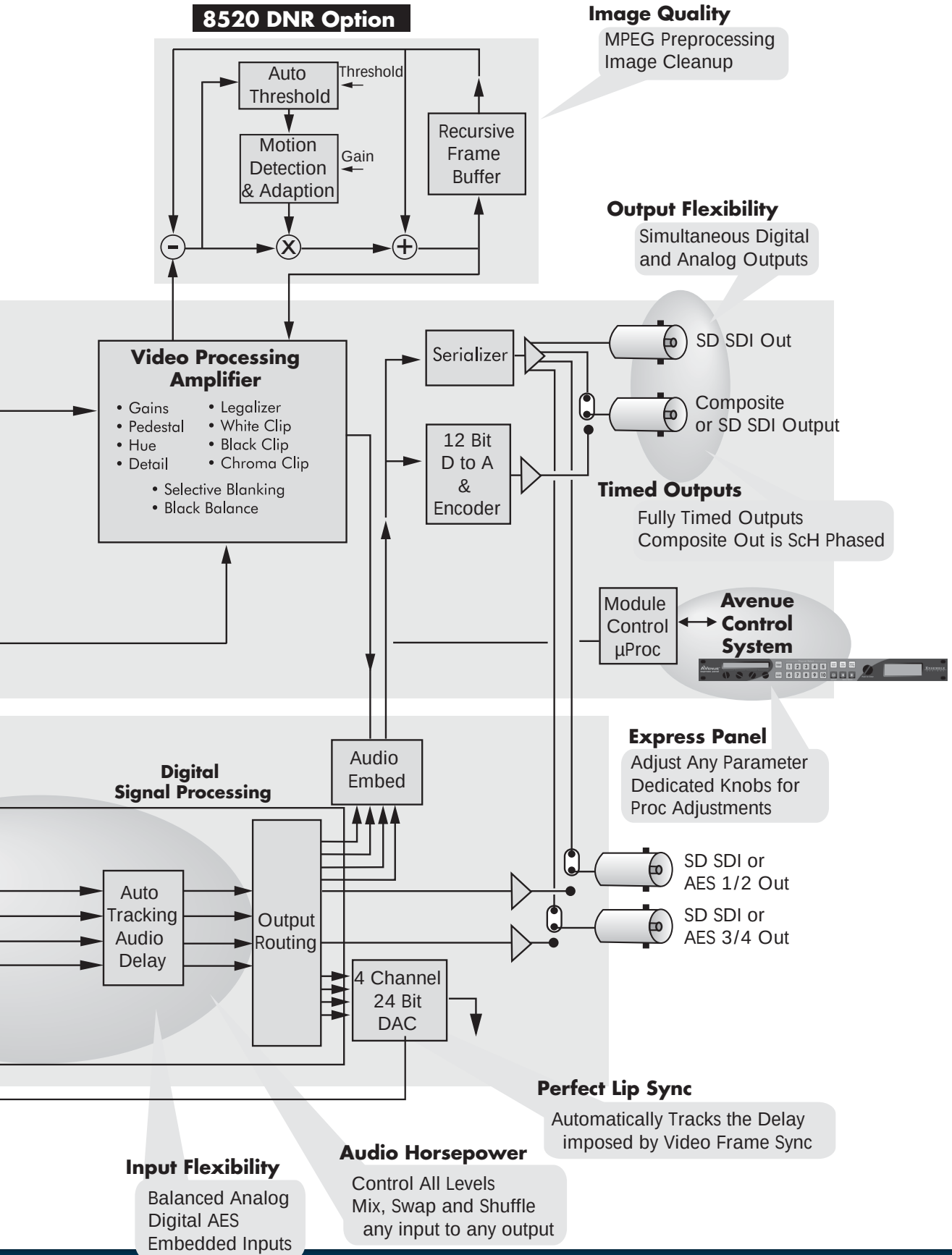



**Analog Flexibility**

User Configurable as:
4 Balanced Inputs
4 Balanced Outputs
or 2 Inputs and 2 Outputs

**Sound Quality**

24 Bit Conversion and Processing
for Fidelity and Accuracy


8520 DNR Option
Auto Threshold
Threshold
Motion Detection & Adaption
Gain
Recursive Frame Buffer
Image Quality
MPEG Preprocessing
Image Cleanup
Output Flexibility
Simultaneous Digital and Analog Outputs
Video Processing Amplifier
• Gains
• Pedestal
• Hue
• Detail
• Legalizer
• White Clip
• Black Clip
• Chroma Clip
• Selective Blanking
• Black Balance
Serializer
12 Bit D to A & Encoder
SD SDI Out
Composite or SD SDI Output
Timed Outputs
Fully Timed Outputs
Composite Out is ScH Phased
Module Control µProc
Avenue Control System
Express Panel
Adjust Any Parameter
Dedicated Knobs for Proc Adjustments
Digital Signal Processing
Audio Embed
Auto Tracking Audio Delay
Output Routing
4 Channel 24 Bit DAC
SD SDI or AES 1/2 Out
SD SDI or AES 3/4 Out
Perfect Lip Sync
Automatically Tracks the Delay imposed by Video Frame Sync
Audio Horsepower
Control All Levels
Mix, Swap and Shuffle
any input to any output
Input Flexibility
Balanced Analog
Digital AES
Embedded Inputs

# 8510
## 4 Channel Audio Processor sub module for 8500

The 8510 Audio Processor is a sub module option for use with the 8500 module. The 8510 adds both analog and digital audio capability with a flexible architecture that addresses a wide range of audio handling needs.

When the 8500 is being used as a video A to D converter, the 8510 can perform the same function with the associated audio. If the 8500 is being fed an SDI signal with embedded audio, the 8510 can produce an analog output of that audio. When using the 8500 as an SDI frame sync, the 8510 can properly resynchronize the embedded audio content.

### Flexible Inputs

The 8510 accepts four channels of balanced analog audio. Analog inputs are digitized at 24 bits of resolution. Two AES inputs provide four channels of digital audio to the input selector. Sample rate converters can be selected in the AES input path, allowing the use of asynchronous digital sources. The 8510 accepts synchronous AC-3 or Dolby E inputs.

An audio disembedder fed by the SDI input to the 8500 provides four additional channels of digital audio. The input selector allows any of these four channels to serve as inputs to the audio processing functions.

### Mix, Swap and Shuffle

The 8510 has a full-featured, four-channel audio mixer. Precise control over audio level is provided for each input. A gain of up to +12dB can be applied to signals with low input levels. Signal phase inversion is selectable on a channel-by-channel basis to correct phase errors in incoming material.

Assignment of input channel to output channel is completely flexible, making it possible to swap any input to any output, or produce a mix of any input combination on any output.

All audio processing is performed at the full 24 bit resolution of the system by a digital signal processor (DSP).

### Tracking Audio Delay

In order to compensate for the delay introduced in the video path by the frame synchronizer function of the 8500, a tracking audio delay automatically delays the four audio channels. This prevents the video synchronizing process from causing lip sync errors. The amount of delay required is communicated to the 8510 by the 8500 module's microcontroller. Changes in delay are made incrementally over several seconds.

In addition to the automatic tracking delay, the 8510 has an additional bulk delay that is user-adjustable up to one second in length. This delay can be used to correct lip sync errors that were already present in the original signal.

### Digital and Analog Output

The four audio output channels can be delivered in both analog and digital form. 24 bit digital to analog conversion produces the analog balanced outputs, with reference level selectable from -10 to +4 dBu.

The output channels are simultaneously available in AES digital form, synchronous to the video reference supplied to the 8500 module. Finally, the four channels may also be embedded into the SDI output of the 8500.

### Embedded Audio Handling

The 8510 has been designed to provide superior handling of embedded audio. The disembedder on the input side follows the timing of the SDI input, even if that input is asynchronous to the house reference. The embedder on the output side is synchronous to house. This allows embedded audio to be safely bypassed around the video framestore with the lip sync properly preserved.

# 8510
## 4 Channel Audio Processor sub module for 8500

### Features

- **24 bit processing throughout**
- **Up to 4 Balanced Analog Inputs**
- **2 AES Inputs (4 Channels)**
- **Embedded Audio Input (4 Channels)**
- **Built-in sample rate converter accepts asynchronous inputs**
- **Up to 4 Balanced Analog Outputs**
- **2 AES Outputs (4 Channels)**
- **Embedded Audio Output (4 Channels)**
- **Embedded Audio-Friendly Synchronization**
- **Mix, Shuffle, Level Adjust of Embedded Audio**
- **Fully adjustable audio levels**
- **Complete shuffling and mixing among all channels**
- **Phase inversion selectable on a channel basis**
- **Tracking Audio Delay**
- **User-adjustable Bulk Audio Delay**
- **Built-in tone generator**
- **100 MHz DSP**
- **Memory Registers**
- **Use with 8500 module**

### Analog Inputs

| | |
|---|---|
| Number | Configurable as two or four |
| Signal Type | Balanced |
| Impedance | >15 K Ω |
| Maximum Input Level | 24 dBu |
| CMRR | >60 dB, 20 Hz to 10 kHz |
| Quantization | 24 bits, 128 x oversampled |
| Sample Rate | 48 kHz |
| Reference Level | -10 dBu to +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 kHz |
| Crosstalk | <102 dB |
| Dynamic Range | >106 dB |

### AES/EBU Digital Inputs

| | |
|---|---|
| Number | Two (total of four channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |
| AC-3, Dolby E | Supported when inputs are synchronous |

### Embedded Inputs

| | |
|---|---|
| Number | One (from SDI video input) |
| Signal Type | SMPTE 274M compliant<br>Selectable to any of four groups |
| Channels | Four |
| Bit Depth | 20 and 24 bit |

### Analog Outputs

| | |
|---|---|
| Number | Configurable as two or four |
| Signal Type | Balanced, transformerless |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x Oversampled |
| Reference Level | -10 dBu to +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 kHz |
| Crosstalk | <102 dB |
| Dynamic Range | >106 dB |

### AES/EBU Digital Outputs

| | |
|---|---|
| Number | Two (total of four channels) |
| Signal Type | AES3id |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

### Embedded Output

| | |
|---|---|
| Number | One (or more, depending on main module) |
| Signal Type | SMPTE 274M compliant |
| Group Assign | Cascade or replace any two of four groups |
| Channels | Four |
| Bit Depth | 24 bit |

# 8520
## Digital Noise Reducer sub module for 8500

The 8520 Digital Video Noise Reducer is an optional sub module for use with the 8500 module. The noise reduction process is downstream from the 8500 Proc Amp controls. The 8520 can be used with any video input source. It only adds 4 microseconds to the throughput delay of the 8500, so it does not introduce problems with system timing.

The 8520 is motion- and scene-adaptive. It removes unwanted noise and artifacts, making it perfect for MPEG compression preprocessing and satellite or ENG feeds.

Several forms of noise reduction are employed to ensure the best possible performance. Recursive Temporal Noise filtering includes Simple Recursive, Motion Adaptive and Motion Adaptive with Impulse Filters. Controls are provided for maximum signal-to-noise improvement and for noise threshold. These can be set manually or run in automatic mode.

Motion Adaptive Recursive Noise filtering works on a pixel-by-pixel basis, comparing the current frame to frames that have already been filtered. If the change that is detected is small, it is considered noise, while if it is large, it is considered motion or a scene change. The detection process uses an LMMSE (Linear Minimum Mean Square Error) filtering algorithm to evaluate the presence of motion. Combining this algorithm with recursive temporal filters preserves fine detail while reducing noise in the presence of motion, including rapidly moving objects and scene changes. Motion trails are minimized while avoiding hard motion failures that some adaptive noise filters can exhibit.

User controls for the Motion Adaptive Recursive Filter include a Noise Threshold, based on how much noise is present in the incoming signal, and Maximum Signal to Noise Improvement, based on how much noise removal is desired. The threshold setting can be automatic or user-adjustable. When set to automatic, the noise level of the input signal is measured and the threshold is set accordingly. This simplifies the setup of the noise reducer and makes it responsive to varying input signal-to-noise levels. This minimizes the need for operator intervention to accommodate feeds of differing quality.

When the combined Motion Adaptive Recursive and Impulse Noise Filter is selected, temporal impulse noise-filtering is used to remove high level, narrow noise impulses, without reducing fine stationary detail.

A special Luma Tie mode reduces dot crawl artifacts from composite originated material by identifying cross-color and cross-luminance effects as unwanted noise. The Show Noise output mode displays what areas of the picture are being affected by the noise-reducer. Noise is represented by white or black, while unaffected areas are represented in gray. This handy mode makes it easy to set optimum adjustments for the material being processed. The Split Screen mode lets you compare the processed output to the original signal.

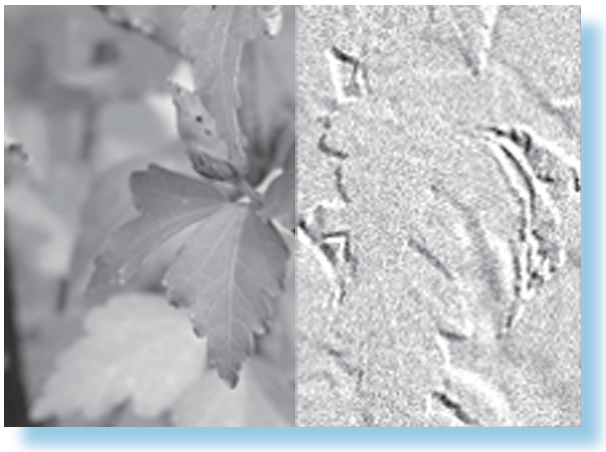
Complete control of the 8520 is provided through the Avenue Control System. Memory registers allow you to store configurations for easy recall.

### Features

- **Motion Adaptive Recursive Filtering**
- **Frame-based recursion**
- **Temporal Impulse Filtering**
- **Motion and Scene Adaptive**
- **Spatial and Temporal modes**
- **Preprocessing for MPEG**
- **12 bit processing**
- **Minimal processing delay**
- **Automatic Noise Level sensing**
- **Automatic or Manual Reduction and Threshold setting**
- **Luma and Chroma Processing with separate controls**
- **Split Screen and Show Noise mode**
- **Luma Tie reduces cross-color artifacts**
- **Use with the 8500 Video Processing Frame Sync**

# 8520
## Digital Noise Reducer sub module for 8500

*The Show Noise mode displays the detected noise and residual motion which will be removed from the video.*



*Split Screen displays the noise-reduced output next to the original scene.*

### Functional

| | |
|---|---|
| Modes | Manual Adaptive |
| | Automatic (low gain) |
| | Automatic (high gain) |
| Processing | Temporal, Recursive |
| Configurations | Independent Luma/Chroma |
| | Chroma tied to Luma |
| Through Delay | <4 µSec |
| Resolution | 12 bit internal processing |

### Controls

| | |
|---|---|
| Gain | 0 to 20 dB |
| Threshold | 0.1 to 10.0 IRE |

### Status and Display

| | |
|---|---|
| Automatic Mode | Displays derived Gain and Threshold |
| Video Out | Normal |
| | Show Noise |
| | Split Screen |

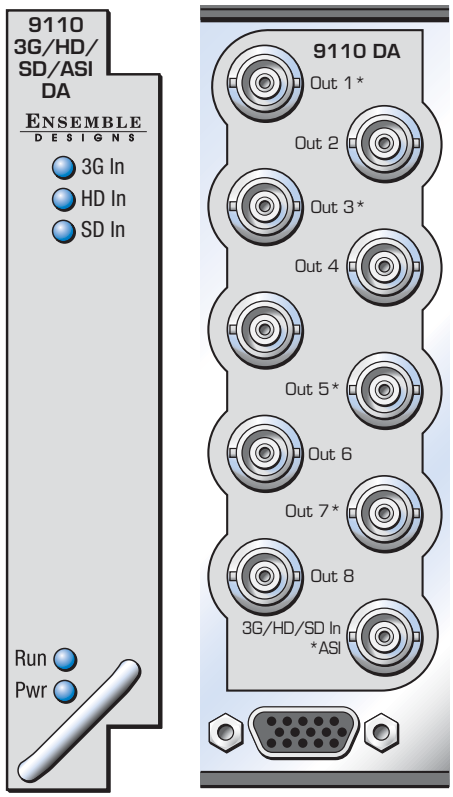
# 9110
## 3G/HD/SD/ASI Reclocking DA

The Avenue 9110 module is multi-rate serial digital distribution amplifier with automatic cable equalization and reclocking. It automatically detects and operates at 270 Mb/s for standard definition (525 or 625) signals and at 1.5 Gb/s or 3 Gb/s for high definition signals. It also can be used with DVB-ASI signals. The module has one input and eight outputs. The module can be used in either the 3RU or 1RU Avenue frame.

Input signal presence and bit rate can be monitored through the Avenue Control System and it is also indicated by LED indicators on the front edge of the module. On loss of signal, the 9110 can generate an alarm that is monitored through Avenue PC.

### Features

- **3G/HD/SD/ASI Distribution Amplifier**
- **Supports all HD, SD and ASI standards**
- **Auto-senses standard definition or high definition input**
- **Reclocked outputs**
- **Auto EQ**
- **Alarm on loss of signal**
- **Passes embedded audio**



## Serial Digital Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M or DVB-ASI 270 Mb/s |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization

## Serial Digital Output

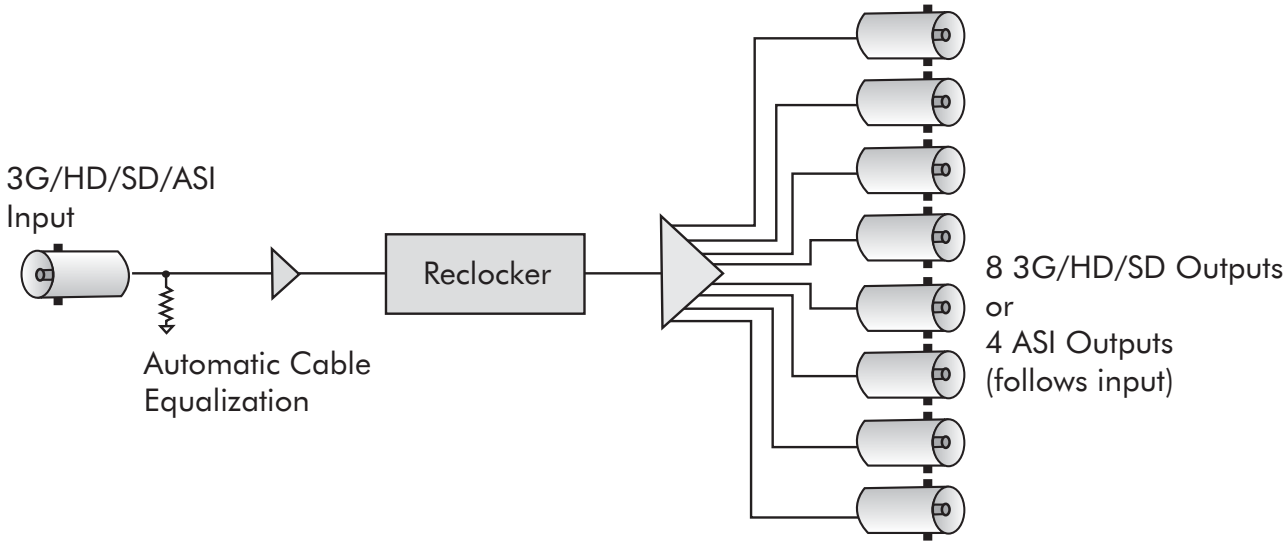
| | |
|---|---|
| Number | Eight (HD, SD) or Four (ASI)<br>ASI on outputs 1,3,5,7 |
| Signal Type | Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |
| Output DC | None (AC coupled) |

## Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M Level A, Level B
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, SMPTE 259M

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |



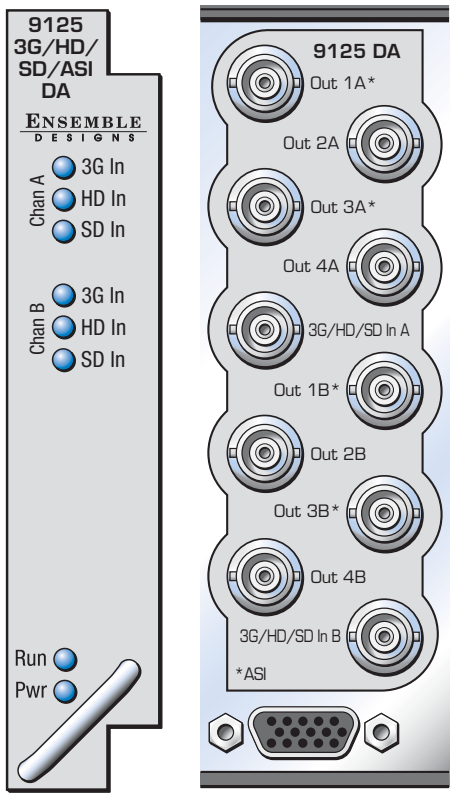
# 9125
## 3G/HD/SD/ASI Dual Reclocking DA

The Avenue 9125 module is a two channel video distribution amplifier that handles 3 Gb/s and 1.5 Gb/s high definition, standard definition and ASI video signals. It automatically detects and operates at 270 Mb/s for standard definition (525 or 625) signals and at 1.5 Gb/s or 3 Gb/s for high definition signals. It also can be used with DVB-ASI signals. The 9125 has automatic cable equalization and reclocking. The module can be used in either the 3RU or 1RU Avenue frame.

Input signal presence and bit rate can be monitored through the Avenue Control System and it is also indicated by LED indicators on the front edge of the module. On loss of signal, the 9125 can generate an alarm that is monitored through Avenue PC.

### Features

- **3G/HD/SD/ASI Distribution Amplifier**
- **Supports all HD, SD and ASI standards**
- **Two channels of distribution per module**
- **Auto-senses standard definition or high definition input**
- **Reclocked outputs**
- **Auto EQ**
- **Alarm on loss of signal**
- **Passes embedded audio**



## Serial Digital Input

| | |
|---|---|
| Number | Two |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M, 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>DVB-ASI 270 Mb/s |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization

## Serial Digital Output

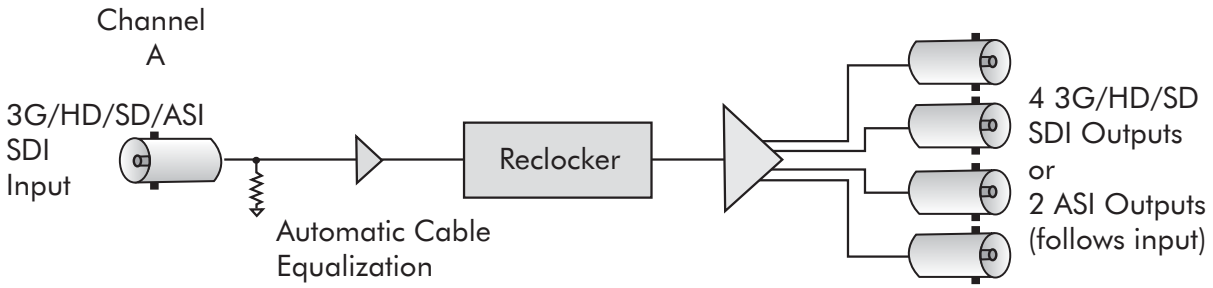
| | |
|---|---|
| Number | Eight (HD, SD)or Four (ASI)<br>ASI on outputs 1A, 3A, 1B, 3B |
| Signal Type | Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |
| Output DC | None (AC coupled) |

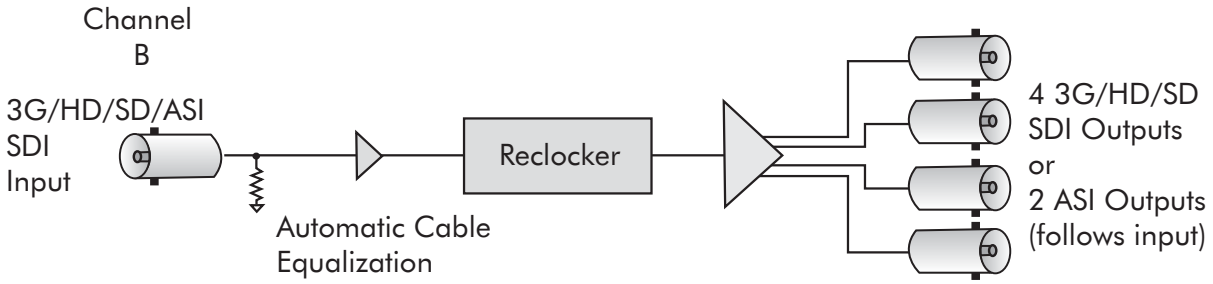
## Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M Level A, Level B
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, , SMPTE 259M

## General Specifications

| | |
|---|---|
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |



# 9400

## 3G Sync Pulse Generator and Test Signal Generator

### 9400 SPG/TSG - Reliable and Easy-To-Use

The 9400 3G/HD/SD Sync Generator and Test Signal Generator is a stable timing source that is perfect for local reference generation in broadcast, remote trucks and post. HD SDI, SD SDI, analog composite, Tri-Level Sync, timecode, AES audio and analog audio reference outputs are generated.

The 9400 can operate from an internal precision frequency reference as a stand-alone Master Sync Generator or lock to a video reference or 10 MHz precision reference. Alternately, the 7400-GPS option can be used. If the external reference is lost, the 7400's softlock provides a graceful transition to the internal TCXO, ensuring consistent reference output.

The 9400 can output multiple formats of Tri-Level Sync, 3 Gb/s and 1.5 Gb/s HD SDI test signals, SD SDI and composite test signals, and color black reference. The 9400 can simultaneously deliver both 525 (NTSC) and 625 (PAL) based signals. Color framing tracks the reference signal. All of the video outputs are derived from the same time base and can be timed with respect to each other.

The 9400 has two identical generators, Generator A and Generator B, each with a variety of outputs. Each set of outputs can be timed with respect to the reference to any point in the television frame. All of the outputs from a particular generator must be selected within the same frame rate family.

The Avenue Frame features a retainer bar to ensure that modules remain properly seated even in the most demanding mobile environments.

### Favorite Test Patterns

There are over 30 test signals including: Full and Split Field Bars at 75% and 100% with Pluge; Black; Flat Field; Pulse and Window; Ramp; Crosshatch; Safe Title; Blanking Markers; Cosite; Checkfield; Pathogenic and 5 Step. The Cyclops feature adds a motion element to the selected video test signal to assist in locating a signal that might be frozen in a frame sync somewhere in the signal chain. An ID slate with user programmable text can overlay the test pattern.

### Customizable Test Patterns

In addition to the standard suite of test patterns, users can create custom test patterns on a computer. Simply transfer test patterns to the included Secure Digital flash memory card using Avenue Logo software and a standard SD card reader, then insert the memory card into the 9400. Custom test patterns can also include motion.

### Audio Generators

The 9400 provides extensive support for analog and digital audio. Because all of the video outputs can be locked to a common time base, the AES digital audio outputs are always synchronous with all of the video outputs – regardless of format. Multiple tone generators make it easy to identify multi-channel content. This bitstream will be included in the set of signals that can be embedded into the test signal outputs.

The audio section of each generator supports sixteen audio channels. The content of each channel is independently programmable. Choices include adjustable frequency tone generators, tone sweeps, silence and timecode. Left/Right Channel ID that synchronizes to the Cyclops feature can also be selected.

All sixteen of these channels can be embedded in the SDI outputs. Each AES output can select from any of the 8 pairs that make up these 16 channels. Similarly, the stereo analog output of each generator can be driven from any of these audio signal pairs.

### Multiple Timecode Generators

Multiple timecode generators make the 9400 convenient for post applications. Timecode is delivered as VITC, DVITC, and LTC both 75 Ohm BNC and 110 Ohm Balanced. One generator can be configured to produce 525/59.94 drop frame timecode while the other generator is making 1080sF/23.98.

### 7400-GPS Option for the Ultimate Precision Reference

For the ultimate in precision, the 7400-GPS option can be used with the 9400 module. The purpose of this GPS option is to provide an extremely precise frequency reference. The oscillator on the 7400-GPS is more accurate than a typical internal precision standard and is equivalent in accuracy to an atomic standard. Increased frequency accuracy makes it possible to frame synchronize signals between different facilities with virtually no dropped or doubled frames. The GPS option also provides precise time of day information, which can be used to drive the 9400 module's internal timecode generators.

The 7400-GPS option seamlessly integrates into the Avenue system by plugging directly onto the 9400 module. It can be easily installed in the field. The 7400-GPS option consists of a compact, weatherproof antenna (with internal high-gain pre-amp) and a receiver sub module which mounts

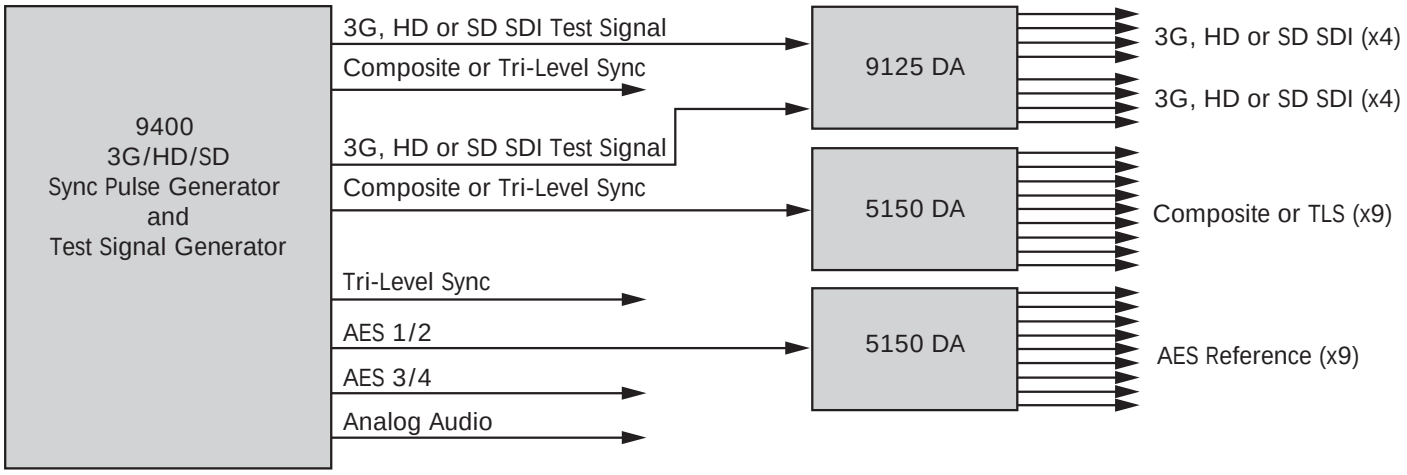
directly to the 9400 module. The included GPS antenna mounts onto standard 3/4" threaded pipe, metal or plastic. Connection from the F-style coaxial fitting on the antenna to the appropriate BNC on the Avenue Frame can be made with customer supplied standard 75 ohm cable. The coax cable can be routed through the center of the pipe for a completely waterproof installation. When low loss cable such as Belden 1694A is used, the antenna can be placed up to 200 feet (60 meters) from the frame. Ideally, the antenna is mounted outdoors where it has an unobstructed view of the sky.

## A Complete SPG and TSG System

The 9400 can be combined with other Avenue modules to create a complete sync pulse and test signal chain. The 7410 is a four channel Tri-Level Sync generator that can output four different types of Tri-Level Sync simultaneously and is very useful in post and hybrid facilities. The 5150 distribution amplifier can be used to distribute multiple copies of AES audio, Tri-Level Sync or composite black signals as needed. For 3 Gb/s or 1.5 Gb/s HD test signal and black distribution, the 9125 DA is a good fit.

## Features

- **Use as Master Sync Gen or lock to external reference or GPS**
- **Can output SD SDI, 1.5 Gb/s HD SDI, 3 Gb/s HD SDI, composite timecode and audio simultaneously**
- **Softlock provides graceful transition to internal TCXO if external reference is lost, ensuring consistent reference output**
- **Outputs can be independently timed**
- **Generates 30+ test signals**
- **Generates closed caption test sequence to test for compliance**
- **Dual Link test patterns**
- **Flash memory card for making custom test patterns**
- **Packages available for ease of ordering**



# 9400
## 3G Sync Pulse Generator and Test Signal Generator

*Description of Outputs*

### Generator A

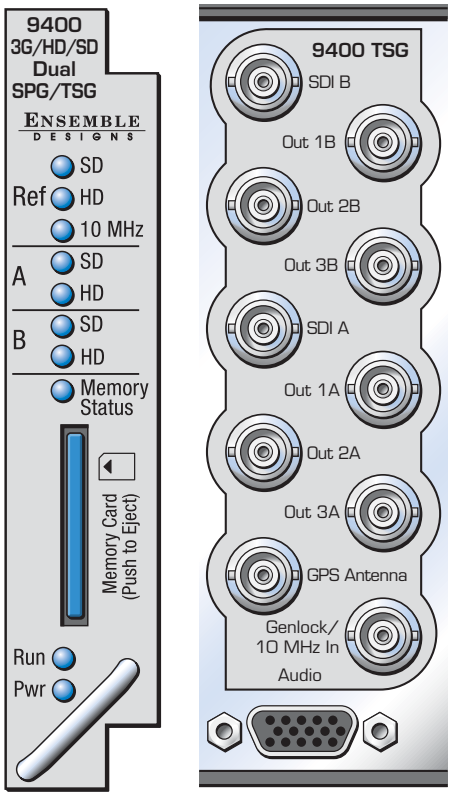
**SDI Out A –** Outputs 3 Gb/s or 1.5 Gb/s HD or SD test signals. Select frame rate family for all of Generator A; 59.94, 50 or 60. Output can include 16 channels of embedded audio. The embedded audio can be any combination of the following: tone, silence, external audio. Can also include DVITC.

**Programmable Out 1A –** Outputs analog composite black, composite 100% bars, or Tri-Level Sync from TLS Gen 1. When SDI Out A is a SD test pattern, this BNC can also output a composite version of that test pattern. Composite output can include VITC.

**Programmable Out 2A –** Outputs one of the following: Tri-Level Sync from TLS Gen 2 (can be different from Out 1A), LTC, AES (any of 8 pairs), AES silence, Word Clock, 6 Hz pulse, 10 MHz (only if locked to internal or GPS reference).

**Programmable Out 3A –** Outputs one of the following: Tri-Level Sync from TLS Gen 2 (same as Out 2A), LTC, AES (any of 8 pairs), AES silence, Word lock, 6 Hz pulse, 10 MHz (only if locked to internal or GPS reference).

**Analog Audio –** Stereo output, 1 of 8 pairs from the audio generator.




### Generator B

Has the same outputs as noted for Generator A. Generator B is completely independent from Generator A. Generator B can operate in a different frame rate family and its set of outputs can be timed independently.

### Order Info

| | |
|---|---|
| 9400 | SPG/TSG Module |
| 7400-GPS | GPS receiver option that plugs onto 9400 module. (Does not take up a slot in Avenue frame) Includes weatherproof antenna. Antenna mounts onto standard 3/4" pipe. Customer to provide 75 Ω 1694A coax up to 60 m/200 ft with F connector for antenna connection and BNC for Avenue frame connection. |
| P94035 | Redundant 3G/HD/SD Sync Gen Package with GPS and Changeover |
| P94057 | Redundant Full Suite 3G/HD/SD Sync Gen Package with GPS and Changeovers |

## Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M, Level A
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, SMPTE 259M
Composite PAL, NTSC

## Frame Rate Families

Each 9400 has 2 identical Generators, each with a variety of outputs. All of the outputs from a particular Generator must be selected within the same frame rate family.

50 Hz (625) Derived Family: 1080i/50, 720p/50, 1080p/25, 1080sF/25, 625i/50

59.94 Hz (525) Derived Family: 1080i/59.94, 720p/59.94, 1080p/23.98, 1080sF/23.98, 525i/59.94

60 Hz Derived Family: 1080i/60, 720p/60, 1080p/24, 1080sF/24

## Reference Input

| | |
|---|---|
| Number | Two: External or Frame Master Reference |
| Signal Type | PAL or NTSC composite video or<br>Tri-Level Sync or<br>10 MHz 1V P-P sine or square |
| Return Loss | >40 dB (applies to external ref input) |

## Serial Digital Outputs

| | |
|---|---|
| Type | HD Serial Digital 2.97 Gb/s,<br>SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s,<br>SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

## Tri-Level Sync Outputs

| | |
|---|---|
| Signal Type | Tri-Level Sync |
| Output DC | ±50 mV |
| Return Loss | >30 dB to 30 MHz |

## Composite Outputs

| | |
|---|---|
| Signal Type | NTSC/PAL |
| Impedance | 75 Ω |
| Return Loss | >40 dB DC to 5.5 MHz |
| Frequency Response | ±0.1 dB 0 to 5.0 MHz |
| Output DC | ±50 mV |
| K Factor | <1.0% |
| Differential Phase | <1.0 degree |
| SCH Phase | ±2 degrees |
| Delay | Adjustable over full frame in sub degree steps |
| Color Framing | tracks reference |

## Accuracy

| | |
|---|---|
| Internal Reference (TCXO) | |
| Freq Error | $<10^{-7}$<br>$< \pm 1$ Hz $F_{sc}$ |
| GPS Option | |
| Freq Error | $<10^{-12}$ |

## Stability

| | |
|---|---|
| Analog Jitter | <1 ns |
| Digital Jitter | <0.2 UI (0.13 UI typical) |
| AES Jitter | <1 ns |

## AES Audio Outputs

| | |
|---|---|
| Type | AES3id tone, 300 Hz to 1.6 KHz, or silent |
| Resolution | 24 bit |

## Analog Audio Outputs

| | |
|---|---|
| Number | Two stereo pairs or four mono |
| Type | Tone, 300 Hz to 1.6 KHz, or silent |
| Impedance | 30 Ω, balanced |
| Reference Level | -10 to + 4 dBu, selectable |

## Additional Output Choices

| | |
|---|---|
| Timecode | DVITC on the SDI outputs<br>VITC on the composite outputs<br>LTC on BNC prgm 2/3 unbalanced or on HD-15 balanced, 1 V P-P drop or non-drop for NTSC |
| 6 Hz Pulse | |
| Word Clock | |
| 10 MHz | when locked to internal or GPS reference |

## Flash Memory

| | |
|---|---|
| Number | One |
| Type | Secure Digital SD Flash Memory Card |
| Size | 2 GB card included |

## File Type

| | |
|---|---|
| Video | .tga |

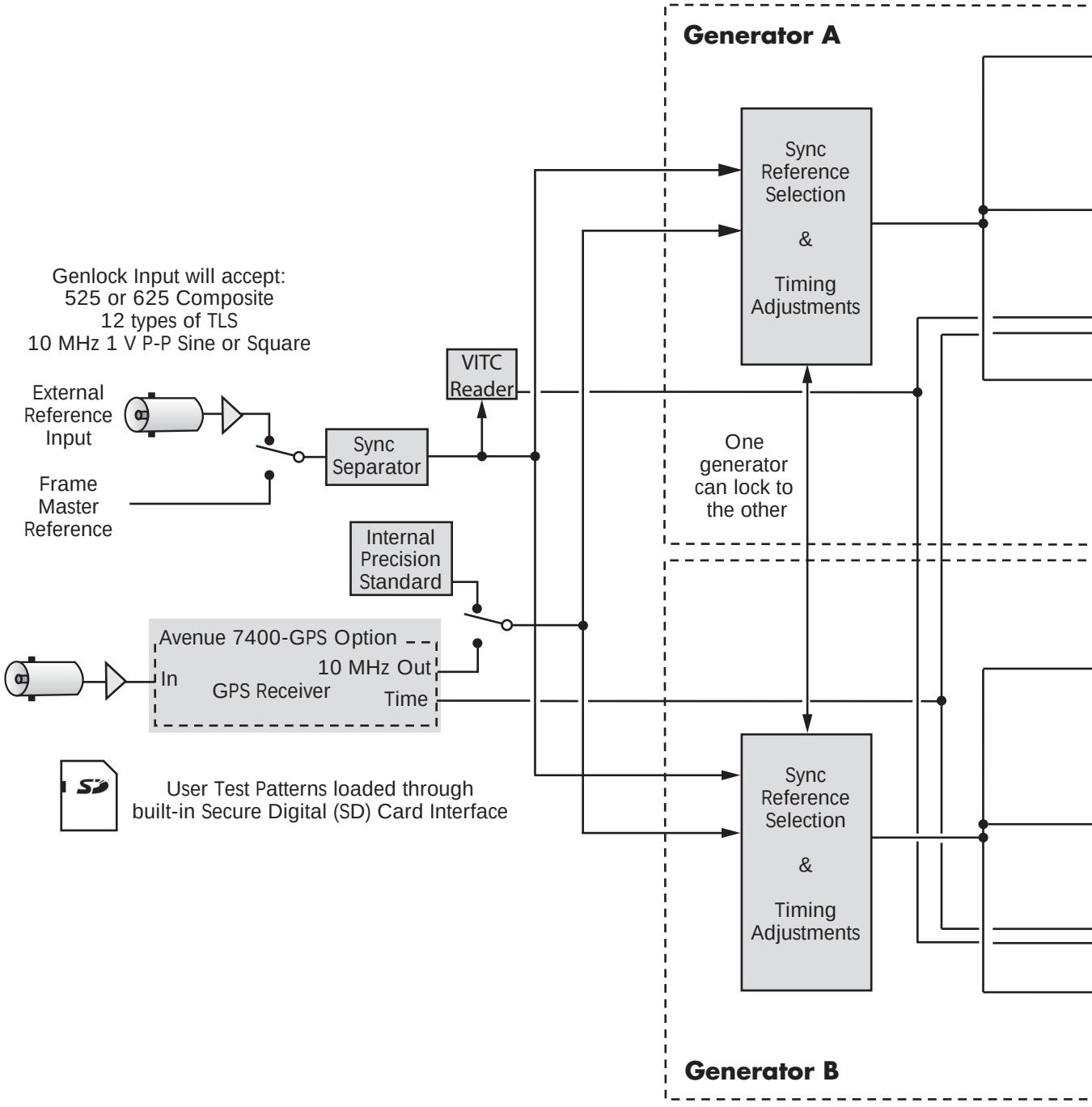
## General Specifications

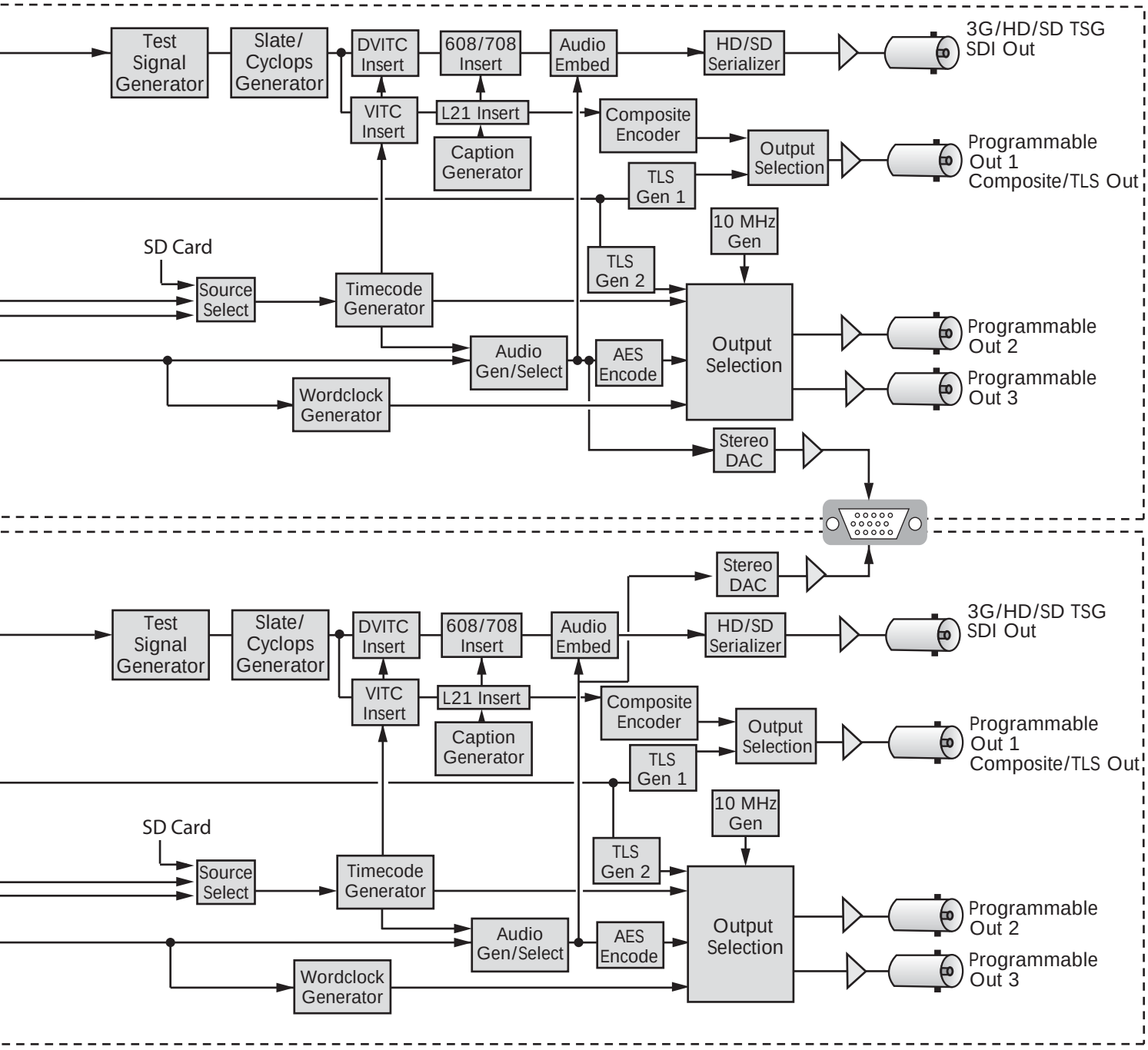
| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

9400 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed

# 9400

## 3G Sync Pulse Generator and Test Signal Generator




Test Signal Generator
Slate/ Cyclops Generator
DVITC Insert
608/708 Insert
Audio Embed
HD/SD Serializer
3G/HD/SD TSG SDI Out
VITC Insert
L21 Insert
Composite Encoder
Output Selection
Programmable Out 1 Composite/TLS Out
Caption Generator
TLS Gen 1
10 MHz Gen
SD Card
TLS Gen 2
Source Select
Timecode Generator
Output Selection
Programmable Out 2
Audio Gen/Select
AES Encode
Programmable Out 3
Wordclock Generator
Stereo DAC
Test Signal Generator
Slate/ Cyclops Generator
DVITC Insert
608/708 Insert
Audio Embed
Stereo DAC
HD/SD Serializer
3G/HD/SD TSG SDI Out
VITC Insert
L21 Insert
Composite Encoder
Output Selection
Programmable Out 1 Composite/TLS Out
Caption Generator
TLS Gen 1
10 MHz Gen
SD Card
TLS Gen 2
Source Select
Timecode Generator
Output Selection
Programmable Out 2
Audio Gen/Select
AES Encode
Programmable Out 3
Wordclock Generator

# MV82 and MV164
## Multiviewers

### New 2.0 – Faster and Better UI

Monitoring all your sources couldn't be easier with Ensemble Designs MV82 and MV164 Multiviewers. Simple intuitive set-up, powerful display options, and incredible image quality with no latency are just the start. Whether you're displaying a simple quad split, or designing an entire control room wall, the new Avenue Multiviewers are the right solution at the right price.

The new Avenue Multiviewer 2.0 gives you an offline mode for creating screen layouts, alarms for ensuring signal integrity, fast authoring tools with eyedropper and paste functions, closed caption support, and countdown clocks. Also new are independent Edit and Control modes, giving you the precise control needed for your particular job, whether you're in engineering or operations.

### Stunning Detail

The Avenue Multiviewer takes advantage of the newest scaling technology and filtering to deliver stunning detail from every source, even when the same signal appears multiple times. Video sources are always displayed at full motion frame rate, even with 16 images on the screen. Sources are sized perfectly with Ensemble's proprietary scaling algorithms, ensuring a beautiful picture, no matter what size you choose. The Avenue Multiviewer is the right choice for your control room, remote truck or boardroom.

### Go Ahead, Check It from Home

The Avenue Multiviewer's web control panel can be used on a Mac, PC or tablet, which means the Multiviewer can literally be used from any location. The browser-based control panel provides intuitive controls for selecting and monitoring particular video and audio sources.

### Straight-Forward Setup

Each Multiviewer output is built on a 4x4 or 3x3 grid. With your computer or iPad, click-to-fill each cell or group of cells to create the output architecture you need. You can easily change the cell's input source from a drop down menu. Intuitive eyedropper and paste authoring tools make designing fast and fun.

### Features

- **Configure in five minutes and start monitoring your video sources right away**
- **New independent Edit and Control modes give operators and engineers just the controls they need**
- **Audio Solo mode for monitoring any audio channel**
- **Scaling technology that delivers stunning quality**
- **Video always displayed at full frame rate**
- **Zero latency between sources, from the top of the screen to the bottom**
- **Straight forward setup with click-to-fill configuration and snap-to cell alignment**
- **Fast, desktop style layout tools including eyedropper and paintbrush**
- **Design layouts offline while Multiviewer is in use**
- **Configurable alarms to check signal integrity**
- **Dual level tally**
- **Closed caption support**
- **Countdown clocks and timers**
- **Packages available for ease of ordering**

### Cell Styles Made Easy

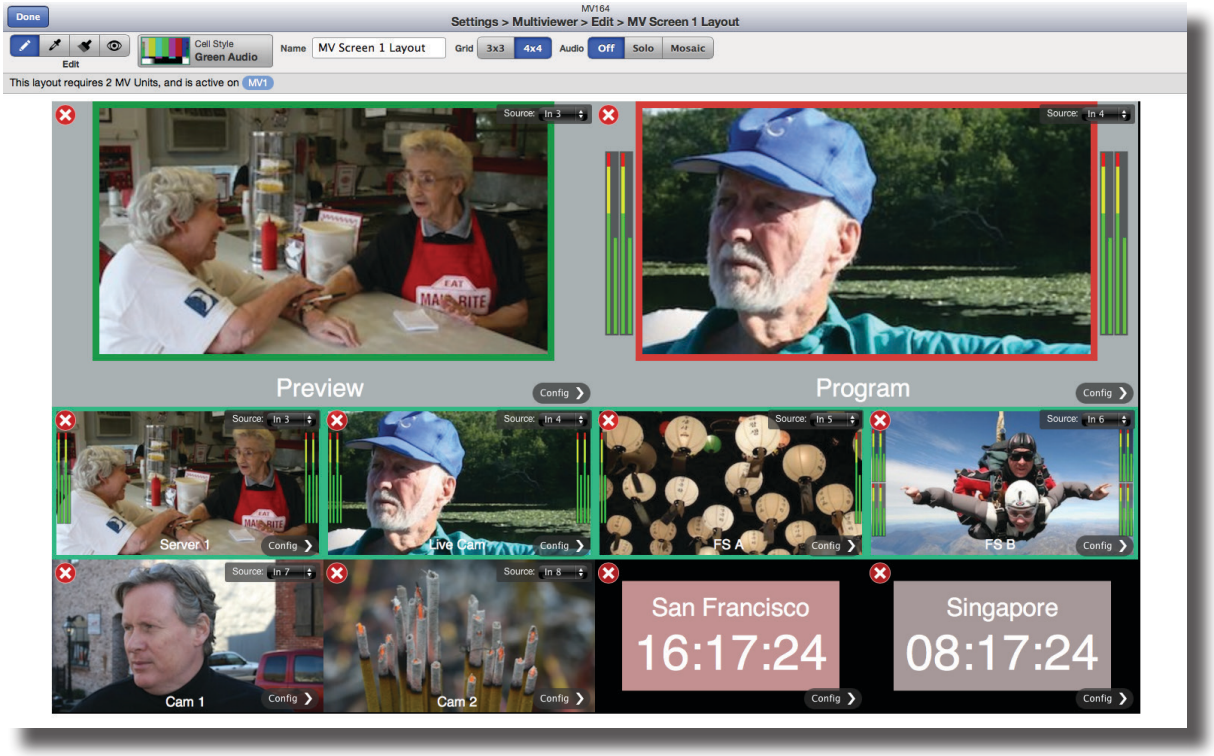
Video can fill the cell or be held back at 85% with a border on the sides and bottom. When 85% is selected, you'll see a visual separation and space for audio meters and labeling information. The matte color tool is used to select background, frame and label color and transparency. When the frame is on, the picture is scaled so no pixels are covered by the surrounding border. The frame can be set to thick, medium or thin. Cell styles and screen configurations can be saved and easily applied as desired. Editing Screen Layouts and Cell Styles can be done completely off-line and then applied to the output without loss of sync.

### Flexible Architecture

The Avenue Multiviewer accepts all standard SD, HD and 3 Gb/s video formats. The MV82 has 8 source inputs and 2 outputs, the MV164 has 16 source inputs and 4 outputs. Outputs can be genlocked and timed with respect to house reference. 1080i or 1080p SDI are output at 59.94 or 50 Hz. When you need to drive an HDMI video monitor, use a BrightEye 81 SDI to HDMI converter at the monitor.

## Edit Mode for Installation and Engineering

With snap-to grid structure, drag and drop sizing and placement, and a user interface that is intuitive and actually fun to use, the Ensemble Designs Multiviewer family has rewritten the book on Multiviewer set-up. Sources, Labels, Tally, Audio Meters, Alarms, and Audio Monitoring are quick and easy to make part of your display. Whether you use a Mac, PC or tablet, you'll be setting up displays like a pro in a matter of minutes – honest!




Designing screen layouts is quick and easy from your PC, Mac or tablet. Click-to-fill configuration, snap-to grids and intuitive menus make setup super-simple. Thumbnail proxies of the actual video inputs contribute to an easy and natural editing experience. An unlimited number of layouts can be created offline. The layout editing window is so accurate that one can design a layout without looking at the actual Multiviewer video output. Multiple screen layouts can be created, saved, and easily recalled, or applied to other Multiviewer outputs. One Multiviewer screen layout might be for a QC position while others could be created for a control room, remote truck or producer position. New screen layouts can be designed while the Multiviewer hardware is in use.

# MV82 and MV164
## Multiviewers

### Different Workflows for Operations and Engineering

Staff setting up and configuring a Multiviewer have very different needs from the day-to-day operators. New, independent Edit and Control modes provide users the precise controls needed for their particular jobs. Installation and engineering staff can use the Edit mode to configure the Multiviewer hardware, set up alarms and create screen layouts. Segment producers, master control operators and QC staff can use the Control windows to see various sources and check signal quality.

### Control Mode for Operations Staff

From a fully enabled Multiviewer Control window, operators can take any of the sources on the Multiviewer output to fullscreen, select the audio from any source, select a different Screen Layout (which may have completely different sources), and clear alarm notices.

Imagine a segment producer of a live show who's got 20 cameras or sources available and has one Avenue Multiviewer output allocated. The Control mode gives access to all the controls needed for the job. An iPad can be used to recall any number of preset Multiviewer layouts, allowing the segment producer to quickly view all of the sources.

For example, a producer may want to verify that the microwave feed is good. From a tablet, one can switch the Multiviewer output to Fullscreen and check that specific source.

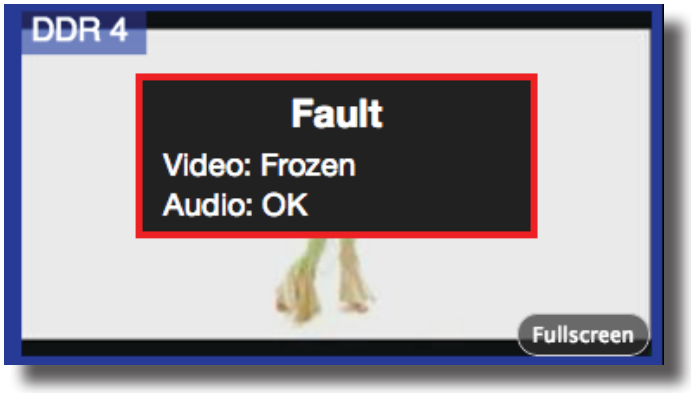
### 16 Channel Audio

While it's easy to look at 16 video sources on a monitor, audio must be monitored one source at a time. Click the Solo button to select and monitor the audio from one of your inputs. The Fullscreen button lets you take any source fullscreen on your monitor; a great tool for QC-ing the quality of a particular feed.

Audio content is displayed on VU meters and can be set to show 4, 8 or 16 channels. A peak indication feature, with fast or slow response, makes it easy to monitor headroom.

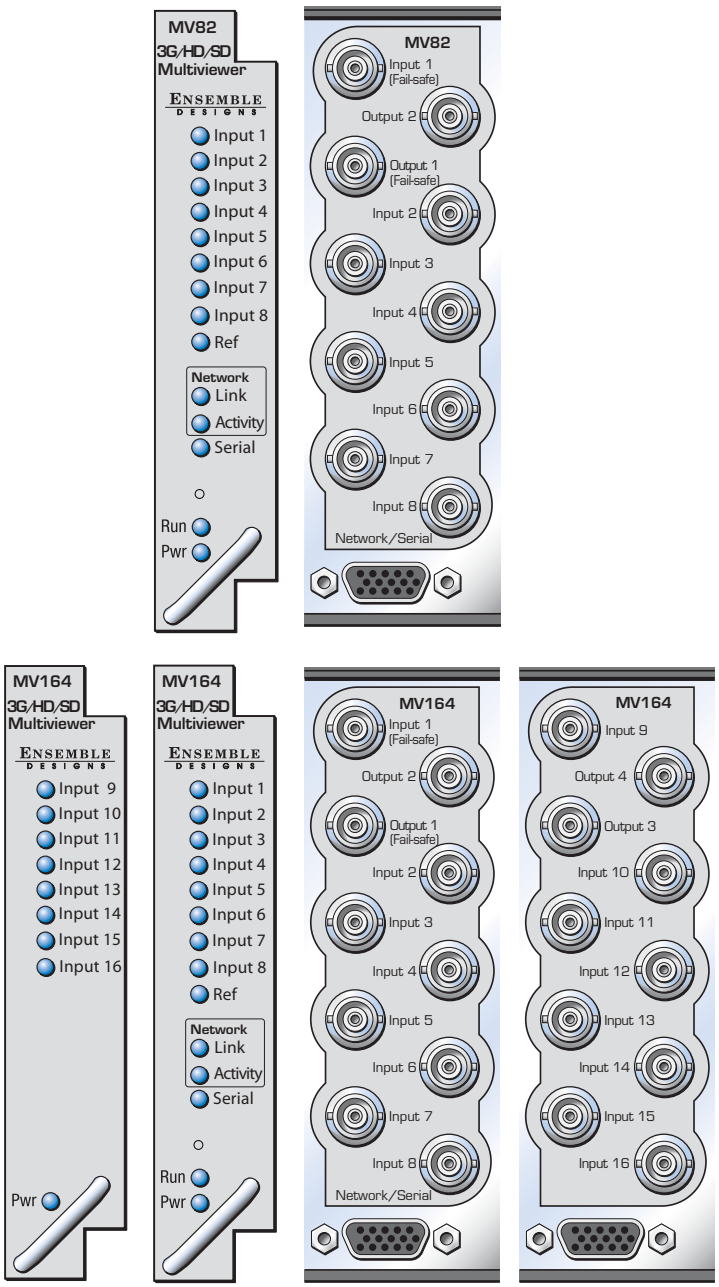
### Alarms

Use alarms to monitor for loss of signal, black, freeze, and audio presence. When a fault is detected, you can choose to have an on-screen display of the Alarm notice show on the Multiviewer output and on the Multiviewer Control window. Using a JL Cooper eBox, alarms can be configured to generate GPO triggers and alarm conditions can be cleared with a GPI.




### Dual Tally

Two levels of tally give you full confidence of which sources are active on air. The Multiviewer can tally against the output of a router, production switcher, effect on the Avenue Layering Engine, or external GPI. Tally can be independently assigned to different elements in the makeup of the cell: frame color, label text, and label background.




| Inputs | Outputs | Images Per Screen |
|---|---|---|
| MV164<br>16 Inputs | 4 Outputs<br>3 Outputs<br>2 Outputs<br>1 Outputs | 4 - 4 - 4 - 4<br>4 - 4 - 8<br>8 - 8 or 12 - 4<br>16 |
| MV82<br>8 Inputs | 2 Outputs<br>1 Output | 4 - 4<br>8 |

### Inputs

| | |
|---|---|
| Number | MV82: Eight<br>MV164: Sixteen |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75Ω |
| Return Loss | >15 dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A<br>Automatic Cable Input Equalization |

GPI requires LAN-based interface port. Available separately.

### Input Standards

1080p 50, 59.94, 60 Hz, SMPTE 424M, 425M, Level A
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
625i 50, 525i 59.94, SMPTE 259M

### Outputs

| | |
|---|---|
| Number | MV82: Two<br>MV164: Four |
| Signal Type | 1080i 50, 59.94 SMPTE 274M -4,5,6<br>1080p 50, 59.94 SMPTE 424M, 425M |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Output DC | None (AC coupled) |

### Reference

| | |
|---|---|
| Number | One via frame master ref input |
| Signal Type | Composite black, Tri-Level Sync, 10 MHz |

### General Specifications

| | |
|---|---|
| Power Consumption | MV82 42 watts, MV164 80 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |

## Order Info

| | |
|---|---|
| MV82 | 3G/HD/SD Multiviewer 8 x 2 |
| MV164 | 3G/HD/SD Multiviewer 16 x 4 |
| P94813 | 3G/HD/SD 16 in 4 out Multiviewer Package |
| P94824 | 3G/HD/SD 32 input Multiviewer Package |
| P94835 | 3G/HD/SD 64 input Multiviewer Package |

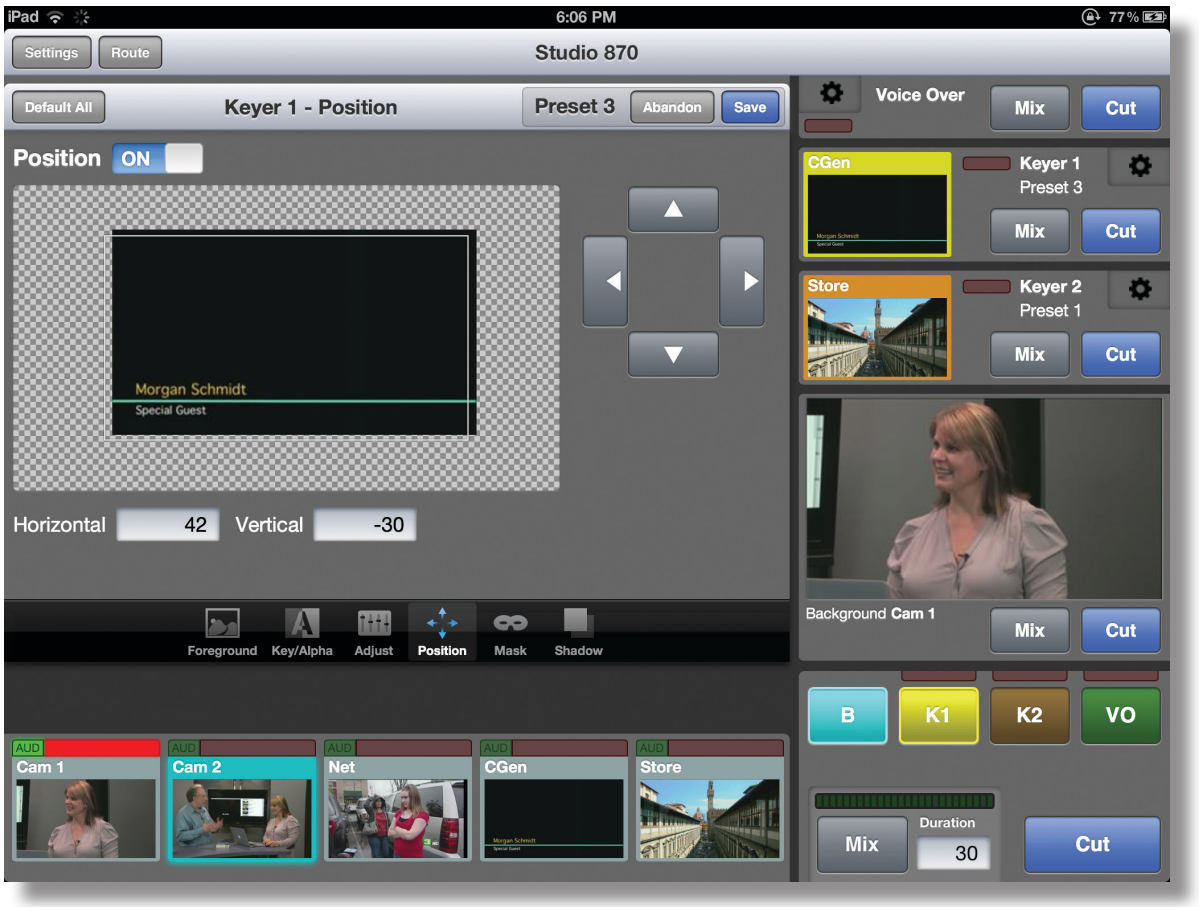
# P9425
## Avenue Layering Engine

### Features

- **Multi layer keying and background transitions**
- **Linear, Luminance, and Additive Modes**
- **Internal LogoStore**
- **Built-in frame syncs on every input**
- **Audio breakaway, voice over and AFV**
- **Supports 16 channels of embedded audio**
- **Channel branding, small master control, centralcasting, fly-pack, remote truck**
- **EAS and downstream keyer option**
- **Hard surface operator control panel**
- **Packages available for ease of ordering**

### More Than a Mix Effect

Use Ensemble's Avenue Layering Engine for broadcast, live venues and presentation. With two, independent linear keyers, program/preset background transitions, and audio mixing and breakaway, it's an agile and flexible solution to combining audio and video content. Inputs can be driven by SDI signals from cameras, remote feeds, character generators, graphic and stillstore systems, and video servers. The full range of SDI signals from SD to HD and 3G formats are supported. Realtime processing and low latency make it easy to integrate – even in complex signal chains.




*You have complete control over the configuration and operation of this powerful layering engine with a web interface, TCP/IP and serial control.*

## Powerful, Flexible Keying and Layering

The extensive features of the Avenue Layering Engine span a wide range of applications. This broad repertoire is matched by an intuitive interface that puts comprehensive control of every element at your fingertips. Keyer presets will recall the entire configuration of a layer with a single touch or keystroke.

The visual interface displays thumbnail views of connected sources and the content stored in the LogoStore. Input signals and control parameters are clearly presented and easily adjusted.

Choose Foreground video from any of the SDI inputs, an internal matte generator, or the built in LogoStore to recall both still and animated graphics.

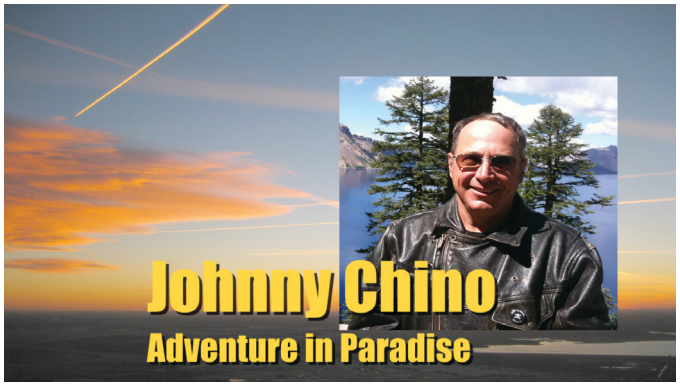
The Key (Alpha) signal can be selected automatically according to the chosen Foreground video, or chosen independently from any input. Use full screen Alpha, along with Mask and Position, to produce mortise effects with live content.

Drop shadows can be added to any key. Adjust position and density to enhance the separation between Foreground and Background video.

The keyers support linear, luminance and additive keying from a variety of video sources. In linear and additive modes, external key signals are faithfully passed to the overlay combiners with the option of user adjustments to fine-tune the effect with hi/lo clip.

Apply masking to any key to exclude unwanted content, or create window inserts.

Position the overlay anywhere on the output raster. Positioning supports live video inputs as well as content from the LogoStore.




*Two key layers and a background source can be simultaneously combined to produce the program output.*

# P9425
## Avenue Layering Engine

### Hard Surface Operator Control Panel

The Avenue 5825 Layering Engine Control Panel is a real panel with real buttons to control keying and vision mixing functions positively and instantly.

The panel features a front panel LCD display that shows realtime thumbnails of sources allowing instant verification of switching selections. When used alongside the award winning web browser interface that can be accessed with any web browser enabled device such as an iPad or laptop computer, all of the functionality of the powerful switching and keying system can be harnessed in a compact, easy-to-use control position. The control panel is connected via IP allowing access from anywhere on the network, and can be powered via POE for easy, single wire hook up. Source selection, cuts, dissolves, and three levels of keying can be independently controlled via the panel.

The Avenue 5825 panel works with other interfaces making it the perfect solution for use with automation. The operator can quickly and positively override automation functions in the event of a service disruption or equipment failure.

### Timing and Synchronization

The Avenue Layering Engine genlocks to a house reference signal, allowing you to time the effects output to match system requirements in your facility. Even asynchronous (wild) sources can be used as inputs to the layering engine. Each input incorporates a frame synchronizer, automatically correcting each source to match system timing. When no external reference is available, as in a flypack system, a stable internal reference signal is used.

### LogoStore

Logos and Graphics created with paint and animation applications can be loaded into the Avenue Layering Engine's LogoStore through a web interface. These elements can then be keyed and combined with live video inputs. The user interface makes it easy to choose from multiple graphics in each keyer, even in a live environment.

The Positioning and Masking features can be applied to LogoStore content. Combined with Keyer Presets, these features allow a single logo to be used in a variety of ways. The LogoStore's non-volatile memory is a great solution to sourcing lower third supers, branding logos, watermarks, and even full screen titles.

### Signal Performance

SDI I/O ports support SD, HD, and 3G data rates. The full 10 bit SDI resolution is carried throughout all of the background, foreground, and alpha paths. Internal processing is performed at even higher resolution so that the final, composited effect is true to every nuance and the subtle details in the original sources.

### Control Interface

Web browser and iPad interfaces put clear and complete control over the Avenue Layering Engine in the hands of an operator. Automation control over Ethernet TCP/IP, SNMP, and RS-232 serial interfaces, using industry standard as well as product specific protocols, provide support for a wide variety of applications. Use an iPad or web browser to quickly and easily create keyed presets that can be recalled on-air by automation systems.

## Complete Audio

Comprehensive audio support is built-in to the Avenue Layering Engine. The primary audio output can be taken automatically from the embedded content in the currently selected background video source. This AFV (Audio Follow Video) mode will produce smooth, pop-free audio transitions that duplicate the background video – whether cutting or mixing. Alternately, the audio can be selected independently (Audio Breakaway) of the background video so that it comes from the embedded content of any connected source.

The primary audio can be augmented by bringing in an audio overlay, or voice over. Similarly to the way a video key contributes to parts of the video effect, this audio overlay can contribute to the final audio output. And just as a keyer can be adjusted to control how much it contributes to the video, the audio overlay has adjustments for the relative mix between the overlay and primary audio elements. This allows such diverse uses as a subtle music background, or dunking the primary audio and running a voice over at full level.

16 channels of embedded audio are supported throughout the entire processing chain. The channel swapping feature of the SDI port configuration tool allows full customization on an input by input basis.

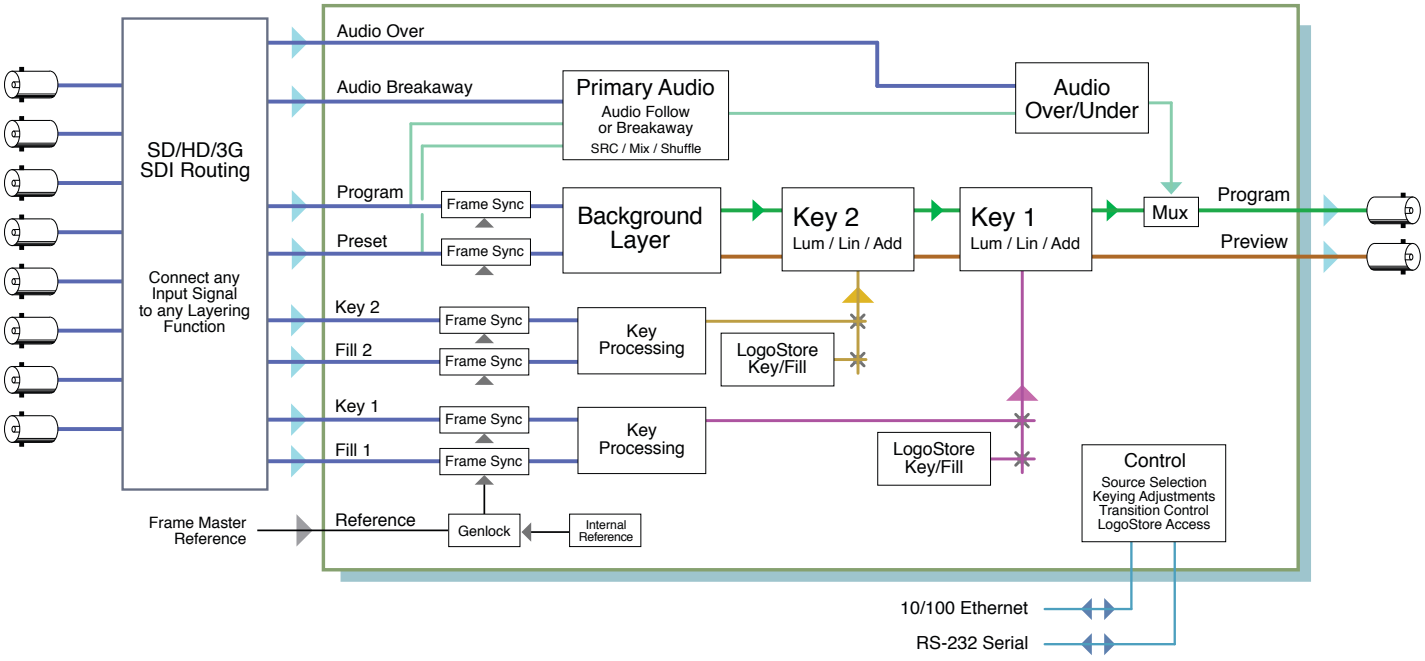
## Integration and Expansion

The basic Avenue Layering Engine configuration provides 8 input ports and 2 outputs. Expansion is easy – it integrates seamlessly into the Avenue Flexible Matrix Router. When installed in one of the router's option positions, the Avenue Layering Engine gains full access to all of the router sources. And the program and look-ahead preview outputs become available as sources to be routed to any of the output destinations.

## EAS and Downstream Keyer Option

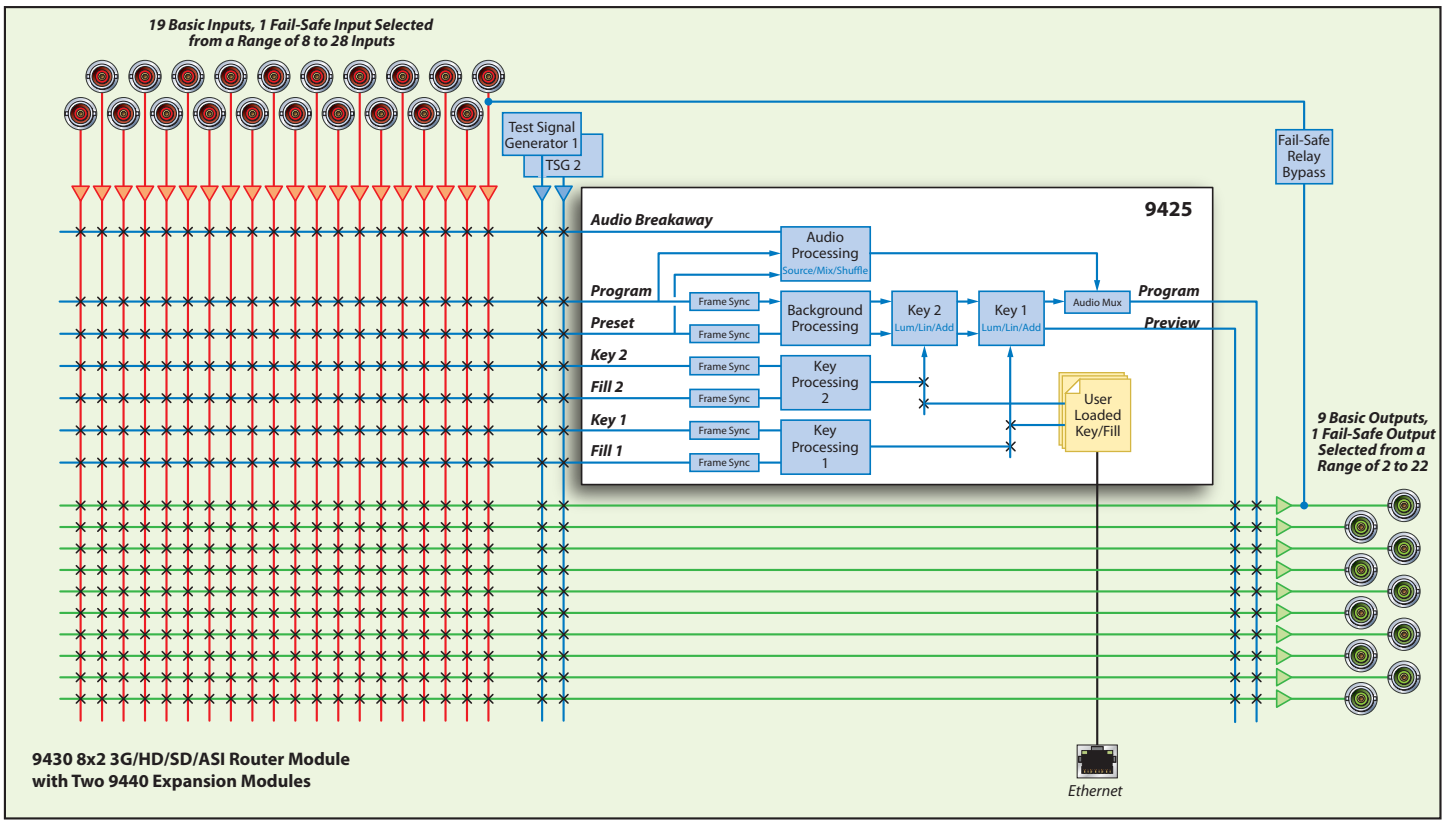
Add the 9425-XK option for additional keying capability. The downstream keyer provides a third layer of keying, drawing from stills and animations in the Layering Engine's LogoStore. A basic character generator is included for producing a lower-third crawl.

The the 9425-XK also provides CAP compliant EAS insertion. Three signals are from the external EAS receiver: a GPI command to put the announcement on air is fed from a JLCooper eBox, an RS-232 ASCII data that feeds the character generator is also fed from the eBox, and a live audio signal that is to be played out with the scrolling CGEN. This signal is brought in through an input on the Layering Engine and it can be either embedded on an SDI signal or delivered as an AES stream.




*Any of the P9425's eight inputs can be used as background video, key fill or source, or audio breakaway and voice over. Program and look-ahead preview outputs are provided. Occupies just one module slot in the Avenue frame.*

# P9425
## Avenue Layering Engine




*System example: Here is an example of a 30 port system that is configured with 20 inputs and 10 outputs. Program, preview and all sources are routable, as shown. 3 module slots are used in the Avenue frame.*

*Any input source or the Layering Engine outputs can be routed to any destination. This configuration consumes only 3 module slots in the 3RU Avenue frame. This flexible architecture puts video effects, audio mixing and routing functionality in a single, convenient package. Alternate configurations are available for every application, from remote trucks to news bureaus to presentation. Connect a source with a single cable and it's simultaneously available to both routing and effects. Ports can be configured as inputs or outputs which means you can configure the system as needed e.g. 28x2, 23x7 or 15x15.*

## Order Info

P9425 includes: 9425 Layering Engine (sub module)
9430 8 x 2 Router Module

### Options

| | |
|---|---|
| 5825 | Layering Engine Control Panel with LCD Display |
| 9425-XK | DSK and EAS Inserter Software Key Option |
| 9440 | Expansion Module: Adds 10 user configurable I/O ports<br>One or two 9440s may be added |
| 9435-4CS | Quad Clean Switch sub module: Four independent clean switches<br>9435-4CS may be added to one 9440 (Expansion Position #1) |
| P94214 | 3G/HD/SD 20 port Layering Engine Package |

## 9430 Specifications

### Inputs

| | |
|---|---|
| Number | Eight |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>DVB-ASI at 270 Mb/s, SMPTE 310M, AES3id |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization

### Outputs

| | |
|---|---|
| Number | Two |
| Signal Type | Follows input |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Output DC | None (AC coupled) |

### Reference

| | |
|---|---|
| Number | One via frame master ref input |
| Signal Type | Composite black, Tri-Level Sync, 10 MHz |

### Standards Supported

1080p 50, 59.94, 60 Hz, SMPTE 424M, 425M
Level A, Level B (9435 Level A only)
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, SMPTE 259M

### General Specifications

| | |
|---|---|
| Power Consumption | 9430 with 9425 sub module 30 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95% noncondensing |
| Altitude | 0 to 10,000 ft |

9430 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed

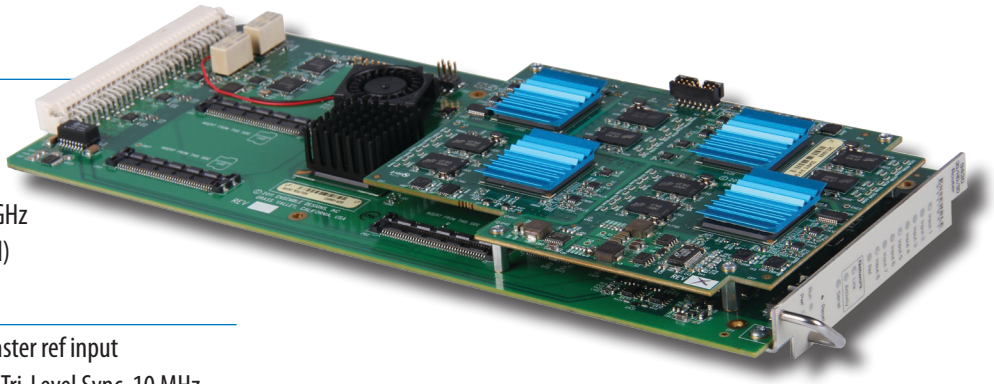
## 9440 Specifications

### Inputs

| | |
|---|---|
| Number | Up to ten, user configurable |
| Signal Type | Same as 9430 |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |

### Outputs

| | |
|---|---|
| Number | Up to ten, user configurable |
| Signal Type | Follows input |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Output DC | None (AC coupled) |



*The P9425 uses just one module slot in an Avenue 3RU or 1RU frame.*

# 9430 and 9440

## 3G/HD/SD/ASI Flexible Matrix Router

### See It

Now you can look at your source before you do a take. The exclusive live thumbnail display in the Avenue Router panel shows you the source before you take it to air.

### Take It

It's the best of both worlds, a router and a clean switch all in one. The clean switch gives you full frame synchronization that locks to your house reference so it can even switch cleanly between asynchronous sources. Flawless audio sample rate conversion makes this router truly Clean and Silent.

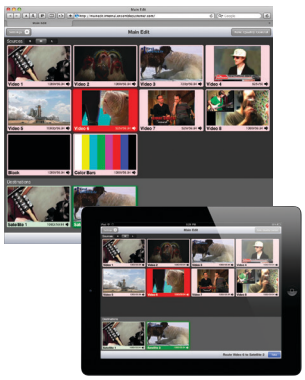
### Choose Your Size

Then Choose Again. And Again.
Highly flexible matrix sizing lets you decide on your own configuration. The basic size is 8x2. Add user configurable input or output ports all the way up to 28x2 (or 8x22) and any size in between. Need a 12x5 or a 15x15? You choose.

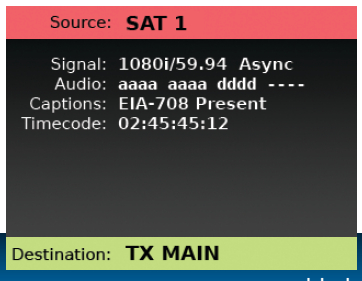
### Features

- **Use this router for master control bypass, QC monitoring, off-site news bureaus and radio shows, mobile trucks, helicopters**
- **Realtime video thumbnails of every SDI source and destination**
- **Highly configurable – Flexible I/O for exactly the matrix size you need**
- **Clean and quiet switch option has full frame sync**
- **Multiviewer option**
- **Look-ahead preview**
- **Signal diagnostics and reporting with indicators for synchronicity and timing, audio, closed captions, timecode and AFD**
- **Built-in, internal black and bar generator. No need for external generators. Saves router inputs**
- **Control choices include the Router Control Panel, iPad, Mac and PC from a web browser, serial protocols via TCP/IP, RS-232 and SNMP**
- **Supports every type of signal you need – HD, SD, 3 Gb/s SDI, ASI and 310M. It's multi-format, use any mix of signal types**
- **Packages available for ease of ordering**

*Realtime video thumbnails travel over Ethernet to the Router Control Panel where they are displayed on a compact, high resolution display. Built-in signal diagnostics show synchronicity and timing, line and frame rate, embedded audio presence or absence, closed caption information, and timecode data.*



*The Avenue router may be controlled from a web browser on a PC, Mac or iPad, from a dedicated hardware control panel, from a dedicated software based control panel, or from an external automation system or computer. The Router Control Panel is powered by an AC supply or Power over Ethernet (PoE).*




*Each control panel, computer or iPad has a user profile assigned to it that specifies which inputs and outputs are accessible from that particular control point. Create as many user profiles as you need.*

# 9430 and 9440
## 3G/HD/SD/ASI Flexible Matrix Router

### New Technology

The Avenue modular digital video router is the most flexible, technologically advanced small router available today. It's ideal for QC monitoring, master control bypass switching, ENG trucks, edit suites, and a host of other applications. Ease of expansion, user-definable input/output port geometry, exclusive video thumbnails, built-in test signal generation, and optional clean and quiet switching on multiple outputs make it perfect for your next project or upgrade.

### Highly Flexible Matrix

The new, flexible matrix design allows you to configure the router to the perfect size for your facility. The basic size is 8x2. You can add user-configurable input or output ports all the way up to 28x2 (or 8x22) and any size in between. The design is future-proof, allowing the router to be easily reconfigured to a different matrix size at any time.

### Exclusive Live Thumbnail Display

Realtime video thumbnails travel over Ethernet to the Router Control Panel where they are displayed on a compact, high resolution display. Video thumbnail generation is an exclusive feature of the Avenue router. This enables the operator to visually verify source content before performing any switching operations. Use the panel at your facility or use it remotely, thousands of miles away.

The Avenue router allows the user to define both source and destination names as part of the configuration process and store them in the router itself. Names are displayed on both the hardware and software control panels along with the video thumbnails.

### Built-in Signal Diagnostics

Circuitry on the 9430 module detects and measures key parameters associated with each video source. Synchronicity and timing, line and frame rate, embedded audio presence/absence, closed caption information, and timecode data are displayed on the Avenue router hardware and software panels. Control panels provide the option of displaying abbreviated information as a thumbnail overlay, or more detailed information as a dedicated screen.

### Clean and Quiet Switching – Done Right

The optional Clean Switch provides full frame synchronization so it can even switch cleanly between asynchronous SDI sources. Use the control system to assign the clean switch to any input or output. Additional ports can be assigned to follow the clean switch, making it appear simultaneously on multiple outputs.

### Architecture

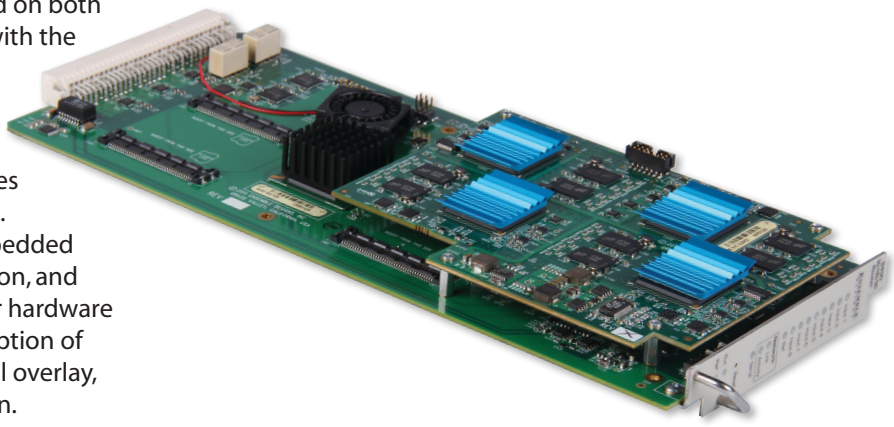
The Avenue router occupies from one to three slots in any Avenue 3RU frame. The router is comprised of three different modules: the 9430 8x2 router module, the 9435 clean switch sub module, and the 9440 ten port expansion module. Power (redundant option available), video reference, and an interface to the Avenue control system is provided by the frame.

While the dimensions of the base 9430 router module are fixed at 8 inputs by 2 outputs, the 9440 module provides ten additional ports, each of which is individually user configurable as either an input or an output. Up to two 9440 expansion modules may be added to the base 9430 module. A 9430 plus a single 9440 supports a total of 11 different configurations ranging in size from 18x2 to 8x12. A 9430 plus two 9440 modules supports a total of 21 different configurations from 28x2 to 8x22.

### Unparalleled Flexibility

Most small routers have a fixed number of input and output ports. Often, they are not expandable, and if they are, a fixed block of inputs and outputs have to be added. This makes it very difficult to match the size of the router to the application at hand.

The unique architecture of the Avenue router makes it possible for the user to custom tailor the input/output dimensions of the router to more closely match the requirements of a particular application. Symmetrical (square) as well as asymmetrical (rectangular) configurations are supported.

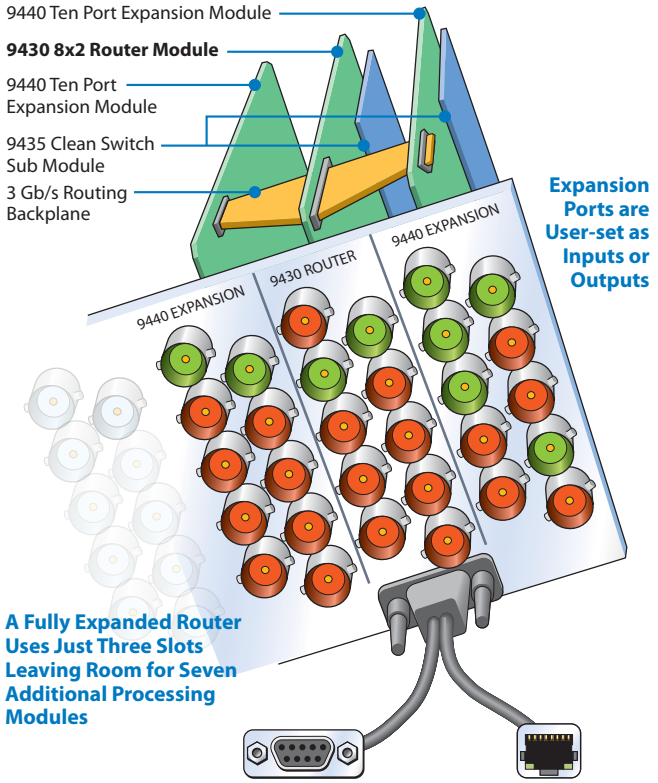


*9430 Flexible Matrix Router module shown with the 9435-4CS Quad Clean Switch option takes up one slot in an Avenue frame. Add one or two 9440 Router Expansion modules to increase your router size.*

# 9430 and 9440

## 3G/HD/SD/ASI Flexible Matrix Router

### Router Expansion Example for a 21 In x 9 Out Configuration




### Internal Generators for Easy QC

Bars/tone and black/silence are sources that are needed in many applications. Internal generation of these sources is another unique capability of the Avenue router. The bar generator includes a user programmable graphics overlay to allow the user to visually identify the source of the bars. This eliminates the need for additional external signal generation equipment, an important factor in many mobile and portable applications. Internal black and bars appear as sources without consuming a connector.

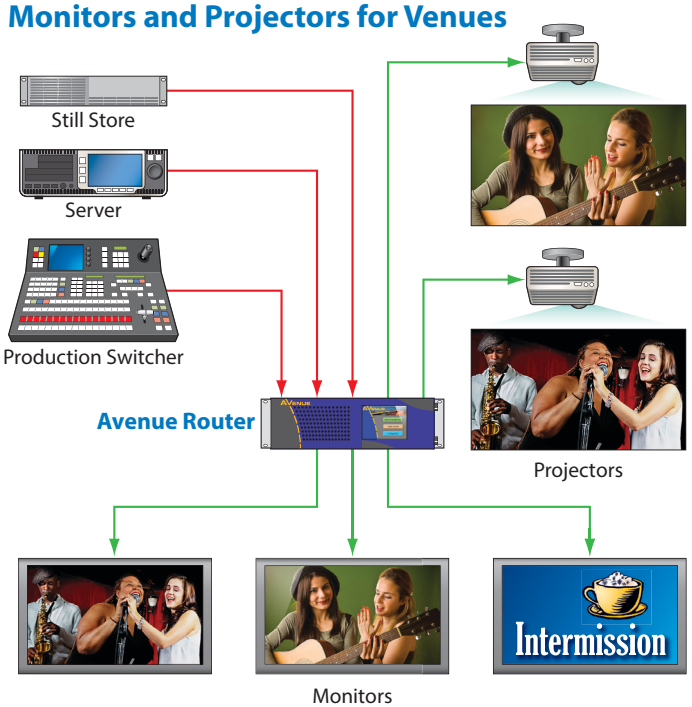
### Clean Switch Option

Add a 9435 or 9435-4CS sub module to the system for clean and quiet switching. The 9435 provides clean and quiet switching for up to two independent destinations while the 9435-4CS provides for four destinations. A single sub module may be added to the base 9430 8x2 router module. A second sub module may be added to expanded systems, providing clean and quiet switching for up to eight independent destinations.

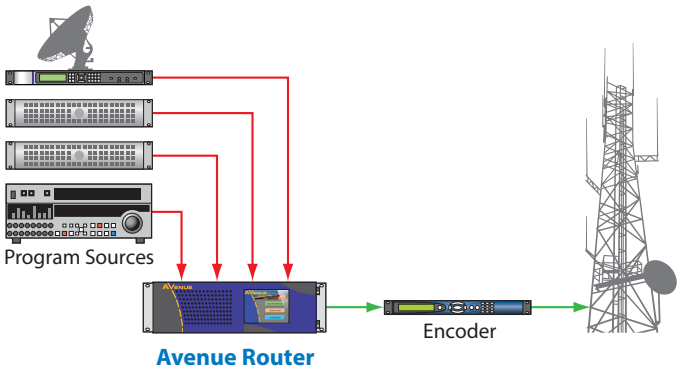
The Avenue router utilizes video frame synchronizers rather than line delays to ensure perfect alignment of mis-timed and completely non-synchronous SDI sources. In addition, the unit's frame synchronizers continue to output black if the input signal goes away. This ensures continuity of the router's video output signal, a significant benefit if the router is feeding an MPEG encoder.

Glitch-free, quiet switching of embedded audio signals requires synchronization and alignment of audio sources at the input to the switcher. With the Avenue router's clean and quiet option, digital audio is de-embedded, and if it is linear PCM, sample rate converted, switched, and re-embedded. Encoded audio streams such as Dolby™ E are de-embedded and re-embedded but not processed in any way.

### Monitors and Projectors for Venues




### Cuts-Only Master Control



## Applications

The Avenue router is ideally suited to a wide range of applications, including mobile and portable systems, QC stations, graphics and post-production islands, ingest, production switcher pre-select, master control bypass, driving on-set monitors, and general utility switching. Look-ahead preview is useful for master control applications. The flexibility of the system makes it possible to tailor the input/output dimensions to a wide range of requirements. VITC captured from the reference input can drive time-scheduled switching.

## Add Keying and Layering

Add the Avenue Layering Engine to your Avenue router and increase its usefulness in broadcast, live venues and presentation. The Avenue Layering Engine provides two, independent linear keyers, program/preset background transitions, and audio mixing and breakaway. Any of your router sources can feed the Layering Engine and the program/preview outputs can be routed to any router destination. The intuitive iPad control interface gives you full control over the mix/effect with program and preview thumbnails and comprehensive view of all graphic layers. There is an equally complete automation protocol, via TCP/IP or RS-232 interfaces, allowing integration into every type of application, including channel branding, master control, fly-pack, DSK and centralcasting.

## Add a Multiviewer

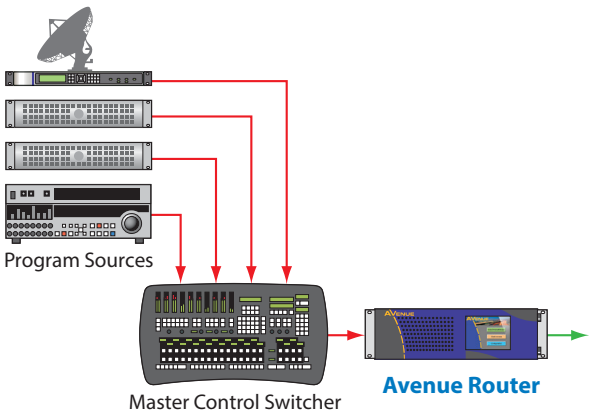
Add Multiviewer functionality to your router with the 9480 sub module option. Sources are sized perfectly with Ensemble's proprietary scaling algorithms, ensuring a beautiful picture, no matter what size you choose. You'll see stunning detail in every position, even when the same source appears multiple times. Configuration is super simple with the click-to-fill function, snap-to grids and intuitive menus. Labels, borders, audio meters and tally are configured with a web browser on your computer or iPad.

## A Single Router with 33 Possible Sizes

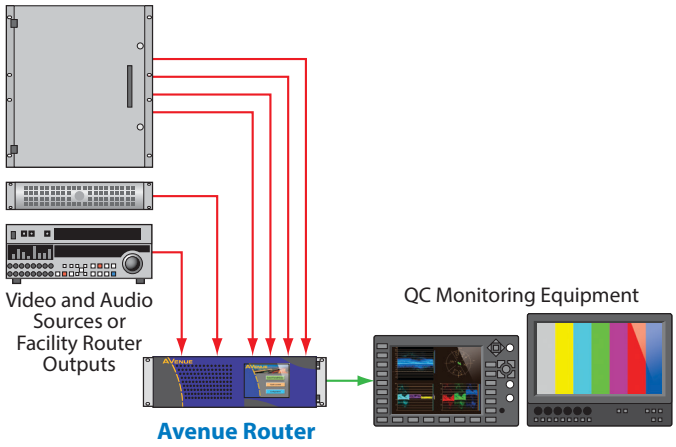
| 9430<br>Router Module<br><br>8 fixed inputs<br>2 fixed outputs | 9430 Router Module<br>+<br>9440 Expansion<br><br>8 fixed inputs<br>2 fixed outputs<br>10 bi-directional ports | 9430 Router Module<br>+<br>2 x 9440 Expansion<br><br>8 fixed inputs<br>2 fixed outputs<br>20 bi-directional ports |
|---|---|---|
| 8x2 | 18x2 | 28x2 |
| | 17x3 | 27x3 |
| | 16x4 | 26x4 |
| | 15x5 | 25x5 |
| | 14x6 | 24x6 |
| | 13x7 | 23x7 |
| | 12x8 | 22x8 |
| | 11x9 | 21x9 |
| | 10x10 | 20x10 |
| | 9x11 | 19x11 |
| | 8x12 | 18x12 |
| | | 17x13 |
| | | 16x14 |
| | | 15x15 |
| | | 14x16 |
| | | 13x17 |
| | | 12x18 |
| | | 11x19 |
| | | 10x20 |
| | | 9x21 |
| | | 8x22 |

*No need for external test signal generators. The router's internal black and bar generator adds two additional SDI sources on top of your I/O port configuration.*

## Master Control Bypass

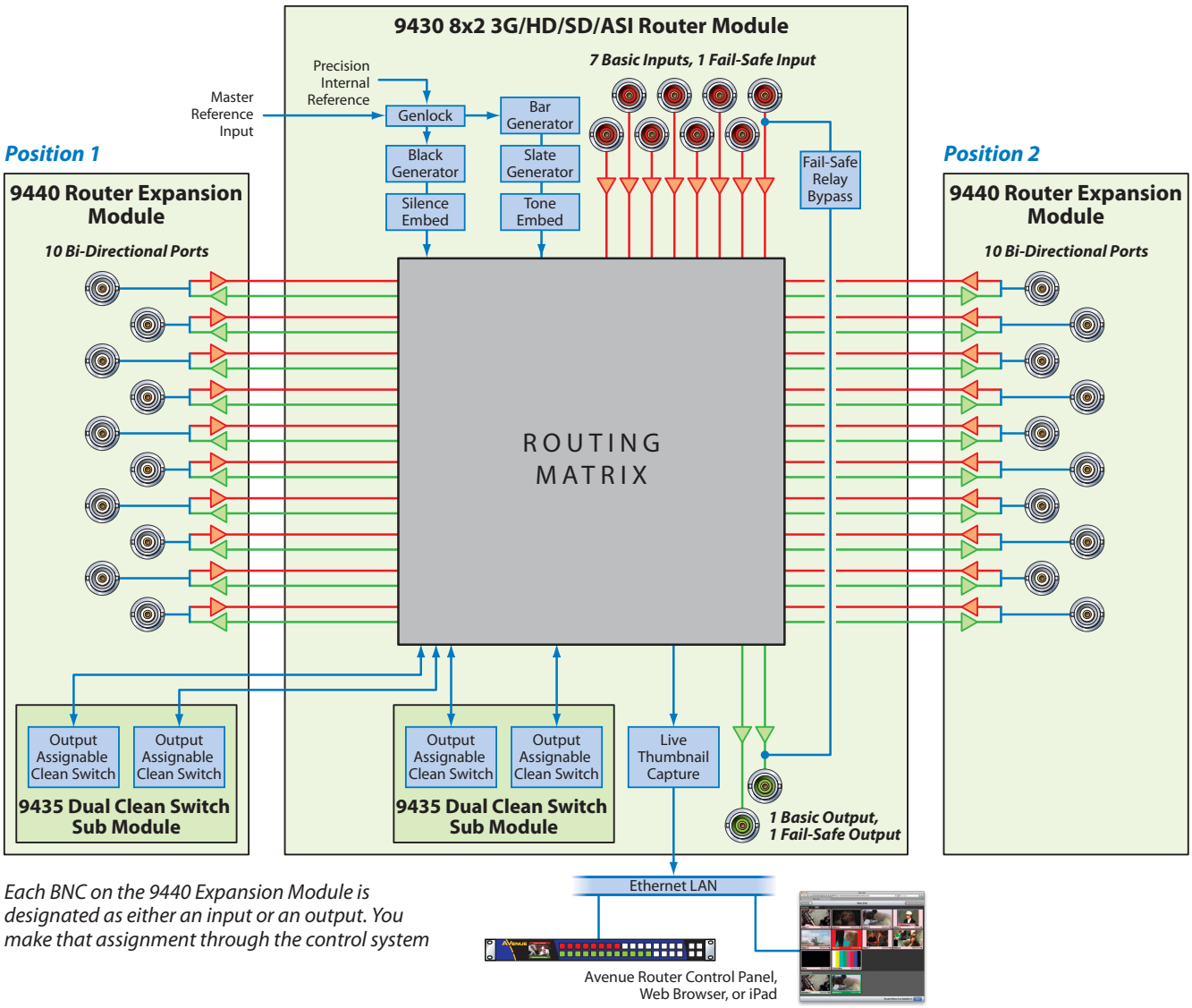



## Quality Control and Signal Monitoring



# 9430 and 9440

## 3G/HD/SD/ASI Flexible Matrix Router




*Each BNC on the 9440 Expansion Module is designated as either an input or an output. You make that assignment through the control system*

## Router Order Info

| | |
|---|---|
| 9430 | 8x2 3G/HD/SD/ASI Router |
| 9440 | Router Expansion Module: Adds 10 user configurable I/O ports<br>One or two 9440s may be added to each 9430 |
| 5830 | Router Control Panel with LCD Preview Display (1RU) |

One sub module option may be added to a 9430. A second sub module may be added to one 9440 (Expansion Position #1)

| | |
|---|---|
| 9435 | Dual Clean Switch sub module: Two independent clean switches per 9435 |
| 9435-4CS | Quad Clean Switch sub module: Four independent clean switches per 9435-4CS |
| 9425 | Avenue Layering Engine sub module |
| 9480 | Multiviewer sub module: Configure as 8x2 or two 4x1s<br>Two 9480s require 9430+9440; configurable as 16x4<br>Outputs 1080i 50/59.94 or 1080p 50/59.94 |
| P94323 | 3G/HD/SD 30 port Router Package with 4 x Clean Switch |

## 9430 Specifications

### Inputs

| | |
|---|---|
| Number | Eight |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>DVB-ASI at 270 Mb/s, SMPTE 310M, AES3id |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization

### Outputs

| | |
|---|---|
| Number | Two |
| Signal Type | Follows input |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Output DC | None (AC coupled) |

### Reference

| | |
|---|---|
| Number | One via frame master ref input |
| Signal Type | Composite black, Tri-Level Sync, 10 MHz |

### Standards Supported

1080p 50, 59.94, 60 Hz, SMPTE 424M, 425M
Level A, Level B (9435 Level A only)
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94 , SMPTE 259M

### General Specifications

| | |
|---|---|
| Power Consumption | 13 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

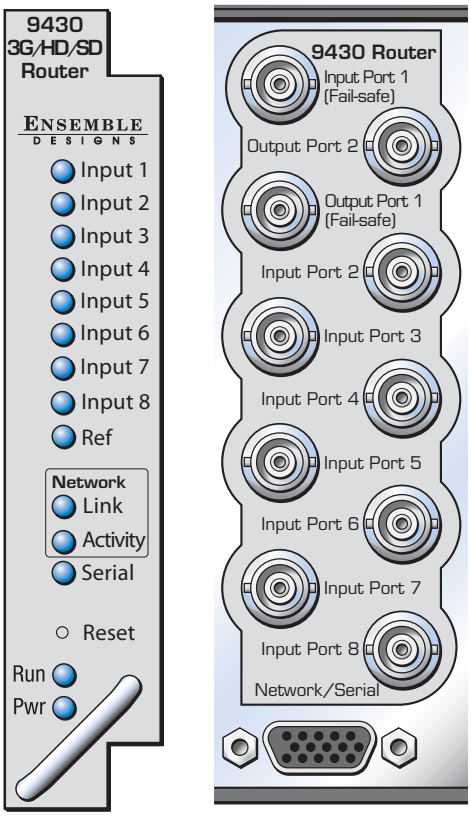
## 9440 Specifications

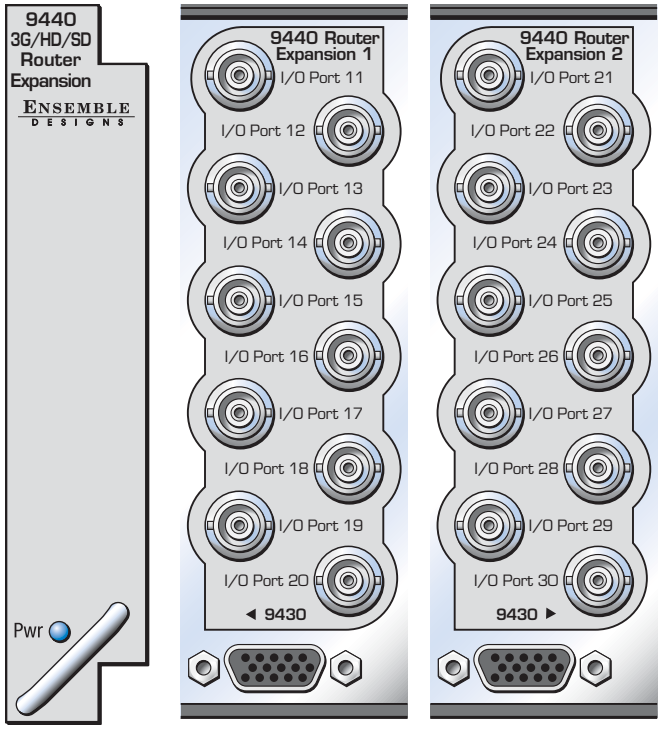
### Inputs

| | |
|---|---|
| Number | Up to ten, user configurable |
| Signal Type | Same as 9430 |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |

### Outputs

| | |
|---|---|
| Number | Up to ten, user configurable |
| Signal Type | Follows input |
| Impedance | 75Ω |
| Return Loss | >15dB to 1.485 GHz |
| Output DC | None (AC coupled) |



# 9455
## 3G Clean and Quiet Protection Switch

### A Clean Switch That's Glitch-Free

The 9455 module is a clean and quiet protection switch for critical broadcast and satellite feeds. It switches cleanly between asynchronous sources which means it can be used live to air. The module has a full video frame synchronizer, rather than a line delay, ensuring perfect alignment of mis-timed and non-synchronous SDI sources.

Clean and quiet switching between sources requires that they be synchronous and precisely timed to each other. The 9455 accomplishes this automatically with integral frame synchronization of the inputs, allowing operation with both synchronous and asynchronous (wild) sources. This frame synchronization feature not only means that the output of the 9455 will always be stable and glitch-free, but it also means that in the event of a total loss of both inputs, consistently timed color black will still be output.

These internal frame synchronizers can be genlocked to an external reference signal so that the output of the 9455 is synchronous to local sources. Alternately, in teleports, headends, and other multi-service facilities where there is no logical common reference, the 9455 will internally generate an accurate reference.

The delay through the 9455 can be adjusted from one to eight frames, with independent control for the Primary and Secondary input paths. By operating with several frames of delay, the fault detection algorithms are given enough time to detect a failure in an input signal and switch to the backup before the fault has actually appeared on-air.

### Perfect Audio

Glitch-free, quiet switching of embedded audio signals is achieved with the 9455's precise synchronization and alignment of audio sources. Digital audio is de-embedded, and if it is linear PCM, sample rate converted, switched, and re-embedded. Encoded audio streams such as Dolby™ E are de-embedded and re-embedded but not processed in any way. PCM audio is supported with asynchronous sources, operation of encoded audio requires all sources to be synchronous, but not necessarily in time.

### Switch Logic

When a fault is detected in the primary input to the 9455, and the secondary input is verified as good, the switch will activate, causing the secondary input to be switched to the module's output. The 9455 includes a passive, fail-safe path that ensures there is an output even in the event of a total power failure. The module can be set to automatically switch back to the primary after the fault condition clears. If both the primary and the secondary inputs signals are faulted, no switch occurs.

The health of a high definition or standard definition video signal is determined by monitoring crucial parameters in order of increasing complexity; Timing Reference Signal (TRS), or a persistent loss of digital sync is tested first. Black, Embedded Audio and Freeze are also evaluated. Each test can be configured by the user. For example, the sophisticated Black Detector includes configurable parameters for black level threshold, pixel count, and duration time.

The Freeze detection system can be set to detect a clean or noisy source. Freeze Time sets the number of seconds for the 9455 to switch to the secondary input after a video freeze condition is detected in the primary input.

### Control and Alarms

Module controls are easily accessed through an Avenue Control Panel, Avenue PC software, GPIs, or the module's front edge controls. GPI inputs allow faults detected in upstream equipment to contribute to the switching logic.

### Features

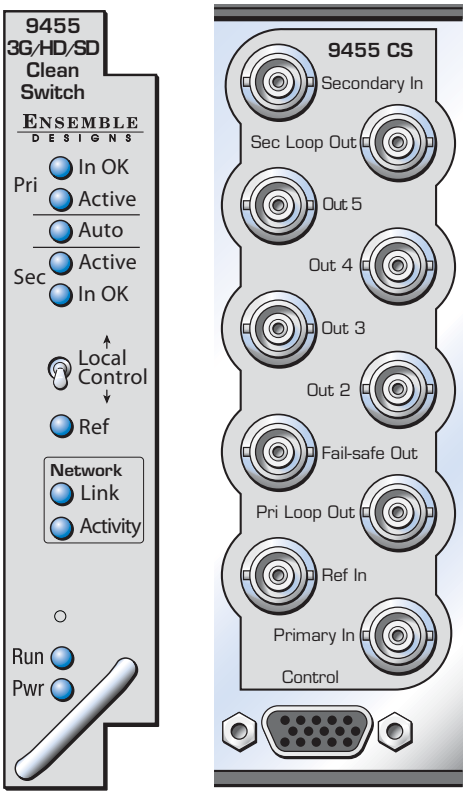
- **Clean and quiet switch for 3G, HD and SD SDI signals**
- **Use for clean switching of asynchronous sources for critical, live feeds**
- **Full frame synchronizer with adjustable delay**
- **Quiet audio switching**
- **Passes embedded audio**
- **External genlock reference input**
- **GPIs and TCP/IP for automation control**
- **Fail-safe bypass in case of power failure**
- **Local and remote control**
- **Memory Registers**

# 9455
## 3G Clean and Quiet Protection Switch

### Input

| | |
|---|---|
| Number | Two |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M Data, SMPTE 337M |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.5 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization




### Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M Level A
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, SMPTE 259M

### Serial Digital Loopback

| | |
|---|---|
| Number | Two total<br>One primary<br>One secondary |
| Impedance | 75 Ω |

### Output

| | |
|---|---|
| Number | Six (includes one fail-safe bypass) |
| Signal Type | HD or SD Serial Digital, follows input |
| Delay | Adjustable up to 8 frames |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

### Reference Input

| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB |

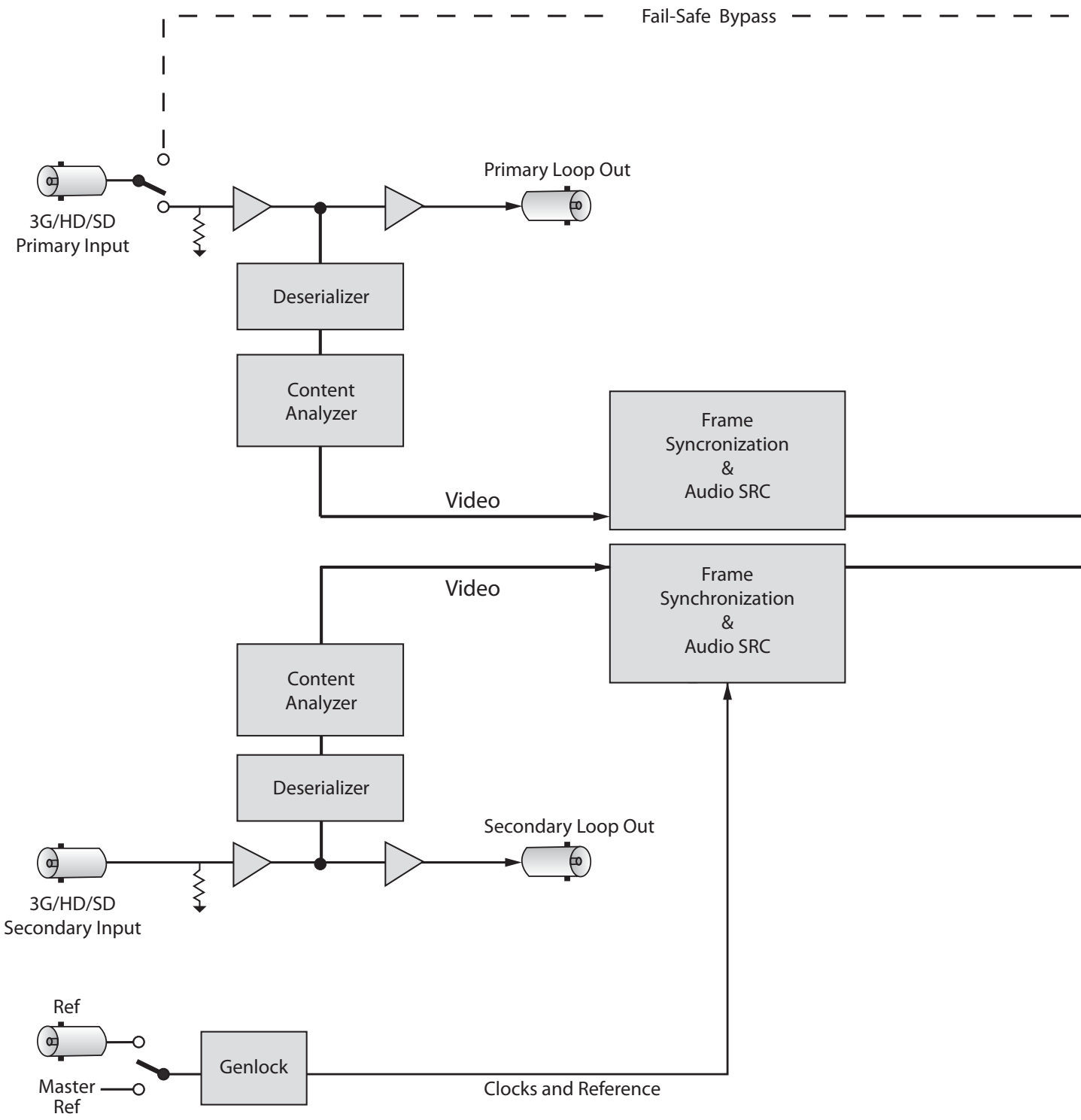
### General Specifications

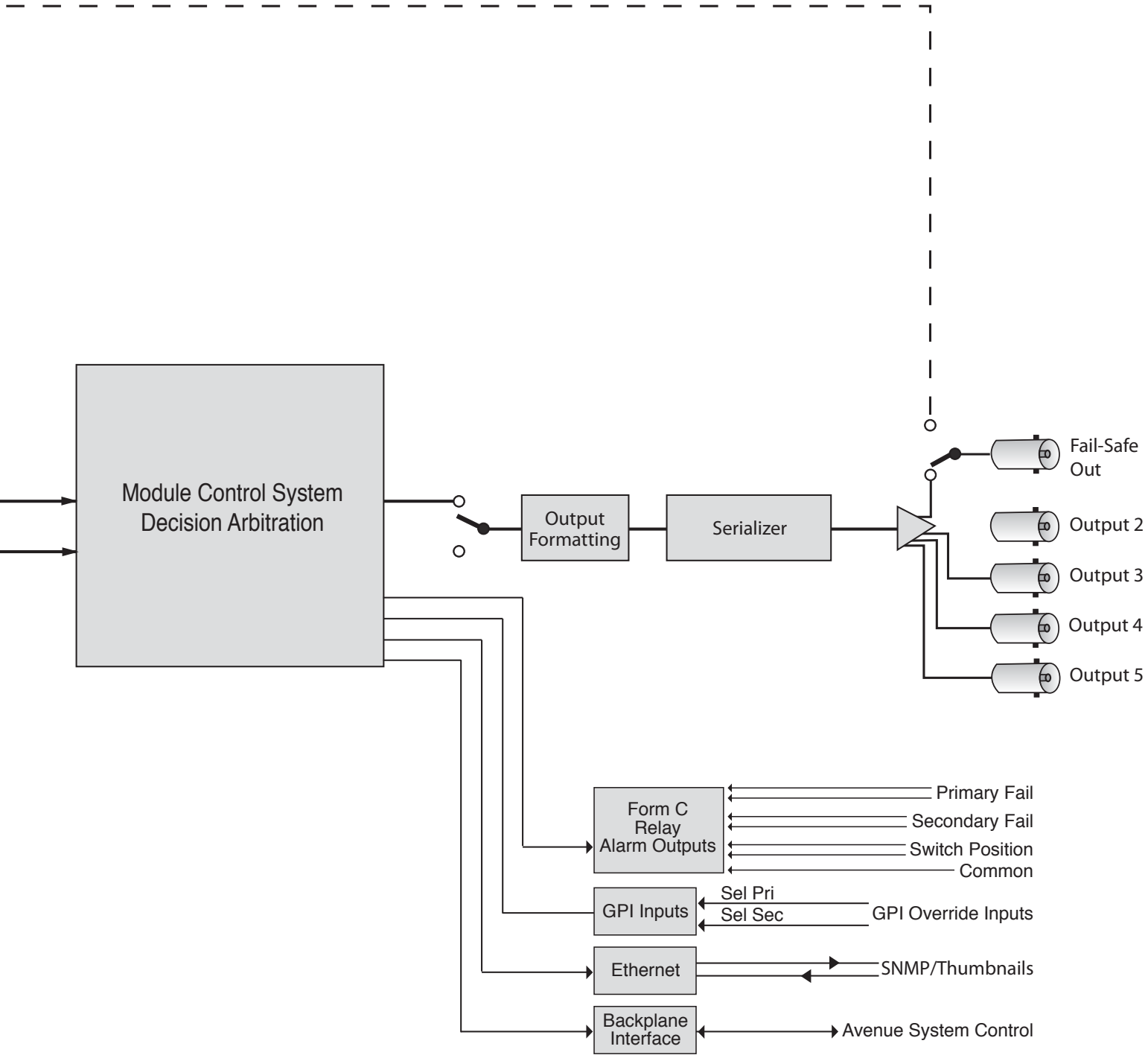
| | |
|---|---|
| Power Consumption | 13 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

9455 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed

# 9455

## 3G Clean and Quiet Protection Switch




Module Control System
Decision Arbitration
Output
Formatting
Serializer
Fail-Safe
Out
Output 2
Output 3
Output 4
Output 5
Form C
Relay
Alarm Outputs
Primary Fail
Secondary Fail
Switch Position
Common
GPI Inputs
Sel Pri
Sel Sec
GPI Override Inputs
Ethernet
SNMP/Thumbnails
Backplane
Interface
Avenue System Control

# 9465
## 3G Sync Changeover

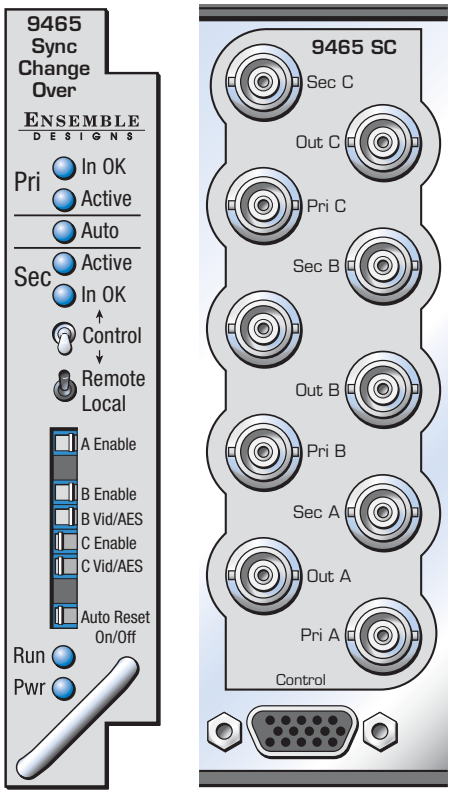
The 9465 3G Sync Changeover module can be used with Avenue's 9400 SPG module, 7400 SPG module, or with third party sync pulse generators. In the event of a failure of the primary sync source, the 9465 changes to the secondary source.

There are three poles or sections on the 9465. One pole tests for 3 Gb/s or 1.5 Gb/s HD SDI, SD SDI, ASI and SMPTE 310M signals. The other two poles test for AES audio, composite video, Bi-Level Sync and Tri-Level Sync. A drop in signal amplitude below a predetermined auto threshold will trigger the switch.

Multiple changeover switches can be ganged together through the control system. Depending on the application, two or more 9465s may be required to handle all signals that need to be protected.

### Features

- **3 poles for signal testing**
- **Use with 3 Gb/s and 1.5 Gb/s HD SDI, SD SDI, analog composite, AES audio, DVB–ASI, SMPTE 310M, Bi-Level Sync, Tri-Level Sync and LTC signals**
- **Gang multiple 9465s and 7465s together as needed**
- **Passes embedded audio**
- **Passive design**
- **GPI inputs for remote manual override**
- **GPI outputs to indicate signal status and switch position**



# 9465
## 3G Sync Changeover

### Input Signals

| | |
|---|---|
| Number | Six |
| Signal Type | 2.97 Gb/s HD Serial Digital, SMPTE 424M, 425M<br>270 Mb/s SD Serial Digital, SMPTE 259M<br>1.485 Gb/s HD Serial Digital, SMPTE 274M, 292M or 296M<br>Analog Composite<br>DVB-ASI, SMPTE 310M<br>AES Digital Audio, LTC,<br>Bi-Level Sync or Tri-Level Sync, selectable |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |

Automatic Cable Input Equalization

### Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M, Level A, Level B
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, SMPTE 259M

### Output Signals

| | |
|---|---|
| Number | Three |
| Signal Type | Follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB to 1.485 GHz |

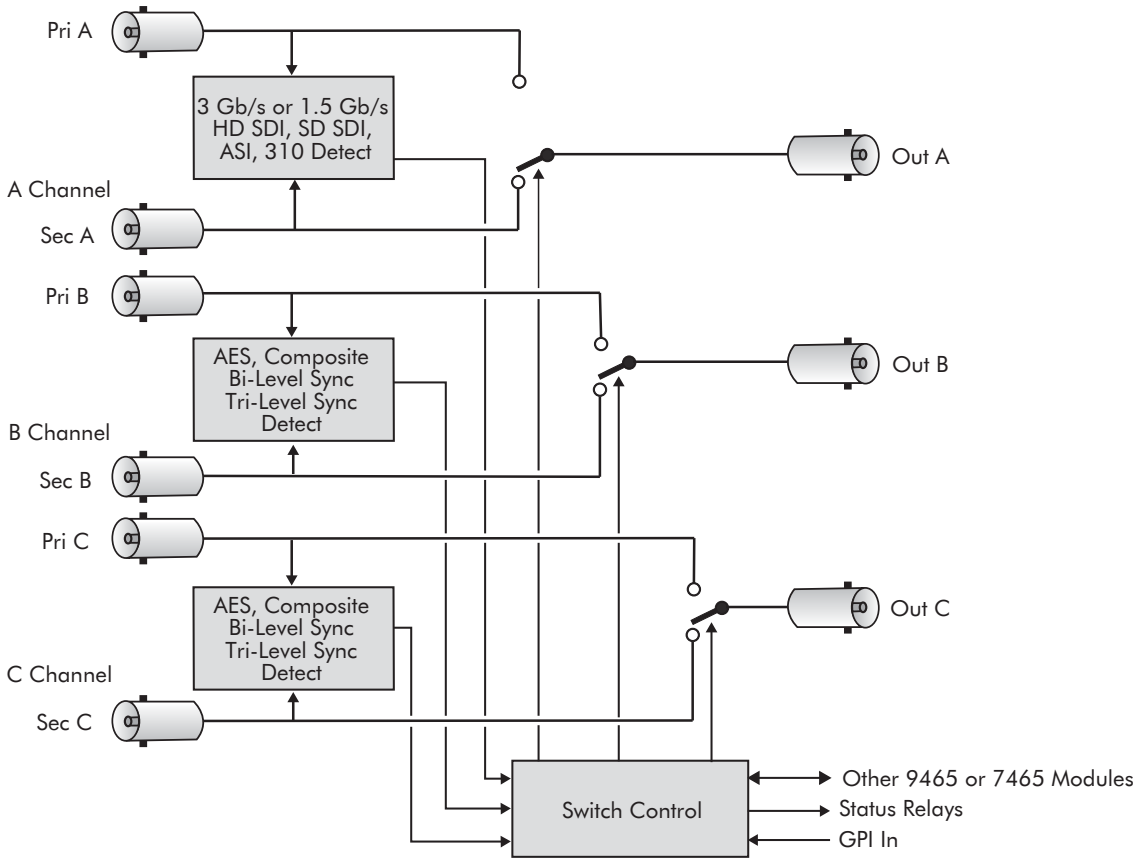
### Switcher Characteristics

| | |
|---|---|
| Type | 75 Ω RF Relay |
| Insertion Loss | <0.5 dB |

### General Specifications

| | |
|---|---|
| Connectors | BNC |
| Power Consumption | <7.0 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |
| Fusing | 1.5 Amp PTC resettable fuse |

9465 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed



# 9550
## 3G Video Processing Frame Sync

The 9550 HD Processing Frame Sync accepts a 3 Gb/s or 1.5 Gb/s high definition video or standard definition video signal for processing, synchronization and timing.

### Flexible Synchronization

An infinitely adjustable timing system genlocks to your house reference. The 9550 genlocks to either composite video (PAL or NTSC) or to Tri-Level Sync. The module can lock to the frame's master reference or reference can be connected directly to the module's external reference BNC. The serial output timing can be set anywhere within a frame of the selected input reference, which can be the module's external BNC reference or the frame's master timing reference.

Upon loss of signal, the 9550 provides freeze frame or black until the signal is recovered.

### Uncompromised Pictures

The HD or SD SDI input is carried at full, uncompressed bandwidth throughout the entire module.

### Complete Proc Amp Functions

The 9550 has a full-featured Proc Amp for adjustment of every signal parameter. Proc controls include Video and Chroma Gain, NTSC-style hue rotation, Black Balance, and Pedestal.

### Audio Support

The 9550 includes a full-featured, sixteen-channel audio mixer. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources. Delay is adjustable up to one second. The audio mixer can be used for embedded audio and for audio sourced from the AES or analog inputs. The 9615 AES and analog audio I/O software key option is required if you want to use the AES or analog inputs and outputs. The 9615 provides four AES input/output ports for eight channels of I/O and also provides four channels of analog audio I/O.

### Dolby and AC-3

The 9550 can be fitted with Dolby and AC-3 encoding and decoding options. The 7615 decoding option can be fed from either an AES input or an AES stream disembedded from the incoming SDI signal. The resulting discrete surround signals are then selectable as inputs to the sixteen channel mixer/shuffler.

The 7630 Dolby encoder is fed from selected outputs of the sixteen channel mixer/shuffler. The resulting encoded bitstream can be output both on an AES output and embedded into the SDI output.

### LevelTrack™ Audio Loudness Control AGC Software and Compliance Options

The 9670 LevelTrack Audio Loudness Control AGC software key can be added as an option. LevelTrack provides control for keeping audio levels consistent in program material.

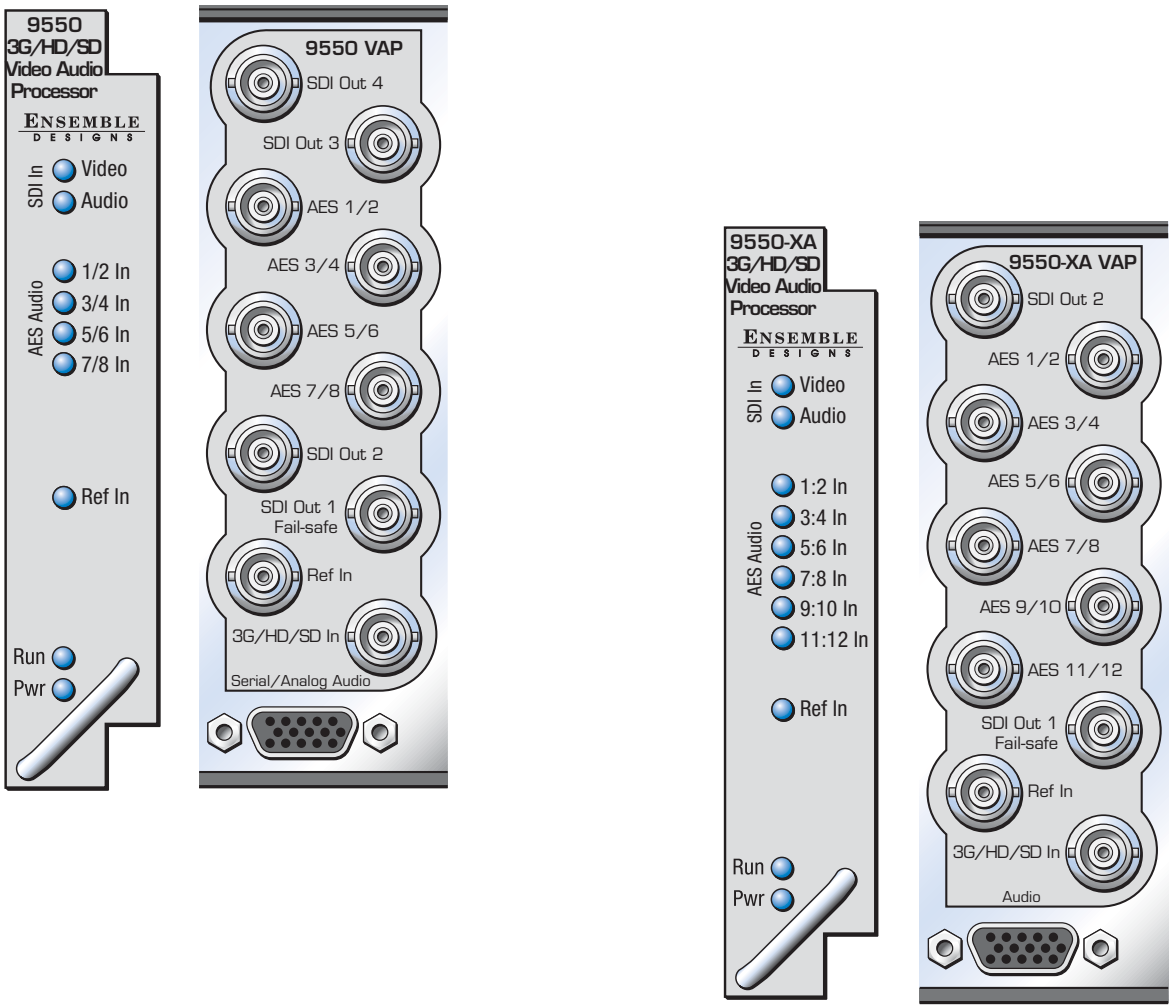
The 9690 Audio Compliance and Monitoring Software can be added for compliance verification and archiving.

### Total Control

Every function and parameter on the 9550 can be controlled from an Avenue Touch Panel or the Avenue PC Control Application. Memory registers can be used to save the complete configuration of the module, making it easy to change instantly between different configurations.

## Features

- **3G, HD or SD SDI I/O**
- **Full-featured Frame Synchronizer with adjustable delay**
- **Comprehensive Proc Amp controls**
- **Color correction**
- **External genlock reference input**
- **Internal Color Bar Generator**
- **Passes embedded audio**
- **AES option for 4 streams/8 channels**
- **Analog audio I/O option**
- **Data mux and demux as per SMPTE 337M**
- **Dolby encoding and decoding options**
- **Audio Loudness Control AGC option**
- **Memory registers**




## Order Info

| | |
|---|---|
| 9550 | 3G/HD/SD Video Processor module |
| 9550-XA | 3G/HD/SD Video Processor module with extra audio outputs<br>XA configuration provides 12 channels of AES I/O and 2 SDI outputs |
| 7615 | Dolby E, Dolby D, AC-3 Decoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7630 | Dolby E Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7635 | Dolby D/AC-3 Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 9615 | AES, analog audio, and data I/O software key option |
| 9670 | LevelTrack Audio Loudness Control AGC software key option |
| 9690 | Audio Compliance and Monitoring Software |

# 9550
## 3G Video Processing Frame Sync

### Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization

### Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M, Level A
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
625i 50, 525i 59.94, SMPTE 259M
Data, SMPTE 337M

### Output

| | |
|---|---|
| Number | Four (one fail-safe bypass) |
| Signal Type | HD or SD Serial Digital, follows input |
| Delay | Adjustable up to 8 frames |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

### Reference Input

| | |
|---|---|
| Number | One external (modules BNC)<br>One internal (frame master ref BNC) |
| Signal Type | PAL or NTSC composite video or Tri-Level Sync |
| Return Loss | >40 dB (applies to external ref input) |

### AES/EBU Digital Inputs (requires 9615 option)

| | |
|---|---|
| Number | Four (total of eight channels) selectable as inputs or outputs |
| Type | AES3id or data, SMPTE 337 |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |

### AES/EBU Digital Outputs (requires 9615 option)

| | |
|---|---|
| Number | Four (total of eight channels) selectable as inputs or outputs |
| Type | AES3id or data |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

### Analog Audio Inputs (requires 9615 option)

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced |
| Connector | 15 pin D |
| Impedance | >15K Ω |
| Maximum Input Level | 24 dBu |
| CMRR | >60 dB, 20 Hz to 10 KHz |
| Quantization | 24 bits, 128 x oversampled |
| Sample Rate | 48 KHz |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Analog Audio Outputs (requires 9615 option)

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced, transformerless |
| Connector | 15 pin D |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x oversampled |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ± 0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Dolby Metadata Inputs/Outputs (requires 9615 option)

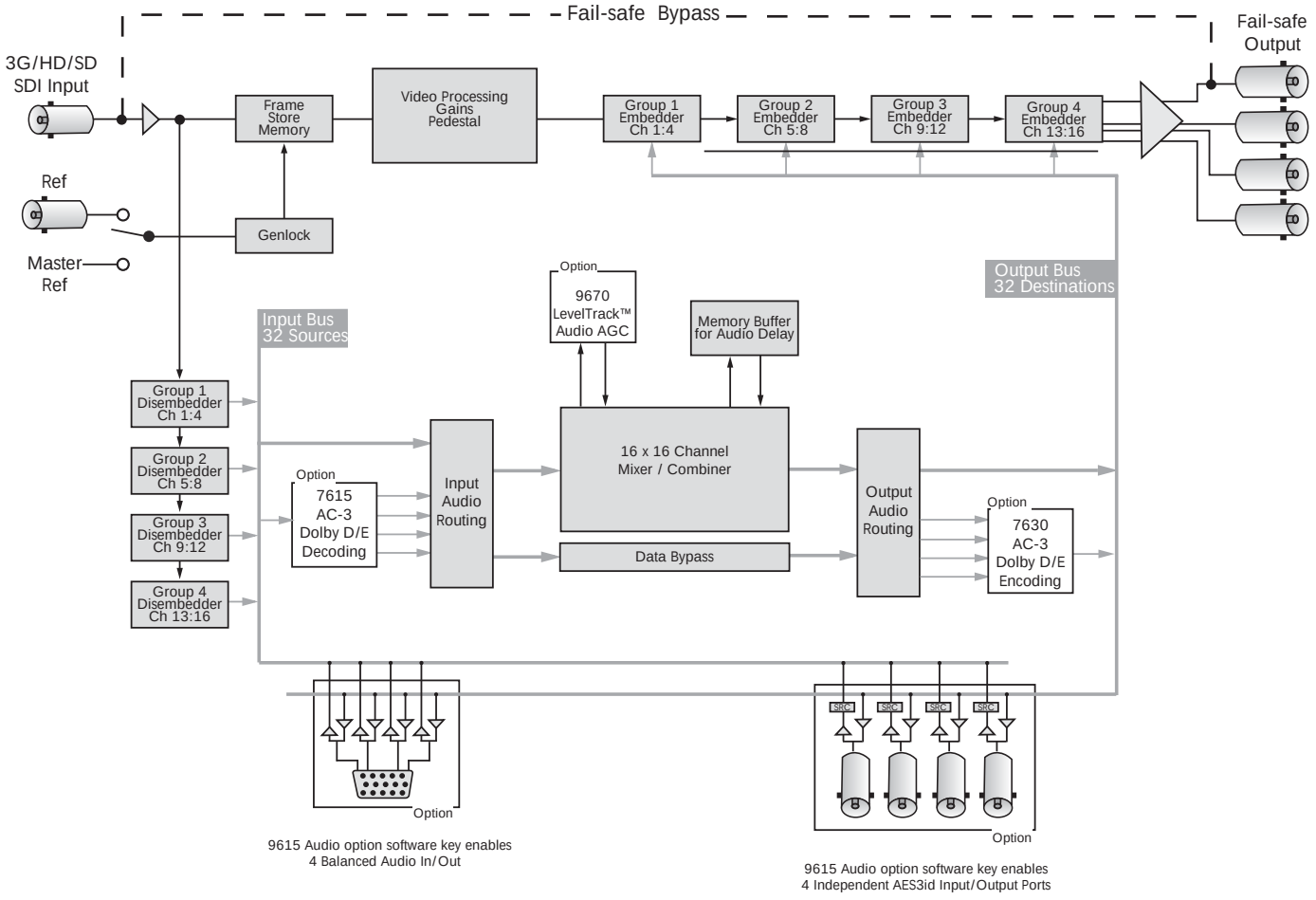
| | |
|---|---|
| Signal Type | Dolby metadata, RS-422, RS-485 |
| Number | Four, selectable as inputs or outputs, share with analog audio I/O |
| Connector | HD-15, balanced |

### Embedded Output (In SDI Outputs)

| | |
|---|---|
| Group Assign | Cascade or replace |
| Channels | Sixteen |
| Bit Depth | 24 Bit |

### General Specifications

| | |
|---|---|
| Power Consumption | 11 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |




*Above, block diagram for the 9550 3G/HD/SD Video Processor module*

*Alternately, for 12 channels of AES I/O and 2 SDI outputs, order the 9550-XA*

# 9600

## 3G Embedder, Disembedder and Data Inserter

The 9600 module is a sixteen-channel audio embedder or disembedder for 1.5 and 3 Gb/s high definition video signal or 270 Mb/s standard definition signals. Eight AES ports automatically configure as inputs or outputs depending on if the module is configured as mux or demux. Additionally, four channels of analog audio are supported.

### Configurable Mux or Demux

When configured as a multiplexer, the 9600 has one serial digital video input and eight AES audio inputs. These eight AES streams are embedded into the video stream. AES inputs are sample rate-converted, allowing the use of asynchronous audio. The output of the module is a digital stream that contains the original video signal and eight AES pairs, or sixteen channels.

When configured as a demultiplexer, audio signals present in the incoming video signal are extracted and delivered as standard AES digital audio streams.

The 9600 includes a full-featured, sixteen-channel audio mixer. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources. Delay is adjustable up to one second.

### In-Line Shuffler

Because the 9600 has simultaneous disembedding and embedding, it is an in-line processor for embedded audio. It can take embedded content, adjust levels and remap channels, and deliver it to the output as an embedded signal.

### Dolby and AC-3

The 9600 can be fitted with Dolby and AC-3 encoding and decoding options. The 7615 decoding option can be fed from either an AES input or an AES stream disembedded from the incoming SDI signal. The resulting discrete surround signals are then selectable as inputs to the sixteen channel mixer/shuffler.

The 7630 Dolby encoder is fed from selected outputs of the sixteen channel mixer/shuffler. The resulting encoded bitstream can be output both on an AES output and embedded into the SDI output.

Additionally, the 9600 fully supports embedding and disembedding of encoded multi-channel bitstreams such as AC-3 and Dolby E.

### LevelTrack™ AGC and Compliance Options

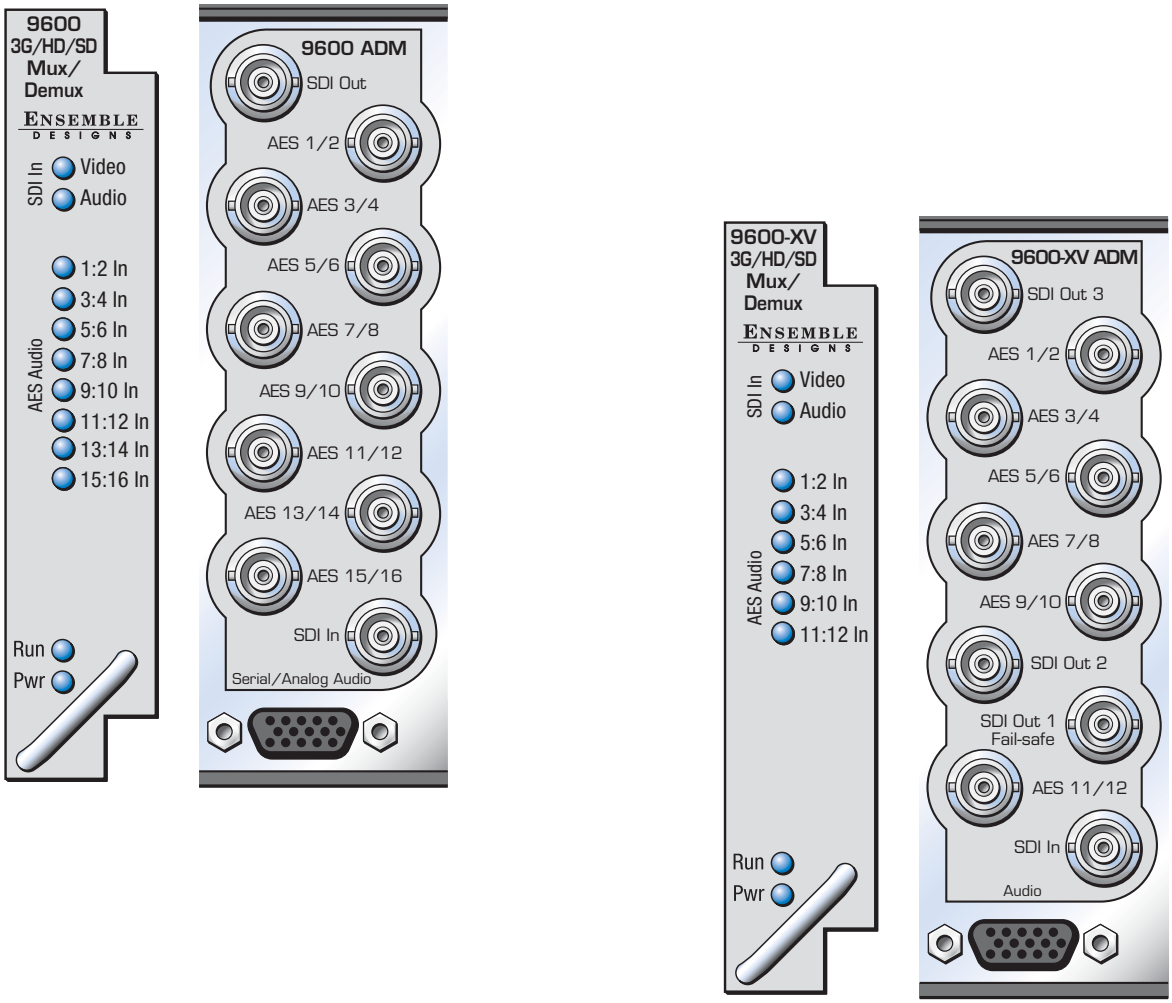
The 9670 LevelTrack™ Audio Automatic Gain Control software key can be added as an option. LevelTrack AGC provides control for keeping audio levels consistent in program material.

The 9690 Audio Compliance and Monitoring Software can be added for compliance verification and archiving.

The 9600 can be configured locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lockout, and customizable menus are just some of the tools included in the Avenue Control System.

### Features

- **Audio embedder or disembedder for 3G, HD or SD signals**
- **Handles 8 AES streams/16 channels**
- **Analog audio I/O**
- **Dolby encoding and decoding options**
- **Up to one second of delay**
- **In-line processor for embedded audio**
- **Audio Loudness Control AGC option**
- **Built-in audio mixer**
- **Phase inversion selectable on a channel basis**
- **Built-in sample rate converters accept asynchronous inputs**
- **26 bit processing resolution**
- **Data mux and demux as per SMPTE 337M**
- **Memory registers**




## Order Info:

| | |
|---|---|
| 9600 | 3G/HD/SD Embedder, Disembedder and Data Inserter module |
| 9600-XV | 3G/HD/SD Embedder, Disembedder and Data Inserter module with extra video outputs<br>XV configuration provides 12 channels of AES I/O and 3 SDI outputs |
| 7615 | Dolby E, Dolby D, AC-3 Decoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7630 | Dolby E Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 7635 | Dolby D/AC-3 Encoder sub module and software key option<br>Dolby processing options incur 1 frame of delay |
| 9670 | LevelTrack Audio Automatic Gain Control software key option |
| 9690 | Audio Compliance and Monitoring Software |

# 9600
## 3G Embedder, Disembedder and Data Inserter

### Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 2.97 Gb/s, SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s, SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization

### Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M, Level A
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
625i 50, 525i 59.94, SMPTE 259M
Data, SMPTE 337M

### Output

| | |
|---|---|
| Number | One |
| Signal Type | HD or SD Serial Digital, follows input |
| Impedance | 75 Ω |
| Return Loss | >15 dB DC to 1.5 GHz |

### AES/EBU Digital Inputs

| | |
|---|---|
| Number | Eight (total of sixteen channels) selectable as inputs or outputs |
| Type | AES3id or data, SMPTE 337 |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 30 kHz to 100 kHz (sample rate converted internally to 48 kHz) |
| Crosstalk | <144 dB |
| Dynamic Range | >144 dB |
| Reference Level | -18 or -20 dBFS (selectable) |

### AES/EBU Digital Outputs

| | |
|---|---|
| Number | Eight (total of sixteen channels) selectable as inputs or outputs |
| Type | AES3id or data |
| Connector | Coaxial, 75 Ω |
| Bit Depth | 20 and 24 bit |
| Sample Rate | 48 kHz, synchronous to video output |
| Reference Level | -18 or -20 dBFS (selectable) |

### Analog Audio Inputs

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced |
| Connector | 15 pin D connector |
| Impedance | >15K Ω |
| Maximum Input Level | 24 dBu |
| CMRR | >60 dB, 20 Hz to 10 KHz |
| Quantization | 24 bits, 128 x oversampled |
| Sample Rate | 48 KHz |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ±0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Analog Audio Outputs

| | |
|---|---|
| Number | Four, selectable as inputs or outputs |
| Type | Balanced, transformerless |
| Connector | 15 pin D |
| Impedance | 30 Ω |
| Maximum Output Level | 24 dBu |
| Resolution | 24 bits, 128 x oversampled |
| Reference Level | -10 dBu or +4 dBu |
| Frequency Response | ± 0.1 dB, 20 Hz to 20 KHz |
| Crosstalk | <106 dB |
| Dynamic Range | >106 dB |

### Dolby Metadata Inputs/Outputs

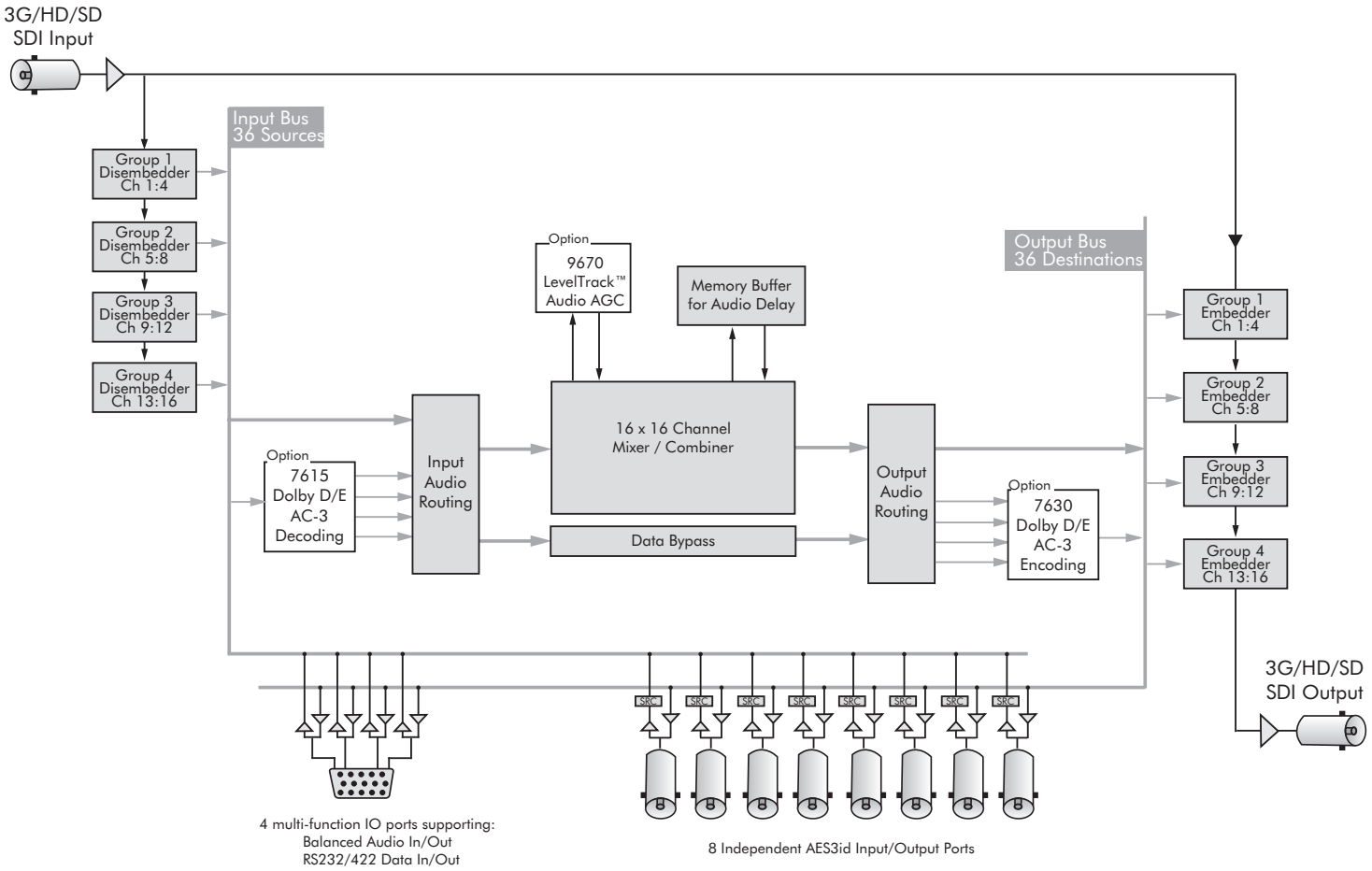
| | |
|---|---|
| Signal Type | Dolby metadata, RS-422, RS-485 |
| Number | Four, selectable as inputs or outputs, share with analog audio I/O |
| Connector | HD-15, balanced |

### Embedded Output (In SDI Outputs)

| | |
|---|---|
| Group Assign | Cascade or replace |
| Channels | Sixteen |
| Bit Depth | 24 Bit |

## General Specifications

| | |
|---|---|
| Power Consumption | 10 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |




*Above, block diagram for the 9600 3G/HD/SD Embedder, Disembedder and Data Inserter module*

*Alternately, for 12 channels of AES I/O and 3 SDI outputs, order the 9600-XV*

# 9670
## LevelTrack Audio Loudness Control AGC Software

### Use LevelTrack to Adjust Your Audio and Stay in Compliance

The LevelTrack™ Audio AGC option adds a user configurable audio level management system to Avenue signal processing modules. LevelTrack AGC corrects mismatched audio levels between different program sources or segments within a program. Errors of this type are regrettably common due to inconsistencies between different providers and program elements.

### 1770 and VU Loudness Algorithms

LevelTrack AGC provides two different approaches for measuring audio levels: VU algorithms and the ITU-R1770 loudness algorithm.

LevelTrack allows you to run your audio against a 1770 LKFS target range. These loudness measurements and adjustments conform to the ITU-R1770 specification. Loudness is frequency dependent and is weighed based upon case studies that reveal how humans perceive sound and loudness.

Alternately, VU algorithms may be used where audio levels are weighted with VU metering and measured in dBFS. The VU approach is particularly useful when calibrating and aligning equipment because it is a frequency independent method.

### Parameters and Control

Range controls are provided for target level, spread, transition time, silence limit, and maximum gain and attenuation. This flexibility allows the operator to customize LevelTrack to suit the specific audio level challenges in a particular installation. All of these parameters can be easily adjusted through the Avenue Control System.

LevelTrack adjusts the levels for up to 16 audio channels. Based upon the history in each channel, gradual changes are applied to prevent the audio level from dropping below or exceeding user programmable thresholds. This automatic level control can be applied on an individual channel, stereo pair, or 5.1 surround grouping. By adjusting the overall level of the signal, rather than masking the errors with compression, LevelTrack does not upset the internal dynamics of the program material.

LevelTrack operates downstream of the manual audio level adjustments that are already provided in Avenue modules. This allows the automatic feature to assist the operator when needed by simply enabling the channel or grouping.

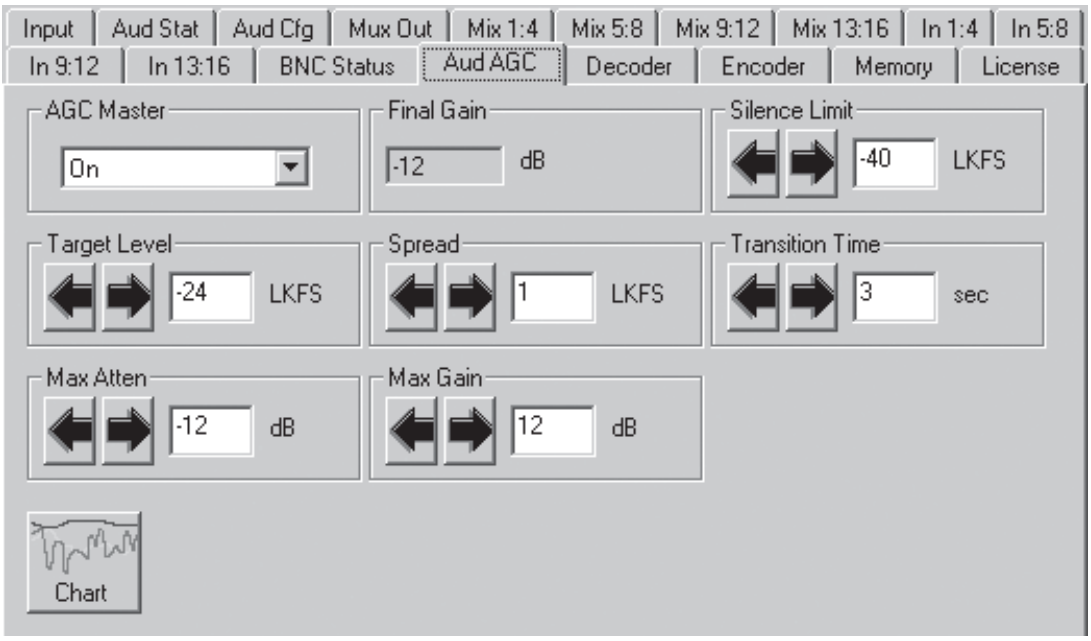
Avenue Modules that can be used with LevelTrack AGC plus 1770 Algorithms

7555 HD/SD Video Processing Frame Synchronizer
7660 HD/SD Embedder, Disembedder and Data Inserter
9550 3G/HD/SD Video Processing Frame Synchronizer
9600 3G/HD/SD Embedder, Disembedder and Data Inserter

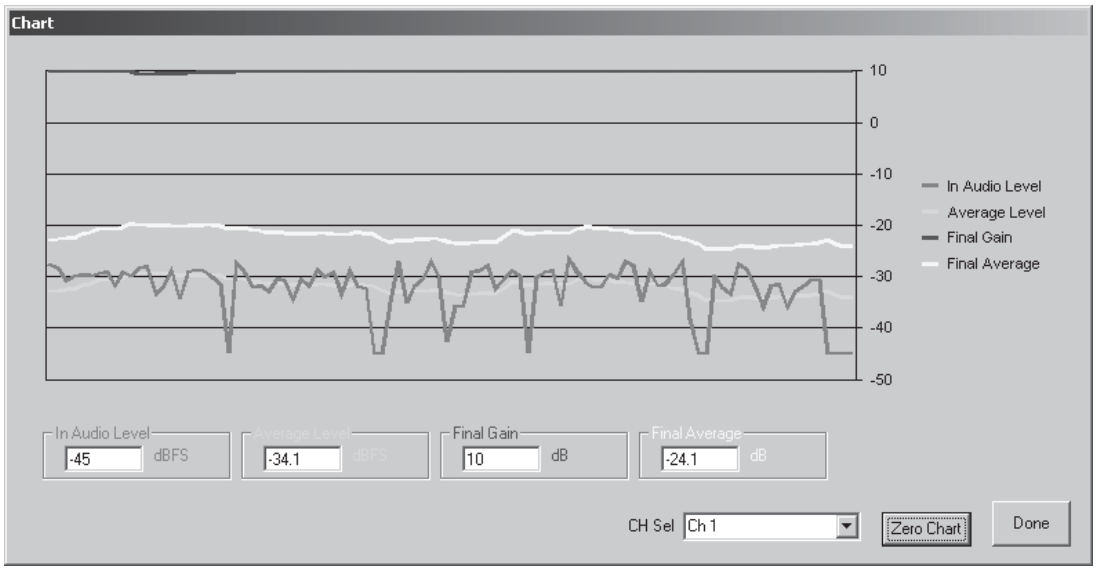
LevelTrack AGC Only

All of the below require 7610 or 8415 in order to use AGC (VU/dBfs only, no 1770 support)

7550 HD Legalizer
7600 HD/SD Embedder, Disembedder
7900 HD Up/Down/Cross Converter
7910 HD Upconverter and Cross Converter
7920 HD Downconverter
7930 HD Cross Converter
7940 SD Aspect Ratio Converter




*LevelTrack is controlled through Avenue PC where you can set your own audio automatic gain control target levels. Both 1770 algorithms and VU metering are provided.*




*The LevelTrack graph shows your audio input level and the final gain applied to the audio signals.*

# 9690
## Audio Compliance and Monitoring Software

### Use Audio Compliance and Monitoring Software to Log Your Audio Levels for Compliance Requirements

Audio Compliance and Monitoring Software provides compliance verification and archiving with the Avenue system. The software gives you the ability to monitor and log levels of audio occurring in selected Avenue modules so that you can show whether audio levels are exceeding a certain configurable limit. You can log both raw data and over limit events. In addition to monitoring and logging, the software can be configured to send email alerts or text messages when audio levels are too high. Use Microsoft Excel, OpenOffice, or any program that can read comma separated values to open the .csv log files.

For broadcasters everywhere, this software allows you to monitor and log audio levels to meet government regulations as well as industry standards and practices.

For broadcasters in the United States, these capabilities are meant specifically to address the need to comply with the Commercial Advertisement Loudness Mitigation (CALM) Act that went into effect in 2012. This law requires broadcasters to ensure that the audio level in commercials is not louder than the regular programming.

Modules that are supported:

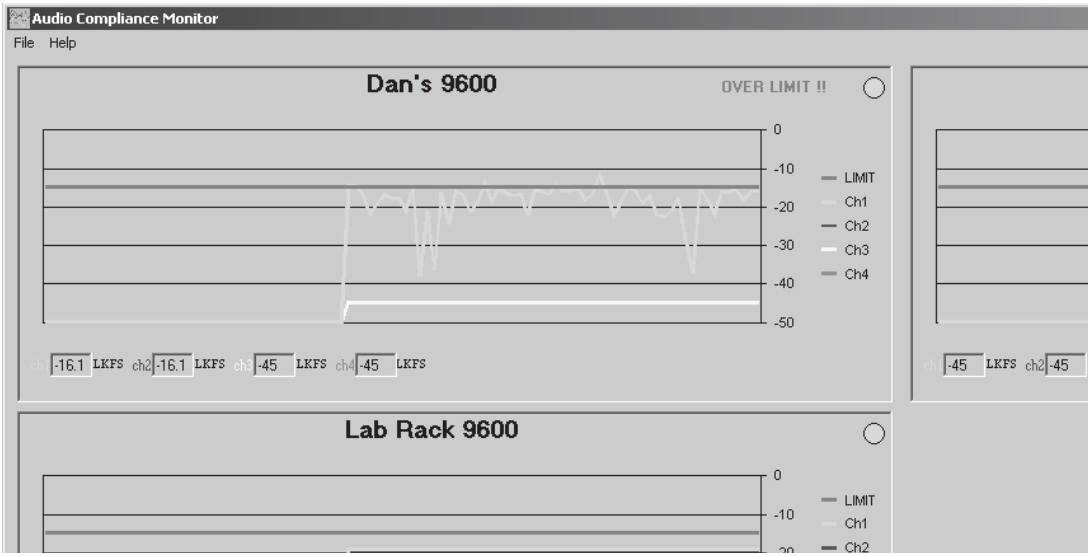
7555 HD/SD Video Processing Frame Synchronizer
7660 HD/SD Embedder, Disembedder and Data Inserter
9550 3G/HD/SD Video Processing Frame Synchronizer
9600 3G/HD/SD Embedder, Disembedder and Data Inserter

### Order Info for 9670 Level Track

9670 LevelTrack Audio Automatic Gain Control Software Key Option
This is a software license and does not require any additional hardware

### Order Info for 9690 Audio Compliance and Monitoring

9690 Audio Compliance and Monitoring Software
This software monitors and logs data for all 16 channels for 4 Avenue modules




*Audio Compliance and Monitoring Software is an option that can be added for compliance verification and archiving. When one of the channels hits a level that exceeds your specified limit, the over limit alarm displays in that module's chart, as shown here.*

12-13-2011.csv - OpenOffice.org Calc

File Edit View Insert Format Tools Data Window Help

Arial 10

I22 -45

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | raw Audio file samples | | | | | |
| 2 | Date | Time | Dan's 9600 Ch 1 | Dan's 9600 Ch 2 | Dan's 9600 Ch 3 | Dan's 9600 Ch 4 |
| 3 | 12/13/2011 | 2:00:28 PM | -25.6 | -27.5 | -45 | -45 |
| 4 | 12/13/2011 | 2:00:29 PM | -26.1 | -27.7 | -45 | -45 |
| 5 | 12/13/2011 | 2:00:30 PM | -15.8 | -17.6 | -45 | -45 |
| 6 | 12/13/2011 | 2:00:31 PM | -16.5 | -18.5 | -45 | -45 |
| 7 | 12/13/2011 | 2:00:32 PM | -14.9 | -16.7 | -45 | -45 |
| 8 | 12/13/2011 | 2:00:33 PM | -13.3 | -15 | -45 | -45 |
| 9 | 12/13/2011 | 2:00:34 PM | -14.2 | -16 | -45 | -45 |
| 10 | 12/13/2011 | 2:00:35 PM | -17.5 | -19.3 | -45 | -45 |
| 11 | 12/13/2011 | 2:00:36 PM | -13.1 | -14.9 | -45 | -45 |
| 12 | 12/13/2011 | 2:00:37 PM | -13.3 | -15.3 | -45 | -45 |
| 13 | 12/13/2011 | 2:00:38 PM | -12.8 | -14.5 | -45 | -45 |

*Audio Compliance Monitor provides logging for both raw data and over limit events.*

# 9950

## 3G Up/Down/Cross Converter and Frame Sync

The 9950 is a frame synchronizer and an up, down and cross converter that supports 3 Gb/s, HD and SD SDI signals. Excellent for on-air use, the 9950 is equally at home in a 3G island, in an HD signal ingest installation, or in a production application. Embedded audio will have automatic delay compensation, dutifully retaining lip sync.

### Upconversion

When configured as an upconverter the 9950 outputs 1.5 HD or 3 Gb/s HD video. All processing is performed on progressive signals at full bandwidth 4:4:4 for optimum signal quality. Aspect ratio conversion choices include: Letterbox, Anamorphic, Crop and Zoom.

### Downconversion

When used as a downconverter, the 9950 has a 3G/HD SDI input and four outputs. The Aspect Ratio Conversion process offers Resizing and Repositioning with choices for: Letterbox, Anamorphic, Crop and Zoom. The 9950 automatically adjusts between 3G/HD and SD color space.

### Cross Conversion

The 9950 provides cross conversion between formats, processing all popular variations of 1080 and 720, making it simple for every facility to ingest any type of 3G, HD or SD signal.

### Aspect Ratio Conversion

The 9950 incorporates an aspect ratio converter for standard definition signals. Resizing and Repositioning includes choices for: Letterbox, Anamorphic, Crop and Zoom.

The 9950 supports AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and downconversion process to adapt automatically to material that is already in letterbox or pillarbox form in order to produce the most appropriate conversion.

### Picture Correction Controls

Input standard and frame rate are auto-detected. The 9950 automatically performs color space conversion. The built-in Proc Amp provides adjustment of signal parameters with controls for video, chroma, setup, hue. Vertical interval data is faithfully preserved and is passed from input to output. The output is timeable with respect to the reference input.

### Flexible Synchronization

An infinitely adjustable timing system genlocks to your house reference. The 9950 genlocks to either composite video (PAL or NTSC) or to Tri-Level Sync. The module can lock to the frame's master reference or reference can be connected directly to the module's external reference BNC. The serial output timing can be set anywhere within a frame of the selected input reference.

Upon loss of signal, the 9950 provides freeze frame or black until the signal is recovered. In freeze mode, audio can be muted or passed as desired.

### Audio Support

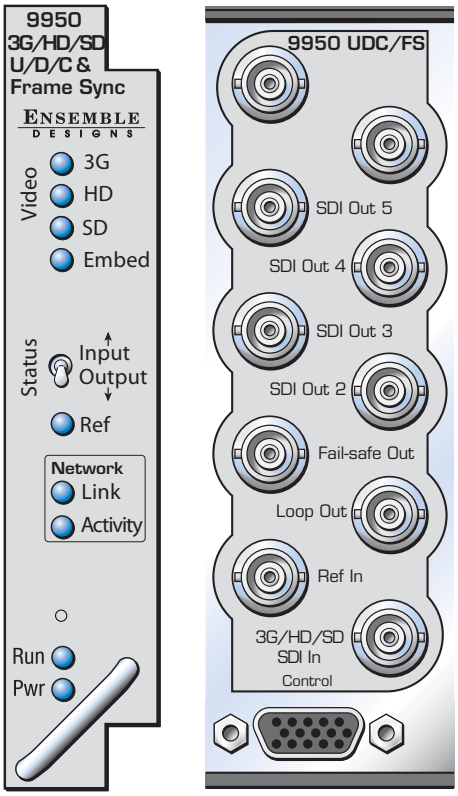
The 9950 supports four groups (16 channels) of audio embedded into the SDI stream. The internal processing disembeds the audio so that it can be processed independently of the video. When the video input and output are not synchronous to each other and the 9950 acts as a frame synchronizer; the audio content is appropriately sample rate converted to the new output sample rate. There is a compensating delay in the audio path to maintain lip sync with the video content. Additionally, delay is adjustable up to one second.

The 9950 includes a full-featured, sixteen-channel audio mixer. The channel swap and shuffle capability allows you to completely rearrange and remix audio channels. It can take embedded content, adjust levels and remap channels, and deliver it to the output as an embedded signal. It provides precise control over audio level, with up to 12 dB of gain to compensate for low level sources.

For discrete AES I/O, analog audio I/O, Dolby encoding, Dolby decoding and automatic gain control, pair the 9950 with the 9600 3G Embedder, Disembedder and Data Inserter. With this 9600 module you can use Dolby encoding and decoding submodules, as well as 9670 Level Track Loudness Control AGC software.

## Features

- High-quality upconverter, downconverter, cross converter, aspect ratio converter
- 3G, HD and SD SDI I/O
- Smart auto-config – set output, then feed any input
- Proc amp with video, chroma, setup and hue adjustments
- Built in bars, black and tone
- Passes embedded audio with proper delay compensation and lip sync preservation
- Supports four groups of embedded audio
- Full frame sync – accepts asynchronous signals
- Reference input – output is timeable
- Automatically adjusts between SD/HD color space
- AFD detection and insertion
- 16 bit processing
- Built-in noise reduction
- Passes closed captioning
- 3:2 pulldown
- Local and remote control
- Memory registers



# 9950

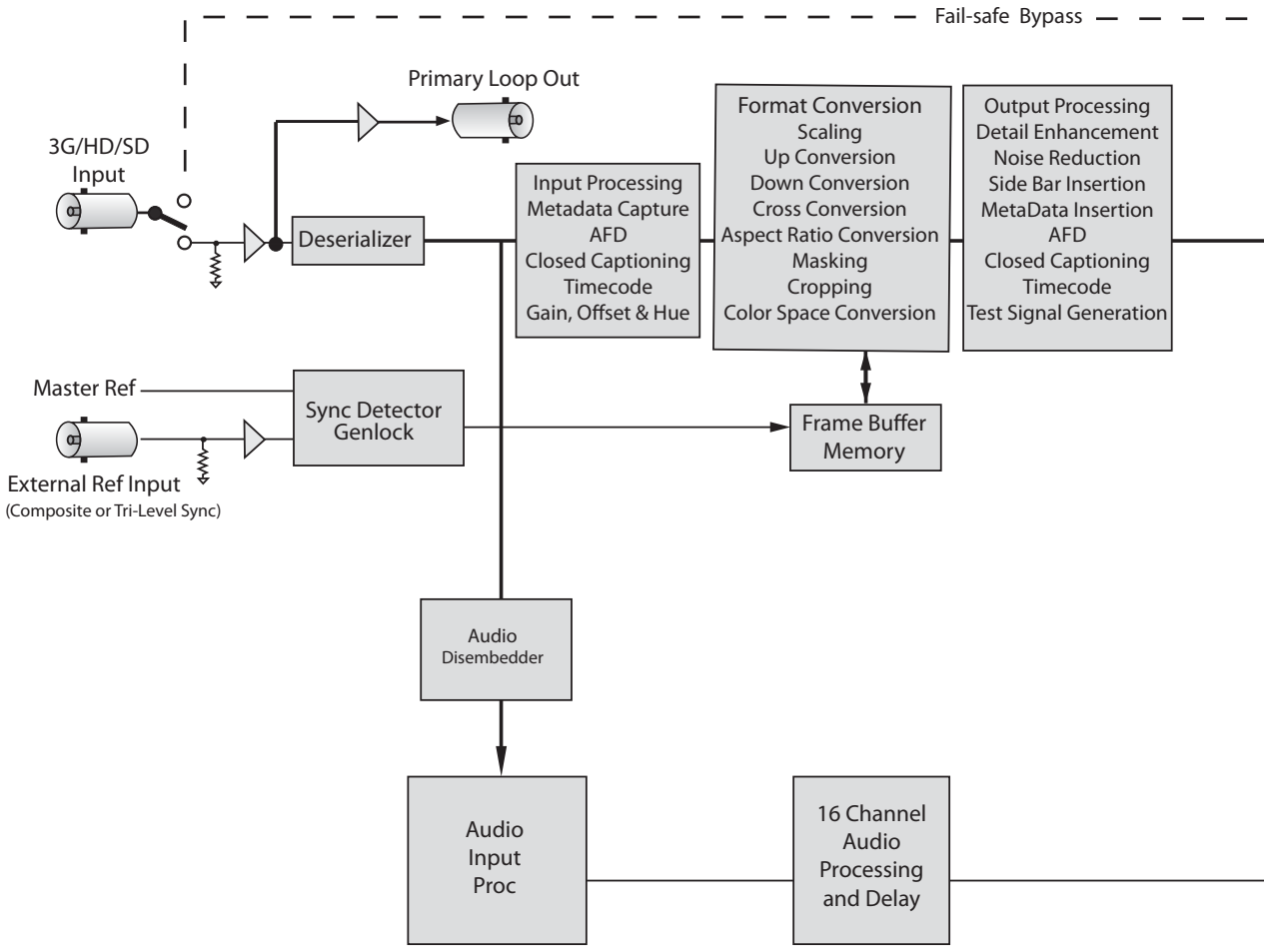
## 3G Up/Down/Cross Converter and Frame Sync

### Automatic Aspect Ratio Conversion

The 9950 supports AFD (Active Format Description) to mark or identify the aspect ratio of the video content. These flags are generated at the output of the module, and they are read at the input. This allows the up and downconversion process to adapt automatically to material that is already in letter or pillarbox form in order to produce the most appropriate conversion.

### Complete Control System

The 9950 can be used locally or controlled and configured remotely with Avenue Touch Screens, Express Panels, or Avenue PC Software. Alarm generation, configurable user levels, module lock out, and customizable menus are just some of the tools included in the Avenue Control System. SNMP support is provided.



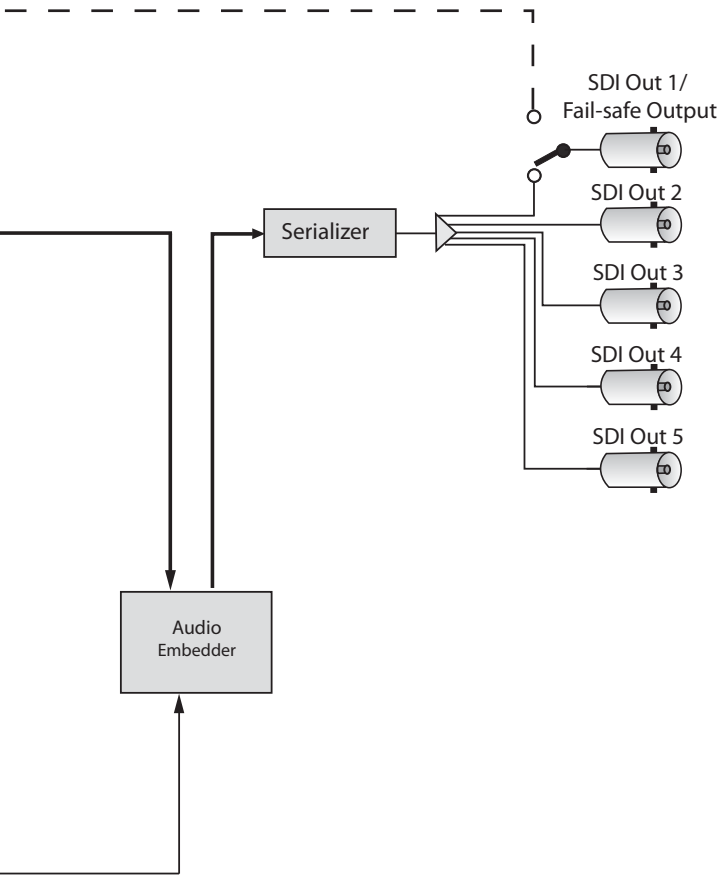
# 9950

## 3G Up/Down/Cross Converter and Frame Sync

### Input

| | |
|---|---|
| Number | One |
| Signal Type | HD Serial Digital 2.97 Gb/s<br>SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s<br>SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>Both 525 and 625 standards |
| Impedance | 75 Ω |
| Return Loss | >15dB to 1.485 GHz |
| Max Cable Length | 270 Mb/s 300 meters Belden 1694A<br>1.485 Gb/s 100 meters Belden 1694A<br>2.97 Gb/s 70 meters Belden 1694A |

Automatic Cable Input Equalization




### Standards Supported

1080p 50, 59.94 Hz, SMPTE 424M, 425M, Level A
1080i 50, 59.94 or 60 Hz, SMPTE 274M -4,5,6
1080p 23.98, 24 or 25 Hz, SMPTE 274M -9,10,11
1080sF 23.98, 24 or 25 Hz, RP211 -14,15,16
720p 50, 59.94 or 60 Hz, SMPTE 296M -1,2,3
525i 59.94, 625i 50, SMPTE 259M

### Format Conversion

HD 50, 59.94 or 60 Hz to/from HD 50, 59.94 or 60 Hz
HD 23.98, 24 or 25 Hz to/from HD 23.98, 24 or 25 Hz
HD 23.98, 24 Hz to/from HD 59.94 or 60 Hz
HD 25 Hz to/from HD 50 Hz
SD 50, 59.94 or 60 Hz to/from HD 50, 59.94 or 60 Hz

### Serial Digital Output

| | |
|---|---|
| Number | Four (one fail-safe bypass) |
| Signal Type | HD Serial Digital 2.97 Gb/s<br>SMPTE 424M, 425M<br>HD Serial Digital 1.485 Gb/s<br>SMPTE 274M, 292M or 296M<br>SD Serial Digital 270 Mb/s, SMPTE 259M<br>Both 525 and 625 standards |
| Impedance | 75 Ω |
| Delay | Up to 8 frames |
| Return Loss | >15dB to 1.485 GHz |

### General Specifications

| | |
|---|---|
| Power Consumption | 13 watts |
| Temperature Range | 0 to 40°C ambient (all specs met) |
| Relative Humidity | 0 to 95%, noncondensing |
| Altitude | 0 to 10,000 ft |

9950 module cannot be installed in slot 3 of a 1RU frame when 5035 System Control module is installed

# Glossary

**AES/EBU –** The digital audio standard defined as a joint effort of the Audio Engineering Society and the European Broadcast Union. AES/EBU or AES3 describes a serial bitstream that carries two audio channels, thus an AES stream is a stereo pair. The AES/EBU standard covers a wide range of sample rates and quantizations (bit depths.) In television systems, these will generally be 48 KHz and either 20 or 24 bits.

**AFD –** Active Format Description is a method to carry information regarding the aspect ratio of the video content. The specification of AFD was standardized by SMPTE in 2007 and is now beginning to appear in the marketplace. AFD can be included in both SD and HD SDI transport systems. There is no legacy analog implementation. (See WSS).

**ASI –** A commonly used transport method for MPEG-2 video streams, ASI or Asynchronous Serial Interface, operates at the same 270 Mb/s data rate as SD SDI. This makes it easy to carry an ASI stream through existing digital television infrastructure. Known more formally as DVB-ASI, this transport mechanism can be used to carry multiple program channels.

**Aspect Ratio –** The ratio of the vertical and horizontal measurements of an image. 4:3 is the aspect ratio for standard definition video formats and television and 16:9 for high definition. Converting formats of unequal ratios is done by letterboxing (horizontal bars) or pillar boxing (vertical pillars) in order to keep the original format's aspect ratio.

**Bandwidth –** Strictly speaking, this refers to the range of frequencies (i.e. the width of the band of frequency) used by a signal, or carried by a transmission channel. Generally, wider bandwidth will carry and reproduce a signal with greater fidelity and accuracy.

**Beta –** Sony Beta SP video tape machines use an analog component format that is similar to SMPTE, but differs in the amplitude of the color difference signals. It may also carry setup on the luminance channel.

**Bit –** A binary digit, or bit, is the smallest amount of information that can be stored or transmitted digitally by electrical, optical, magnetic, or other means. A single bit can take on one of two states: On/Off, Low/High, Asserted/Deasserted, etc. It is represented numerically by the numerals 1 (one) and 0 (zero). A byte, containing 8 bits, can represent 256 different states. The binary number 11010111, for example, has the value of 215 in our base 10 numbering system. When a value is carried digitally, each additional bit of resolution will double the number of different states that can be represented. Systems that operate with a greater number of bits of resolution, or quantization, will be able to capture a signal with more detail or fidelity. Thus, a video digitizer with 12 bits of resolution will capture 4 times as much detail as one with 10 bits.

**Blanking –** The Horizontal and Vertical blanking intervals of a television signal refer to the time periods between lines and between fields. No picture information is transmitted during these times, which are required in CRT displays to allow the electron beam to be repositioned for the start of the next line or field. They are also used to carry synchronizing pulses which are used in transmission and recovery of the image. Although some of these needs are disappearing, the intervals themselves are retained for compatibility purposes. They have turned out to be very useful for the transmission of additional content, such as teletext and embedded audio.

**CAV –** Component Analog Video. This is a convenient shorthand form, but it is subject to confusion. It is sometimes used to mean ONLY color difference component formats (SMPTE or Beta), and other times to include RGB format. In any case, a CAV signal will always require 3 connectors – either Y/R-Y/B-Y, or R/G/B.

**Checkfield –** A Checkfield signal is a special test signal that stresses particular aspects of serial digital transmission. The performance of the Phase Locked-Loops (PLLs) in an SDI receiver must be able to tolerate long runs of 0's and 1's. Under normal conditions, only very short runs of these are produced due to a scrambling algorithm that is used. The Checkfield, also referred to as the Pathological test signal, will "undo" the scrambling and cause extremely long runs to occur. This test signal is very useful for testing transmission paths.

**Chroma –** The color or chroma content of a signal, consisting of the hue and saturation of the image. See also Color Difference.

**Component –** In a component video system, the totality of the image is carried by three separate but related components. This method provides the best image fidelity with the fewest artifacts, but it requires three independent transmission paths (cables). The commonly used component formats are Luminance and Color Difference (Y/Pr/Pb), and RGB. It was far too unwieldy in the early days of color television to even consider component transmission.

**Composite –** Composite television dates back to the early days of color transmission. This scheme encodes the color difference information onto a color subcarrier. The instantaneous phase of the subcarrier is the color's hue, and the amplitude is the color's saturation or intensity. This subcarrier is then added onto the existing luminance video signal. This trick works because the subcarrier is set at a high enough frequency to leave spectrum for the luminance information. But it is not a seamless matter to pull the signal apart again at the destination in order to display it or process it. The resultant artifacts of dot crawl (also referred to as chroma crawl) are only the most obvious result. Composite television is the most commonly used format throughout the world, either as PAL or NTSC. It is also referred to as Encoded video.

**Color Difference –** Color Difference systems take advantage of the details of human vision. We have more acuity in our black and white vision than we do in color. This means that we need only the luminance information to be carried at full bandwidth, we can scrimp on the color channels. In order to do this, RGB information is converted to carry all of the luminance (Y is the black and white of the scene) in a single channel. The other two channels are used to carry the "color difference". Noted as B-Y and R-Y, these two signals describe how a particular pixel "differs" from being purely black and white. These channels typically have only half the bandwidth of the luminance.

**Decibel (dB) –** The decibel is a unit of measure used to express the ratio in the amplitude or power of two signals. A difference of 20 dB corresponds to a 10:1 ratio between two signals, 6 dB is approximately a 2:1 ration. Decibels add while the ratios multiply, so 26 dB is a 20:1 ratio, and 14 dB is a 5:1 ratio. There are several special cases of the dB scale, where the reference is implied. Thus, dBm refers to power relative to 1 milliwatt, and dBu refers to voltage relative to .775V RMS. The original unit of measure was the Bel (10 times bigger), named after Alexander Graham Bell.

**dBFS –** In Digital Audio systems, the largest numerical value that can be represented is referred to as Full Scale. No values or audio levels greater than FS can be reproduced because they would be clipped. The nominal operating point (roughly corresponding to 0 VU) must be set below FS in order to have headroom for audio peaks. This operating point is described relative to FS, so a digital reference level of -20 dBFS has 20 dB of headroom before hitting the FS clipping point.

**DVI –** Digital Visual Interface. DVI-I (integrated) provides both digital and analog connectivity. The larger group of pins on the connector are digital while the four pins on the right are analog.

**EDH –** Error Detection and Handling is a method to verify proper reception of an SDI or HD SDI signal at the destination. The originating device inserts a data packet in the vertical interval of the SDI signal and every line of the HD signal which contains a checksum of the entire video frame. This checksum is formed by adding up the numerical values of all of the samples in the frame, using a complex formula. At the destination this same formula is applied to the incoming video and the resulting value is compared to the one included in the transmission. If they match, then the content has all arrived with no errors. If they don't, then an error has occurred.

**Embedded Audio –** Digital Audio can be carried along in the same bitstream as an SDI or HD SDI signal by taking advantage of the gaps in the transmission which correspond to the horizontal and vertical intervals of the television waveform. This technique can be very cost effective in transmission and routing, but can also add complexity to signal handling issues because the audio content can no longer be treated independently of the video.

**Eye Pattern –** To analyze a digital bitstream, the signal can be displayed visually on an oscilloscope by triggering the horizontal timebase with a clock extracted from the stream. Since the bit positions in the stream form a very regular cadence, the resulting display will look like an eye – an oval with slightly pointed left and right ends. It is easy to see from this display if the eye is "open", with a large central area that is free of negative or positive transitions, or "closed" where those transitions are encroaching toward the center. In the first case, the open eye indicates that recovery of data from the stream can be made reliably and with few errors. But in the closed case data will be difficult to extract and bit errors will occur. Generally it is jitter in the signal that is the enemy of the eye.

**Frame Sync –** A Frame Synchronizer is used to synchronize the timing of a video signal to coincide with a timing reference (usually a color black signal that is distributed throughout a facility). The synchronizer accomplishes this by writing the incoming video into a frame buffer memory under the timing direction of the sync information contained in that video. Simultaneously the memory is being read back by a timing system that is genlocked to a house reference. As a result, the timing or alignment of the video frame can be adjusted so that the scan of the upper left corner of the image is happening simultaneously on all sources. This is a requirement for both analog and digital systems in order to perform video effects or switch glitch-free in a router. Frame synchronization can only be performed within a single television line standard. A synchronizer will not convert an NTSC signal to a PAL signal, it takes a standards converter to do that.

**Frequency Response –** A measurement of the accuracy of a system to carry or reproduce a range of signal frequencies. Similar to Bandwidth.

**H.264 –** The latest salvo in the compression wars is H.264 which is also known as MPEG-4 Part 10. MPEG-4 promises good results at just half the bit rate required by the currently dominant standard, MPEG-2.

**HD –** High Definition. This two letter acronym has certainly become very popular. Here we thought it was all about the pictures – and the radio industry stole it.

**HDCP –** (High-bandwidth Digital Content Protection) is a content encryption system for HDMI. It is meant to prevent copyright content from being copied. Protected content, like a movie on a Blu-Ray disc is encrypted by its creator. Devices that want to display the protected content, like a television, must have an authorized key in order to decode the signal and display it. The entity that controls the HDCP standard strictly limits the kinds of devices that are allowed decryption keys. Devices that decrypt the content and provide an unencrypted copy are not allowed.

**HDMI –** The HIgh Definition Multimedia Interface comes to us from the consumer marketplace where it is becoming the de facto standard for the digital interconnect of display devices to audio and video sources. It is an uncompressed, all-digital interface that transmits digital video and eight channels of digital audio. HDMI is a bit serial interface that carries the video content in digital component form over multiple twisted-pairs. HDMI is closely related to the DVI interface for desktop computers and their displays.

**IEC –** The International Electrotechnical Commission provides a wide range of worldwide standards. Among them, they have provided standardization of the AC power connection to products by means of an IEC line cord. The connection point uses three flat contact blades in a triangular arrangement, set in a rectangular connector. The IEC specification does not dictate line voltage or frequency. Therefore, the user must take care to verify that a device either has a universal input (capable of 90 to 230 volts, either 50 or 60 Hz), or that a line voltage switch, if present, is set correctly.

**Interlace –** Human vision can be fooled to see motion by presenting a series of images, each with a small change relative to the previous image. In order to eliminate the flicker, our eyes need to see more than 30 images per second. This is accomplished in television systems by dividing the lines that make up each video frame (which run at 25 or 30 frames per second) into two fields. All of the odd-numbered lines are transmitted in the first field, the even-numbered lines are in the second field. In this way, the repetition rate is 50 or 60 Hz, without using more bandwidth. This trick has worked well for years, but it introduces other temporal artifacts. Motion pictures use a slightly different technique to raise the repetition rate from the original 24 frames that make up each second of film—they just project each one twice.

**IRE –** Video level is measured on the IRE scale, where 0 IRE is black, and 100 IRE is full white. The actual voltages that these levels correspond to can vary between formats.

**ITU-R 601 –** This is the principal standard for standard definition component digital video. It defines the luminance and color difference coding system that is also referred to as 4:2:2. The standard applies to both PAL and NTSC derived signals. They both will result in an image that contains 720 pixels horizontally, with 486 vertical pixels in NTSC, and 576 vertically in PAL. Both systems use a sample clock rate of 27 MHz, and are serialized at 270 Mb/s.

**Jitter –** Serial digital signals (either video or audio) are subject to the effects of jitter. This refers to the instantaneous error that can occur from one bit to the next in the exact position of each digital transition. Although the signal may be at the correct frequency on average, in the interim it varies. Some bits come slightly early, others come slightly late. The measurement of this jitter is given either as the amount of time uncertainty or as the fraction of a bit width. For 270 Mb/s SD video, the allowable jitter is 740 picoseconds, or 0.2 UI (Unit Interval – one bit width). For 1.485 Gb/s HD, the same 0.2UI spec corresponds to just 135 pico seconds.

**Luminance –** The "black and white" content of the image. Human vision had more acuity in luminance, so television systems generally devote more bandwidth to the luminance content. In component systems, the luminance is referred to as Y.

**MPEG –** The Moving Picture Experts Group is an industry group that develops standards for the compression of moving pictures for television. Their work is an on-going effort. The understanding of image processing and information theory is constantly expanding. And the raw bandwidth of both the hardware and software used for this work is ever increasing. Accordingly, the compression methods available today are far superior to the algorithms that originally made the real-time compression and decompression of television possible. Today, there are many variations of these techniques, and the term MPEG has to some extent become a broad generic label.

**Metadata –** This word comes from the Greek, meta means 'beyond' or 'after'. When used as a prefix to 'data', it can be thought of as 'data about the data'. In other words, the metadata in a data stream tells you about that data – but it is not the data itself. In the television industry, this word is sometimes used correctly when, for example, we label as metadata the timecode which accompanies a video signal. That timecode tells you something about the video, i.e. when it was shot, but the timecode in and of itself is of no interest. But in our industry's usual slovenly way in matters linguistic, the term metadata has also come to be used to describe data that is associated with the primary video in a datastream. So embedded audio will (incorrectly) be called metadata when it tells us nothing at all about the pictures. Oh well.

**Multi-mode –** Multi-mode fibers have a larger diameter core than single mode fibers (either 50 or 62.5 microns compared to 9 microns), and a correspondingly larger aperture. It is much easier to couple light energy into a multi-mode fiber, but internal reflections will cause multiple "modes" of the signal to propagate down the fiber. This will degrade the ability of the fiber to be used over long distances. See also Single Mode.

**NTSC –** The color television encoding system used in North America was originally defined by the National Television Standards Committee. This American standard has also been adopted by Canada, Mexico, Japan, Korea, and Taiwan. (This standard is referred to disparagingly as Never Twice Same Color.)

**Optical –** An optical interface between two devices carries data by modulating a light source. This light source is typically a laser or laser diode (similar to an LED) which is turned on and off at the bit rate of the datastream. The light is carried from one device to another through a glass fiber. The fiber's core acts as a waveguide or lightpipe to carry the light energy from one end to another. Optical transmission has two very significant advantages over metallic copper cables. First, it does not require that the two endpoint devices have any electrical connection to each other. This can be very advantageous in large facilities where problems with ground loops appear. And secondly, and most important, an optical interface can carry a signal for many kilometers or miles without any degradation or loss in the recovered signal. Copper is barely useful at distances of just 1000 feet.

**Oversampling –** A technique to perform digital sampling at a multiple of the required sample rate. This has the advantage of raising the Nyquist Rate (the maximum frequency that can be reproduced by a given sample rate) much higher than the desired passband. This allows the use of more easily realized anti-alias filters.

**PAL –** During the early days of color television in North America, European broadcasters developed a competing system called Phase Alternation by Line. This slightly more complex system is better able to withstand the differential gain and phase errors that appear in analog amplifiers and transmission systems. Engineers at the BBC claim that it stands for Perfection At Last.

**Pathological Test Pattern –** see Checkfield

**Progressive –** An imaging scanning technique that progresses through all of the lines of a frame in a single pass. Computer monitors all use progressive displays. This contrasts to the Interlace technique common to television systems.

**Return Loss –** An idealized input or output circuit will exactly match its desired impedance (generally 75 ohms) as a purely resistive element, with no reactive (capacitive or inductive) elements. In the real world, we can only approach the ideal. So, our real inputs and outputs will have some capacitance and inductance. This will create impedance matching errors, especially at higher frequencies. The Return Loss of an input or output measures how much energy is returned (reflected back due to the impedance mismatch). For digital circuits, a return loss of 15 dB is typical. This means that the energy returned is 15 dB less than the original signal. In analog circuits, a 40 dB figure is expected.

**RGB –** RGB systems carry the totality of the picture information as independent Red, Green, and Blue signals. Television is an additive color system, where all three components add to produce white. Because the luminance (or detail) information is carried partially in each of the RGB channels, all three must be carried at full bandwidth in order to faithfully reproduce an image.

**ScH Phase –** Used in composite systems, ScH Phase measures the relative phase between the leading edge of sync on line 1 of field 1 and a continuous subcarrier sinewave. Due to the arithmetic details of both PAL and NTSC, this relationship is not the same at the beginning of each frame. In PAL, the pattern repeats every 4 frames (8 fields) which is also known as the Bruch Blanking sequence. In NTSC, the repeat is every 2 frames (4 fields.) This creates enormous headaches in editing systems and the system timing of analog composite facilities.

**Setup –** In the NTSC Analog Composite standard, the term Setup refers to the addition of an artificial offset or pedestal to the luminance content. This places the Black Level of the analog signal 54 mV (7.5 IRE) positive with respect to ground. The use of Setup is a legacy from the early development of television receivers in the vacuum tube era. This positive offset helped to prevent the horizontal retrace of the electron beam from being visible on the CRT, even if Brightness and Contrast were mis-adjusted. While the use of Setup did help to prevent retrace artifacts, it did so at the expense of dynamic range (contrast) in the signal because the White Level of the signal was not changed.

Setup is optional in NTSC systems, but is never used in PAL systems (see 'Perfection' characteristic of PAL). This legacy of Setup continues to persist in North American NTSC systems, while it has been abandoned in Japan.

In the digital component world (SD and HD SDI) there is obviously no need for, and certainly every reason to avoid, Setup. In order for the interfaces between analog and digital systems to operate as transparently as possible, Setup must be carefully accounted for in conversion products. When performing analog to digital conversion, Setup (if present) must be removed and the signal range gained up to account for the 7.5% reduction in dynamic range. And when a digital signal is converted back to analog form, Setup (if desired on the output) must be created by reducing the dynamic range by 7.5% and adding the 54 mV positive offset. Unfortunately, there is no truly foolproof algorithm to detect the presence of Setup automatically, so it's definitely a case of installer beware.

**SDI –** Serial Digital Interface. This term refers to inputs and outputs of devices that support serial digital component video. This could refer to standard definition at 270 Mb/s, HD SDI or High Definition Serial Digital video at 1.485 Gb/s, or to the newer 3G standard of High Definition video at 2.97 Gb/s.

**SMPTE –** The Society of Motion Picture and Television Engineers is a professional organization which has done tremendous work in setting standards for both the film and television industries. The term "SMPTE"' is also shorthand for one particular component video format - luminance and color difference.

**Single Mode –** A Single mode (or mono mode) optical fiber carries an optical signal on a very small diameter (9 micron) core surrounded with cladding. The small diameter means that no internally reflected lightwaves will be propagated. Thus only the original "mode" of the signal passes down the fiber. A single mode fiber used in an optical SDI system can carry a signal for up to 20 kilometers. Single mode fibers require particular care in their installation due to the extremely small optical aperture that they present at splice and connection points. See also Multi-mode.

**TBC –** A Time Base Corrector is a system to reduce the Time Base Error in a signal to acceptable levels. It accomplishes this by using a FIFO (First In, First Out) memory. The incoming video is written into the memory using its own jittery timing. This operation is closely associated with the actual digitization of the analog signal because the varying position of the sync timing must be mimicked by the sampling function of the analog to digital converter. A second timing system, genlocked to a stable reference, is used to read the video back out of the memory. The memory acts as a dynamically adjusting delay to smooth out the imperfections in the original signal's timing. Very often a TBC will also function as a Frame Synchronizer. See also Frame Sync.

**Time Base Error –** Time base error is present when there is excessive jitter or uncertainty in the line to line output timing of a video signal. This is commonly associated with playback from video tape recorders, and is particularly severe with consumer type heterodyne systems like VHS. Time base error will render a signal unusable for broadcast or editing purposes.

**Timecode –** Timecode, a method to uniquely identify and label every frame in a video stream, has become one of the most recognized standards ever developed by SMPTE. It uses a 24 hour clock, consisting of hours, minutes, seconds, and television frames. Originally recorded on a spare audio track, this 2400 baud signal was a significant contributor to the development of video tape editing. We now refer to this as LTC or Longitudinal Timecode because it was carried along the edge of the tape. This allowed it to be recovered in rewind and fast forward when the picture itself could not. Timecode continues to be useful today and is carried in the vertical interval as VITC, and as a digital packet as DVITC. Timecode is the true metadata.

**Tri-Level Sync –** For many, many years, television systems used composite black as a genlock reference source. This was a natural evolution from analog systems to digital implementations. With the advent of High Definition television, with even higher data rates and tighter jitter requirements, problems with this legacy genlock signal surfaced. Further, a reference signal with a 50 or 60 Hz frame rate was useless with 24 Hz HD systems running at film rates. Today we can think of composite black as a bi-level sync signal – it has two levels, one at sync tip and one at blanking. For HD systems, Tri-Level Sync, which has the same blanking level (at ground) of bi-level sync, but the sync pulse now has both a negative and a positive element. This keeps the signal symmetrically balanced so that its DC content is zero. And it also means that the timing pickoff point is now at the point where the signal crosses blanking and is no longer subject to variation with amplitude. This makes Tri-Level Sync a much more robust signal and one which can be delivered with less jitter.

**USB –** The Universal Serial Bus, developed in the computer industry to replace the previously ubiquitous RS-232 serial interface, now appears in many different forms and with many different uses. It actually forms a small local area network, allowing multiple devices to coexist on a single bus where they can be individually addressed and accessed.

**VGA –** Video Graphics Array. Traditional 15-pin, analog interface between a PC and monitor.

**WSS –** Wide Screen Signaling is used in the PAL/625 video standards, both in analog and digital form, to convey information about the aspect ratio and format of the transmitted signal. Carried in the vertical interval, much like closed captioning, it can be used to signal a television receiver to adjust its vertical or horizontal sizing to reflect incoming material. Although an NTSC specification for WSS exists, it never achieved any traction in the marketplace.

**Word Clock –** Use of Word Clock to genlock digital audio devices developed in the audio recording industry. Early digital audio products were interconnected with a massive parallel connector carrying a twisted pair for every bit in the digital audio word. A clock signal, which is a square wave at the audio sampling frequency, is carried on a 75 ohm coaxial cable. Early systems would daisy chain this 44.1 or 48 kilohertz clock from one device to another with coax cable and Tee connectors. On the rising edge of this Work Clock these twisted pairs would carry the left channel, while on the falling edge, they would carry the right channel. In most television systems using digital audio, the audio sample clock frequency (and hence the 'genlock' between the audio and video worlds) is derived from the video genlock signal. But products that are purely audio, with no video reference capability, may still require Word Clock.

**YUV –** Strictly speaking, YUV does not apply to component video. The letters refer to the Luminance (Y), and the U and V encoding axes using in the PAL composite system. Since the U axis is very close to the B-Y axis, and the V axis is very close to the R-Y axis, YUV is often used as a sort of shorthand for the more long-winded "Y/R-Y/B-Y".

**Y/Cr/Cb –** In digital component video, the luminance component is Y, and the two color difference signals are Cr (R-Y) and Cb (B-Y).

**Y/Pr/Pb -** In analog component video, the image is carried in three components. The luminance is Y, the R-Y color difference signal is Pr, and the B-Y color difference signal is Pb.

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