BrightEye™ 30 D

Audio ADC and DAC, Bi-directional Converter with Delay User Guide

ENSEMBLE
D E S I G N S

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This user guide provides detailed information for using the **BrightEye™ 30 D** Audio ADC and DAC, Bi-directional Converter with Delay unit.

The information is organized into the following sections:

- Product Overview
- Functional Description
- Applications
- Rear Connectors
- Operation
  - Front Panel Controls Indicators
  - BrightEye PC
- Warranty and Factory Service
- Specifications
- Glossary

PRODUCT OVERVIEW

BrightEye 30 D is a flexible audio converter that can function as a two channel bi-directional ADC and DAC, or as a four channel ADC or DAC with audio delay adjustment. BrightEye 30 D can function as a delay unit for two channels of analog audio. BrightEye 30 D can also be used as a sample rate converter.

With 24 bit processing, convenient front panel controls, a powerful PC-based configuration tool, and a compact form-factor, the BrightEye 30 D is perfect for desktop, post, and broadcast applications.

Input presence, conversion mode, analog reference level, VU status, and gain adjustments are all located on the front panel. More advanced adjustments are available via the BrightEye PC application.

A glossary of commonly used video terms is provided at the end of this manual.

FUNCTIONAL DESCRIPTION

BrightEye 30 D has four channels of digital audio I/O (two AES streams) and four channels of balanced analog audio I/O. It also has a reference input that accepts analog video reference, AES, and Word Clock. An audio delay control is available using the BrightEye PC application and from the front panel.

BrightEye 30 D has five different operating modes. In order to simplify the use of the BrightEye 30 D's resources, inputs and outputs are automatically configured for the various modes.

1. Analog to Digital Converter Mode

In this mode BrightEye 30 D is a four channel analog audio to digital (AES) converter. All four analog audio I/O's are configured for input, and the two AES connectors are both outputs. In this mode, there are four analog audio inputs and two AES output streams.

The four analog inputs are digitized with a sample rate of 48Khz at 24 bits of resolution. The conversion process uses 256x oversampling which results in phenomenally low distortion, flat frequency response and large dynamic range. The analog input stage can be configured to operate at either -10dBu (consumer) or +4dBu (professional) analog reference levels.
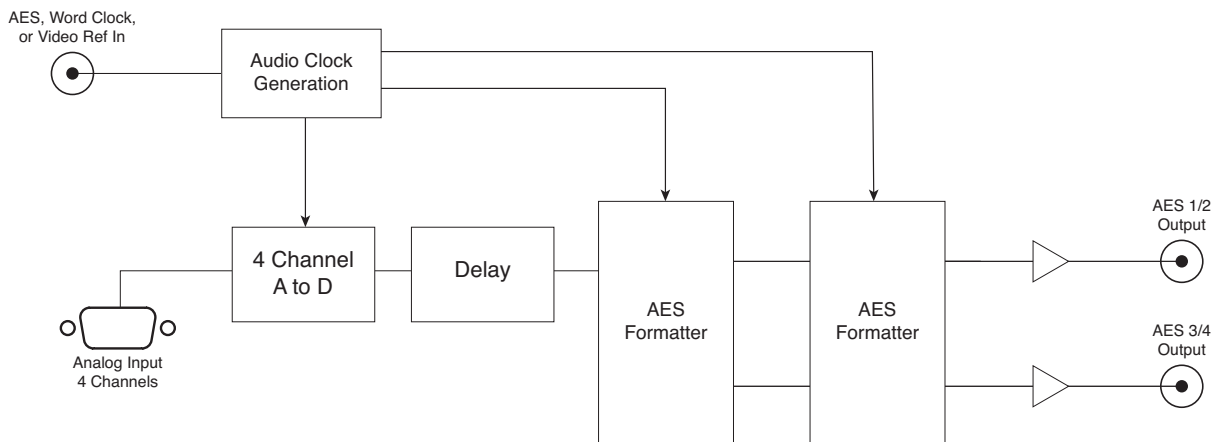
BrightEye 30 D Analog to Digital Converter Mode

The converted signals pass through a four channel mixer/shuffler providing individual adjustment of gain and channel inversion (to address out of phase inputs). The four output channels are each formed by summing any combination of inputs. Each output can contain any of the input channels, allowing, for example, stereo to mono mixdown, left/right channel swaps, and simultaneous stereo and mono outputs.

Finally, these four processed signals are output in digital form through the two AES connectors.

In order to access all of the features of the mixer/shuffler, configuration of BrightEye 30 D must be done using BrightEye PC and the unit's USB connection. The BrightEye PC interface further provides selection between -18 dBFS and -20 dBFS for the digital reference level.

Front panel controls allow simple adjustment of gain in pairs of channels (1&2, 3&4) and VU and peak signal indication.

The reference input is active in this mode. It will accept analog composite video (NTSC or PAL), 48kHz AES, or 48 kHz wordclock. The reference circuitry will automatically detect any of these four signals and lock BrightEye 30 D's internal clocks to the reference signal. When locked to a reference, the AES outputs of BrightEye 30 D will be synchronous to that reference.

Successful genlock is indicated by a steady Green 'Ref' LED on the front of the unit. The LED will light Red if some sort of genlock signal is present but BrightEye 30 D is not able to lock to it. BrightEye 30 D operates internally at 48Khz sample rate, and reference signals must be compatible with that rate.

The LED will be extinguished if no reference signal is detected. In this case, the clocks are derived from an internal standard which exceeds AES specifications for clock accuracy and jitter performance.

2. Digital to Analog Converter Mode

In this mode BrightEye 30 D is a four channel digital (AES) to analog audio converter. Both AES connectors are inputs and all four analog channels are outputs. When configured as a DAC, BrightEye 30 D will accept AES inputs with sample rates from 44.1 to 96 kHz. These AES sources pass through a sample rate converter to produce a standard sample rate of 48kHz.
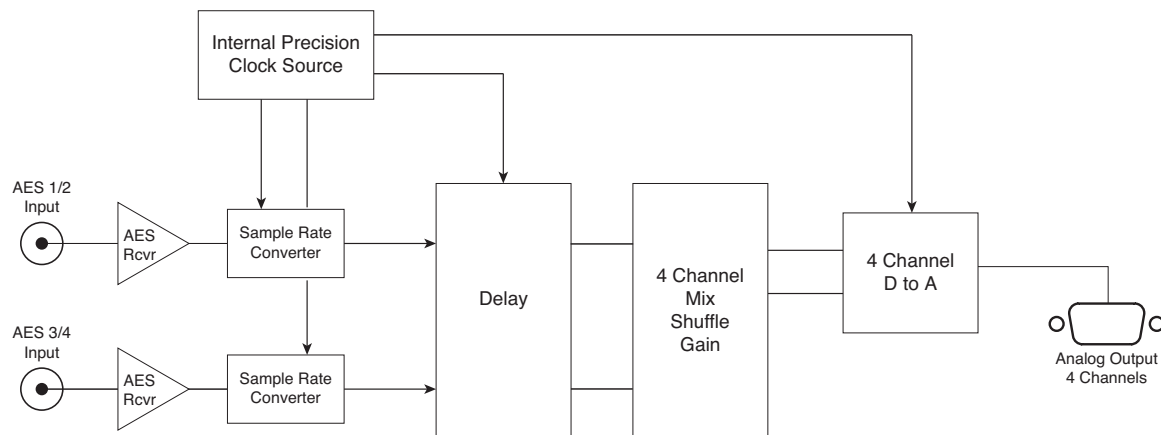
BrightEye 30 D Digital to Analog Converter Mode

The four incoming digital audio signals feed the four channel mixer/shuffler. As with analog to digital mode, this provides individual adjustment of gain and channel inversion (to address out of phase inputs). The four output channels are each formed by summing any combination of inputs. Each output can contain any of the input channels, allowing, for example, stereo to mono mixdown, left/right channel swaps, and simultaneous stereo and mono outputs.

Digital to analog conversion is performed with 24 bits of precision at 48kHz with 256x oversampling.

The processed signals are output as balanced analog signals at either -10 dBm or +4 dBm reference level.

In order to access all of the features of the mixer/shuffler, configuration of BrightEye 30 D must be done using BrightEye PC and the unit's USB connection. The BrightEye PC interface further provides selection between -18 dBFS and -20 dBFS for the digital reference level.

Front panel controls allow simple adjustment of gain in pairs of channels (1&2, 3&4) and VU and peak signal indication.

The reference input is not used in this mode. All clocks are derived from the incoming digital signals. The 'Ref' LED will be extinguished.

3. Bi-Directional Conversion

In Bi-Directional mode, BrightEye 30 D is simultaneously a two channel digital to analog converter and a two channel analog to digital converter. The channel 1/2 AES connector is an input (accepting sample rates from 44.1 to 96 kHz), while the channel 3/4 AES connector is an output. Analog channels 1/2 are outputs, and analog channels 3/4 are inputs.

The AES input presented to channel 1/2 is sample rate converted to 48kHz, synchronous to the reference if one if provided. The AES output on channel 3/4 will also be at a 48kHz sample rate and will also be synchronous to the reference input.
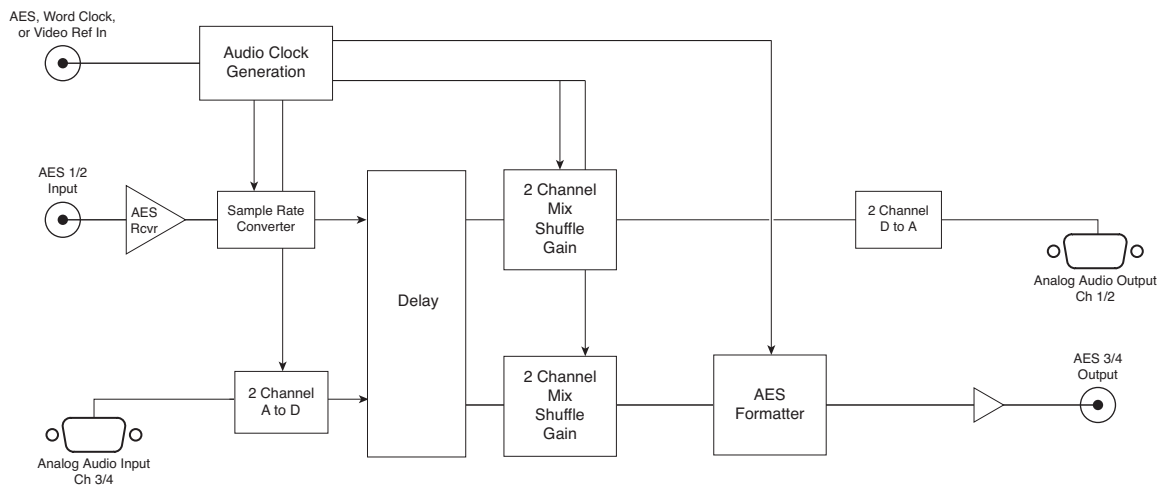
BrightEye 30 D Bi-Directional Conversion Mode

The four channel mixer/shuffler is sub-divided into two, two channel mixer/shufflers. The digital to analog path is supported by channels 1 and 2. The reverse path (analog to digital) uses channels 3 and 4. Channel assignments are limited to only allow assignment of inputs 1 and 2 to outputs 1 and 2; and inputs 3 and 4 to outputs 3 and 4.

The channel 1/2 outputs of the mixer are presented on analog outputs 1/2; and mixer's channel 3/4 outputs drive the 3/4 AES output connector.

Conversion to and from the analog domain is performed at 48kHz, oversampled by 256x to 24 bits of precision.

The reference input is active in this mode. It will accept analog composite video (NTSC or PAL), 48kHz AES, or 48 kHz wordclock. The reference circuitry will automatically detect any of these four signals and lock BrightEye 30 D's internal clocks to the reference signal. When locked to a reference, the channel 3/4 AES output of BrightEye 30 D will be synchronous to that reference.

Successful genlock is indicated by a steady Green 'Ref' LED on the front of the unit. The LED will light Red if some sort of genlock signal is present but BrightEye 30 D is not able to lock to it. BrightEye 30 D operates internally at 48Khz sample rate, and reference signals must be compatible with that rate.

The LED will be extinguished if no reference signal is detected. In this case, the clocks are derived from an internal standard which exceeds AES specifications for clock accuracy and jitter performance.

4. Two Channel Analog Audio Delay Mode

In Two Channel Analog Audio Delay mode, BrightEye 30 D passes two channels of analog audio through the unit and applies a user selectable amount of delay to the audio. The Delay menu in the BrightEye PC application or the Delay mode on the front panel is used for setting the amount of delay. Audio levels and mixing controls are available through the mix menu.

Audio inputs and outputs are connected to the 15 pin D connector on the rear of the unit. The AES inputs and outputs are not used in this mode. Since the delay is fixed and not tracked to any video signal, a reference signal is not used in this mode.
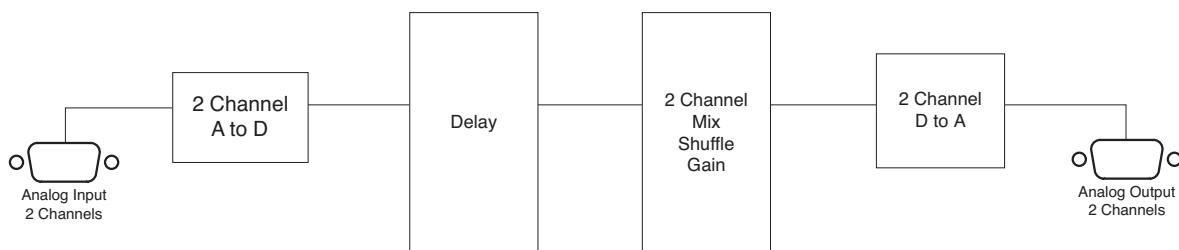
**BrightEye 30 D Analog Audio Delay Mode**

5. Sample Rate Conversion (and two channel Digital to Analog Conversion)

When configured as a digital sample rate converter, BrightEye 30 D is a two channel device, processing the channel 1/2 AES input connector and outputting to the channel 3/4 AES output connector. The same signals are also output in analog form on channels 3/4.

The channel 1/2 AES input will accept signals with sample rates from 44.1 to 96 kHz. The signal is digitally sample rate converted to 48kHz. The new sample rate can be locked to an external reference (see below) in order to generate a digital output which is synchronous to the reference.

After sample rate conversion, the two audio channels feed the Channel 1/2 inputs of the mixer/shuffler. By default, channel 1 is routed to output 3 and channel 2 is routed to channel 4. Inputs 1/2 can be routed to any combination of outputs 3/4.

Finally, the channel 3/4 outputs of the mixer/shuffler feed the AES 3/4 output and analog audio channels 3/4.
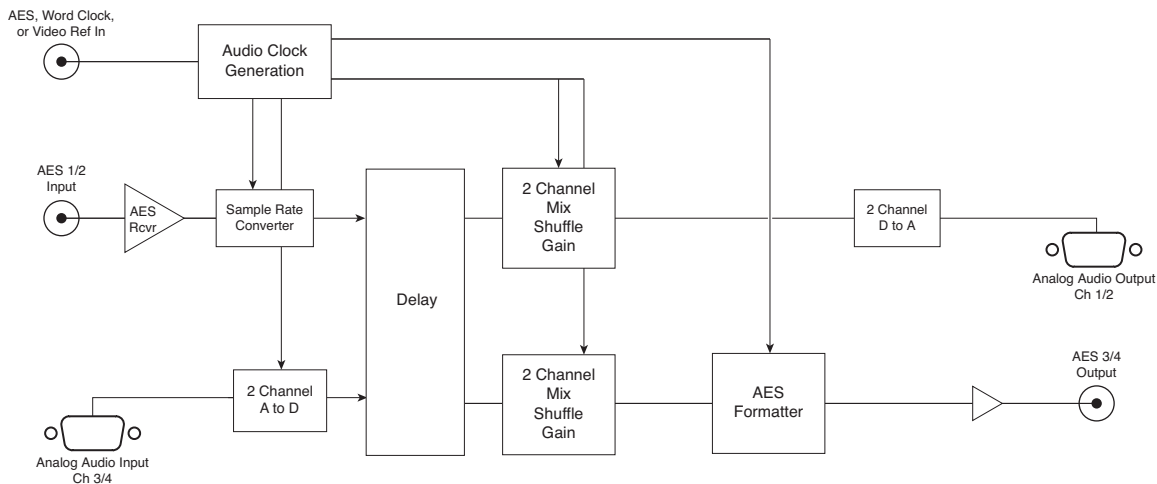
BrightEye 30 D Bi-Directional Conversion Mode

Digital to analog conversion is performed with 24 bits of precision at 48kHz with 256x oversampling.

The reference input is active in this mode. It will accept analog composite video (NTSC or PAL), 48kHz AES, or 48 kHz wordclock. The reference circuitry will automatically detect any of these four signals and lock BrightEye 30 D's internal clocks to the reference signal. When locked to a reference, the Channel 3/4 AES output of BrightEye 30 D will be synchronous to that reference.

Successful genlock is indicated by a steady green 'Ref' LED on the front of the unit. The LED will light red if some sort of genlock signal is present but BrightEye 30 D is not able to lock to it. BrightEye 30 D operates internally at 48Khz sample rate, and reference signals must be compatible with that rate.

The LED will be extinguished if no reference signal is detected. In this case, the clocks are derived from an internal standard which exceeds AES specifications for clock accuracy and jitter performance.

APPLICATIONS

The BrightEye 30 D can be used for four channel analog to digital or digital to analog conversion, as well as two channel bi-directional conversion. Additionally, the BrightEye 30 D can provide two channel sample rate conversion with two channel digital to analog conversion. These preset modes can be further adjusted to fit particular applications (with channel mixing and other features.) Some of the many possible applications are explained and illustrated below.

Analog to Digital Conversion

In this application, the BrightEye 30 D is configured to convert four channels of analog audio into two streams of AES audio. Note the use of the BrightEye 54 for AES and composite reference. In most video applications, it is essential that AES sample clocks be locked to a video reference.
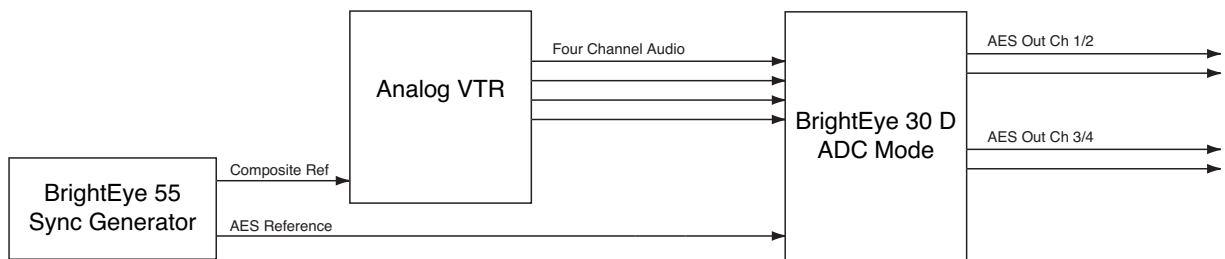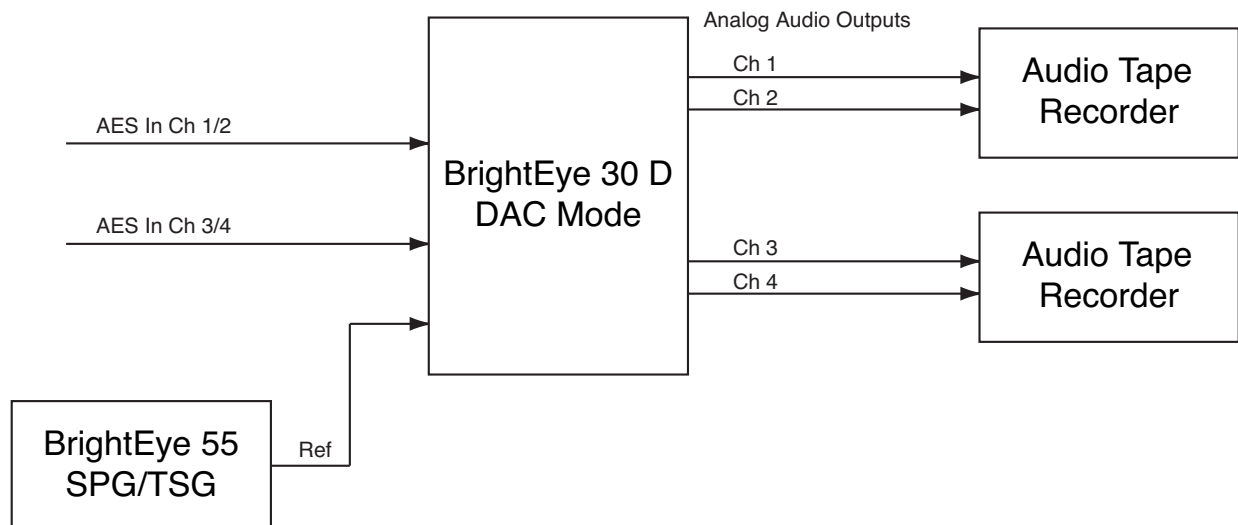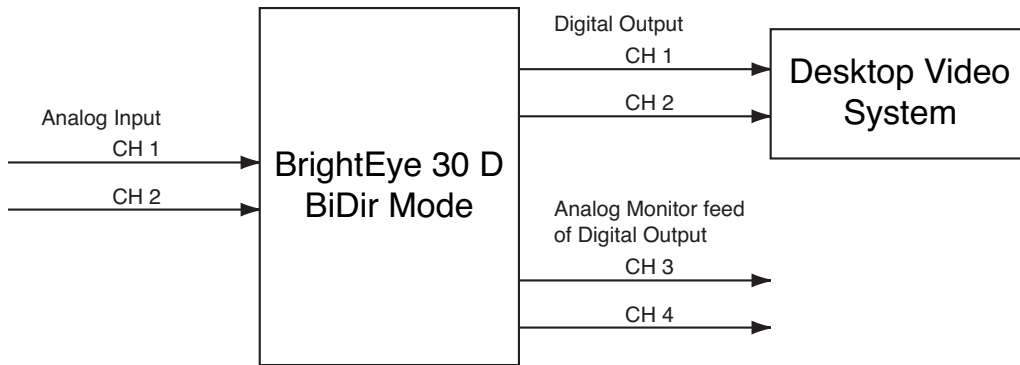

Digital to Analog Conversion

In this application, the BrightEye 30 D is configured to convert four channels of analog audio into two streams of AES digital audio. Note the use of the BrightEye 54 for AES (or composite reference.) In most video applications, it is essential that AES sample clocks be locked to a video reference.
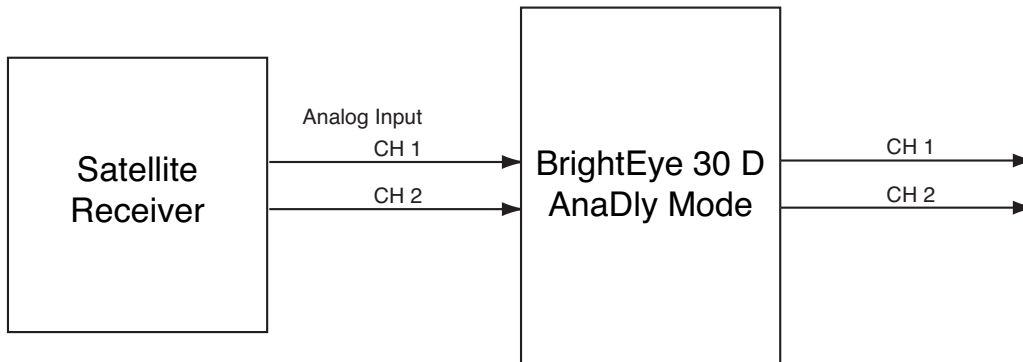
Bi-Directional Conversion Mode

Use BrightEye 30 D in Bi-Directional mode to simultaneously convert analog signals to digital for input to a digital media capture card in a desktop video system AND convert the digital audio output back to analog for monitoring.
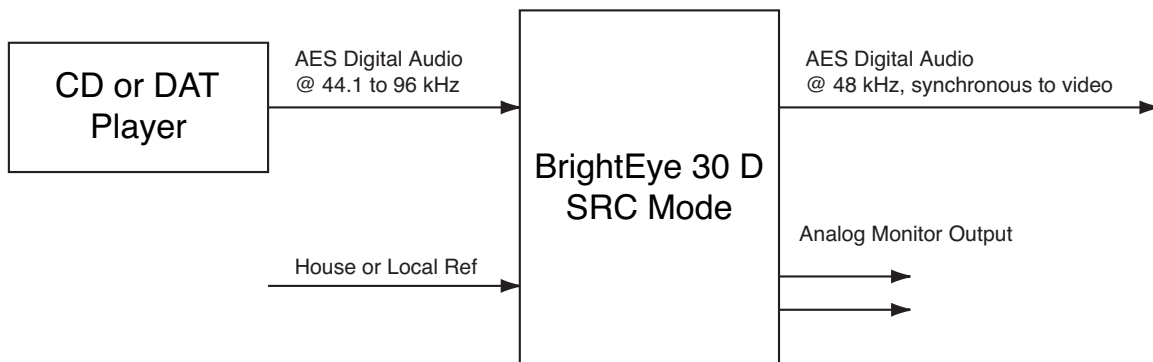
```
                                    Digital Output
                                    CH 1
                                                    ┌──────────────┐
                                    CH 2            │ Desktop Video│
                    ┌──────────────┐                │    System    │
  Analog Input      │              │                └──────────────┘
  CH 1              │ BrightEye 30 D│
                    │  BiDir Mode  │   Analog Monitor feed
  CH 2              │              │   of Digital Output
                    │              │   CH 3
                    │              │
                    └──────────────┘   CH 4
```

Two Channel Analog Delay Mode

Use BrightEye 30 D to delay two channels of analog audio to compensate for video delay due to frame synchronization or to correct incoming sources.

```
  ┌──────────────┐                 ┌──────────────┐
  │              │  Analog Input   │              │   CH 1
  │              │  CH 1           │ BrightEye 30 D│
  │  Satellite   │                 │  AnaDly Mode │   CH 2
  │  Receiver    │  CH 2           │              │
  │              │                 │              │
  └──────────────┘                 └──────────────┘
```

Sample Rate Conversion Mode

Use BrightEye 30 D to convert AES content at 44.1 kHz sampling rate to 48kHz synchronous to a video or digital audio reference. CD or DAT audio playback can then be used in a professional video environment.

```
  ┌──────────────┐                      ┌──────────────┐
  │              │ AES Digital Audio    │              │  AES Digital Audio
  │ CD or DAT    │ @ 44.1 to 96 kHz     │ BrightEye 30 D│  @ 48 kHz, synchronous to video
  │  Player      │                      │  SRC Mode    │
  └──────────────┘                      │              │  Analog Monitor Output
                    House or Local Ref  │              │
                                        └──────────────┘
```

REAR CONNECTORS

All connections to the BrightEye 30 D are made on the rear of the unit. Refer to the illustration below.
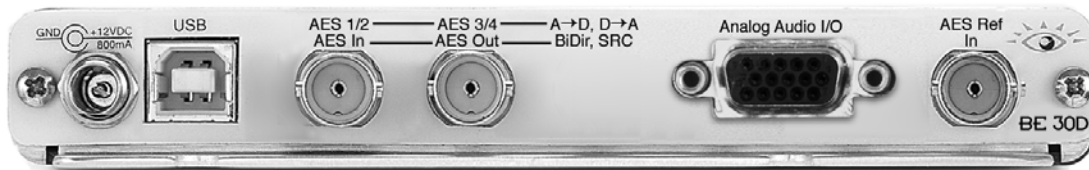
BrightEye 30 D Rear Connectors

Power Connection

A modular power supply is supplied with the product. Connect it to the 12 volt DC power input connection on the far left. Use the locking ring to secure it.

USB Connector

The USB connector is used to provide more comprehensive control, diagnostics, and upgrades to the converter from a PC. Use the BrightEye PC application included on CD-ROM with every unit to make adjustments as described in the **OPERATION** section of this user guide.

AES 1/2 and AES 3/4 (ADC and DAC modes)

AES 1/2 and **AES 3/4** are BNC connectors that can function as either digital audio inputs (ADC mode) or outputs (DAC mode.) Each connector can input or output an AES stream (each containing two channels.)

AES In and AES Out (BiDir and SRC modes)

AES In and AES Out are BNC connectors that provide AES input and AES output, respectively.

Analog Audio I/O

The **Analog Audio Out** is a HD15 connector that provides analog audio inputs and outputs. In ADC mode it functions as an input, in DAC mode it functions as an output, in BiDir it provides both inputs and outputs, in AnaDly mode it provides both inputs and outputs, and in SRC mode it provides two channels of analog output.

Analog Audio Pinouts					
Signal	**Pins**	**Input**	**Output**	**Bi Dir**	**SRC**
Aud 1 +, −, G	1, 2, 7	Input 1	Output 1	Analog output from AES 1/2 In	Output 1
Aud 2 +, −, G	5, 4, 3	Input 2	Output 2		Output 2
Aud 3 +, −, G	11, 12, 6	Input 3	Output 3	Analog input to AES 3/4 Out	Output 3
Aud 4 +, −, G	15, 14, 8	Input 4	Output 4		Output 4
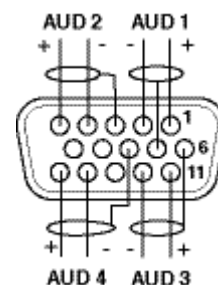
AES Ref In

The **AES Ref In** is a BNC connector that accepts an AES refence signal, audio word-clock signal, or composite reference signal.

OPERATION

Control and operation of the BrightEye 30 D is performed from the front panel or with the BrightEye PC Control application.

Some control settings are only available with BrightEye PC. These parameters cannot be monitored or controlled with the front panel.

Front Panel Controls and Indicators

The front panel of the converter, shown in the figure below, provides status indicators and control over video input and output selection, and gain.

Status Indicators

The following status indicators are provided on the front panel:

Ref

Illuminate green when a valid reference is present on the **AES Ref In** connector. Illuminates red when an invalid reference is present, and does not illuminate when there is no signal present. A valid reference is AES, Word Clock, or Composite Video.

Mode

The currently selected conversion Mode (**A –> D**, **D –> A**, **BiDir**, **AnaDly** or **SRC**) is illuminated green.

Analog Ref Level

The currently selected analog reference level for input and output (**-10 dB** or **+4 dB**) is illuminated green.

Delay

Delay status is indicated with five indicators. When there is no Delay, none of the Delay indicators illuminate. The Delay indicators incrementally illuminate, up to the point where all five are illuminated, and maximum Delay is selected. Delay can be adjusted in msec from 0 to 1000 in 1 msec increments..

Ch 1/2 and Ch 3/4

VU output level and the status of the **Gain** adjustment for each of these channel pairs is indicated by the state the **VU** and **Gain** indicators. The **VU** indicator illuminates red when the audio level exceeds the headroom level set by the user (with the **Peak Indicator** control in BrightEye PC.) Additionally, the **VU** indicator illuminates orange when the output is above 0 VU, illuminates green when the output is above -20 VU, and doesn't illuminate when the output is

BrightEye 30 D Front Panel

below -20 VU. The **Gain** indicator illuminates red when the gain level has been adjusted off from unity by the user. The 0 VU point corresponds in the digital domain to the digital reference level (-18 or -20 dBFS) and in the analog domain to the analog reference level (-10 or +4 dBu.)

Power (Pwr)

Illuminates green when power is applied to the converter and the internal voltage regulator is functioning correctly.

Controls

Adjustable parameters are controlled from the front panel using the three push-buttons on the right hand side of the control panel.

The control system has the following modes:

> **Idle** – all indicators are steady-state (no blinking)
>
> **Mode select** – currently selected conversion mode blinks
>
> **Analog Ref Level select** – currently selected analog audio reference level blinks
>
> **Delay** – blinks quickly when delay adjustments are made, slowly when selected for adjustment but still at default
>
> **Ch 1/2 or 3/4 Gain** – blinks quickly when gain adjustments are made, slowly when selected for adjustment but still at default

The normal state of the control panel is **Idle.** The panel state is changed by pressing the **Mode** button. Each press will advance to the next state. When no button presses are detected for 15 seconds, the state will automatically switch to **Idle**.

When one of the adjustable controls is blinking, its value can be changed by pressing the **Right** or **Left** arrow button.

Adjustments made to the controls are stored in non-volatile memory, so the converter will "wake up" in the correct state when power is interrupted and then restored.

The control values are not saved until until the 15 second time out has occurred. If power is removed before the time out period, the new state will not be saved.

The controls and their indicators are described below:

Mode

This control selects the conversion mode with the following choices:

> **A –> D** – Convert analog to digital audio
>
> **D –> A –** Convert digital to analog audio
>
> **BiDir –** Convert two channels of analog to digital and simultaneously convert two channels of digital to analog
>
> **AnaDly–** Passes two channels of analog through with delay
>
> **SRC –** Convert the sample rate of the AES In and output the reclocked audio on AES Out, with simultaneous analog monitoring

Analog Ref Level

This control selects analog reference levels for input and output, with the following choices:

-10 dB – Accept -10 dB inputs, and provide -10 dB outputs

+4 dB – Accept +4 dB inputs, and provide +4 dB outputs

Delay

This control selects the Audio Delay. Delay can be adjusted from 0 to 1000 msec in increments of 1 msec, using the left and right buttons when this control is selected on the front panel.The five delay indicators on the front panel provide information about the amount of delay that is set. When 1 LED is lit, delay is set somewhere in the range of 1 to 200 msec; 2 LEDs - 201-400 msec; 3 LEDs -401-600 msec, 4 LEDs 601-800 msec, 5 LEDs - 801-1000 msec. With BrightEye PC a specific delay value can be entered.

Ch 1/2 and Ch 3/4 VU Indicators

These indicators provide information about the level of the analog outputs on these channels. More detailed indicators are available through the BrightEye PC application.

Ch 1/2 and Ch 3/4 Gain Adjustment Indicators

These controls allow for quick adjustment of Gain level for the two channel pairs. For independent channel adjustment, and other controls, use BrightEye PC.

BrightEye PC Control

The BrightEye PC application is included on CD-ROM with every BrightEye unit. Installation and instructions for using BrightEye PC are given in the data pack that accompanies the application.

If the unit is connected to a computer running the BrightEye PC application, the following menus are available for controlling and monitoring the BrightEye 30 D unit.
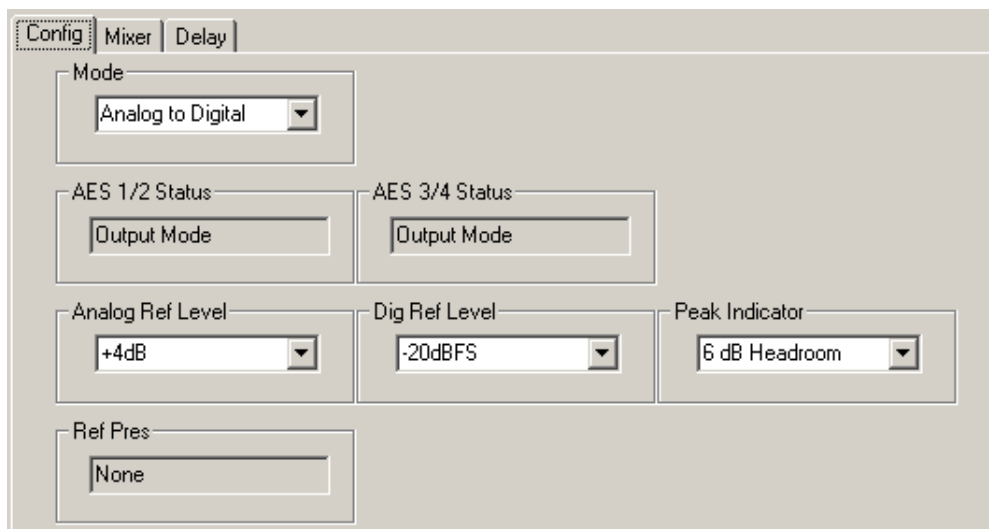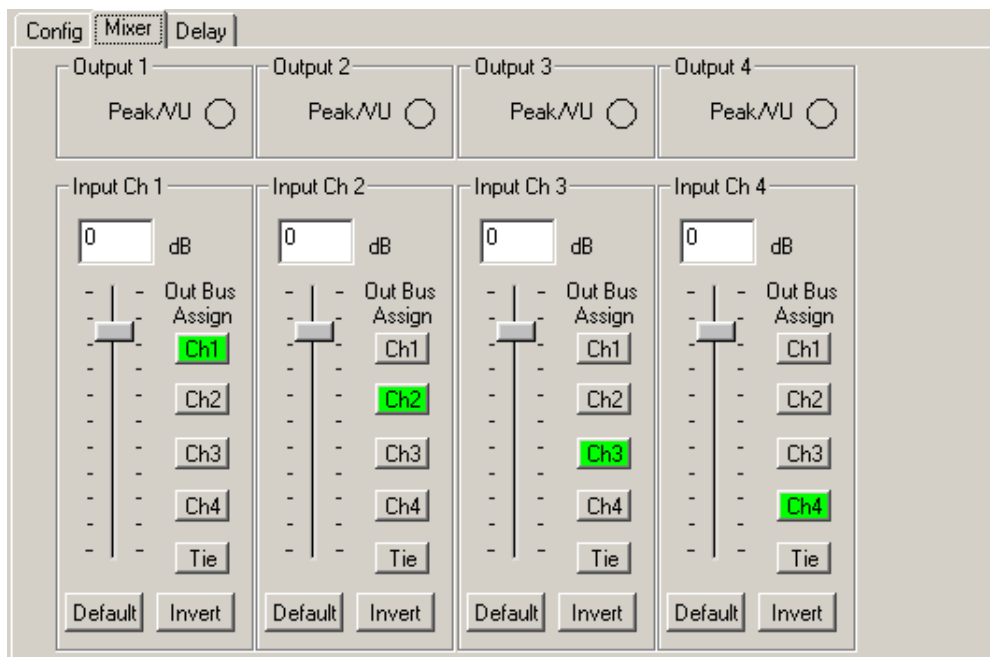

BrightEye 30 D Config Menu in BrightEye PC

Config

- **Mode** – select device conversion mode. This pulldown lets you choose between: **Analog to Digital**, **Digital to Analog**, **Bi-Directional**, **Two Channel Analog Delay**, and **Sample Rate Convert**.

- **AES 1/2 and AES 3/4 Status** – these controls indicate the status/behavior of the AES I/O connections. They show: **No Input**, **Audio Present**, **Data Present**, **Input Mode**, or **Output Mode**.

- **Analog Ref Level**– selects analog output reference level for input and output. This pulldown lets you chose between: **-10 dBu** or **+4 dBu**.

- **Dig Ref Level** – selects the digital reference level. This pulldown lets you choose between: **-20 dBFS** or **-18 dBFS**.

- **Peak Indicator** – selects the amount of headroom to use in determining peak levels. This pulldown lets you chose between: **Clipping**, **2 dB Headroom**, **4 dB Headroom**, **6 dB Headroom**, **8 dB Headroom**, or **10 dB Headroom**.

- **Ref Pres** – indicates the status of the reference input. This indicator shows: **None**, **525 Unlocked**, **625 Unlocked**, **AES Unlocked**, **WClk Unlocked**, **525 Lock**, **625 Lock**, **AES Lock**, or **WClk Lock**.

Mixer

- **Outputs 1-4** – provides peak/VU status, with the same methodology as the front panel VU indicators, but on a per channel basis, rather than per channel pair. **Peak/VU** indicators illuminate red when the audio level on that channel exceeds the headroom level set by the user (with the **Peak Indicator** control.) Additionally, the **VU** indicator illuminates orange when

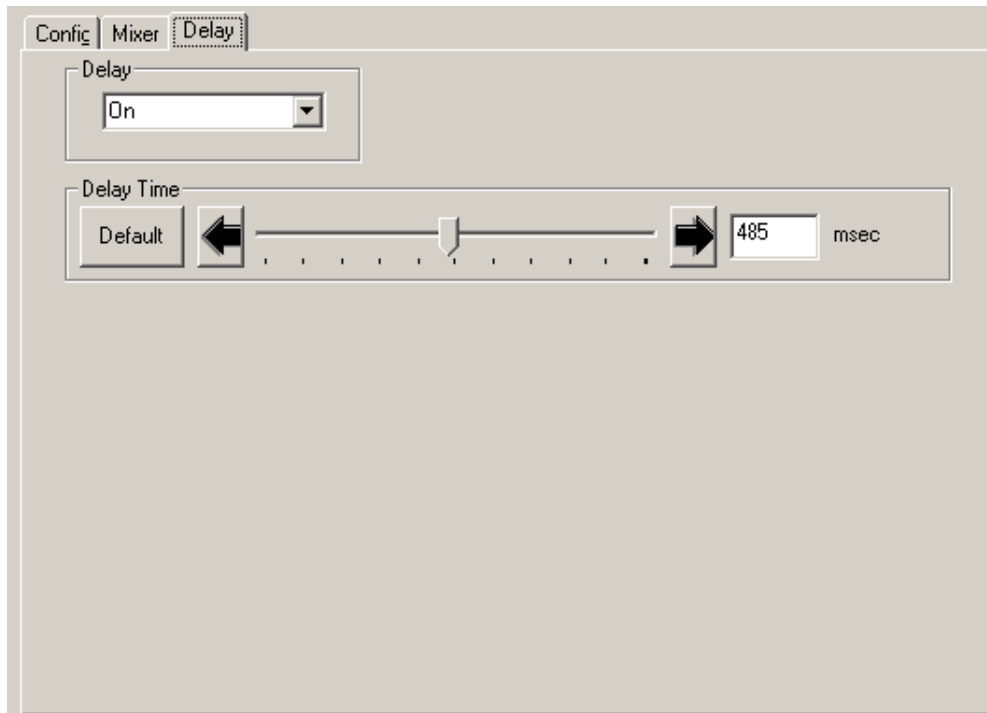**BrightEye 30 D Mixer Menu in BrightEye PC**

the output is above 0 VU, illuminates green when the output is above -20 VU, and doesn't illuminate when the output is below -20 VU.

- **Inputs Ch 1-4** – these controls provide mixing and output level control for AES channels 1 to 4 of the selected AES group. The text field at the top of

the control indicates the amount of gain applied to the channel in dB. The gain level can be adjusted by moving the vertical slider control, or entering a desired level directly in the field (from -70 dB to +12 dB.) On the right-hand side of the control are Output Bus Assignment buttons. These buttons control which analog output channel the AES channels are mapped to. It is possible to map an Input channel to anywhere from zero to four output channels.

The **Tie** function is used for stereo operation where gain of a pair of channels is usually desired to be the same.

The **Default** button resets the gain to unity (0 dB.) The Invert button allows inversion of a channel to permit phase correction.

BrightEye 30 D Delay Menu in BrightEye PC

Delay

• **Delay** – enable the audio delay function by selecting **On**. Disable the delay function by selecting **Off**.

• **Delay Time** – adjust the amount of audio delay in msec from 0 to 1000 in increments of 1 msec. Use the slider, arrows, or enter a specific value. Use the **Default** button to return to the factory default value.

WARRANTY AND FACTORY SERVICE

Warranty

Ensemble Designs, Inc. warrants this product to be free from defect in material and workmanship for a period of two years from the date of delivery. During this two year warranty period, Ensemble Designs, Inc. will repair any defective units at Ensemble's expense if the unit should be determined to be defective after consultation with a factory technician.

This warranty is not transferable. Any implied warranties expire at the expiration date of this warranty.

This warranty does not cover a defect that has resulted from improper or unreasonable use or maintenance as determined by us. This warranty is void if there is any attempt to dissemble or adjust factory set presets without factory authorization.

Factory Service

If you require service (under warranty or not), please contact Ensemble Designs and ask for Customer Service before you return the unit. This will allow the service technician to provide any other suggestions for identifying the problem and recommend possible solutions.

You may also refer to the technical support section of the Ensemble web site for the latest information on your equipment at the URL below:

http://www.ensembledesigns.com/support

If you return equipment for repair, please get a Return Material Authorization Number (RMA) from the factory first.

Ship the product and a written description of the problem to:

Ensemble Designs, Inc.
Attention: Customer Service RMA #####
870 Gold Flat Rd.
Nevada City, CA 95959 USA
(530) 478-1830
Fax: (530) 478-1832
service@ensembledesigns.com
http://www.ensembledesigns.com
Be sure to put your RMA number on the outside of the box.

SPECIFICATIONS

AES/EBU Digital Inputs:
Number:	Two (total of four channels, selectable as inputs or outputs)
Type:	AES3id
Connectorization:	Coaxial, 75 Ω BNC
Bit Depth:	20 and 24 bit
Sample Rate:	30 KHz to 100 KHz (Sample Rate Converted internally to 48KHz)
Reference Level:	-18 or -10 dBFS (selectable)
AC-3, Dolby-E:	Supported when inputs are synchronous

AES/EBU Digital Outputs:
Number:	Two (total of four channels) (selectable as inputs or outputs)
Type:	AES3id
Connectorization:	Coaxial, 75 Ω BNC
Bit Depth:	20 and 24 bit
Sample Rate:	48KHz (Synchronous to video output)
Reference Level:	-18 or -10 dBFS (selectable)

Analog Audio Inputs:
Number:	Four (selectable as inputs or outputs)
Type:	Balanced
Impedance:	>15K Ω
Max. Input Level:	24 dBu
CMRR:	>60 dB, 20 Hz to 10 KHz
Quantization:	24 bits, 128x Oversampling
Sample Rate:	48 KHz
Reference Level:	-10 dBu or +4 dBu
Frequency Response:	±0.1 dB, 20 Hz to 20 KHz
Crosstalk:	<102 dB
Dynamic Range:	>106 dB

Analog Audio Outputs:
Number:	Four (selectable as inputs or outputs)
Type:	Balanced, transformerless
Impedance:	30 Ω
Max. Output Level:	24 dBu
Resolution:	24 bits, 128x Oversampled
Reference Level:	-10 dBu or +4 dBu
Frequency Response:	±0.1 dB, 20 Hz to 20 KHz
Crosstalk:	<102 dB
Dynamic Range:	>106 dB

General Specifications:
Size:	5.625" W x 0.8 " H x 5.5" D (143 mm x 20 mm x 140 mm) including connectors
Power:	12-24 volts, 7 watts (100-230 VAC modular power supply provided)
Temperature Range:	0 to 40 degrees C ambient
Relative Humidity:	0 to 95% noncondensing

Due to ongoing product development, all specifications subject to change.

GLOSSARY

This is a brief glossary of commonly used terms associated with this product.

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 quantization (bit depths.) In television systems, these will generally be 48 KHz and either 20 or 24 bits.

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 single 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.

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 trans-mitted 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 ever 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.**Frame**

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 an 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.

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 gen-locked 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.

IEC

The International Electrotechnical Commission provides a wide range of worldwide standards. 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 present 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, bit 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 each digital transition. Although the signal may be at the correct frequency on average, in the interim it varies. Some bits come slightly early, other 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 video, the allowable jitter is 740 picoseconds, or 0.2 UI (Unit Interval – one bit width).

Luminance

The "black & 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.

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 bitrate 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. Firstly, 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 importantly, 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 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 amplifiers and transmission systems. Engineers at the BBC claim that it stands for Perfection At Last.

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.

SDI

Serial Digital Interface. This term refers to inputs and outputs of devices that support serial digital component video. This generally means standard definition at 270 Mb/s. The use of "HD-SDI" is beginning to appear to indicate High Definition Serial Digital Video at 1.485 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 monomode) 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 Multimode.

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, gen-locked 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.

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.