LYNXTechnik AG®

Broadcast Television Equipment

Reference Manual

P VD 5840 D

P VD 5840 U

P VD 5840 DO

P VD 5840 UO

Dual Channel SD/HD/3G Multi-format Frame Synchronizer with Full Embedded and External AES Audio Support

Revision 3.0 – May 2015

This Manual Supports Device Revisions:	
P VD 5840 Firmware Revision	679
Control System GUI Release	8.2.1

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Warranty

LYNX Technik AG warrants that the product will be free from defects in materials and workmanship for a period of two (3) years from the date of shipment. If this product proves defective during the warranty period, LYNX Technik AG at its option will either repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, customer must notify LYNX Technik of the defect before expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by LYNX Technik, with shipping charges prepaid. LYNX Technik shall pay for the return of the product to the customer if the shipment is within the country which the LYNX Technik service center is located. Customer shall be responsible for payment of all shipping charges, duties, taxes and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure, or damage caused by improper use or improper or inadequate maintenance and care. LYNX Technik shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than LYNX Technik representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non LYNX Technik supplies; or d) to service a product which has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty servicing the product.

THIS WARRANTY IS GIVEN BY LYNX TECHNIK WITH RESPECT TO THIS PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. LYNX TECHNIK AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. LYNX TECHNIK`S RESPONISIBILITY TO REPAIR AND REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. LYNX TECHNIK AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTIAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER LYNX TECHNIK OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Regulatory information

Europe

Declaration of Conformity

We LYNX Technik AG
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Germany

Declare under our sole responsibility that the product

TYPE: **P VD 5840 D; P VD 5840 U; P VD 5840 DO; P VD 5840 UO**

To which this declaration relates is in conformity with the following standards (environments E1-E3):

EN 55103-1 /1996
EN 55103-2 /1996
EN 60950-1 /2006

Following the provisions of 89/336/EEC and 73/23/EEC directives.

Winfried Deckelmann

Weiterstadt, October 2011

Place and date of issue *Legal Signature*

USA

FCC 47 Part 15

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

Getting Started

Most CardModules are installed into the rack frames and system tested in the factory. If this is an upgrade part or service exchange item then the module is supplied in a padded cardboard carton which includes the CardModule, rear connection plate and mounting screws.

Packaging

The shipping carton and packaging materials provide protection for the module during transit. Please retain the shipping cartons in case subsequent shipping of the product becomes necessary. Do not remove the module from its protective static bag unless observing adequate ESD precautions. Please see below.

ESD Warning

This product is static sensitive. Please use caution and use preventative measures to prevent static discharge or damage could result to module.

Preventing ESD Damage

Electrostatic discharge (ESD) damage occurs when electronic assemblies or the components are improperly handled and can result in complete or intermittent failure.

Do not handle the module unless using an ESD-preventative wrist strap and ensure that it makes good skin contact. Connect the strap to any solid grounding source such as any exposed metal on the rack chassis or any other unpainted metal surface.

Caution

Periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 Megohms.

Product Description

The PVD 5840 FLEXCARD is a high performance SD/HD/3G frame synchronizer / line synchronizer with full embedded and external AES audio support. Basic functionality is a single channel multi format frame synchronizer including 3G processing, Noise Reduction, basic Color Correction (RGB Gain and Lift) and SDTV Aspect Ratio Conversion (ARC).

P VD 5840 DO and UO: The SDI input can be switched between the BNC input and an optional Fiber input.

There are various Hardware options provided for optical video inputs and outputs. Up to two optical inputs and two optical outputs can be added. CWDM versions are also available.

The module provides support for AFD (Active Format Description), WSS (Wide Screen Signaling) and VI (Video Index) for automated control of the optional converter stages.

Transparency resp. conversion of embedded Metadata is also ensured, including Time Code and Closed Caption.

Eight AES ports are provided which can be switched by the user individually as AES inputs or outputs.

Dolby E processing is included in the audio processing stages, i.e. encoded Dolby E streams are synchronized to the Reference Signal and the Guard Band is automatically aligned.

Software options can be activated at any time for additional functionality (no hardware or firmware modifications required)

- Second input channel
  option code OC-5840-SCND
- A second channel of High Quality UP/DOWN/CROSS conversion
  option code OC-5840-UPXD2

When using 5 units of P VD 5840 in one RackFrame, please use the optional high power PSU R PS 5018

Input Video Formats

The module has two multi-format serial digital inputs (second input is optional) with automatic input detection. The module will detect the following input standards and configure the input stage automatically for operation in the connected format.

SDTV Formats	HDTV Formats
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
3GBit/s Formats Level A	1080psf / 24Hz
1080p / 50Hz	1080psf / 25Hz
1080p / 59.94Hz	720p / 23.98Hz
1080p / 60Hz	720p / 24Hz
	720p / 25Hz
Optional:	720p / 29.97Hz
3GBit/s Formats Level B Dual Link	720p / 30Hz
1080p / 50Hz	720p / 50Hz
1080p / 59.94Hz	720p / 59.94Hz
1080p / 60Hz	720p / 60Hz

As the synchronizer uses a single studio reference input both input signals should be the same input frequency range (odd or even frame rate) as the reference for normal operation. (Formats can be different but the odd or even frame rate must match;

Example 1:

Input 1 = 1080i/59.94Hz
Input 2 = 525 59.94Hz
Reference = 59.94Hz

➔ This is a valid configuration

Example 2:

Input 1 = 1080i/59.94Hz
Input 2 = 720P/50Hz
Reference = 59.94Hz

➔ This is NOT a valid configuration.
The signal from input 2 will appear on the output with disturbances.

NOTE: *In this context*
25Hz, 30Hz, 50Hz, 60Hz are even frame rates
29,98Hz, 59.94Hz are odd frame rates

Output Video Formats

The module provides six SDI outputs plus two optional fiber optic outputs, user assignable in four sets of two outputs; these sets can be mapped independently to any of the two input channels. Supported output video formats are:

SDTV Formats	**HDTV Formats**
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
3GBit/s Formats Level A	1080psf / 24Hz
1080p / 50Hz	1080psf / 25Hz
1080p / 59.94Hz	720p / 23.98Hz
1080p / 60Hz	720p / 24Hz
	720p / 25Hz
Optional:	720p / 29.97Hz
3GBit/s Formats Level B Dual Link	720p / 30Hz
1080p / 50Hz	720p / 50Hz
1080p / 59.94Hz	720p / 59.94Hz
1080p / 60Hz	720p / 60Hz

The output format frequency (or frame rate) is determined by the connected reference signal and the output will remain fixed to this reference regardless of the connected input signals.

For input signals mismatched to the connected reference frame rate, the synchronizer will show this as an asynchronous source (indicated by a yellow status indication in the GUI) and any output signal derived from this “async” source can show video disturbances (see below “Reference Lock”)

Input Reference Signal

The module has a very flexible input reference stage which facilitates the use of either SDTV analog bi-phase sync (i.e. black burst) or HDTV analog tri-level sync. The reference input is “cross lock” compatible so an SDTV reference can be used to frequency lock HDTV signals (and vice versa). The connected reference is auto detected and the synchronizer automatically configures the outputs to the frame rate of the connected reference signal.

Supported reference signals are shown below.

SDTV Analog Bi-Level Sync	HDTV Analog Tri-Level Sync
525 / 59.94Hz	1080i / 50Hz
625 / 50Hz	1080i / 59.94Hz
	1080i / 60Hz
	1080p / 23.98Hz
	1080p / 24Hz
	1080p / 25Hz
	1080p / 29.97Hz
	1080p / 30Hz
	1080psf / 23.98Hz
	1080psf / 24Hz
	1080psf / 25Hz
	720p / 23.98Hz
	720p / 24Hz
	720p / 25Hz
	720p / 29.97Hz
	720p / 30Hz
	720p / 50Hz
	720p / 59.94Hz
	720p / 60Hz

Reference Lock

If the input frame rate, the output frame rate and the frame rate of the reference signal are equal, exactly half of each other or double of each other then all modes of the

P VD 5840 operates with no limitations:

- All 25 Hz and 50 Hz input formats will be synchronized to any 25 Hz or 50 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 25 Hz or 50 Hz.
- All 30 Hz and 60 Hz input formats will be synchronized to any 30 Hz or 60 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 30 Hz or 60 Hz.
- All 29.97 Hz and 59.94 Hz input format will be synchronized to any 29.97 Hz or 59.94 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 29.97 Hz or 59.94 Hz.
- All 23.98 Hz input formats will be synchronized to any 23.98 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 23.98 Hz.
- All 24 Hz input formats will be synchronized to any 24 Hz reference signal (from the tables above). The output frame rate can be any format with a frame rate of 24 Hz.

***NOTE**: If the frame rate of the reference signal is not equal, double or half of the input/output frame rate, then all functions still are available except the video delay as the frame rate of the output video does not match the frame rate of the reference signal.*

The video output remains frequency locked to the Reference signal. In this case a synchronized DolbyE signal *will not match* the required guard band of the video output signal.

***NOTE**: If the input frame rate, the output frame rate and the frame rate of the reference signal do not match then the module's converters (if activated) will perform a rudimentary frame rate conversion with drop and repeat frames. This mode of operation is not a recommended or specified functionality for the P VD 5840, and unwanted artifacts may occur.*

Frame Synchronization

The algorithms used for frame synchronization are extremely robust and very tolerant of poor input signals. The Synchronizer uses "Flywheel" functionality. This allows the module to recover from any missing sync pulses on the input signal(s) by predicting where they should be and then re-inserting them.

If no converters are active, the frame synchronizer passes the video in the connected input format.

The Synchronizer can also be switched into a Line Synchronizer Mode (see page 37)

ARC (Aspect Ratio Conversion)

The basic module includes two ARCs (**A**spect **R**atio **C**onverters) which can be used to convert SDTV signals between 4:3 or 16:9 aspect ratios.

The ARC is a high quality image processor which has extended functionality including manually adjustable image size and position. The ARC is an internal resource which can be routed to any of the two available outputs.

Modes supported are as follows:

Conversion from 16:9 to 4:3 Aspect Ratio

Letterbox

This takes the 16:9 aspect ratio of the input signal and fits it horizontally into the 4:3 SD image area with black bars at the top and bottom of the image.

Center Cut:

This mode cuts the center portion of the 16:9 input signal and fills the 4:3 SD image area

Stretch to Fill:

This mode takes the 16:9 input signal and distorts (vertically stretches) the image to fit the available 4:3 SD image area.

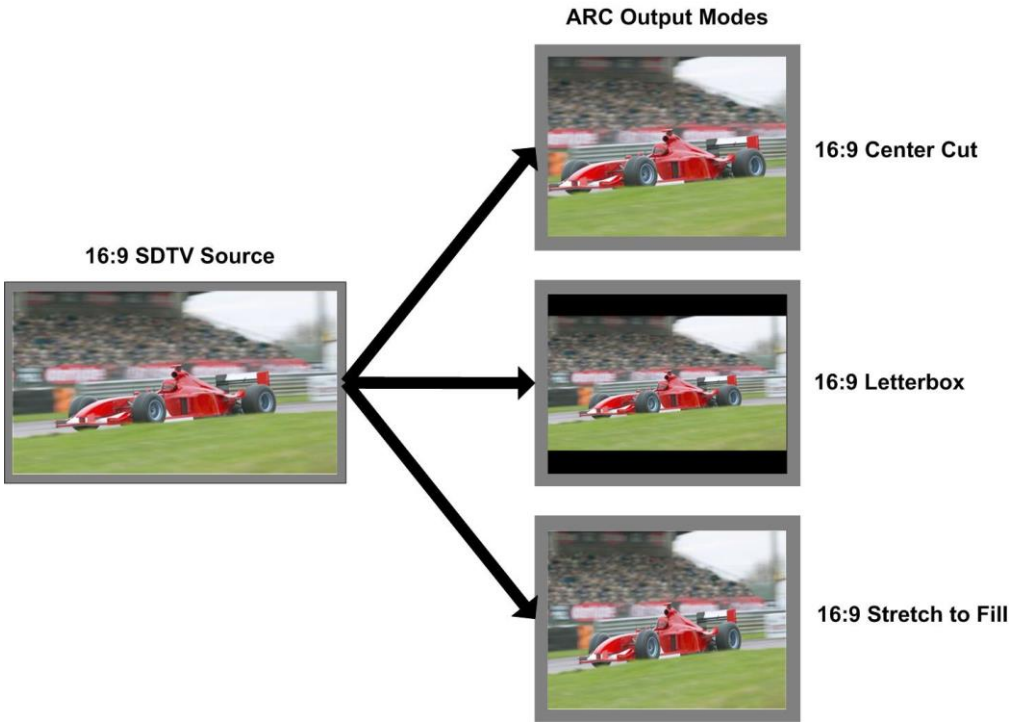

Figure 1: Aspect Ratio Conversion 16:9 to 4:3

Conversion from 4:3 to 16:9 Aspect Ratio

PillarBox

This takes the 4.3 aspect ratio of the input signal and fits it vertically into the 16:9 SD image area with black bars at the left and right of the image.

Center Cut

This mode cuts the horizontal center portion of the 4:3 input signal and fills the 16:9 SD image area (cropping the top and bottom of the image)

Stretch to Fill

This mode takes the 4:3 input signal and distorts (horizontally stretches) the image to fit the available 16:9 SD image area

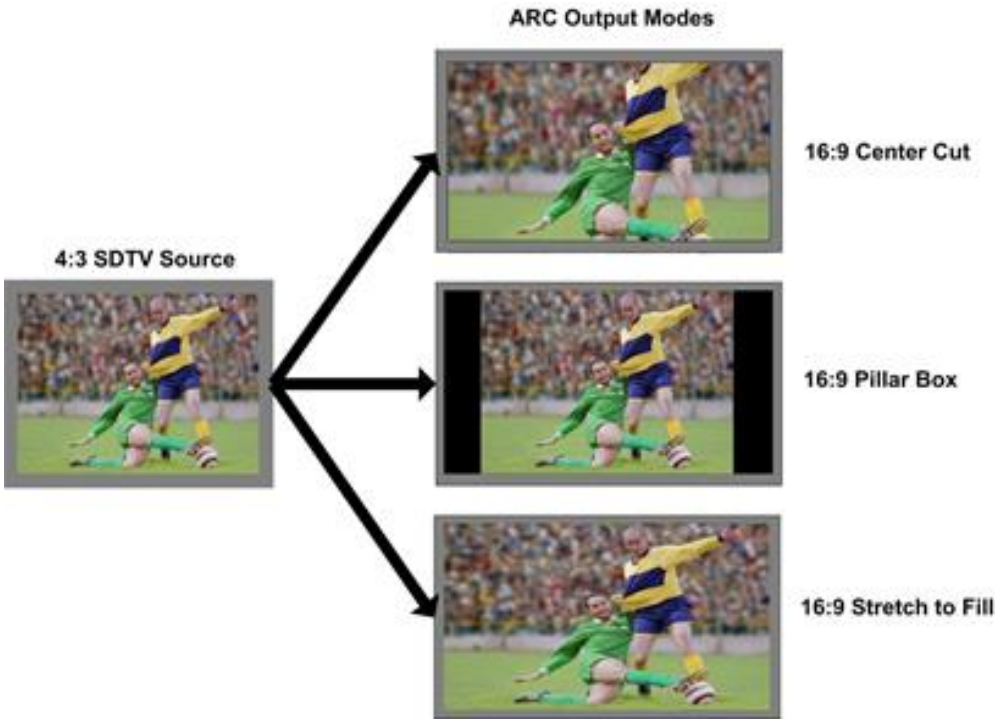

Figure 2: Aspect Ratio Conversion 4:3 to 16:9

ARC Image Size and Positioning

The high quality ARC provides the ability to manually adjust image position and size for the conversion process.

A 14:9 conversion setting is also added.

Please refer to the GUI section of this manual for more information of the controls provided and how to use them.

NOTE: *The converter can by automatically controlled by AFD (Active Format Description), WSS (Wide Screen Signaling) and VI (Video Index). Please refer to the GUI section of this manual for more information of the controls provided and how to use them.*

Video Processing

Proc Amp Functions

Each of the four output channels has an associated video processing amp which provides user adjustable ***Gain***, ***Saturation***, ***Black Level*** and ***Hue*** using GUI sliders.

Aperture Correction

An adjustable horizontal aperture corrector is provided for each of the two output channels. This can be used to add (or remove) image sharpness as required.

NOTE: *When using the down converter the filtering process results in a very slight loss of high frequency information (which is normal), the aperture corrector can be used to compensate for this slight loss.*

Test Patterns

Each of the two output channels has its own independent test pattern generator which provides a wide selection of test patterns which can be switched into each output.

The selected test pattern is also available as one of the modes the synchronizer will switch to when excessive video TRS errors are encountered. Possible synchronizer actions when the input video errors become excessive are:

- Freeze Field 1
- Freeze Field 2
- Freeze Frame
- Selected Test Pattern
- Black
-

Programmable Video Output Delay

Each of the two SDI outputs has separate programmable video output delay which can be set (independently) between 0 and 3 frames (max). The adjustment is available in pixel, line and full frame increments.

This adjustment will delay the SDI video output relative to the connected reference by the delay setting specified. (+ fixed delay)

NOTE: The Synchronizer (including the OC-5840-UPXD2 option, if installed) has fixed frame delays depending on the signal path and selected function (see below). The 0 > 3 frame user adjustment is additional delay relative to the fixed delays.

Fixed Processing Delays

The Synchronizer (including the OC-5840-UPXD2 option, if installed) has fixed frame delays depending on the signal path and selected function - see below:

Input Standard	Output Standard	Delay (ms)	Delay (Frames - rounded to ½ frame)
1080i 50	1080i 50	120	3
1080i 50	720p 50	80	4
1080i 50	1080p 25	120	3
1080i 50	720p 25	120	3
720p 50	1080i 50	80	2
720p 50	720p 50	60	3
720p 50	1080p 25	60	1.5
720p 50	720p 25	80	2
1080p 25	1080i 50	80	2
1080p 25	720p 50	80	4
1080p 25	1080p 25	120	3
1080p 25	720p 25	120	3
1080i 59.94	1080i 59.94	98	3
1080i 59.94	720p 59.94	65	4
1080i 59.94	1080p 29.97	99	3
1080i 59.94	720p 29.97	99	3
720p 59.94	1080i 59.94	65	2
720p 59.94	720p 59.94	48	3
720p 59.94	1080p 29.97	49	1.5
720p 59.94	720p 29.97	82	2.5
1080p 29.97	1080i 59.94	65	2
1080p 29.97	720p 59.94	48	3
1080p 29.97	1080p 29.97	99	3
1080p 29.97	720p 29.97	99	3
1080i 60	1080i 60	98	3
1080i 60	720p 60	65	4
1080i 60	1080p 30	99	3
1080i 60	720p 30	99	3
720p 60	1080i 60	65	2
720p 60	720p 60	48	3
720p 60	1080p 30	65	2
720p 60	720p 30	82	2.5
1080p 30	1080i 60	65	2
1080p 30	720p 60	48	3
1080p 30	1080p 30	99	3
1080p 30	720p 30	99	3
1080p 24	1080p 24	124	3
1080p 24	720p 24	124	3
1080p 24	1080psF 24	82	1
1080psF 24	1080p 24	124	3
1080psF 24	720p 24	124	3
1080psF 24	1080psF 24	123	1.5
1080p 23.97	1080p 23.97	124	3
1080p 23.97	720p 23.97	124	3
1080p 23.97	1080psF 23.97	103	1
1080psF 23.97	1080p 23.97	124	3

1080psF 23.97	720p 23.97	124	3
1080psF 23.97	1080psF 23.97	123	1.5
1080i 50	625	119	3
720p 50	625	79	2
1080p 25	625	99	2.5
1080i 59.94	525	99	3
720p 59.94	525	82	2.5
1080p 29.97	525	82	2.5
625	625	119	3
525	525	65	2
625	1080i 50	78	2
625	720p 50	78	4
625	1080p 25	119	3
625	720p 25	119	3
525	1080i 59.94	65	2
525	720p 59.94	48	3
525	1080p 29.97	65	2
525	720p 29.97	99	3
1080i 60	1080p 60	50	3
720p 60	1080p 60	34	2
1080p 30	1080p 60	50	3
1080p 50	1080i 50	100	2.5
1080p 50	720p 50	60	3
1080p 50	1080p 50	60	3
1080p 50	1080p 25	80	2
1080p 50	720p 25	80	2
1080p 50	625	80	2
1080p 59.94	1080i 59.94	66	2
1080p 59.94	720p 59.94	49	3
1080p 59.94	1080p 59.94	49	3
1080p 59.94	1080p 29.97	66	2
1080p 59.94	720p 29.97	66	2
1080p 59.94	525	99	3
1080p 60	1080i 60	66	2
1080p 60	720p 60	49	3
1080p 60	1080p 60	49	3
1080p 60	1080p 30	66	2
1080p 60	720p 30	66	2

Audio Processing

The module will de-embed the complete audio payload from the incoming two SDI streams (second input is optional), i.e. per channel 4 AES groups = 8 AES = 16 audio channels per channel, and passed to an AES audio input matrix along with up to 8 external AES inputs.

The type of audio (PCM, Dolby E or Audio Data) is detected by the module automatically.

The AES input matrix has up to 24 selectable input channels. The audio is fed through selectable sample rate converters (SRC's) where the audio is re-sampled and synchronized.

PCM Audio using the sample rate converters will be free from any audio interference ("pops and clicks") when frames are dropped or repeated by the frame synchronizer.

NOTE: If an encoded Dolby E audio signal is detected by the module the associated SRC and the following audio processing will be switched off automatically. For asynchronous Dolby E streams you should use Audio Pathway 2 which provides Dolby E synchronizers.

There are two separate audio pathways through the frame synchronizer, each one selected according to the application and requirements for audio processing.

The audio streams can be individually delayed in various zones (see GUI section).

Pathway 1

This audio pathway is scaled 20 x AES signals wide (40 audio channels). The audio is fed into a full audio processing stage, which includes mono gain adjustment, mute, phase inversion, silence and overload detection and stereo down mix.

Pathway 2 – (For DolbyE)

The PVD 5840 is transparent to any embedded or external DolbyE bit streams:

a) If the input is synchronous - then any audio pathway can be used,

b) If the input is asynchronous, pathway 2 provides 4 DolbyE synchronizers, which synchronizes the DolbyE signal to the reference signal and automatically aligns the guard-band.

Synchronization and automatic guard band alignment only works correctly if the frame rates of the video input/output matches the reference signal (see above "Reference lock).

The Dolby Synchronizers have to be referenced to one of the video outputs or the AES audio outputs for correct guard band alignment (see also description on page 60)

Automatic Audio Synchronization & Channel Assignment (ASCA)

The P VD 5840 Frame Synchronizer provides comprehensive audio routing capabilities; providing a separate AES input crossbar and also individual mono crossbars for each output channel. While this provides the greatest level of flexibility it can also be cumbersome for basic applications which just need the audio passed through the system transparently (The same embedded audio configuration on the input is required on the synchronized output).

Figure 3: ASCA

The Automatic Audio Synchronization and Channel Assignment (ASCA) function has been introduced to address this, and once enabled will ensure the incoming embedded audio streams are synchronized and then routed to the appropriate output. (i.e. audio is embedded into the same group of the same video program).

The ASCA function is enabled and configured on the video proc tab using the LYNX Desktop Controller (control system)

NOTE: *External AES inputs are not supported while the ASCA function is enabled The ASCA function is by default OFF which required manual configuration of the audio crossbars*

Working Principle

Depending on the type of audio content (PCM, DolbyE, other data ...), different synchronization methods, and therefore different internal audio pathways have to be used for each audio input stream. The ASCA function will automatically select the appropriate audio pathway through the module by automatically configuring the various internal audio crossbars based on the type of audio signal.

Limited Sync Resources

The synchronization resources are limited on each module. There are a total of 24 sample rate converters (SRC) and 4 DolbyE frame-synchronizers (DE-FS) available.

In the event that the available synchronization resources for Dolby E Streams are exceeded, the remaining audio content will be passed through **un-synchronized** and a warning will be visible in the control system GUI.

For example, this situation can occur if there are more than 4 DolbyE streams embedded in the incoming SDI signal: the available resources (per SDI channel) are applied to the embedded audio streams in the following order of priority (if one of the audio-streams is not present, it will not be assigned any resources):

1. Audio streams de-embedded from group 1
2. Audio streams de-embedded from group 2
3. Audio streams de-embedded from group 3
4. Audio streams de-embedded from group 4
5. In the event of unavailable synchronization resources, a warning will be issued and the remaining audio-channels will be process un-synchronized. All audio signals will be delivered on the output in any case. So the limitation applies only in an asynchronous environment.

Limitations:

1. Audio Disturbances

Whenever the ASCA function is re-configuring the audio-channels, the configuration process will possibly generate audible disturbances in some of the audio output channels (embedded or AES) of the same video program. Such re-configuration will be triggered by any change of the appropriate input configuration (video, embedded audio). Therefore this function is recommended to be used in environments, in which the incoming signal configuration does not change while a programming stream is being processed. I.e. it can be used for automatic pre-setup only.

2. Flexibility: Crossbars and processing

Using the ASCA function imposes the following limitations to the audio infrastructure:

- Internal audio processing (mute, gain, invert, …) is disabled and set to neutral
- Takes full control over all internal audio-crossbars (input and output), except the crossbar configuring the external AES output channel assignment.

Accordingly, the effected audio-crossbars and audio processing parameters will be grayed out and set to read-only in the control system.

3. Persistence of user settings

After turning the ASCA function ON, audio-infrastructure settings (crossbars, SRCs, Embedders) are modified by an automatic process. When the ASCA function is then turned OFF again, previous settings are *not* automatically restored. As a consequence, turning the ASCA ON and OFF can result in a modified audio-infrastructure (crossbars, processing).

4. External AES input not usable

Turning the ASCA function ON will allocate all available Dolby E synchronization resources to the signals de-embedded from the video input. The external AES inputs cannot be used at all.

On the other hand, the external AES outputs are not controlled by ASCA, i.e. the "AES output" crossbar is still active (not grayed out). However, the automatic ASCA process can re-assign individual audio streams to different internal audio channels. So, if an external AES output is connected to a particular internal audio stream, the content of that stream can change spontaneously, because ASCA has modified the AES input crossbar, following a change of the audio in the input signal.

5. DolbyE Frame synchronizer timing assignment

The ASCA function will use the available DE-FS channels to provide frame-synchronization and guard-band alignment of the DolbyE signal. If the same video signal is assigned to multiple video outputs (using the video crossbar on the main page of the GUI), and if those video outputs use a different timing offset (relative to the current sync. input), then the correct audio/video timing of the DolbyE stream can only be guaranteed for the first of those SDI outputs. For details refer to section "Maintaining DolbyE Transparency" / "Pathway 2 – Dolby E" of the product user manual.

Noise Reduction

The module provides Noise Reduction functionality for one or two channels:

The adaptive noise reduction function processes the input data in either progressive or interlaced format. Application of noise reduction to noisy interlaced signals can optimize the de-interlacer performance.

General Noise Reduction

General noise reduction comprises of both adaptive 2D and 3D noise reduction. 3D noise reduction corrects for temporal and spatial noise; and 2D noise reduction corrects spatial. 3D noise reduction is applied to any interlaced or progressive signal with a pixel rate less than or equal to 75Mp/s. 2D noise reduction is applied to any interlaced or progressive signal. The selection of 2D or 3D noise reduction processing is automatically controlled by the firmware in accordance with the video signal being processed.

Block Artifact Reduction

Block Artifact Reduction (BAR) locates and reduces block edges produced by DCT based compression processing. BAR can be applied to any interlaced or progressive input signal.

Mosquito Noise Reduction

Mosquito Noise Reduction (MNR) dynamically adapts to image content, effectively reducing mosquito artifacts around sharp edges in DCT based compression. It can be applied to any interlaced or progressive signal.

Detail Enhancement (Sharpness and Texture)

The detail enhancement function provides both sharpness and texture enhancement, realized by adaptive horizontal, vertical and diagonal large edge and small edge enhancement processes. Overshoot / undershoot control is provided to minimize ringing on the enhanced edges. In addition, noise rejection is provided to minimize the amount of enhancement applied to the noisy areas of the image.

For ease of use the various controls are combined into two parameters: Level and Threshold:

- **Level:** controls the level of the horizontal, vertical as well as the diagonal high pass filtered picture content, which will be added to the original signal again, i.e. the gain of the high frequency content in the signal.
- **Threshold**: This parameter controls the level of signal which is passed through for level control, i.e. all amplitudes in the signal below this threshold will not be used for the detail enhancement.

GPI Function

The two GPI inputs (**G**eneral **P**urpose **I**nterface) which are switch input functions (contact closure) can be used to perform a number of functions. The influence of these inputs can be set by the user. See section GPI Influence on page 65.

Functional Diagrams and Module Layout

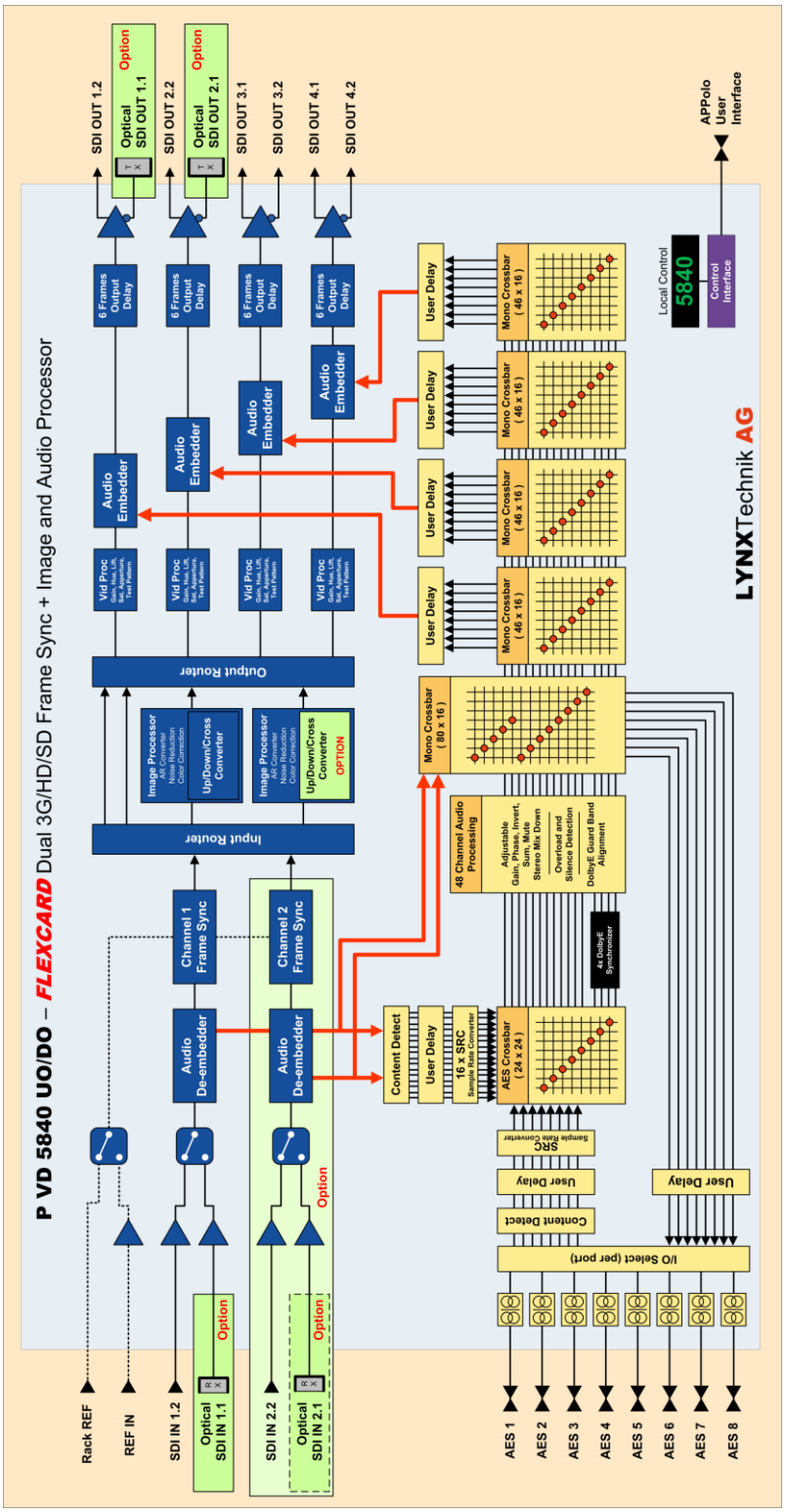

Figure 4: Functional Diagram

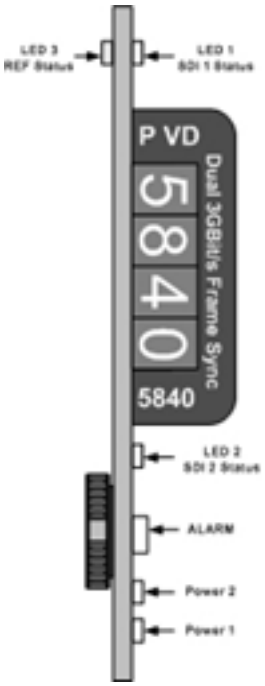

Figure 6: Card Edge

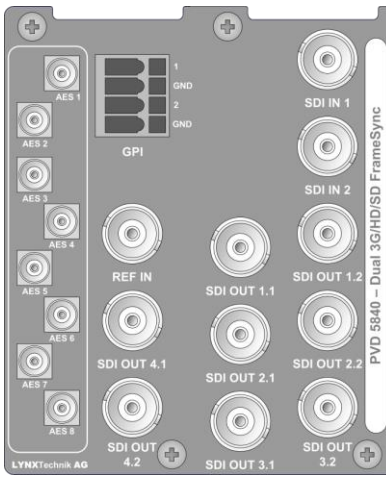

Figure 10: Rear Termination Panel P VD 5480-U

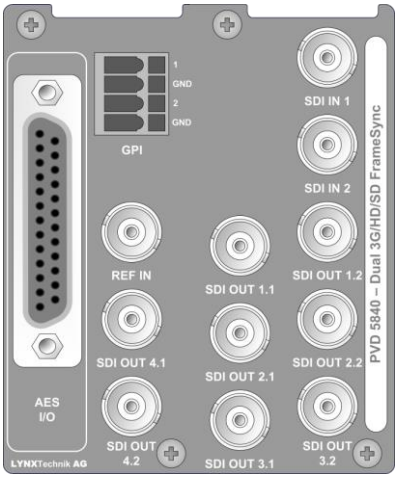

Figure 9: Rear Termination Panel P VD 5840-D

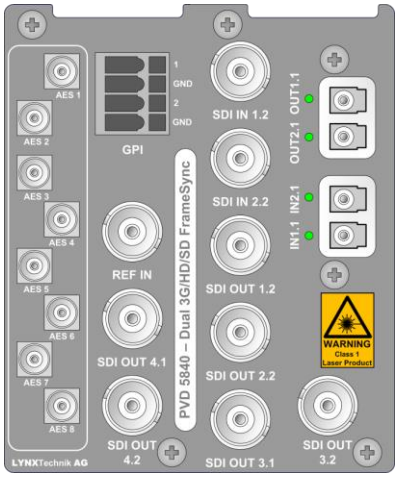

Figure 8: Rear Termination Panel P VD 5480-UO

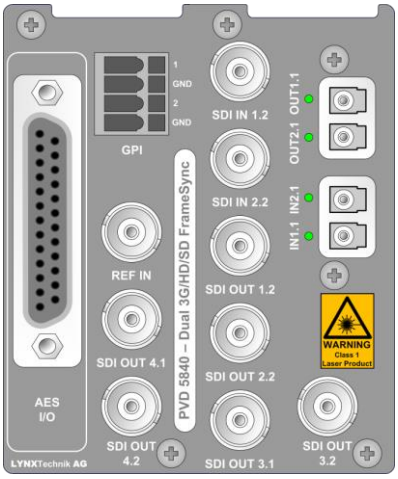

Figure 7: Rear Termination Panel P VD 5480-DO

Figure 5: Board Layout

NOTE: *Cooling fan operation is monitored and alarmed with the module alarm LED and also within the LYNX control system.*

Connections

Video

The P VD 5840 uses standard 75 Ohm BNC connectors for SDI connectivity. We recommend the use of high quality video cable for digital video connections to reduce the risk of errors due to excessive cable attenuation. Max cable lengths the module will support are shown below.

SDTV = 250m Belden 8281 (270Mbits/s)

HDTV = 140m Belden 1694A (1.4Gbits/s)

3GBit/s = 80m Belden 1694A (2.97Gbits/s)

NOTE: *Due to the compact design of the connection plate it will be necessary to use a connection tool to secure the BNC video connectors.*

Audio

The module provides for both Unbalanced (AES3id on MINI DIN connectors) and Balanced (AES3) external audio connections.

The **P VD 5840 U** versions provides MiniDIN (DIN1.0/2.3) connections for unbalanced AES3id

The **P VD 5840 D** versions provides a SubD25 connector for balanced AES3 (pin layout see table below and Figure 11)

Pin Number	Connection	Pin Number	Connection
1	AES 8 +	14	AES 8 -
2	AES 8 GND	15	AES 7 +
3	AES 7 -	16	AES 7 GND
4	AES 6 +	17	AES 6 -
5	AES 6 GND	18	AES 5 +
6	AES 5 -	19	AES 5 GND
7	AES 4 +	20	AES 4 -
8	AES 4 GND	21	AES 3 +
9	AES 3 -	22	AES 3 GND
10	AES 2 +	23	AES 2 -
11	AES 2 GND	24	AES 1 +
12	AES 1 -	25	AES 1 GND
13	n.c.		

It is recommended to use high quality screened (twisted pair) cable for the balanced audio connections. LYNX Technik provides optional audio breakout cables which will bring out all audio connections to in line XLR connectors. Model number R AC M 25-8 or R AC F 25-8

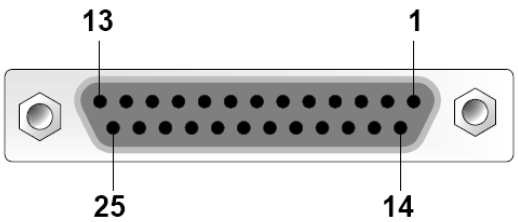

Figure 11: SubD25 Audio connector
(looking into connector from back of module)

Optical Fiber (P VD 5840 DO and UO)

The P VD 5840 provides LC connectors for single mode fiber cables (option).

Multimode fiber cables can be used also, but this will limit the max. fiber length to approx. 1km.

***NOTE**: Please take care that surfaces of fiber cables and LC connectors are always protected against scratching and dust if no fiber cables are connected. Dust and/or scratches will lead to high attenuation of the optical power transmitted.*

Installation

If this module was supplied as part of a system it is already installed in the rack enclosure. If the module was supplied as a field upgrade please follow the installation procedure below.

NOTE Observe static precautions when handling card.
Please see ESD warnings on Page 7.

This module has a double width rear connection panel, meaning it will occupy two slots of a standard Series 5000 Card Rack. This is to accommodate the additional connections needed for this module and to also provide adequate space for cooling in the rack. Up to five P VD 5806 modules can be accommodated in a single Series 5000 rack frame.

When using 5 units of P VD 5840 in one RackFrame, please use the optional high power PSU R PS 5018

Each Card Module is supplied with a rear connection panel and mounting screws. Please follow the procedure below for the installation of the card module into the Series 5000 Card Frame.

We recommend you power the rack down before installing any additional modules into an existing card frame.

1. Select a free two slot space in the card frame where the CardModule will be located.
2. Remove the blank connection panels from the rear of the rack (if fitted)
3. Install the rear connection panel using the screws supplied. Do not tighten the screws fully
4. Slide the card module into the card frame and carefully check the CardModule connects to the rear connection plate. The card should fit easily and should not require excessive force to insert - if you feel any resistance, there could be something wrong with the rear connection panel location. **Do not** try and force the connection this may damage the connectors. Remove the rear connection panel and check alignment with the CardModule.
5. Insert and remove the CardModule a few times to ensure correct alignment and then tighten the two screws to secure the rear connection plate.
6. Power up the rack and check the module LED's and matrix display illuminate. Check the module is automatically logged into the control system device tree. *(It may take a few seconds for the control system to "discover" the new module)*

NOTE: *The use of the optional control system is **mandatory** for the control and setup of this module. If you do not have the control system, then please contact your LYNX representative for details on how to upgrade your installation with the LYNX control system.*

Firmware Options

The basic module is a single channel frame synchronizer and HQ UP/Down/Cross/Converter with full audio support, providing two user mapped outputs. With the addition of the following firmware options the performance and features of the module can be greatly enhanced and customized to meet a specific application.

NOTE: *Firmware options can be added at any time by simply purchasing and installing a license code string. No hardware or firmware modifications are needed.*

For information on how to install a licensed option please refer to the GUI section of this manual.

Up/Down/Cross Conv. Option (OC-5840-UPXD2)

One high quality up, down and cross conversion is already pre-installed with the basic unit.

The addition of this option adds a second channel of high quality up, down and cross conversion to the module. This is an internal resource which can be mapped to any (or all) available outputs. Modes of operation are described below.

Note : *The operation of the Converter can be set to Up Conversion -OR- Down Conversion -OR- Cross Conversion.*

Down conversion

Modes of operation are described below.

4:3 Letterbox

This takes the 16:9 aspect ratio of the input HD or 3GBIt/s signal and fits it into the 4:3 SD aspect ratio screen with black bars at the top and bottom of the image.

4:3 Center Cut

This mode cuts the center portion of the 16:9 input signal and fills the 4:3 SD aspect ratio screen.

4:3 Stretch to Fill

This mode takes the 16:9 input signal and distorts (vertically stretches) the image to fit the available 4:3 SD aspect ratio space.

This converter also adds a 14:9 conversion

Figure 12: Downconversion modes

Up Conversion

The UP converter will convert the connected SDTV input standard to the selected HD/ 3GBit/s Standard within the same or half the frame rate. See below

525 / 59.94Hz Input Signal Converted to 1080i / 59.94Hz or 720P / 59.94Hz

625 / 50Hz Input Signal Converted to 1080i / 50Hz or 720P / 50Hz

Modes of operation are as follows:

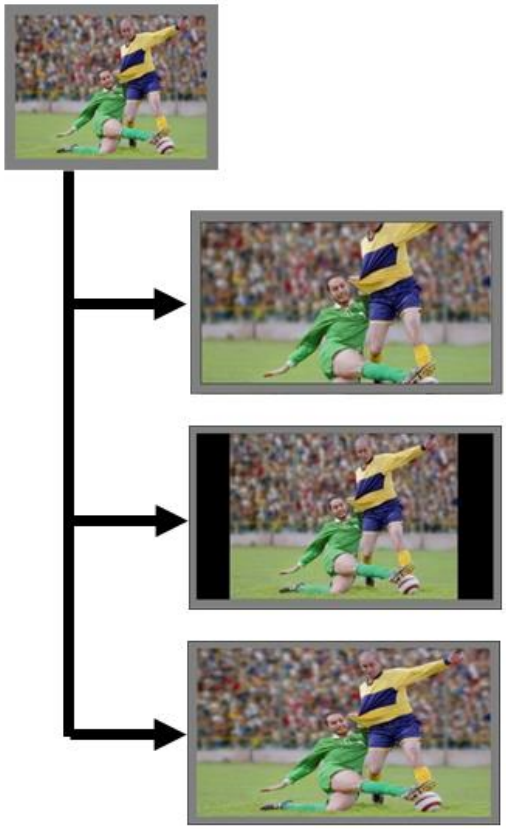

Figure 13: Up-Conversion modes

Center Cut

This mode cuts the horizontal center portion of the 4:3 SD input signal and fills the 16:9 HD/ 3GBit/s aspect ratio image area. (top and bottom of image are cropped)

PillarBox

This takes the 4:3 SD aspect ratio of the input signal and fits it vertically into the 16:9 HD/ 3GBit/s image area with black bars at the left and right of the image.

Stretch to Fill

This mode takes the 4:3 SD input signal and distorts (horizontally stretches) the image to fit the available 16:9 HD/ 3GBit/s image area.

14:9 Conversion

This mode takes the 4:3 SD input signal and distorts (horizontally stretches) the image to fit the available 14:9 HD/ 3GBit/s image area.

Cross Conversion

When used in cross conversion mode the module will cross convert the video signal between formats within the same or half the frame rate.

Image Size and Positioning

This option also provides the ability to manually adjust the image size and position of the converted output. For more information on the controls and use of this feature please refer to the GUI section of this manual for more details.

NOTE: *The converters can be automatically controlled by AFD (Active Format Description), WSS (Wide Screen Signaling) and VI (Video Index). Please refer to the GUI section of this manual for more information of the controls provided and how to use them.*

Color Space Conversion

The conversion options also provide integrated color space conversion capability which will automatically compensate for the conversion of the wider 709 HD color space into the more narrow 601 SDTV color space or vice versa ensuring legal color reproduction.

Detail Enhancement (Sharpness and Texture)

The detail enhancement function provides both sharpness and texture enhancement, realized by adaptive horizontal, vertical and diagonal large edge and small edge enhancement processes. Overshoot / undershoot control is provided to minimize ringing on the enhanced edges. In addition, noise rejection is provided to minimize the amount of enhancement applied to the noisy areas of the image.

For ease of use the various controls are combined into two parameters: Level and Threshold:

Level: controls the level of the horizontal, vertical as well as the diagonal high pass filtered picture content, which will be added to the original signal again, i.e. the gain of the high frequency content in the signal.

Threshold: This parameter controls the level of signal which is passed through for level control, i.e. all amplitudes in the signal below this threshold will not be used for the detail enhancement.

Second Input Option (OC-5840-SCND)

The addition of this option will enable the second input and provide a second channel of frame synchronization. This also includes a 16 channel de-embedder with 16 additional inputs into the integrated AES input crossbar.

It is possible to switch seamlessly between the two inputs (clean switch) which can be configured to trigger via GPI input or can be switched via the control system.

NOTE: *Both inputs are referenced to the single reference input used for the module*

3G Level B Dual Link (OC-5840-3G-LevelB-DL)

The 3G Level B Dual Link option will add the 3G Level B Dual Link capabilities to the P VD 5840.

With this option activated the P VD 5840 will detect and process 3G Level B Dual Link input signals.

Each SDI output processor of the P VD 5840 can be individually configured to either output a 3G Level A or 3G Level B Dual Link signal.

Settings and Control

The P VD 5840 module has an integrated micro-controller, which enables the module to be configured and controlled locally using the multifunction switch and 4 character dot matrix display, or from remote using a GUI interface when using one of the optional controllers and control software.

NOTE: *This module is extremely compact and flexible with hundreds of possible user settings. It is not practical to make all these settings available on the local dot matrix display. The use of the control system is mandatory to access the large array of settings possible. Please refer to the GUI section of this manual for details on the controls provided. Some rudimentary module settings are possible via the local controls, which are detailed below.*

Once set, all settings are automatically saved in non-volatile internal memory. (Flash RAM) The module will always recall the last used settings.

Multi Function Switch

The CardModule is equipped with a multi-function switch located on the front bottom edge of the card. (see Figure 14)

Using the Local Display Menus

Making local adjustments to the module is done using the multifunction switch and the integrated 4-character dot matrix display. The menu system is layered, and navigation through the system is done using the **UP** and **DOWN** functions of the switch. **ENTER** is used to move between menu levels and also enter a selection.

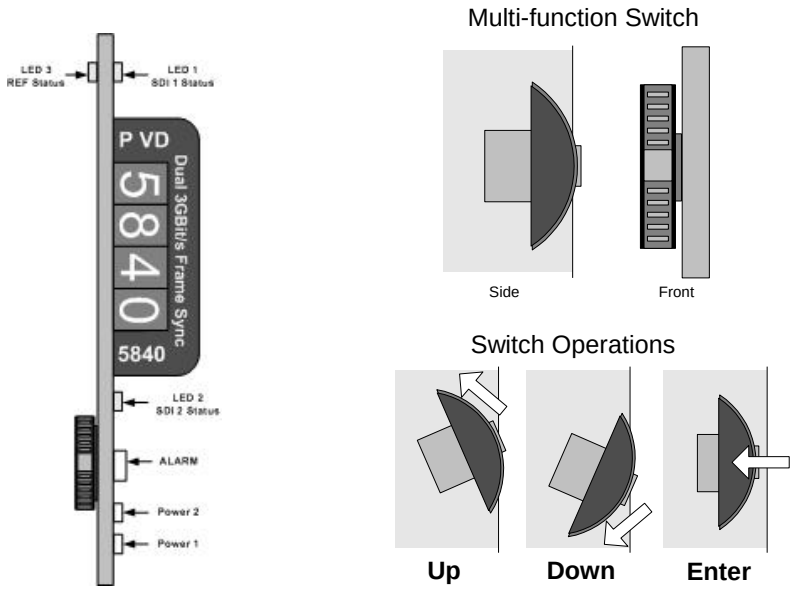

Figure 14: Multi-Function Switch on left card edge

Menu Structure

The Menu structure is defined in the next table, and can be used to help navigating through the menu system.

ENTER moves between levels

UP/DOWN moves between items within the level

When a new setting is entered the system will jump back one level in the menu system.

- The “back” selection in the menu structure will take you back one level when selected.
- When an item is selected which has several setting possibilities the first value displayed will be the value currently stored in the system. The order of the available settings for any menu item in the table supplied does not represent the order the settings will actually be displayed.
- When left unattended, the menu will default to the root display after a short timeout.

LEVEL 1	LEVEL 2	LEVEL 3	Notes
P VD 5840			***Root Display***
	REF		*Reference Selection*
		EXT	*Reference taken from module rear connection panel*
		INT	*Reference taken from common rack reference*
		back	
	FPS		***Output frame rate selection***
		ODD	*All outputs jammed to 59.94Hz, 23.98 Hz or 29,97 Hz frequency frame rate**
		EVEN	*All outputs jammed to 50Hz, 24 Hz, 25, 30 Hz or 60 Hz frequency frame rate**
		AUTO	*Output frame rate is derived from connected reference (default)*
		back	
	RSET		***Reset Factory Defaults***
		NO	
		YES	*Reset factory defaults*
		back	
	back		

NOTE: *The FPS setting from the local card-edge menu is provided for use in facilities which operate in a single fixed format and wish to maintain this constant output frame rate at all times (regardless of the connected reference signal, or any disturbance to the connected reference signal). This will prevent the output frame rate and format automatically “tracking” the connected reference standard should this change. The output video signal will maintain the “jammed” to the video frame rate but the video will be disturbed if the input reference signal changes.*

Alarm/LED Status Indicators

LED 1: SDI 1 Status

LED Color	Indication
Green ●	SDI 1 input ok
Yellow ●	SDI 1 Frame Rate Mismatch *(Mismatch between the fixed output frame rate and the SDI 1 input. Conversion taking place)*
Red ●	SDI 1 input missing

LED 2: SDI 2 Status

LED Color	Indication
Green ●	SDI 2 input ok
Yellow ●	SDI 2 Frame Rate Mismatch *(Mismatch between the fixed output frame rate and the SDI 2 input. Conversion taking place)*
Red ●	SDI 2 input missing

LED 3: REF Status

LED Color	Indication
Green ●	Reference Signal present and ok
Yellow ●	Reference Present, but not used *(Module is set to free run with no lock to external reference)*
Red ●	Reference cannot be detected

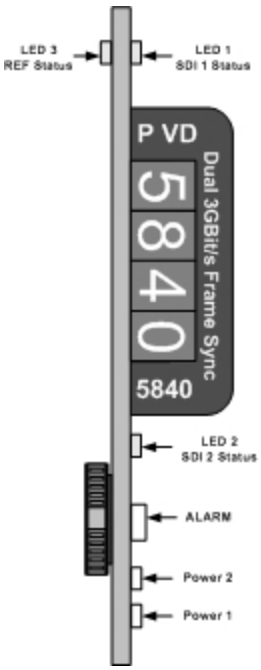

Figure 15: Card Edge LEDs

Alarm LED

The (slightly larger) Alarm LED on the lower edge of the module is visible through the RackFrame's front cover and provides a general indication of the module status.

LED Color	Indication
Green ●	Normal Operation .
Yellow ●	Problem with one of the SDI inputs
Yellow flashing ●●	"Locate Device" activated from Control System
triple yellow flash ●●●●	Saving current configuration to local flash-RAM
Red ●	Problem with both SDI inputs
Red Flashing ●●	Cooling Fan Failure

Power LEDs

Power 1	Indication
Green ●	Power from Main PSU ok
Off ●	No power from Main Power Supply
Power 2	**Indication**
Green ●	Power from Redundant PSU ok
Off ●	No power from Redundant PSU

NOTE: *If one of the Power LEDs should be OFF while the corresponding PSU is working correctly, then please contact technical support for a verification of the board's power input fuse.*

Control System GUI

All LYNX CardModules support a computer interface which allows setting the modules parameters using a simple GUI interface. Access to all standard features *and in some cases* extended features is possible using this interface. The complex nature and extensive user settings provided on the P VD 5840 requires the use of the control system.

***NOTE**: Any settings made using the control system overrides any local settings made on the module. All settings are stored in internal flash ram and will survive power cycles and long term storage.*

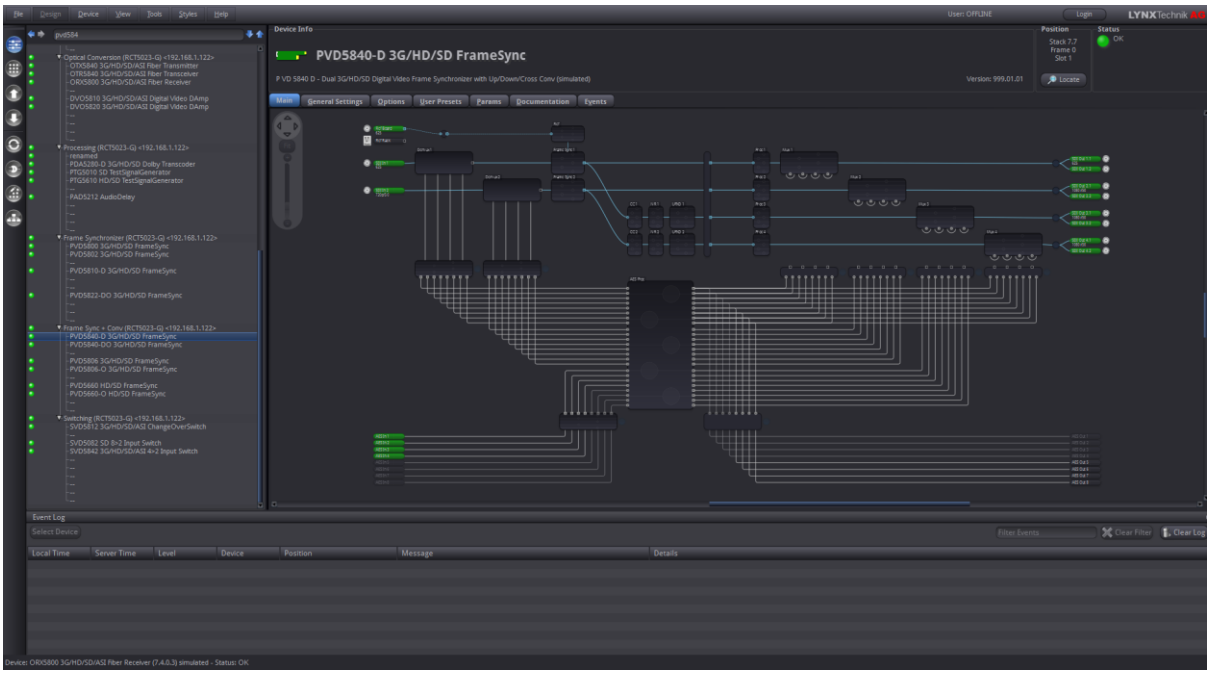

Figure 16: P VD 5840 in APPolo GUI

Figure 16 shows the complete module GUI. The “Device Info” area across the top contains information about the module including name and firmware revision. The “Position” area displays the modules position and physical location. This is useful if the device is installed as part of a larger installation.

NOTE: The Locate button (in the “Position” area) is a useful tool to quickly identify a module in larger systems. Activating “Locate” will flash the module’s alarm LED in yellow color. (this does not affect the module’s operation in any way).
This function will be stopped automatically (timeout).

The “Error Log” at the bottom of the screen displays an individual timestamp’ed message for any error or warning condition in the system. The same information can always be found in the APPolo Control System’s textual logfiles.

The primary GUI screens and functions are described in the following sections.

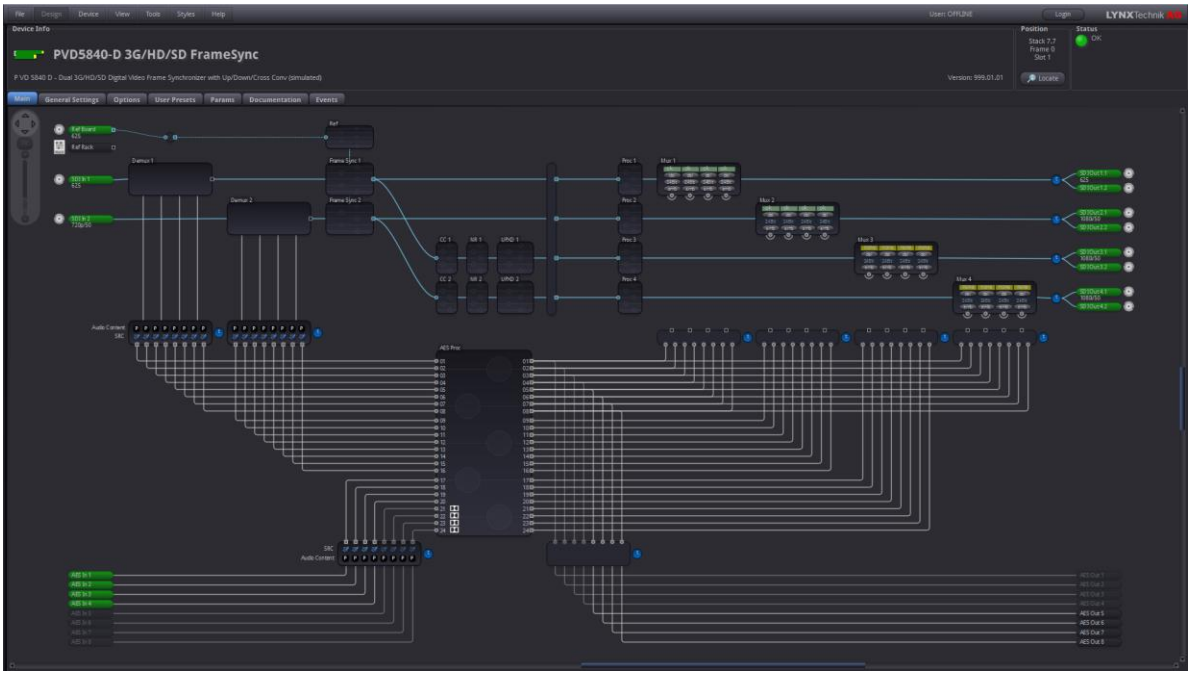

Figure 17: P VD 5840 MAIN Tab

Overview

The MAIN Tab (Figure 17) visualizes the module's functionality. The audio and video signals are presented flowing from left to right. Selections are made using onscreen sliders, radio buttons, drop down selections and checkboxes. The screen can be zoomed in/out using the mouse-wheel or the navigation tool in the top left corner of the screen. When zooming closer, the contents of the individual boxes will become visible.

Video Routing

Two video input signals on the left deliver their signal first to an Audio Deembedder (for extraction of all contained audio channels) and then to the Synchronizer. After that, these input signals can be routed through one of up to two converter paths (second converter is available depending on option code OC_5840_UPXD2).

Each of the 4 independent SDI outputs can be connected to one of the two converters or to one of the two direct input signals. Each SDI output has its own independent video processing and audio embedding stage. Each SDI output can be delayed independently.

Further details can be found in the following sections.

Audio Routing

All 8 AES channels are deembedded from each SDI input. In addition, up to 8 external AES inputs can be used. This makes a total of up to 24 AES inputs that can be processed and then assigned to any one of the outputs (4 SDI embedders and up to 8 external AES outputs).

Further details can be found in the following sections.

NOTE: *there are a total of 8 external AES ports. Each of the port can be configured to be an input or an output port. See page 63.*

flexGUI path highlighting and signal patching

The flexGUI shows all current signal connections as lines (i.e. it does not show any signal lines that are actually unused dead ends). Hovering the mouse pointer over any such signal line will highlight the complete signal path that leads to this point. This illustrates clearly where the particular signal is coming from. Similarly, the downstream path is highlighted to show where this signal is going to.

To re-connect a signal (change the routing) you can think of a signal line as a patch-cable that has to be connected to the desired source. Hovering the mouse-pointer over a flexible signal will show a handle. Grab the handle (click-and-hold) with the left mouse button and drag-and-drop it to the new desired source. More details are shown below.

Reference Source Selection

The complete P VD 5840 processing clock is derived from one single Reference signal. This reference signal can be derived either from a digital source (SDI Input 1 or 2) or from an Analog REF signal (Figure 18). If the REF Source type is set to Analog, then a second switch (Figure 19) selects between the BNC connector on the module's local Backpanel and the Rack-Reference (distributed to all slot-positions in the RackFrame).

NOTE: *selecting a digital reference from an SDI input is useful for applications where the P VD 5840 is used as a video delay line.*

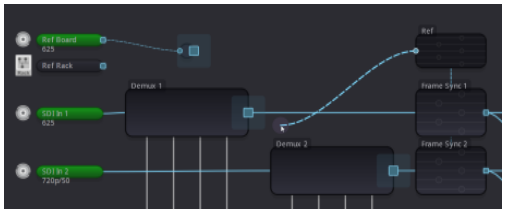

Figure 18: Selecting Digital vs. Analog Reference mode

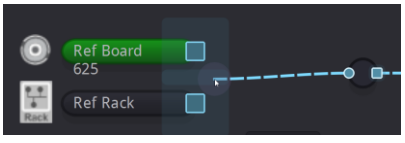

Figure 19: Selecting Analog REF Source

Frequency Pre-select

This is where the frame synchronizer output frequency (or frame rate) is selected. This can be fixed into a frame rate which will never change to maintain this constant output frame rate at all times regardless of the connected reference signal, or any disturbance to the connected reference signal. This will prevent the output frame rate and format automatically "tracking" the connected reference standard should this change. The output video signal will maintain the fixed to the video frame rate but the video will be disturbed if the input reference signal changes.

It is also possible for the synchronizer to configure the output frame rate based upon the connected reference. This is the default setting for the module. Possible settings are:

- Even (24, 25, 30 or 50 Hz)
- Odd (23,98, 29,97 or 59,94 Hz)
- Follow (last) reference *(default)*

NOTE: *The synchronizer is supplied from the factory with the last stored reference as 50Hz. With no reference connected, it is possible to change the last stored reference to something else. Simply select the desired fixed frequency and then re-select "follow last reference". Now the module will use this new setting through a power cycle. This value will not be restored to 50Hz following a "Restore Factory Defaults" operation. Instead, the stored setting is preserved.*

SDI Synchronization

For each SDI input, one of three different modes of video synchronization can be selected

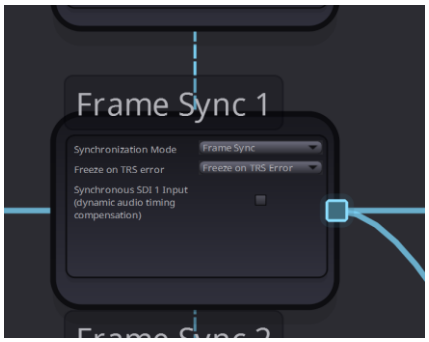

Figure 20: GUI Framesync

Frame Sync This is the default mode. In this mode, an internal video buffer always holds one complete frame of video. This complete frame of video can be used for repeated delivery to the output (frame-repeat) in case of an underflow of input data (framesync roll-over). Optionally, the last good input frame can also be repeated to the output in case of TRS errors in the input signal.

As a consequence of holding one full frame of video at all times, this mode requires an absolute minimum of 1 frame of total processing time (input to output). Additional total proc.time is added by several other factors.

Line Sync (H) This mode is only applicable for synchronous input signals. It can be used to achieve minimum total proc.time. The input signal is buffered for 1 line to correct timing differences within 1 line. The absolute minimum total proc.time is 1.5 lines. The output signal is aligned to the next possible H-pulse from the Reference.

Line Sync (V) In this mode, the video input will also be stored in a video buffer. After this minimum proc.time has passed by, the output of the same video frame from the buffer starts at the next available V-pulse from the reference. The total proc.time equals the offset between SDI and REF. A minimum processing time of approx. 1.5 lines applies.

NOTE: *Both Line Sync modes can be applied to synchronous input signals only. I.e. they must not be applied to an input signal that is (potentially) not genlocked to the REF input.*

NOTE: *In both of the Line Sync modes, the video converter paths can NOT be used. If a converter path is to be used, the associdated input path has to be configured to "Frame Sync" mode.*

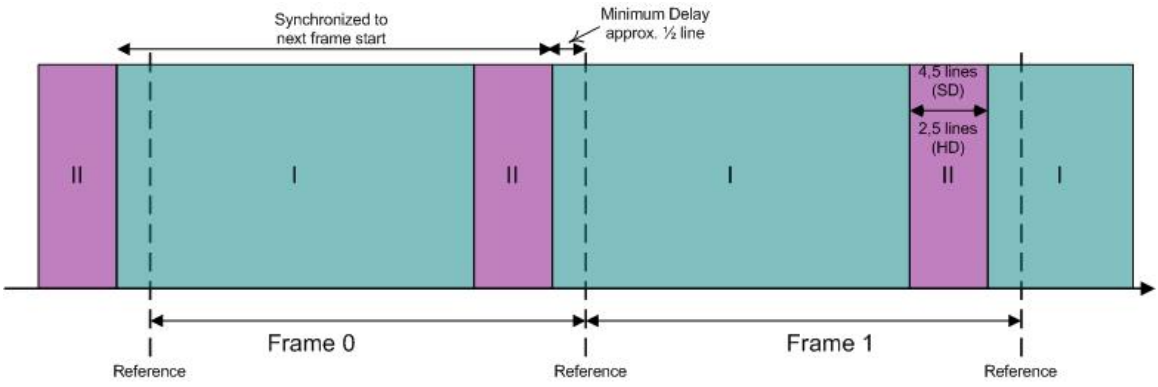

Figure 21: input timing windows

For distortion free switching in front of the P VD 5840, e.g. in a router, all signals have to be in area “I” or all signals in area “II”.

Area “II” is a window for line synchronization of 2.5 lines (HD) and 4.5 lines (SD).

Area “I” is an extension of the standard line synchronization to allow for “infinite” line synchronization. As this extended functionality is buffered differently, distortion free switching is only possible within these two areas.

To adjust the timing of video signals relative to the reference to avoid larger delays the video output delay function can be used (see page 55). This shifts the video signal into the required area. This adds the manually adjusted delay, but avoids the additional frame delay, e.g. if a signal is in the area of the minimum delay.

Freeze Mode

This is where the reaction of the synchronizer is defined in the case of excessive video errors (TRS Errors). The output can be configured to freeze (“Freeze on TRS Error”) or pass the input signal transparently when excessive errors are encountered. If configured to pass video transparently (“Transparent”) then all video content errors and disturbances are passed from the input to the output. The TRS (“Timing Reference Signal”, aka “sync framing”) is, however, always restored correctly on the output.

NOTE: *The synchronizer is very robust in its ability to handle poor quality input signals but there may be occasions where excessive errors cannot be recovered by the synchronizer. This is generally qualified by TRS errors. TRS means “Timing Reference Signals” and is a sequence of digital values embedded in the SDI data streams. If the frame synchronizer cannot recover these errors, then the channel will freeze the video until the errors can be recovered. One function of the synchronizer is to repair any bad TRS values ensuring a stable and technically correct video stream is delivered on the outputs.*

Synchronous SDI Input (minimum audio delay)

The checkbox for “Synchronous SDI Input” should be activated ONLY when the SDI input is really synchronous to the REF (no frequency differences, or “wandering” over time).

If activated the embedded audio to video delay at the output is always minimal. This is achieved by automatically compensating any delay offset between input and REF in the audio path. If this function is activated on a non-synchronous input signal (i.e. where that offset changes over time), then the automatic timing compensation in the audio path would constantly be re-adjusted. This would result in audible disturbances.

SDI Input select (BNC/Fiber)

(this applies to the optical product variants DO/UO only)

The SDI input signal for each channel can be selected from two physical inputs, either the electrical BNC or the optional fiber connector, see Figure 22.

In either case, if a valid SDI signal is detected, the format indicated and the input symbol is shown in green color.

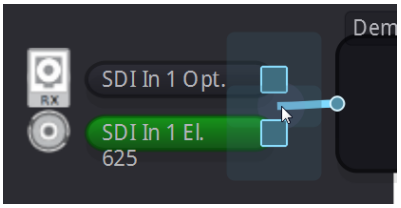

Figure 22: Optical vs. Electrical SDI

Scaler Control

One high-quality up/down/cross converter is pre-installed in the basic unit. For a second such converter path the OC_5840_UPXD2 option is has to be activated. The following description applies to both converter paths (they are functionally identical)

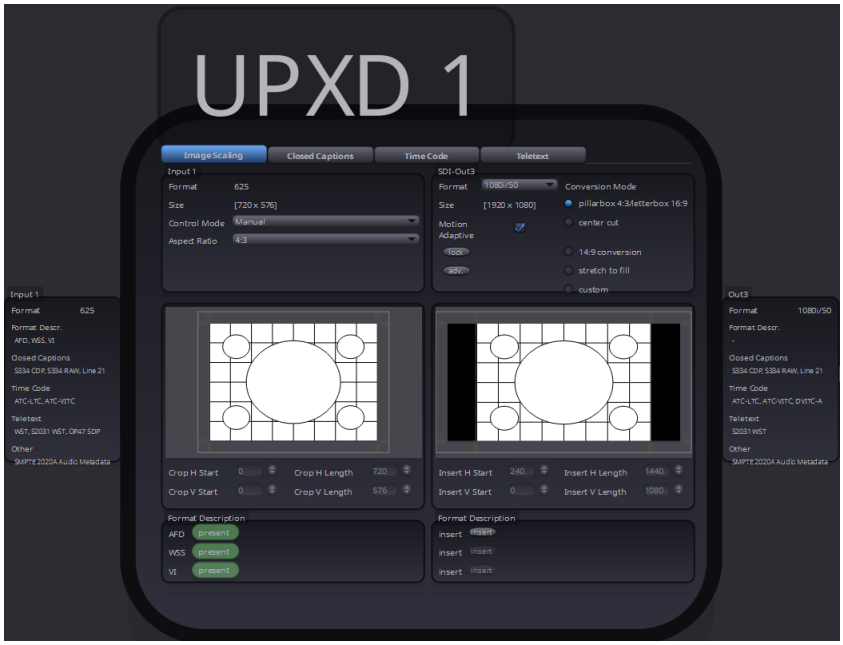

Figure 23: Converter Control

Please note that the Converter takes a sequence of input images from the input memory buffers and generates a sequence of new output images for the device playout buffers. The active (visible) image content is calculated pixel by pixel, based on input pixel data from multiple horizontal and vertical neighboring pixels (applying spatial digital filtering), as well as pixels from previous and next input images (motion compensated processing).

As mentioned earlier, an input stream can only be processed in a Converter if that input stream is processed in “Framesync” mode. This is because only in Framesync mode is the input image data available as one or more complete frames of SDI in a memory buffer (this is not the case with any of the LineSync Modes).

The active image data is constructed from input image data and filled into the active picture area of the output image. Similarly, all the metadata has to be copied from the HANC or VANC space of the input image to the appropriate place in the output image. In some cases (i.e. where the input ANC data format is not supported in the output picture, e.g. after an upscaling process), this involves a conversion of the ANC metadata contents.

For metadata such as CloseCaptions, TimeCode and Teletext contents, this process of conversion of metadata can be influenced manually, if this should be desired. See the next sections for details.

NOTE: *Embedded audio content (as a special form of ANC data) is not processed in this context. Instead, embedded audio is handled by the explicit audio routing infrastructure. See page 57.*

Image Input Control

Control Mode

The input aspect ratio and other settings can either be specified manually (default), or they can be derived from one of the supported standard format description indications: (AFD, WSS or VI)

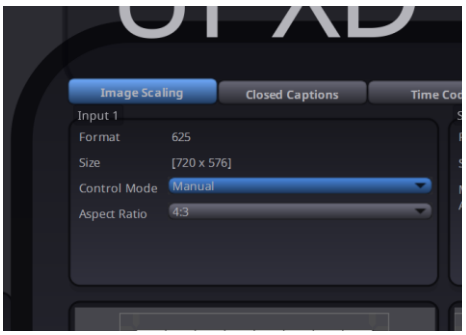

Figure 24: Converter Input Control

Input Aspect Ratio

For SDTV input signaly, the source aspect ratio can be set to 4:3 or 16:9. This setting can be derived from AFD, WSS or VI, see above.

Image Output Control

Output Format

With this selection you can specify the output video format. The available selections are qualified by the frequency pre-selection (see page 37) and the attached reference signal.

For SDTV output formats the aspect ratio is also part of the selection. This choice influences the aspect ratio operation mode (see below) and also the value of the inserted WSS, AFD, VI code, if applicable.

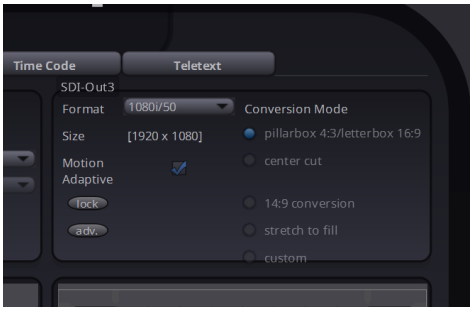

Figure 25: Converter Output Control

Conversion Mode

The Aspect Ratio Converter provides three different modes for any of the possible aspect ratio conversion operations. See page 13 for further details.

Inserted Format Description

With the three checkboxes provided you can select what type of format description will be inserted into the video signal as metadata. This information is created depending on the settings of the converters. If there was already metadata of this type inserted it will be overwritten (if the related checkbox is selected).

NOTE: *If none of the checkboxes are selected, then no format description data will be inserted into the newly generated output image.*

Motion Adaptive Filtering

The check box “motion adaptive” filtering is used to improve picture quality for moving images and reduces motion blur, and should be selected for normal use. For still images and conversion from progressive to progressive standards the checkbox should be switched off.

Input Cropping

With these controls it’s possible to crop the input image which will be used for conversion (cropping will appear on the converted image output). To use this function the “advanced settings” (“adv.”) checkbox has to be activated.

Output Sizing/Positioning

With these controls the size and positioning of the output image can be set. Any remaining parts of the resulting image which have no content will be filled with black. To use this function the “advanced settings” (“adv.”) checkbox has to be activated.

NOTE: *It is also possible to manually drag the input and output cropping extremities using the mouse pointer on the GUI. Simply position the mouse over the green line you wish to move, click and drag the line to the desired point on the image.*

NOTE: *If a non-standard setting is used, the Conversion setting will jump to “custom”*

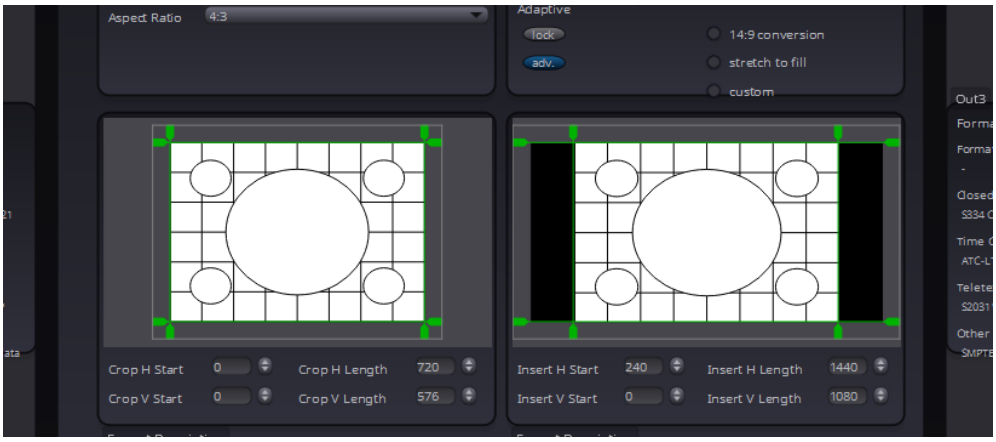

Figure 26: Input Cropping -> Output Insertion

Closed Captions

Close Caption metadata will be taken over from input to output. A format conversion and transcoding will be applied whenever necessary. This automatic process can be configured manually, if desired

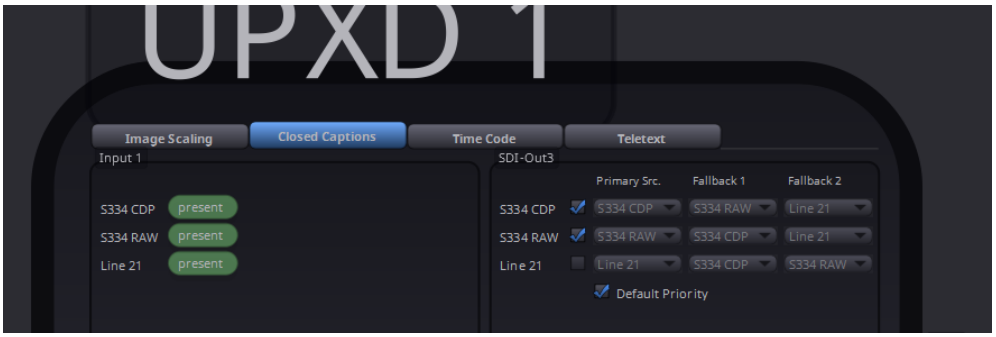

Figure 27: Close Captions Control

Closed Captions Detection

The following standard transport types for CloseCaption data can be detected on the input of the converter:

S334CDP Closed Captions in SMPTE 334 CDP transport packet (containing CEA-708 and/or CEA-608 data)

S334RAW Closed Captions in SMPTE 334 RAW transport packet (containing CEA-608 data)

Line21 Closed Captions in Line 21 (containing CEA-608 data, in 525 video standard only)

If any of these Closed Captions transport packets are detected in the input, this is indicated on the left hand side.

Closed Captions Re- Insertion

Activating the respective checkboxes will re-insert the various transport packets into the converter output SDI stream. For each of the possible formats, the content of the inserted data packages will, by default, be taken from the same format on the inputs side. If that particular format should, however, not be available on the input side, then the source channel selection will fall back to another possible format of CloseCaption data, as indicated in the “Fallback 1” and “Fallback 2” fields.

This pre-defined priority of fallback decisions can be adapted manually after de-activating the “Default Priority” checkbox.

Time Code

TimeCode metadata will be taken over from input to output. A format conversion and transcoding will be applied whenever necessary. This automatic process can be configured manually, if desired

Figure 28: Timecode Control

The following standard transport types for timecode data can be detected on the input of the converter:

ATC-LTC Ancillary Time Code (SMPTE 291M 2008) carrying LTC codeword data.

ATC-VITC Ancillary Time Code (SMPTE 291M 2008) carrying VITC codeword data.

DVITC Digitized Vertical Interval Time Code (SMPTE 266M 2008) *DVITC is only supported in SD-SDI signals (525/625).*

Time Code input detection

ATC-LTC, ATC-VITC and DVITC will be detected if present in the incoming video signal Detected Time Codes are indicated with “present” with green background. For DVITC also the insertion lines are indicated. For DVITC two insertions per video signals are possible, normally the second insertion is a duplicate of the first one.

For ATC-VITC a DVITC line index is shown. This information is part of the ATC-VITC data and indicates the original insertion line of the VITC signal, which should be used if this data is converted back to DVITC

DVITC Reader line selection

For the two DVITC Readers per SDI input signal, the reading line can be specified. Only the specified input lines will be searched for DVITC data. The reading line can be set to “AUTO”. In this case, all possible lines will be searched for DVITC content. It can take a while until the correct line is identified.

Time Code output insertion:

Activating the respective checkboxes will re-insert the various transport packets into the converter output SDI stream. For each of the possible formats, the content of the inserted data packages will, by default, be taken from the same format on the inputs side. If that particular format should, however, not be available on the input side, then the source channel selection will fall back to another possible format of TimeCode data, as indicated in the “Fallback 1” and “Fallback 2” fields.

This pre-defined priority of fallback decisions can be adapted manually after de-activating the “Default Priority” checkbox.

DVITC Inserter line selection

DVITC can be inserted in two different lines (Inserter A and B) of the output SDI signal with selectable line numbers of the vertical blanking. See table below for standard recommendations.

Table 4 – VITC Line select number (SDTV interfaces only)

(VITC line select number)					525/60		625/50	
					bit b5 = 0	bit b5 = 1	bit b5 = 0	bit b5 = 1
DBB2 bits b4 through b0					VITC on line N	Repeated VITC on line (N+2)	VITC on line N	Repeated VITC on line (N+2)
b4	b3	b2	b1	b0	field 1/field 2 [3]	field 1/field 2	field 1/field 2	field 1/field 2
0	0	1	1	0	—	—	6/319	8/321
0	0	1	1	1	—	—	7/320	9/322
0	1	0	0	0	—	—	8/321	10/323
0	1	0	0	1	—	—	9/322	11/324
0	1	0	1	0	10/273	12/275	10/323	12/325
0	1	0	1	1	11/274	13/276	11/324	13/326
0	1	1	0	0	12/275	14/277	12/325	14/327
0	1	1	0	1	13/276	15/278	13/326	15/328
0	1	1	1	0	14/277	16/279	14/327	16/329
0	1	1	1	1	15/278	17/280	15/328	17/330
1	0	0	0	0	16/279	18/281	16/329	18/331
1	0	0	0	1	17/280	19/282	17/330	19/332
1	0	0	1	0	18/281	20/283	18/331	20/333
1	0	0	1	1	19/282	—	19/332	21/334
1	0	1	0	0	20/283	—	20/333	22/335
1	0	1	0	1	—	—	21/334	—
1	0	1	1	0	—	—	22/335	—

Teletext

Teletext metadata will be taken over from input to output. A format conversion and transcoding will be applied whenever necessary. This automatic process can be configured manually, if desired.

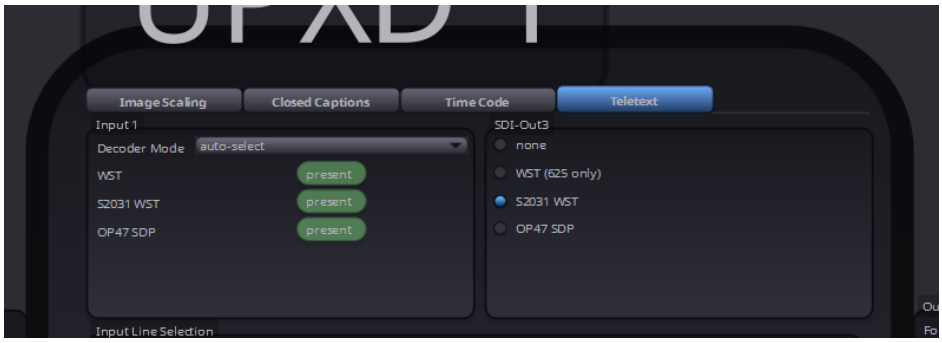

Figure 29: Teletext Control

The following standard transport types for teletext data can be detected on the input of the converter:

WST World System Teletext
This analog information has been designed mainly for PAL TV. In the SDI domain, this is an emulation of analogue teletext for digital TV.
One page of teletext content is encoded in several lines of the VANC. All these lines together, carried in one video frame, make one complete page of teletext. The same group of lines in the next video frame make another page of teletext.
WST is only supported in SD-SDI signals (525/625).

S2031 WST SMPTE 2031 WST: Carriage of DVB/SCTE VBI Data in VANC
This is basically a digital equivalent of WST (see above). Where in WST, the payload of one page of teletext is carried in a group of VANC lines, S2031-WST carries the same amount of data in a group of digital ANC packets. The amount of VANC lines (WST) and ANC packets (S2031-WST) is equal – one ANC packet carries the equivalent of a VANC line. In addition, a S2031-WST ANC packet carries the WST line number that shall be used as a default, when this data should be encoded into WST again.

OP47 SDP Free TV Australia Operational Practice OP- 47
OP-47 is an alternative (yet not compatible) way to store and distribute CloseCaptioning and Subtitling data in the VANC space.

Teletext Decoder

On the input side of the Converter, all of the above formats can be detected simultaneously. Only one of these data streams can be converted to the output. By default, the output will use the identical format from the input. This automatic selection can be overwritten by a manual switch “Decoder Mode”.

Teletext Inserter

Only one of the above Teletext formats can be embedded into the Converter Output. If more than one input source of Teletext data is available, the identical format will be chosen on the input by default. This automatic selection can be overwritten by a manual switch “Decoder Mode”.

The graphical illustration in the lower part of the Teletext window shows the amount of data packets that are involved in the teletext transport. One green box represents one packet of data, where many such packets together in one video frame make up one page of teletext.

If the current format is WST or S2031-WST (on the input or the output), then the appropriate VANC line numbers are shown inside the green boxes. In the case of WST, this number shows the VANC line in which this packet resides. In the case of S2031-WST this number shows the line number that shall be used, when this packet should be transcoded to WST (see description of S2031-WST above).

When the output format is specified as WST (only for SD-SDI outputs), then the VANC line-numbers for insertion of the WST information will be chosen automatically. This automatic selection of output line numbers can be overwritten by setting the “Line Selection Mode” to “Manual”. Now an individual line can be activated or de-activated (blocked) by clicking into the line-box. See Figure 30.

NOTE: *This can be very useful for example if a particular line has to be kept free of WST data (because this would interfere with downstream equipment). Please make sure to activate additional lines until all packets from the source stream have found a destination line.*

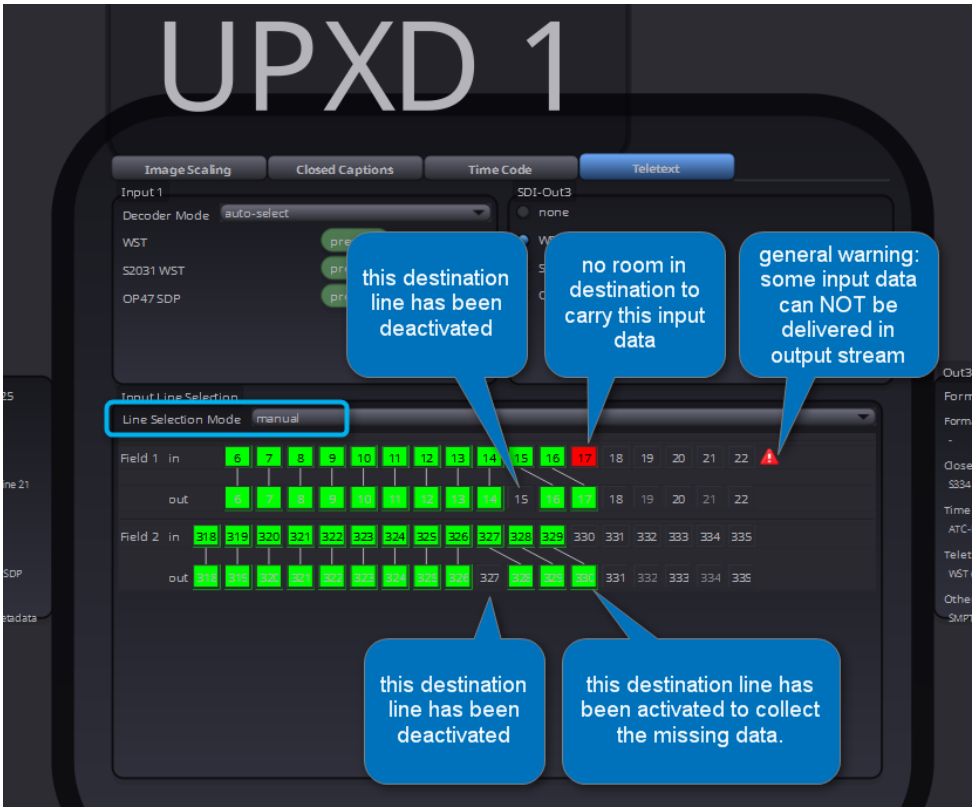

Figure 30: manual control on WST lines

Video Processing

Each SDI output has its own Video Processor. The following description applies to all of the SDI outputs equally (unless otherwise noted).

Figure 31: Video Output Processing

Aperture Correction

Horizontal aperture correction is provided for each output channel, which can be used to sharpen or soften the video signal. (This is sometimes required for down converted video signals as the filtering process rolls off the high frequency very slightly). If adjusted in the positive direction this will increase sharpness, if adjusted in the negative direction this will soften the image.

There is a check box to switch aperture correction ON and OFF. Setting Aperture correction to “OFF” has the same effect as setting in the numerical value to zero.

Output Coupling

Coupling Outputs is a possibility to increase the number of rear-plate connectors per individual output, at the expense of reducing the amount of independent output channels.

All SDI outputs except SDI output 1 can be coupled to other outputs. Coupling an SDI output to another SDI output will automatically set all parameter controls for this output to a read-only state (controls in GUI will be greyed out). The current values of all of these parameters will dynamically be taken over from the reference output.

The following couple-modes can be set up:

- Output 1 can NOT be coupled to any other output.
- Output 2 can be coupled to Output 1

- Output 3 can be coupled to Output 1 or 2
- Output 4 can be coupled to Output 1 or 2 or 3

3G Format

This switch determines what 3G streaming format will be output. There are three selections to choose of:

- Auto The streaming format will be determined automatically
- Level A The output format is forced to 3G Level A
- Level B DL The output format is forced to 3G Level B Dual Link

The 3G output streaming format can be determined for each output individually. This switch only has an effect if the output receives a 3G format.
The SW option OC-PVD5840-3G-LevelB-DL needs to be activated otherwise this switch is greyed out.

Clip CR/Cb Headroom

If activated all Luminance (Y) values below 64 and above 940, and all Chrominance (Cr,CB) values below 64 and above 864 will be clipped.

H and V Blanking

A checkbox selection is provided for H (Horizontal) and V (Vertical) blanking. When selected the video output will have new blanking applied in both of these areas (which will overwrite any information in the vertical and horizontal blanking intervals).

Output if no input

This selection defines the behavior of the respective SDI output signal if no input signal is present on the connected input channel. Choices are:

- Freeze repeat the last good input picture *(see "Freeze Mode" below)*
- Black show a full-field black picture
- Test Pattern show the pre-selected test-pattern *(see "Test Pattern" below)*

Freeze Mode

This selection determines the exact content that shall be delivered on the SDI output, if the signal has to be shown in "freeze" state. there are two possible reasons why an SDI output can go into "freeze": See "Freeze on TRS Error" (page 39) and "Output if no Input" (above). Possible settings are:

- Freeze Field 1
- Freeze Field 2
- Freeze Frame

NOTE: *In a progressive video standard, this selection has no effect.*

Test Pattern Pre-select

A wide range of patterns is provided which can be selected using the drop down selection provided. The pre-selected pattern can explicitly be switched ON (see below). This same pre-selected pattern will be used if the “Output if no Input” mode is set to “Test Pattern” (see above). The following patterns are provided:

- Full field Black
- Full field White
- Full field Yellow
- Full field Cyan
- Full field Green
- Full field Magenta
- Full field Red
- Full field Blue
- 15% Grey (full field)
- 75% Color bars
- 75% Color bars over Red
- Pathological PLL/EQ

Test Pattern Standard

The P VD 5840 can be used a standalone test. In this case, this setting can be used to select the exact video format that shall be generated from the SDI output. By default, the output standard will follow the last input standard. If this setting is modified from its default, it will fall back to the default setting as soon as a regular input standard is connected again.

Otherwise, the selection is limited to those video standards that use the exact same framerate as the reference signal, or half or double that frame rate.

Test Pattern Enable

This checkbox simply switches on the pre-selected test Pattern. When activated, the whole processing box will appear in yellow background color.

Video Adjustments

Four sliders are provided to allow for the adjustment of individual video parameters. Separate sliders are provided for

- Video Brightness (gain)
- Saturation
- Pedestal (Black level)
- Hue

Default (null) settings are 0% (this is the default). Sliders can be quickly returned to the factory null (or transparent) settings by double-clicking onto the slider handle.

Color Correction

A simple primary Color Correction is available as part of each Conversion Path. The transmission function for the R, G and B channel can be adjusted as “Gain & Offset”. Alternatively, the function can be modified to a “Peak & Black” behavior.

The GUI sliders for modification of R, G, and B values can optionally be “ganged”, so that they can be operated as a connected group of sliders.

Settings all sliders to value zero sets the transmission function to neutral, which equals “no color correction applied”.

Figure 32: Color Correction

Noise Reduction

The adaptive noise reduction function processes the input data in either progressive or interlaced format. Application of noise reduction to noisy interlaced signals can optimize de-interlacer performance.

Different algorithms are provided. Each of them is optimized for a particular type of noise artifacts in the video content. The following sections briefly describe each of them.

General Noise Reduction

General noise reduction comprises of both adaptive 2D and 3D noise reduction. 3D noise reduction corrects for temporal and spatial noise, while 2D noise reduction corrects for spatial noise only. 3D noise reduction is applied to any interlaced or progressive signal with a pixel rate less than or equal to 75Mp/s. 2D noise reduction is applied to any interlaced or progressive signal. The selection of 2D or 3D noise reduction processing is automatically controlled by the firmware in accordance with the video signal being processed.

Block Artifact Reduction

Block Artifact Reduction (BAR) locates and reduces block edges produced by DCT based compression processing. BAR can be applied to any interlaced or progressive input signal.

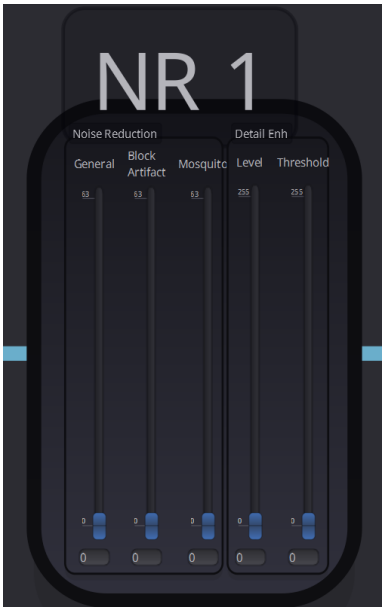

Figure 33: Noise Reduction

Mosquito Noise Reduction

Mosquito Noise Reduction (MNR) dynamically adapts to image content, effectively reducing mosquito artifacts around sharp edges in DCT based compression. It can be applied to any interlaced or progressive signal.

Detail Enhancement (Sharpness and Texture)

The detail enhancement function provides both sharpness and texture enhancement, realized by adaptive horizontal, vertical and diagonal large edge and small edge enhancement processes. Overshoot / undershoot control is provided to minimize ringing on the enhanced edges. In addition, noise rejection is provided to minimize the amount of enhancement applied to the noisy areas of the image.

For ease of use the various internal controls are combined into two separate parameters.

Level This parameter controls the level of the horizontal, vertical and diagonal high pass filtered picture content, which will be added to the original signal. I.e. the gain of the high frequency content in the signal.

Threshold: This parameter controls the level of signal which is passed through for level control, i.e. all amplitudes in the signal below this threshold will not be used for the detail enhancement.

Timing and Delays

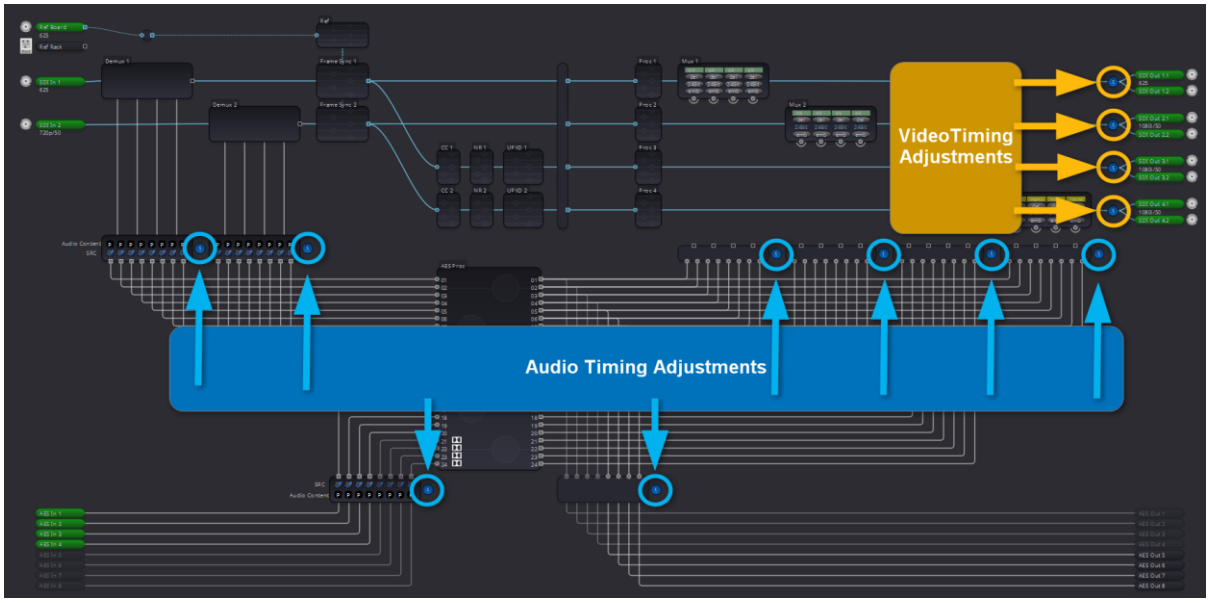

Figure 34: Audio and Video Timing Adjustments

Different internal processing paths for audio and video signals require different internal processing times. Independently from these internal processing delays, a sophisticated algorithm will make sure that all signals that are received on the input will be delivered from the outputs in the exact same relative timing.

As an example, embedded audio streams, which are separated from the video by the audio-deembedder near the input, and which are then routed on internal channels that are independent and separate from the video infrastructure, will be embedded back into the video after they have been timing-adjusted to match the processing delay of the video path.

NOTE all audio processing algorithms in the device require a total processing time of about 3ms. The video processing path, consisting of Synchronizer (compensating the offset between SDI and REF), Framestore (in Framesync mode) and optional video Converter can sum up to a total processing delay of multiple video frames. Consequently, the audio paths which lead to the video embedders contain an internal compensation delay of the equivalent amount of milliseconds, so that the embedder joins video and audio signals in perfect lip-sync relationship.

Video Timing Adjustments

By default, all video outputs deliver their SDI stream with a correct H/V alignment to the REF signal. A manual additional User Delay can be applied to each SDI output, offering an additional delay of up to a maximum of 12 additional video frames. This manual user video delay is adjustable in one of two dimensions:

- User Delay in Frames, Lines, Pixels.
  The equivalent amount of Milliseconds will be calculated (depending on the current video standard) and displayed as read-only value.
- User Delay in Milliseconds.
  The equivalent amount of Frames, Lines and Pixels will be calculated (depending on the current video standard) and displayed as read-only values.

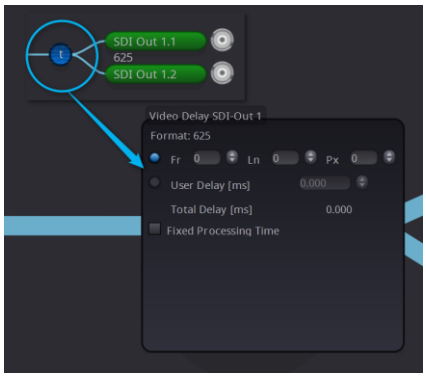

Figure 35: Video Output Delay

When the current video standard changes (e.g. because a different source signal is detected at the input), then the manual delay settings in the current dimensions are kept constant, while the corresponding other dimension might change their current values (depending on the current video standard).

NOTE: *The adjustable delay applied is in addition to the internal processing delay of the module. Please refer to the tables provided in the "Fixed Video Processing Delays" section (page 16) for more information on internal processing delays.*

NOTE: *Adjusting the Video Output delay always delays embedded audio contents together with the video content. It is NOT possible to influence the relative timing between audio and video contents with these controls. Relative audio-video timing (aka lip-sync) can only be influenced while audio and video are still kept on independent paths. See "*

Audio Timing Adjustments" below.

Fixed Video Processing Time

Activating the “Fixed Processing Time” per SDI Output forces the total delay to a relative long minimum delay value. This is, in fact, the worst-case total delay for any video path, independent of e.g. the video conversion mode. Activating the “Fixed Processing Time” on one or more SDI outputs guarantees constant and equal output timing on these channels, even under varying conditions such as a change of input format (which would otherwise potentially change the processing time of the video conversion) and other influences.

Audio Timing Adjustments

Audio signals are processed as fast as possible. The minimum processing delay across the complete internal infrastructure is approx.. 3ms. When an individual audio signal is embedded into any of the SDI output streams, then the audio content is implicitly delayed by the appropriate amount of time, so that the relative timing (lip-sync) between the affected audio and video content on the input is replicated on the output.

Additional User Audio Delay can be applied to any internal audio stream. This can be used to correct for mismatched relative audio timing (lip-sync), e.g. by delaying an early-audio signal by the appropriate amount of milliseconds (i.e. when video is later than audio). Such user delay will simply be added to the internal audio delay.

Even a late-audio situation (when video is earlier than audio) can be corrected by entering negative values as user audio delay. These negative values will then be subtracted from the internal audio compensation delay.

Input vs. Output Delay

User Audio Delay values can be manipulated in the context of Audio Inputs (next to the Audio Inputs on the left side of the GUI) as well as the Audio Outputs (audio destinations on right side of GUI). Technically, there is no difference between these two locations. Internally, both values will be added up, and the resulting total delay will be applied (i.e. it makes no difference if a signal is delayed in the context of the input or the output, or even both).

The main difference is the presence of the audio crossbar between those two locations. The general recommendation is to correct for input-related timing problems with the controls that are located at the inputs. And output-related timing adjustments (e.g. compensating for a problem downstream) shall be corrected with the output-related controls. Following this rule will make it easy to operate the audio crossbars later, without having to re-adjust the timing compensation afterwards.

AES Output Tracking Delay

All audio content is automatically delayed to match the video processing delay, before the audio content is actually embedded into the SDI stream. This is called automatic tracking delay. Each internal audio path is automatically tracked to the corresponding SDI signal.

For external AES outputs, no such tracking is done by default. As a result, if the same audio source stream is simultaneously delivered to an external AES output as well as to an embedder, the AES output signal will appear much earlier than the embedded content.

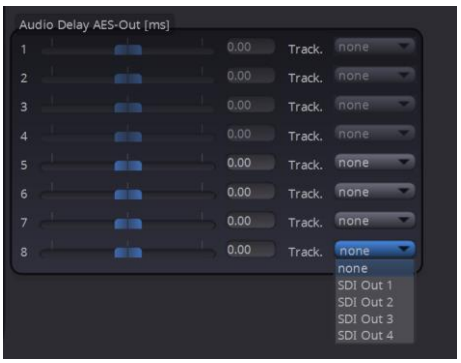

Figure 36: AES Output tracking delay

AES Output Tracking offers the ability to manually specify a timing-dependency between an individual AES output and one of the SDI outputs. If enabled, the AES

output will deliver the audio content with the exact timing as if that same audio content would have been embedded into the specified SDI output.

Timing Tab

The Timing Tab provides an overview of the video and audio delays in relation to each other. The displayed delays are displayed:

- Processing Delay
- Auto Compensation Delay
- User Delays
- Total Delay

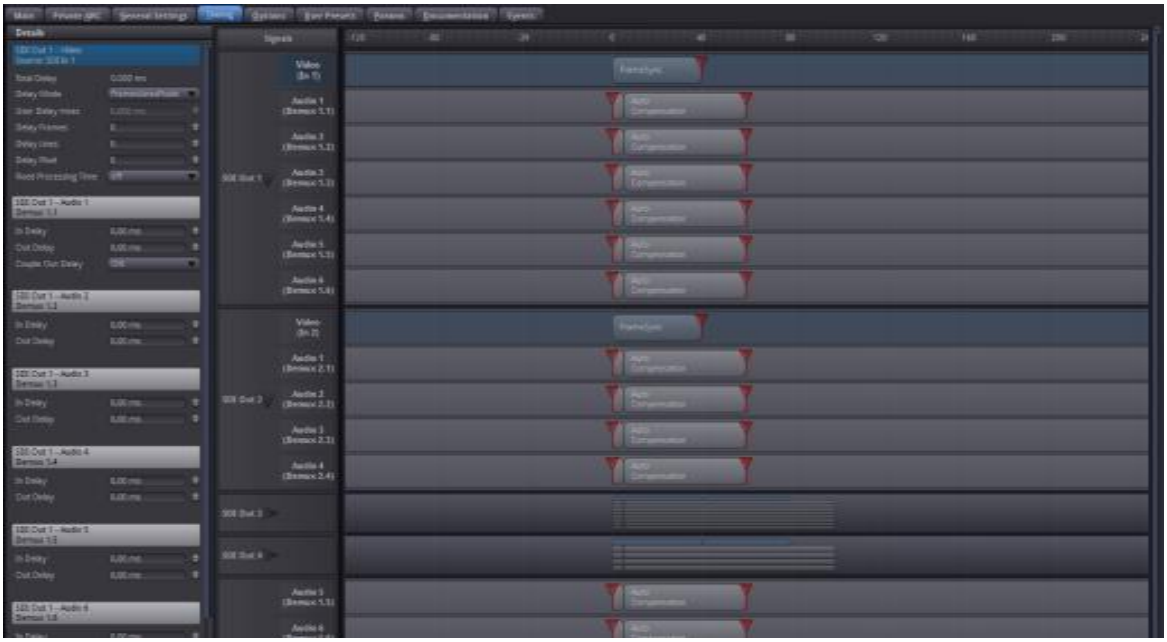

Figure 37: Timing Tab

In addition to providing a complete overview of the timing, the timing tab can be used to setup all timing related configurations.

Audio Infastructure

The complete audio payload of 8 AES per SDI is deembedded from each SDI input stream. In addition, up to 8 external AES inputs can be applied to the module. All of these AES streams are supplied to the internal audio infrastructure.

Phase Aligned Deembedding

The SDI Audio Deembedder deembedds all of the contained Audio Groups (up to four Groups) simultaneously. When the deembedder detects a new SDI stream (e.g. after connecting the signal or after a change of video standard), then the deembedding process starts for all groups, and all groups will be deembedded with correct phase alignment between all channels.

There is, however, a particular situation in which a phase aligned deembedding across all deembedded groups is NOT guaranteed by default: Consider the following scenario:

1. SDI contains audio groups 1 and 2 (audio groups 3 and 4 are not present in the SDI stream). Both groups are deembedded with a correct phase aligment between all of their AES streams, as explained above.
2. While SDI stream is being received without interruption, audio group 3 is added by the upstream embedder. I.e. the HANC content is re-arranged dynamically, and another additional audio group appears, which has not been present initially.
3. The SDI Audio Deembedder will start to de-embed the content of the additional group and deliver the AES content, as usual. The content of new group 3, however, is not guaranteed to be phase-aligned with the content of groups 1 and 2 (which had been there before already).

I.e. if the content of the HANC space is re-arranged to accommodate for an additional audio group while other audio groups remain present, the additional groups are, by default, not guaranteed to be deembedded phase-aligned to the previous content.

Such phase-aligned deembedding can optionally be guaranteed, even in the above case. This can be achieved by enabling the Parameter “DeembPhaseSync1” (SDI1) resp. “DeembPhaseSync2” (SDI2) can be enabled on the “Params” tab (page 67). As a consequence, all deembedding will be re-initialized on a re-arrangement of the HANC content. In the above scenario, there would be an audible disturbance in the contents of groups 1 and 2 when group 3 appears in the HANC.

NOTE: *The Params-Tab contains another pair or parameters with similar names: “DeembPhaseSyncVerify*”. These are ON by default and they guarantee phase alignment within a stereo-pair. This is not the same as guaranteeing phase alignment across groups, as explained above.*

Audio Content Detection

For every input AES channel, the content type is automatically detected and displayed in the APPolo GUI by a single upper-case Letter. The following indications are supported:

P PCM stream (transparent stereo)

E DolbyE encoded stream

D Other encoded data (e.g. AC-3)

<none> If no letter is displayed at all, then this AES channel does not currently carry any data.

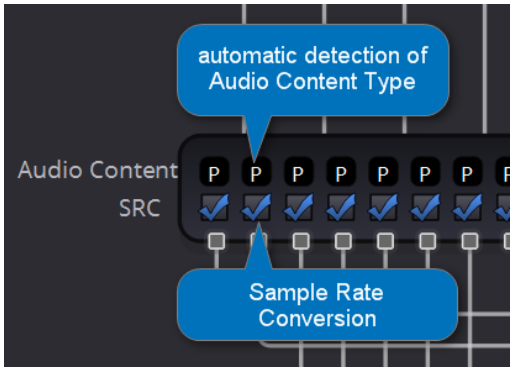

Figure 38: Content Detection and SRC

NOTE: *Automatic Content Detection can be overwritten by manual decision (click onto the box with the letter 'P'). This is, however, only recommended for testing purposes. I.e. in order to achieve best possible signal integrity, it is strongly recommended to leave the Content Detection algorithm in "automatic" mode.*

Sample Rate Conversion

A Sample Rate Converter (SRC) is provided per each AES input stream. The SRC will re-sample the input to a 48kHz samping rate as derived from the current REF source. SRCs are enabled by default (checkbox in APPolo GUI is set to active). If the content type has been detected as anything but PCM (letter 'P', see above), then the SRC operation will automatically be bypassed. I.e. it is NOT possibile to destroy an encoded bitstream (such as DolbyE or AC-3) by accidentally leaving the SRC activated.

NOTE: *If the input AES stream is already sampled at 48kHz, but if that sampling rate has not been genlocked to the same REF, then the use of the built-in SRC's is mandatory to achieve the correct sampling structure for the internal processing.*

Audio Processing

The Audio Processing block provides access to the detailed audio processing functionality. The following functions are available per mono-channel.

Gain Adjustment	[-66.3dB … +18dB]
Phase Inversion	[on / off]
Mute	[on / off]
Mono Downmix	per output mono-channel: enable the addition of the other (sibling) mono-channel as a simple (a+b)/2 downmix.
Overlevel Detection	a yellow warning indication will be displayed, if the signal content reaches the potential digital clipping (code values reach 0xFFF).

Silence Detection	a yellow warning indication will be displayed if the signal content is detected as silent (<60dB) for more than 10 sec)
Test Tone	A 1000 Hz Test Tone can be generated and applied to both mono channels at the same time. If enabled, the AES input stream is ignored and NOT delivered at the output.

NOTE: *all AES processing is automatically disabled (neutralized) when the content type is NOT PCM audio. This guarantees that an encoded bitstream (such as DolbyE or AC-3) is not disturbed by such processing.*

Figure 39: AES processing

DolbyE

The P VD 5840 provides automatic processing and correct synchronization of DolbyE encoded AES streams. As mentioned above, DolbyE contents can be detected as such. For DolbyE streams, all AES processing (such as SRC, gain/phase adjustment etc.) is disabled.

It is recommended to route DolbyE encoded streams through one of the internal AES paths no. 21 through 24. For regular PCM contents, these paths provide the exact same capabilities as all the other audio paths. For DolbyE contents, however, these paths provide two additional processing capabilities:

DolbyE Frame-Synchronization: Similar to a Video-framesync, the DolbyE framesync drops or repeats a complete DolbyE frame at the point of roll-over (i.e. when the incoming asynchronous data would lead to a buffer overflow/underflow). The repeating / dropping of frames happens at the exact same moment for DolbyE audio frames as for video frames. This guarantees correct lip-sync even if DolbyE content is processed independently from the SDI path.

DolbyE Guardband Alignment: The AES path delay for DolbyE encoded streams will make sure that the DolbyE bitstream is embedded into an SDI stream with correct timing alignment of the Dolby Guardband.

DolbyE Guardband alignment can only be achieved for one SDI embedder per internal audio path. I.e. if one internal audio path carries a DolbyE stream, and if this DolbyE stream is embedded into more than one SDI output, then the Guardband Alignment is adjusted for that one SDI stream that had been connected first. The DolbyE Guardband Alignment can then potentially be inaccurate for the other SDI output. In this case, the input crossbar should be used to route that one DolbyE stream over two independent internal audio streams. Each of these internal audio streams can then achieve the correct Guardband Alignment for its own SDI embedder.

NOTE: *see here for more information on DolbyE Guardband Alignment: http://www.dolby.com/us/en/technologies/dolby-e-preferred-alignment.html*

NOTE: *Internal Parameters AudioDolbyETiming* can be used to take manual influence on the SDI channel that shall control the Guardband Alignment position. See 67 for info on the Parameters-Tab.*

Audio Crossbars

After going through the audio processing stage, each internal audio stream is delivered to the output audio crossbar. Here, each of the possible audio destinations (embedder and external outputs) can select from all of the available signals.

The APPolo Control software offers two different types of audio cross bar controls. The type of control can be determined in the “view” menu of the APPolo Control software.

Matrix Control

With this control mode activated, hovering over the audio crossbars will show a checkered matrix field.

The switching principal is identical to a traditional matrix. Move the mouse pointer to the cross point where the desired input and output cross and press the left mouse button.

The switched cross points are indicated by a blue frame around the cross point

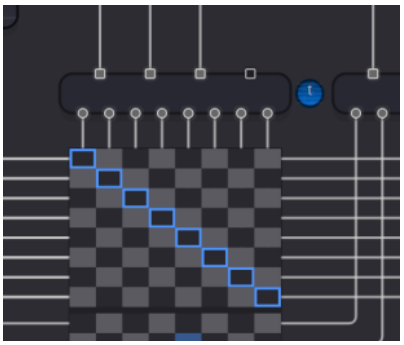

Figure 40: Audio Matrix

To access the mono controls, right click on the desired cross point and select “Show Mono Controls”. The column of the selected cross point will then be shown with left and right selection cross points.

To exit the mono control simply move the mouse outside of the audio cross bar matrix.

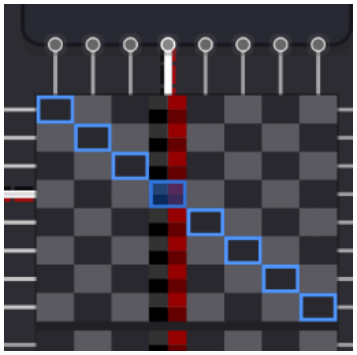

Figure 41: Mono Controls

Drag & Drop

To have this switching mode activated, the entry “Audio Crossbar Matrix” needs to be de-selected.

An output can be connected to a new source by simply clicking onto an existing connection and dragging and connecting the open handle to the desired source signal (Figure 42: Audio Crossbar Operation).

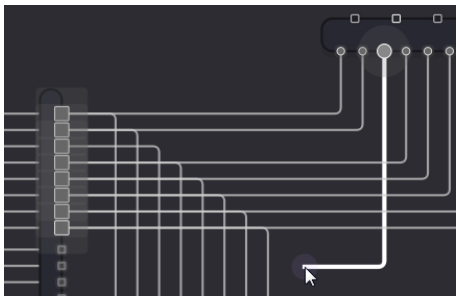

Figure 42: Audio Crossbar Operation

One single white line in this diagram represents a stereo-connection (containing a left and a right channel). If required, the left and right signals can be connected independently (to perform mono-switching).

Access to the individual mono-channels is given by clicking the Right Mouse Button onto a white AES line and then selecting “Show Stereo Channels” from the menu (Figure 43: Audio Mono Crossbar).

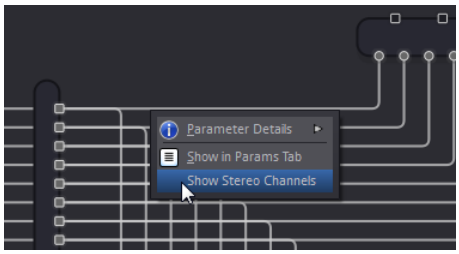

Figure 43: Audio Mono Crossbar

Embedder

All four embedded audio-groups can be (re-) embedded into each of the SDI outputs. An existing embedded group can also be removed from the SDI stream, even without embedding anything. (Re-) embedding a group will implicitly remove this same group from the input SDI stream, if applicable.

An embedded audio-group can only be embedded as a complete group, containing two AES streams. If you want to replace only one out of the two AES streams in the SDI, you need to feed the other AES stream from the Deemedder (on the left) through the audio-processing block and the output crossbar to the Embedder, and re-embed it together with that other (new) AES content into the same group. This will, technically, replace the complete embedded group in the SDI stream.

Embedding audio into an HD-SDI and 3G-SDI stream will always be done in 24bit resolution. When embedding into SD-SDI, 24bit embedding is activated by default, but can be de-activated (reducing the embedding to 20bit). This may be required to satisfy some non-standard-compliant SDI deembedder.

AES Port Setup

The P VD 5840 provides a total of eight external AES ports. Each of these ports can be configured to be an AES input (receiver) or an AES output (source). By default, i.e. when delivered from the factory, AES ports 1 through 4 are configured as AES inputs, while AES ports 5 through 8 are configured as outputs.

This default port configuration can be modified at any time. An explicit un-locking of these configuration switches is required to prevent from accidental changes to these fundamental configuration settings.

A modified AES port configuration will NOT be reset by a “Reset to Factory Default” operation (see page 70).

NOTE: *Please make sure NOT to configure an AES port as an output, while an external signal source might send a signal into that port. This misconfiguration might potentially result in permanent damage of hardware components.*

User Presets

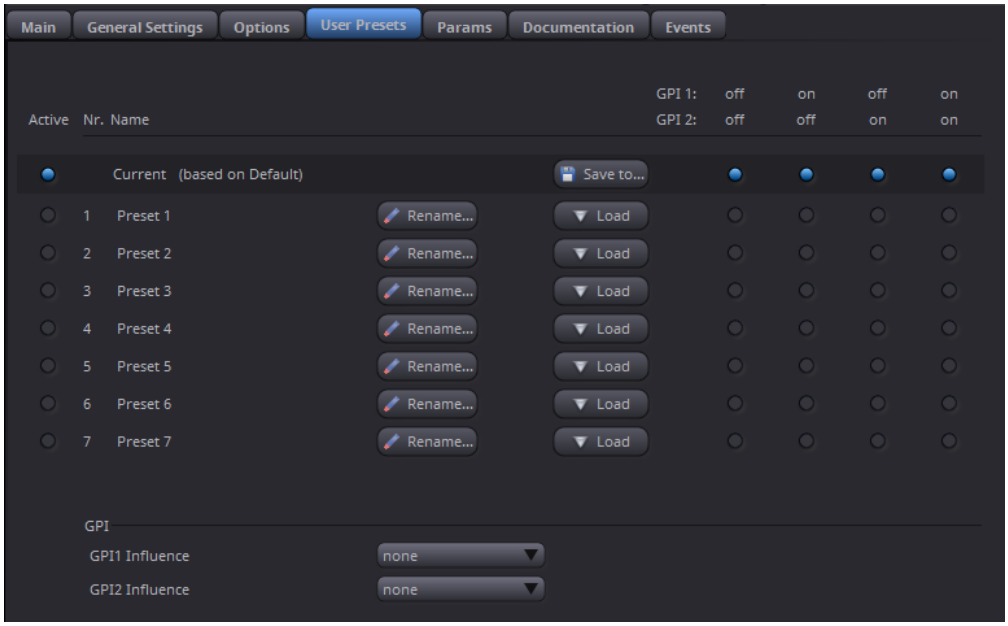

Figure 44: User Presets Tab

The User Presets Tab provides the ability to store and recall seven different sets of User Presets. Each such User Preset contains a current value for all settings (parameters) of the complete device. Restoring a User Preset means to apply these current values to all parameters at once. I.e. it is not possible to restore a User Preset and thereby modify only a subset of the internal parameters.

All User Presets are stored in on-board flash-RAM, where they are preserved even during long periods of no power supply.

Saving a User Preset

The current configuration of the complete device is stored into one of the User Presets by following these steps:

1. On the “User Presets” Tab, click the button “Save To” to open the dialog shown in (Figure 45: Saving a User Preset)
2. Select one of the User Preset slots (click button to the right). Optionally: rename the User Preset. (max 8 characters).
3. Click “Save”

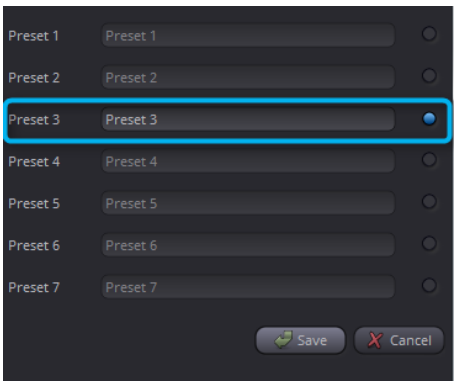

Figure 45: Saving a User Preset

Loading a User Preset

An existing User Preset can be restored into the Current Settings of the complete device by following these steps:

1. On the “User Presets” Tab, click the “Load …” button next to the User Preset.
2. In the next dialog, confirm that this is what you want.

Activating User Presets by GPI

External GPI contacts can be used for quick activation of User Presets by following these steps:

1. In the right columns, specify the required GPI polarities for the User Preset.
2. Set the GPI influence of GPI1 and/or GPI2 to “switch user presets”. The presets are now activated based on the polarity of the GPI inputs.
3. The active Preset is indicated by the highlighted background bar in the respective line.

The current configuration of a Preset can only be modified by the procedure explained above. If one of the stored Presets is activated by GPI, all control parameters for the P VD 5840 are read-only.

NOTE: *Only the complete device configuration can be loaded using User Presets. I.e. it is not possible to restore a User Preset and thereby modify only a subset of the internal parameters. For more fine-grained control to individual parameters by GPI, please refer to LYNX APPolo AutoControl / GPI Control (look at http://appolo.lynx-technik.com)*

GPI Influence

The P VD 5840 has two local GPI contacts that can be used for various functions. The drop-down selections named “GPI Influence” on page “General Settings” can be used to specify their function. By default, the “GPI Influence” is “None” for both GPIs.

The following selections are available:

None	*(default)*
Switch Video inputs	*(only available if the second SDI input is enabled) (only available for GPI1)* All video crossbars are disabled. All SDI outputs are supplied with the same video input signal from either SDI input 1 or 2, following the current status of GPI1
Freeze Input 1 Freeze Input 2 Freeze both inputs	All outputs that are connected to SDI Input 1 will show the same repeated still image while GPI is active.
Switch user presets	(see section “Activating User Presets by **GPI**”, page 65)

Options Tab

This is where the optional functions can be enabled. A textual license code can be entered to unlock the associated functionality. If the module was purchased with Options pre-installed then you will see the option status as green (Active).

If you would like to add any option after delivery, then you will need to purchase the specific license codes from LYNX Technik: Click the “request code” button next to the desired option. Please forward the displayed information with your purchase order to your authorized LYNX dealer or representative. Once you receive the option license string simply type it (or paste it using the windows clipboard) into the area provided and press “activate”.

Activation of an option is confirmed when the option status turns green.

Device Event Tab

The Events Tab is where the module alarming and error notifications are configured for the module. Any of the possible Events that the device can generate can be disabled here, which will declare such Events as irrelevant. Once an Event has been disabled in this Events-Tag, the Event will not be reported to the APPolo control system, it will not be logged in the logfiles, and it will not even influence the local LEDs of the device.

For all Events that are enabled (which is the default): as soon as the monitored condition becomes critical (e.g. input signal lost), the Event becomes ACTIVE. This change of state generates a message in the APPolo Control System. This message is stored in the APPolo Server logfile. Later, when the condition is not critical anymore (e.g. input signal present again), another message is logged in the APPolo Event System, and also saved in the logfile.

Additionally, these messages can be displayed in the APPolo GUI’s Event Log (bottom part of the APPolo GUI, enabled from the “View” menu). This can, however be disabled by removing the checkboxes from the “Log in GUI” columns (separately for “Event becomes Active” and “Event not active anymore” messages.

Similarly, an SNMP trap can be generated from the APPolo Server for any message in the APPolo Event System. Refer to the LYNX Remote Control Guide for more information on SNMP (available from http://appolo.lynx-technik.com)

Parameters

The “Params” tab lists all available control parameters of the complete device. Every switch and function in any other part of the GUI is actually just a graphical control of a parameter listed on this page. There are, however, a number of parameters for more detailed control that are only accessible in this list of parameters on the “Params” tab.

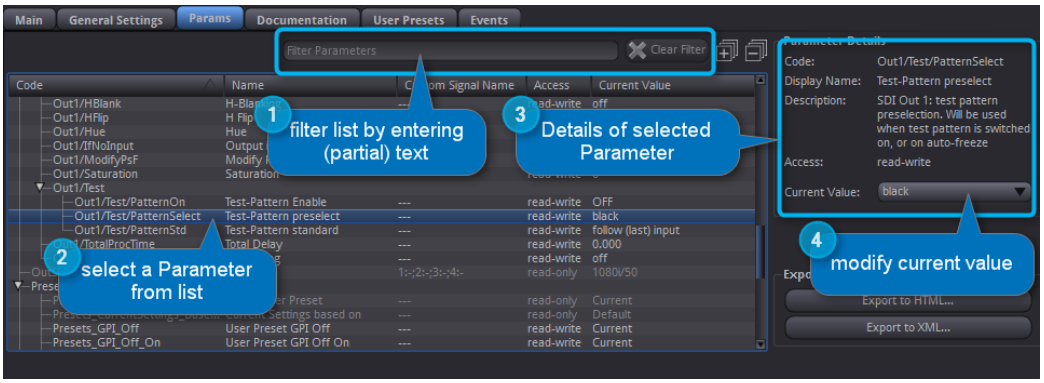

Figure 46: Param Tab

All parameters are defined by the following aspects:

- Code: This is a unique code to identify the parameter. The Code can contain the slash-character ‘/’, to provide some structure to the total collection of parameters. The Parameter Code is always to be specified as the complete text string (i.e. including all slashes).
- Name: a human readable short parameter name, which is used as the default text label in most parts of the GUI, as well as in any CustomControl Panel.
- Access: read-write or read-only accessibility. Note that for some parameters, the accessibility status may potentially change, depending on the current value of other parameters. E.g. the value of parameter A might be controlled automatically by default, so the accessibility of A will be displayed as “read-only”. But a boolean parameter B might be provided to switch off the automatic behavior. So when parameter B is set to MANUAL, then parameter A would dynamically change to “read-write”.
- Current Value: This is the current value of the parameter. If Accessibility is “read-write” (see above), then the Current Value can be modified.
- Description: a textual explanation of the behavior of the individual parameter.

You can use the “Filter” function (located above the actual list of parameters) to show only a subset of the complete list, based on textual filtering. The filter will actually search in any part of the parameter definition, including the parameter code, the textual description and even the Current Value.

NOTE: *In theory, it would be possible to manage and monitor the complete functionality of the P DA 5288 by accessing the relevant parameters on this tab only. All the other tabs in the GUI are only provided to provide better explanations and overview.*

Parameters control everything

As stated in the previous chapter, the complete behavior of any LYNX Device can be controlled and monitored with the parameters listed on the “Params” tab. All other parts of the LYNX APPolo Control System use exactly the same parameters access and control the devices.

- The LYNX CustomControl feature connects the individual elements of a custom-made Design to real device parameters by their Code.
  See http://appolo.lynx-technik.com/ -> CustomControl for details.
- The LYNX AutoControl automation rules access the individual Parameters (for both Conditions and Actions) by their Code.
  See http://appolo.lynx-technik.com/ -> AutoControl for details.
- The LYNX RemoteIF API addresses individual Parameters by Code.
  See http://appolo.lynx-technik.com/ -> RemoteControl for details.

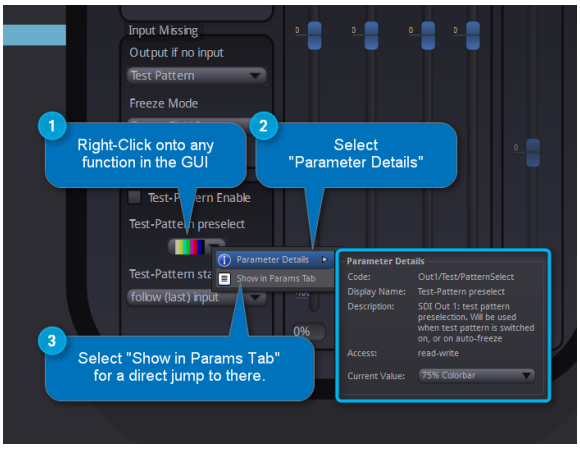

Figure 47: Parameter Details from GUI

- The LYNX SNMP Control provides one OID (numerical address in the MIB) per individual Parameters. The exact mapping of Parameter Code to OID is provided in the MIB files.
  See http://appolo.lynx-technik.com/ -> RemoteControl for details.

Finding the Parameter Code name for a given Parameter in the graphical GUI is made easy by clicking the Right-Mouse-Button onto the graphical control anywhere in the GUI and then selecting the “Parameter Details” option (see Figure 47).

General GUI functions

There are a number of functions and commands of the LYNX APPolo Control System which are common for all LYNX devices.

A click with the Right-Mouse-Button on any module in the DeviceTree will generate the same menu that is available from the “Device” menu. This menu provides the following options:

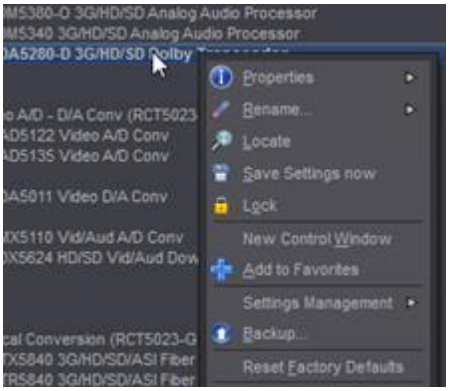

Figure 48: Device Menu from Tree

Device Properties

The first entry in the Device menu opens a sub-menu page which shows device specific properties about the selected module.

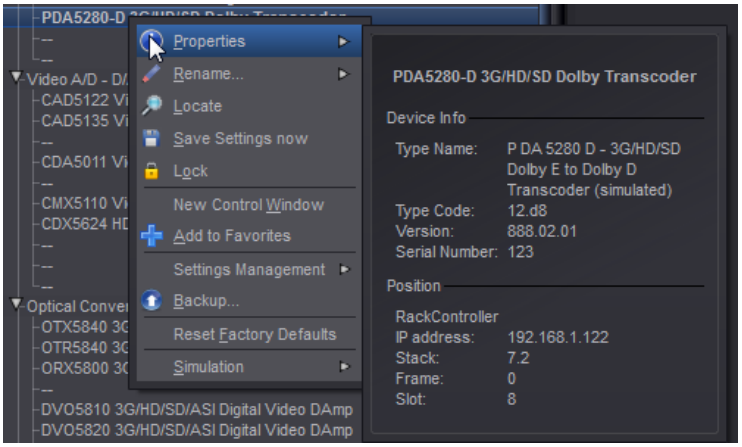

Figure 50: Device Properties Menu

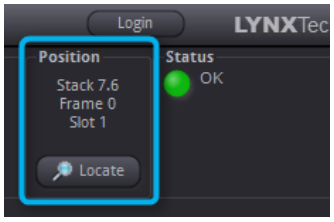

Figure 49: Locate Position

Locate

This function is useful if you need to physically locate a module in a larger system quickly (for removal or maintenance purposes) When Locate selected this will flash the module alarm LED yellow. This function does not impact normal module operation and will timeout after a short time period.

New Control Window

Selecting this option will open up a separate GUI window showing just the controls for the current module. This new window can be used to arrange multiple devices on your desktop or similar.

Rename

It is possible to rename individual items (RackFrames and individual devices) in the APPolo Device Tree. The default name of a device is the LYNX product name. This name can be modified at any time. The original (default) name can be restored by simply removing the custom name from that renaming-field (save this as an empty name).

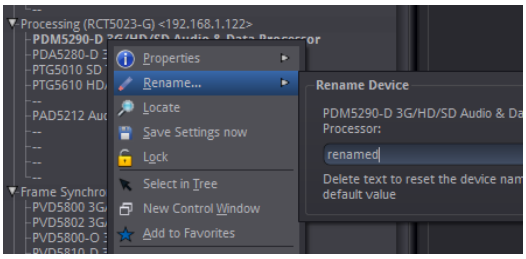

Figure 51: Rename Device

NOTE: *The names are stored inside the flash memory of a LYNX server (if installed) or the hard disk of the connected Computer respectively.*

Save Settings Now

Any modification to any parameter of a device is immediately propagated from the APPolo GUI to the hardware device (card) and made effective. The current settings are saved in a local FlashRAM of the device, so that the device will continue to work in the exact same configuration after a power-cycle. But in order to reduce the number of write-operations on the physical FlashRAM, the actual storage of a modified configuration into the FlashRAM is only executed approximately 10 seconds after the last change to any setting in the whole card. This operation is visualized on the board by all local LEDs flashing three times in yellow color.

Consequently, if you remove a card from a system BEFORE the last changes have been saved to FlashRAM, those last changes will not be available on the next power-up.

The “Save Settings Now” operation in this menu can force the current configuration of this device to be stored to the local FlashRAM now. If in doubt, this function should be executed before a device is physically removed from the system, or before electrical power is shut down.

Lock

Selecting this will lock the device to prevent from any accidental changes being made to the modules settings. The module status can be seen but all the controls will be grayed out. To unlock simply deselect the lock control from the menu.

Reset Factory Defaults

Executing this function will reset all the individual settings of all parameters of the device back to the predefined state that has been defined by the manufacturer. All custom adaptions will be lost. This operation cannot be undone.

Settings Management

The complete current configuration of one device can be copied into an internal “clipboard” and pasted onto a different device of the same type. Alternatively, the complete current configuration can be stored to a local file (as a very simple single-device backup).

Specifications

Video Inputs (BNC)	
Signal Type	Serial digital video SMPTE 292M, 344M, 259M-C, 424 M, 3G Level B Dual Link according to SMPTE ST 425-1 (option)
Input standards	See table on page 8
No. of inputs	2 (second input optional)
Connector	BNC
Impedance	75 Ohm
Cable Equalization	Up to 250m Belden 8281 (270MHz) Up to 140m Belden 1694A (1.485GHz) Up to 80m Belden 1694A (2.97GHz)
Return Loss	> 15 dB (270MHz) > 10dB (1.485GHz)
OPTIONAL: Video Input (Fiber) – P VD 5840 DO/UO	
Signal Type	SMPTE 297M-2006
No. of inputs	2
Connector	LC/PC (single mode transmit/receive – duplex connection)
Wavelength	1260nm – 1620nm
Reference Input	
Signal Type	Analog Bi-level / Tri-level (auto detect) cross lock compatible. Standards see table on page 11
No of inputs	1 x External or internal rack reference (selectable)
Connection	BNC
Impedance	75 Ohm
Video Outputs (BNC)	
Signal Type	Serial digital video SMPTE 292M, 344M, 259M-C, 424 M, 3G Level B Dual Link according to SMPTE ST 425-1 (option)
Output standards	See table on page 10
No. of outputs	4 separate outputs (1 x Out1, 1 x Out 2, 2 x Out3, 2 x Out4) (can be mapped to any available internal resources)
Connector	BNC
Impedance	75 Ohms
Jitter	< 0.2 UI (Timing Jitter); (270MHz) < 0.2 UI (Alignment Jitter); < 1.0 UI (Timing Jitter); (1.485GHz) < 0.3 UI (Alignment Jitter); < 2.0 UI (Timing Jitter); (2.97GHz)
Return Loss	> 15 dB (1.485GHz); 10dB (2.97GHz)
OPTIONAL: Video Outputs (Fiber) – P VD 5840 DO/UO	
Signal Type	SMPTE 297M-2006
No. of outputs	2
Connector	LC/PC (single mode transmit/receive – duplex connection)
Wavelength	Standard: 1310nm (non-CWDM), other wavelengths for CWDM as option
Transmission power	Standard: 1310nm (non-CWDM):-5dBm, other wavelengths for CWDM as option: -1dBm
Video Processing	
Delay adjustment range	Up to 3 frames of programmable delay in pixel / line / frame increments. Independent for all 4 outputs
Minimum delay	Variable, depending on selected functionality and installed options. Please refer to “Fixed Video Delays” table in this manual
Video adjustments	Gain, Saturation, Hue, Black Level, Noise Reduction, Color Correction
Aperture correction	Horizontal only, adjustable for each output channel (3)
Color space conversion	601 > 709 or 709 > 601 or transparent (selectable) **Note.** Requires optional conversion path

AES Audio Inputs / outputs	
Signal	PVD 5840 U/UO = AES3 id un-balanced on Mini DIN connectors P VD 5840 D/DO = AES3 balanced on SubD 25 connector
No. of inputs / outputs	8 x AES ports (each can be configured to be an input or an output)
Coupling	Transformer
Audio Processing	
De-embedder	De-embed all audio (2 x 4 audio groups = 2 x 8 AES)
Audio input matrix	24 x AES audio input crossbar provides channel assignment prior to processing including Sample Rate Converters for all inputs to matrix
Audio pathways	Multiple internal paths: **Pathway 1**= 20 x AES with full audio processing (gain / phase invert / mute / overload and silence detection, mix down) **Pathway 2** = Same as Pathway 1 plus 4 x DolbyE synchronizers
Audio delay	Audio is delayed to match the video delay and will automatically track the frame synchronizer. User adjustment of 0.660 second (in ms) is provided
Audio Embedders	Independent embedders apply 4 audio groups (8 AES) into each SDI output stream. User selectable.
Operating Modes	
Frame Sync	Basic SD / HD / 3GBit/s Multi-rate Frame/Line Synchronizer Other functions (e.g. Up/Down/Cross Conversion) are optional
Control	
Local Controls	Local alphanumeric display with integrated menu system for setting basic module parameters.
Remote Control	Comprehensive remote control and status monitoring supported when used with a LYNX Controller option. The use of the control system is mandated for this module
External GPI	Single GPI input on BNC connector. GPI influence configured in control system.
Electrical Specifications	
Operating Voltage	12 VDC
Power Consumption	34 W max. If using 5 units of type P VD 5840 in one RackFrame, please use optional high power PSU R PS 5810
Safety	IEC 60950/ EN 60950/ VDE 0805
Mechanical	
Size	283mm x 78mm
Weight	CardModule 200g, connector plate 150g
Rack space	Requires 2 slots in rack frame (max 5 modules per RackFrame)
Ambient	
Temperature	5°C to 40°C Maintaining specifications
Humidity	90% Max non condensing

Service

Parts List

Due to the very dense design and high level of integration there the module is not user serviceable. Please contact LYNX for repairs or to request an exchange unit. There is one consumable part used on this module which is the cooling fan. A service kit is available to exchange the fan. Ordering information below.

Part type: **Cooling Fan Service Kit Series 5000 CardModules**

Technical Support

If you are experiencing problems, or have questions please contact your local distributor for further assistance.

Technical support is also available from our website:

http://support.lynx-technik.com/support/home

Please do not return products to LYNX without an RMA. Please contact your authorized dealer or reseller for more details.

More detailed product information and product updates may be available on our web site:

www.lynx-technik.com

Contact Information

Please contact your local distributor; this is your local and fastest method for obtaining support and sales information.

LYNX Technik can be contacted directly using the information below.

Address	LYNX Technik AG Brunnenweg 3 D-64331 Weiterstadt Germany
Website	www.lynx-technik.com
E-Mail	info@lynx-technik.com

LYNX Technik manufactures a complete range of high quality modular products for broadcast and Professional markets, please contact your local representative or visit our web site for more product information.

LYNXTechnik **AG**

Broadcast Television Equipment