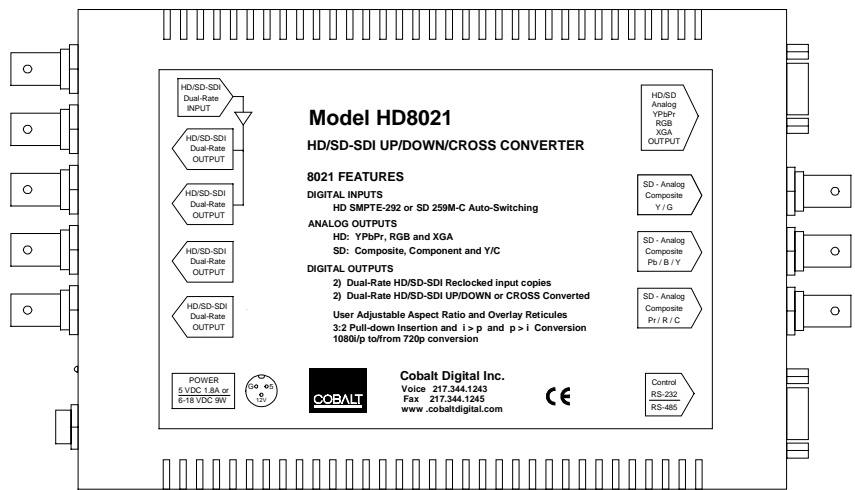




Model HD-8021
Up/Down and Cross
Format Converter



Owner's Manual

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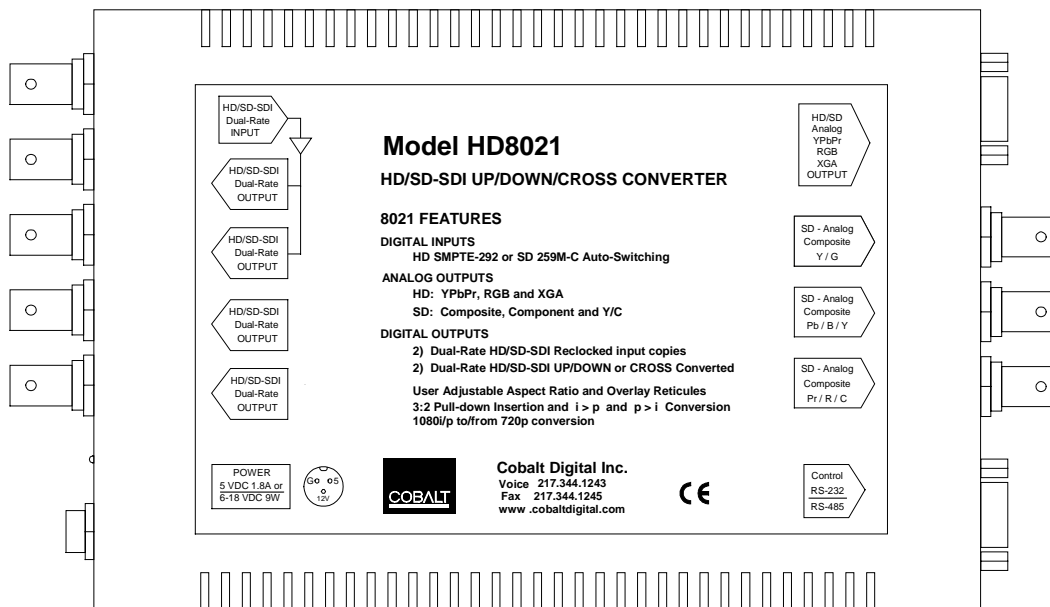
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Overview

The HD-8021 is a high quality 10-bit, Down and Cross Format converter with monitoring grade up-conversion, that bridges SMPTE 292 high definition (HD) and 259M-C standard definition (SD) signal formats.

The 8021 can Upconvert SD, Downconvert HD and Format convert from one HD standard into another and output HD/SD serial digital, HD analog and SD analog video. In addition, the 8021 can re-aspect the image, change i to p, p to i and add 3:2 pull-down. Safe Area reticules, 4x3 and 16x9, full aperture for 4x3 and center cross can be selected on any or all outputs.

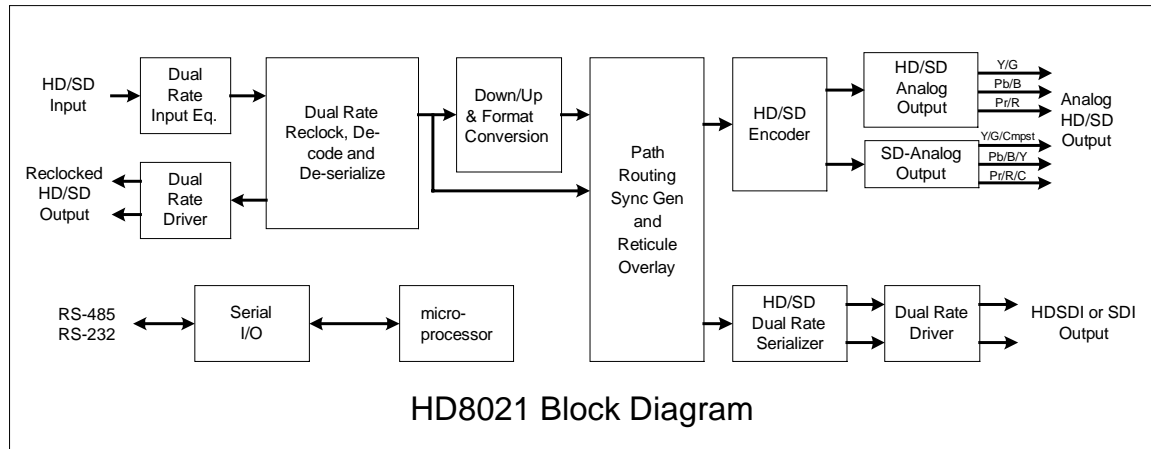
The image processing is full 10-bit using a 24-tap spatial filter. Down conversions of HD to SD signals are de-jittered to reduce chroma phase jitter of SD analog signals. All analog outputs are encoded at 12-bits to preserve the 10-bit video signal.



The input and outputs of the 8021 are the following. One dual-rate HD/SD serial digital input, with a set of reclocked dual-rate serial outputs and a set of imaged processed dual-rate digital outputs. Two sets of analog outputs, the first set is on HD-15 (XGA) connector and can be dual-rate analog HD or SD analog. The second analog output is SD only and is supplied through three BNCs. All analog video outputs are encoded to 12-bits. The HD analog video can be YPbPr or GBR with either embedded tri-level or bi-level signals or H & V sync. The SD analog outputs on the BNC connectors, can be User configured as three composite, or one composite and one Y/C, or component in YPbPr (BetaCam™, MII™ or SMPTE levels) or GBR with embedded sync. The SD output on the HD-15 (XGA) connector, in dual-rate analog mode can be either RGB or YPbPr in BetaCam™, MII™ or SMPTE levels with embedded bi-level sync.

Block Diagram

The 8021 has a very flexible signal flow path and feature set that combines several products into one compact package. To understand the capabilities of the 8021, this section reviews the basic structure of the 8021.



Signal Flow

Starting in the upper left of the block diagram, the dual-rate (HD/SD) serial digital signal is equalized, reclocked and then deserialized. During this process, the video standard and frame rate is determined.

A copy of the reclocked digital serial is sent to a distribution amplifier to create two active and reclocked output loops. Each output is dual-rate and follows the input signal.

Coming out of the deserializer, the parallel video data path goes in two directions. The first is to the conversion engine where it is up, down, format, aspect and/or frame rate converted depending on the signal input and User settings. The second copy of the deserializer goes is to an FPGA who's function is to select which input goes to which output (digital, HD/SD analog) and what overlays are to be applied to individual outputs.

Based on the Users setting of the external configuration dip switches and the type of signal detected at the deserializer, the hardware is automatically configured and the signal processing is sent to the correct output device to the right of the routing chip. Either, the converted signal or the raw signal is sent to the following: HD Digital to analog encoder (HD D/A), SD digital to analog encoder (SD D/A) or dual-rate serializer with or without reticule overlays on any of these paths as preset by the User.

For example, this will allow the User to feed a HD monitor and have SD automatically be converted to HD for that monitor and with the aspect ratio and overlay pattern desired. When an HD signal is present, the preset conditions are set to bypass any conversions and thus the input HD signal is sent to the monitor.

This works well if the monitor is 16x9 as HD input signals are likely to be in 16x9 format, but what if is an HD 4 x 3 monitor? In this case, the 8021 is configured such that the SD signal is in correct aspect, but not the HD. When the SD is sent to the scalar engine, it will be upconverted and kept in 4x3 aspect space. And the HD inputs would also go through the scalar engine, and be aspect changed to letterbox or center cut, depending on the User desired mode.

For a SD output example, you'd have SD signals configured to bypass processing and HD signals downconverted and set to 4x3 aspect ratios. If your monitor were 16x9, the as above, you'd ARC the SD signal to 16x9 space (0.75H) and downconvert HD to SD without aspect correction.

Outputting to an XGA monitor works the same way, but in this case a 4x3 XGA monitor would have SD being upconverted and HD being downconverted with aspect change. For a 16x9 XGA monitor, the SD would be upconverted and aspect changed while the HD would be downconverted.

Should an alternate aspect ratio display be used, for example a 16x10 flat panel, set the user's aspect settings (internal rotary switches) to adjust for the correct aspect ratio for both HD and SD signals.

The user settings can be saved for recall should the 8021 be powered down.

Conversion Capabilities

The 8021 has extensive re-format and up/down conversion capabilities. It can act as an upconverted, downconverter, format (1080-720) converter, aspect ratio converter (ARC), frame rate converter and DVE.

The Format conversions are listed in the chart below.

From	→	To	HD 1080	HD 720	XGA 1024x768	SD		
1080	sF	23.98	i 29.97	sF/p 23.98	---- p 59.94	p 59.94	486 i 29.97	
1080	p	23.98	i 29.97	p/sF 23.98	---- p 59.94	p 59.94	486 i 29.97	
1080	sF	24	i 30	p 24	---- p 60	p 60	----	
1080	p	24	i 30	sF 24	---- p 60	p 60	----	
1080	i	25	i 25	p 25	p 25	p 50	p 50	575 i 25
1080	p	25	i 25	p 25	p 25	p 50	p 50	575 i 25
1080	i	29.97	i 29.97	p 29.97	p 29.97	p 59.94	p 59.94	486 i 29.97
1080	p	29.97	i 29.97	p 29.97	p 29.97	p 59.94	p 59.94	486 i 29.97
1080	i	30	i 30	p 30	p 30	p 60	p 60	----
1080	p	30	i 30	p 30	p 30	p 60	p 60	----
720	p	25	i 25	p 25	p 25	p 50	p 50	575 i 25
720	p	29.97	i 29.97	p 29.97	p 29.97	p 59.94	p 59.94	486 i 29.97
720	p	30	i 30	p 30	p 30	p 60	p 60	----
720	p	50	i 25	p 50	p 25	p 50	p 50	575 i 25
720	p	59.94	i 29.97	p 29.97	p 29.97	p 59.94	p 59.94	486 i 29.97
720	p	60	i 30	p 30	p 30	p 60	p 60	----
486	i	29.97	i 29.97	p 29.97	p 29.97	p 59.94	p 59.94	486 i 29.97
575	i	25	i 25	p 25	p 25	p50	p 50	575 i 25

Notes:

1. All rates translated to effective frame rates, interlaced rates “ i ” are two times the number shown. For example, i 29.97 is 59.94 fields per second (two fields per frame thus the interlaced frame rate is 29.97); but progressive “ p ” 29.97 is 29.97 frames per second.
2. SD active line rates are PAL (575) and NTSC (486).
3. The 8021 cannot accept native 720 p24/23.98 or sF24/23.98, however it can convert those signals if they are delivered inside a 59.94/60 transportation wrapper (as typically done with this format) and processed as 59.94/60.

How to Configure an 8021

At first glance, understanding how to setup an 8021 can be daunting, but it does break down into four basic switch groups. The first bank (S1) sets the conversion mode, the second bank (S2), sets the aspect ratio and digital output rules, the third bank (S3) sets the analog encoder for both SD and HD and the fourth bank (S4) sets the overlay reticules.

8021 Switch Settings: The 8021 auto-detects the input standard and applies the conversion according to the user settings below.

Conversion Mode Switch 1			Aspect Control Switch 2				Analog Output Switch 3			Reticule (Overlay) Switch 4					
1	2	IF SD Input then:	1	2	3	SD Input to SD/HD/XGA	1	2	3	SD Analog configuration	1	2	3	Digital Out Reticules ON/OFF	
ON	OFF	SD Upconvert to 720	ON	ON	ON	No Aspect change	ON	ON	ON	SD Composite 3 Copies	2	SD	Analog Out Reticules ON/OFF	2	SD Analog Out Reticules ON/OFF
OFF	ON	SD Upconvert to 1080	OFF	OFF	ON	0.75 Vert (Letter Box)	ON	OFF	ON	SD Composite & Y/C	3	HD	Analog Out Reticules ON/OFF	3	HD Analog Out Reticules ON/OFF
OFF	OFF	SD Re-aspect to SD	ON	OFF	OFF	1.33 Vert	OFF	ON	ON	SD YPbPr BetaCam **	4	Center	Cross (+) ON/OFF	4	Center Cross (+) ON/OFF
ON	ON	Force to Analog XGA 1024x768	ON	OFF	ON	0.75 H (Pillar Box)	OFF	ON	OFF	SD YPbPr Mill **	5	4x3	Safe Area ON/OFF	5	4x3 Safe Area ON/OFF
			ON	ON	OFF	1.33 H (Center Cut)	OFF	OFF	ON	SD YPbPr SMPTE **	6	4x3	Full Aperture ON/OFF	6	4x3 Full Aperture ON/OFF
			OFF	OFF	OFF	User Aspect Setting	OFF	OFF	OFF	SD GBR **	7	15x9	Safe Area ON/OFF	7	15x9 Safe Area ON/OFF
3	4	5	IF HD Input then:	4	5	6	7	4	5	6	7	8	9	10	
ON	OFF	OFF	HD Downconvert	ON	ON	ON	HD Input to SD/HD/XGA	ON	ON	ON	SD Color ON/OFF	ON	ON	ON	LED STATUS
OFF	ON	OFF	HD Cross-Convert (1080 <-> 720)	OFF	OFF	ON	No Aspect Change	ON	ON	ON	SD Setup ON/OFF-NTSC	ON	ON	ON	Locked and Operating
OFF	OFF	OFF	HD Re-aspect to HD	OFF	OFF	ON	0.75 Vert (Letter Box)	OFF	ON	ON	SD Color Bars (Analog)	OFF	OFF	OFF	No Power
ON	OFF	ON	Force 720 p59.94/60/50	OFF	ON	OFF	1.33 Ver	ON	ON	ON	Force SD to HD-Port *	Blink Slow	Blink Slow	Blink Slow	No Input Signal
ON	ON	ON	Force 1080 i 29.97/30/25	ON	OFF	ON	0.75 H (Pillar Box)	OFF	ON	ON	Oversample mode	Blink Fast	Blink Fast	Blink Fast	Bad signal/mis-configuration
ON	ON	ON	Output Analog XGA 1024x768	ON	ON	OFF	1.33 H (Center Cut)	ON	ON	ON	2X on HD analog				
			OFF	OFF	OFF	User Aspect Setting *	ON	ON	ON	16x on SD analog					
6	7	Video vs. Special Film Modes	8	9	10	HD 10% Underscan	9	10	11	12	13	14	15	16	
OFF	OFF	Video conversions (see below)	OFF	OFF	OFF	Digital Output Selection	OFF	OFF	OFF	HD Analog Output	ON	ON	ON	HD Analog YPbPr **	
ON	OFF	Film i to p (e.g. 24sF to 24p)	ON	ON	ON	Digital Out Follows Scalling	ON	ON	ON	HD Analog RGB **	OFF	OFF	OFF	HD Analog Sync Type	
ON	ON	Film p to i (e.g. 24p to 24sF)	OFF	OFF	OFF	Digital Out is always SD	ON	ON	ON	HD Analog Sync Type	ON	ON	ON	Sync on Video - Tri-level	
ON	ON	Film p to i add 3.2 (24p/sF to 30i)	ON	ON	ON	Digital Out is always HD	OFF	OFF	OFF	H & V on External BNCs	OFF	OFF	OFF	H & V on External BNCs	
8	9	Reserved	ON	ON	ON	Digital Out is copy of Input									
9	10	Reserved													
10		Reserved													


* Dual Rate Analog - See Owner's Manual
** Only one component signal HD/SD at a time

Conversion Mode Examples:	S1	1	2	3	4	5	6	7
NTSC to 1080i 29.97		OFF	ON	X	X	X	OFF	OFF
NTSC to 720p 59.94		ON	OFF	X	X	X	OFF	OFF
1080i 29.97 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
720p 59.97 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 29.97 to 720p 59.94		X	X	OFF	ON	OFF	OFF	OFF
720p 59.94 to 1080i 29.97		X	X	OFF	ON	OFF	OFF	OFF
1080p/sF 23.98 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 23.98 to 1080i 29.97		X	X	OFF	ON	OFF	OFF	OFF

Video conversion chart for normal modes (S-1: 6-OFF; 7-OFF)		1080 > PAL	i25 > i25; p25 > i25
1080i <-> 720p	i30 <-> p60; i29.97 <-> p59.94; 25i <-> 50p	720 > PAL	p25 > i25; p50 > i25
1080p <-> 720p	30p <-> 30p; 29.97p <-> 29.97p; 25p <-> 25p	NTSC > 1080	i29.97 > i29.97
All > XGA	Auto > p60; p59.95, p50, p48(3:2 on 24/23.98)	NTSC > 720	i29.97 > p59.94
1080 <-> NTSC	23.98sF/p > i29.97; i/p29.97 > i29.97	PAL > 1080	i25 > i25
720 <-> NTSC	p29.97 > i29.97; 59.94 > i29.97	PAL > 720	i25 > p50

PAL settings are the same for PAL to PAL frame Rates

ON ↑ S1 Conversion Mode 1 2 3 4 5 6 7 8 9 10
 S2 Aspect Control 1 2 3 4 5 6 7 8 9 10
 S3 Analog Output 1 2 3 4 5 6 7 8 9 10
 S4 Reticule (Overlay) ↓ 1 2 3 4 5 6 7 8 9 10 OFF



Switch Bank 1 - Conversion Mode

The first bank, S1 or Conversion Mode, is where the preset conversion rules are set for the obtaining the signal formats in the conversion capability chart. In this group, there are presets for SD inputs and presets for HD inputs.

The first two switches (1-2) are for SD and determine what type of conversion to do when an SD signal is present. The next four switches (3-6) are for HD and determine what type of conversion to do when an HD signal is present.

When SD is present, there are four types of SD conversion: SD upconvert to 720; SD upconvert to 1080; SD re-aspect to SD and SD to XGA (1024x768)

The SD switch functions are:

Switch Bank 1 – Conversion Mode - SD Conversion Settings		
S1-1	S1-2	Function
ON	OFF	SD Upconvert to HD – 720
OFF	ON	SD Upconvert to HD – 1080
OFF	OFF	SD Re-aspect to SD (DVE or ARC mode)
ON	ON	SD Upconvert to XGA (analog 1024 x 768)

When HD is present, there are four types of HD conversions and four additional processing steps, such as interlaced to/from progressive and frame rate control. The four types of HD conversions are, HD Downconvert to SD, HD Cross-convert (Format Convert) 1080 to/from 720, HD Re-aspect to HD and HD to XGA (analog 1024x768). The additional controls for HD are: operate in video modes, convert interlaced signals to progressive, convert progressive to interlaced, and convert progressive to interlaced and add 3:2 pull down.

The HD conversion switch functions are:

Switch Bank 1 - Conversion Mode - HD Conversion Settings			
S1-3	S1-4	S1-5	Function
ON	OFF	OFF	HD Downconvert to SD
OFF	ON	OFF	HD Crossconvert 1080 to/from 720
OFF	OFF	OFF	HD Re-aspect to HD (DVE or ARC)
ON	OFF	ON	Force 720 p 60 / 59.94 / 50
OFF	ON	ON	Force 1080 i30 / i29.97 / i25
ON	ON	ON	Force XGA (analog 1024 x 768)

The HD extended conversion mode switch functions are:

Switch Bank 1 - Conversion Mode – HD Extended Settings		
S1-6	S1-7	Function
OFF	OFF	Normal HD conversion mode for Video applications
OFF	ON	Force interlace to progressive where possible
ON	OFF	Force progressive to interlace where possible
ON	ON	Add 3:2 pull-down to 23.98/24 sF/p signals

Switches S1-8, S1-9 and S1-10 are reserved for future use.

A detailed listing of all input and output conversion modes with the corresponding settings for Switch Bank 1, is given the detailed settings chart on the next page.

To use this chart, select the input on the left and go across until you find the match the desired output function at the top of the chart. If the conversion mode is supported, a letter will be present in the intersecting box. To configure the 8021 for this mode, look up the dip-switch settings associated with the “letter” at the bottom of the chart. In some cases, there is more than one way to configure the 8021 for the desired result and this is reflect by having more than on letter in the intersecting box.

Detailed 8021 Switch Configuration Guide

		Serial Digital or Analog Output																					
		1920 x 1080i										1280x720					1024 x 768 Analog only			720x625	720x525		
		i 30	i 29.97	i 25	p 30	p 29.97	p 25	sF 24	sF 23.98	p 24	p 23.98	p 60	p 59.59	p 50	p 30	p 29.97	p 25	p 60	p 59.95	p 50	i 25	i 29.97	
Serial Digital Input	1920 x 1080	i 30	H		J						D		E			M							
		i 29.97		H		J						D		E			M				A		
		i 25			H		J						D		E			M		A			
		p 30	K		H							F		D			M,N						
		p 29.97		K		H							F		D			M,N				A,B	
		p 25			K		H							F		D			M,N		A,B		
		sF 24	H,L					K		J		D,G						M,P					
		sF 23.98		H,L					K	J			D,G						M,P				A,C
	p 24	L					K		H		L							M,P					
	p 23.98		L					K		H		L							M,P				A,C
	1280 x 720	p 60	D			E						H		J			M						
		p 59.59		D		E							H		J			M					A
		p 50			D		E							H		J			M		A		
		p 30	F			D						K			H			M,N					
		p 29.97		F			D						K			H			M,N				A,B
p 25			F			D						K			H			M,N		A,B			
720x 625	i 25			Q									S		T				V		U		
	720x 525	i 29.97		Q									S			T			V				U

Switch Settings for Conversion Mode switch bank 1, switches 1-7

Note: 1 = ON 0 = Off X = doesn't matter

HD > SD	
A	XX 101 00
B	XX 101 10
C	XX 101 11

HD<>HD 720<>1080	
D	XX 011 00
E	XX 011 01
F	XX 011 10
G	XX 011 11

HD > HD (Re-aspect)	
H	XX 001 00
J	XX 001 01
K	XX 001 10
L	XX 001 11

HD > XGA	
M	XX 111 00
N	XX 111 10
P	XX 111 11

SD > HD	
Q	01 XXX 00
R	01 XXX 01
S	10 XXX 00
T	10 XXX 01

SD > SD	
U	00 XXX 00

SD > XGA	
V	11 XXX 00

Switch Bank 2 - Aspect Mode

This bank controls the aspect mode for SD and HD inputs and the SDI output configuration. The first four switches determine the SD aspect rules for SD inputs and the second four switches determine the aspect rules for HD inputs. This enables preset rules that are unique for SD vs. HD signals as rule that will be applied automatically by the 8021.

8021 Switch Settings: *The 8021 auto-detects the input standard and applies the conversion according to the user settings below.*

Conversion Mode Switch 1							Aspect Control Switch 2							Analog Output Switch 3							Reticule (Overlay) Switch 4						
1	2	IF SD Input then:	1	2	3	SD Input to SD/HD/XGA	1	2	3	SD Analog configuration	1	2	3	Digital Out Reticules ON/OFF													
ON	OFF	SD Upconvert to 720	ON	ON	ON	No Aspect change	ON	ON	ON	SD Composite 3 Copies	2	SD Analog Out Reticules ON/OFF															
OFF	ON	SD Upconvert to 1080	OFF	OFF	ON	0.75 Vert (Letter Box)	ON	OFF	ON	SD Composite & Y/C	3	HD Analog Out Reticules ON/OFF															
OFF	OFF	SD Re-aspect to SD	OFF	ON	OFF	1.33 Vert	OFF	ON	OFF	SD YPbPr BetaCam **	4	Center Cross (+) ON/OFF															
ON	ON	Force to Analog XGA 1024x768	ON	OFF	ON	0.75 H (Pillar Box)	OFF	ON	OFF	SD YPbPr Mill **	5	4x3 Safe Area ON/OFF															
			ON	ON	OFF	1.33 H (Center Cut)	OFF	OFF	ON	SD YPbPr SMPTE **	6	4x3 Full Aperture ON/OFF															
			OFF	OFF	OFF	User Aspect Setting *	OFF	OFF	OFF	SD GBR **	7	15x9 Safe Area ON/OFF															
3	4	5	IF HD Input then:	4	SD 10% Underscan	4	SD Color ON/OFF	4	SD Setup ON/OFF-NTSC	7	User Reticule vs. Default ON/OFF																
ON	OFF	OFF	HD Downconvert	5	6	7	HD Input to SD/HD/XGA	5	SD Color Bars (Analog)	8	Reticule Color WHT/ON-BLK/OFF																
OFF	ON	OFF	HD Cross-Convert (1080 <-> 720)	ON	ON	ON	No Aspect Change	6	Force SD to HD-Port *	9	Reticule Follows Zoom ON/OFF																
OFF	OFF	OFF	HD Re-aspect to HD	ON	OFF	ON	0.75 Vert (Letter Box)	7	Oversample mode																		
ON	OFF	ON	Force 720 p59.94/60/50	ON	ON	OFF	1.33 Ver	8	2X on HD analog																		
OFF	ON	ON	Force 1080 i 29.97/30/25	ON	OFF	ON	0.75 H (Pillar Box)	OFF	16x on SD analog																		
ON	ON	ON	Output Analog XGA 1024x768	ON	ON	OFF	1.33 H (Center Cut)	9	HD Analog Output																		
			6	7	Video vs. Special Film Modes	OFF	OFF	OFF	HD Analog YPbPr **																		
OFF	OFF	OFF	HD Downconvert	OFF	OFF	OFF	User Aspect Setting *	10	HD Analog RGB **																		
OFF	ON	OFF	Film i to p (e.g. 24F to 24p)	8	HD 10% Underscan	9	Digital Output Selection	ON	HD Analog Sync Type																		
ON	ON	ON	Film p to i (e.g. 24p to 24sF)	9	10	Digital Output is always SD	OFF	Digital Out is copy of Input	ON	Sync on Video - Tri-level																	
ON	ON	ON	Film p to i add 3:2 (24p/sF to 30i)	OFF	OFF	Digital Out is always HD	ON	Digital Out is copy of Input	OFF	H & V on External BNCs																	
			8	Reserved	ON	ON	Digital Out is copy of Input																				
			9	Reserved																							
			10	Reserved																							

Conversion Mode Examples:							
S1	1	2	3	4	5	6	7
NTSC to 1080i 29.97	OFF	ON	X	X	X	OFF	OFF
NTSC to 720p 59.94	ON	OFF	X	X	X	OFF	OFF
1080i 29.97 to NTSC	X	X	ON	OFF	OFF	OFF	OFF
720p 59.97 to NTSC	X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 29.97 to 720p 59.94	X	X	OFF	ON	OFF	OFF	OFF
720p 59.94 to 1080i 29.97	X	X	OFF	ON	OFF	OFF	OFF
1080p/sF 23.98 to NTSC	X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 23.98 to 1080i 29.97	X	X	OFF	ON	ON	OFF	OFF

Video conversion chart for normal modes (S-1: 6-OFF; 7-OFF)			
1080i <-> 720p	i30 <-> p60; i29.97 <-> p59.94; 25i <-> 50p	1080 > PAL	i25 > i25; p25 > i25
1080p <-> 720p	30p <-> 30p; 29.97p <-> 29.97p; 25p <-> 25p	720 > PAL	p25 > i25; p50 > i25
All > XGA	Auto > p60; p59.95, p50, p48(3:2 on 24/23.98)	NTSC > 1080	i29.97 > i29.97
1080 <-> NTSC	23.98sF/p > i29.97; i/p29.97 > i29.97	NTSC > 720	i29.97 > p59.94
720 <-> NTSC	p29.97 > i29.97; 59.94 > i29.97	PAL > 1080	i25 > i25
		PAL > 720	i25 > p50

PAL settings are the same for PAL to PAL frame Rates

ON Conversion Mode Aspect Control Analog Output Reticule (Overlay) ↓

0.10 ↑ S1 1 2 3 4 5 6 7 8 9 10 S2 1 2 3 4 5 6 7 8 9 10 S3 1 2 3 4 5 6 7 8 9 10 S4 1 2 3 4 5 6 7 8 9 10 OFF

LED STATUS

ON	Locked and Operating
OFF	No Power
Blink Slow	No Input Signal
Blink Fast	Bad signal/mis-configuration

* Dual Rate Analog - See Owner's Manual
** Only one component signal HD/SD at a time

The first four switches (S2 - 1,2,3,4) control the aspect ratio of SD inputs. When an SD signal is applied at the input, regardless of how it will be format converted in the output, the aspect rules for the SD input are controlled by first three switches (S2 - 1,2,3). If the SD is being upconverted to HD (16x9 space), then for correct aspect ratios, the User has to either Pillar box (reduce the H axis by multiplying by 0.75) otherwise the aspect ratio will be incorrect. Enabling User aspect mode allows the User to set ASPECT ratios by using the internal switch settings.

Switch Bank 2 - Aspect Mode - SD Aspect Ratio Settings			
S2-1	S2-2	S2-3	Function is applied to SD inputs only
ON	ON	ON	No aspect Change for SD inputs
OFF	OFF	ON	0.75 V (letter box) – reduce Vertical to 75%
OFF	ON	OFF	1.33 V – expand Vertical by 133%
ON	OFF	ON	0.75 H (pillar box) – reduce Horiz. to 75%
ON	ON	OFF	1.33 H (center cut) – expand Horiz. by 133%
OFF	OFF	OFF	User Aspect settings (set via internal switches)

The fourth switch (S2 - 4) controls electronic underscan. When enabled, the 8021 provides a convenient underscan mode which is useful on CRT monitors that do have underscan controls.

Switch Bank 2 - Aspect Mode - SD Underscan Control	
S2-4	Function
ON	Reduce image by an additional 10 percent
OFF	No aspect reduction

The next four switches (S2 – 5,6,7,8) control the aspect ratio of HD inputs. When an HD signal is applied at the input, regardless of how it will be format converted in the output, the aspect rules for the HD input are controlled by the first three of these switches (S2 - 5,6,7). If the HD is being downconverted to a 4x3 space, the to be aspect correct the User has to either Letter box (reduce the vertical axis to 0.75) or Center cut, by expand the H axis by 1.333 otherwise the aspect ratio will be incorrect. Enabling User aspect mode allows the User to set ASPECT ratios by using the internal switch settings.

Switch Bank 2 - Aspect Mode - HD Aspect Ratio settings			
S2-5	S2-6	S2-7	Function is applied to HD inputs only
ON	ON	ON	No aspect change
OFF	OFF	ON	0.75 V (letter box) – reduce Vertical to 75%
OFF	ON	OFF	1.33 V – expand Vertical by 133%
ON	OFF	ON	0.75 H (pillar box) – reduce Horiz. to 75%
ON	ON	OFF	1.33 H (center cut) – expand Horiz. by 133%
OFF	OFF	OFF	User Aspect settings (set via internal switches)

The fourth switch of this group (S2 – 8) controls electronic underscan. When enabled, the 8021 provides a convenient underscan which is useful on CRT monitors that do not support underscans.

Switch Bank 2 - Aspect Mode - HD Underscan Control	
S2-8	Function
ON	Reduce image by an additional 10 percent
OFF	No aspect reduction

The last two switches of bank 2 control the Dual-rate HD/SD SDI image processed outputs. They can be set to track the output of the scaling engine, which is setup by S1 (1-7), forced to always be SD, forced to always be HD and set to be reclocked copies of the input. The forced SD or HD functions are use full if you are driving an SD only or HD only source. For example if you are using a SD Digital Waveform monitor to monitor the output of a dual rate router. The 8021 could be configured to output only SD on the imaged processed HD/SD SDI output BNCs. If the source selected on the router were SD, then the signal would bypass image scaling and go directly to the output BNCs. On the other hand if and HD source were called up on the router, the HD signal would be downconverted and sent to the output BNCs. This does require that the input conversion mode switches, S1 (3,4,5) be set to downconvert. Otherwise the HD downconversion does not take place and the “force SD” outputs we be muted.

Switch Bank 2 – Aspect Mode - HD/SD-SDI Output Configuration		
S2-9	S2-10	Function
OFF	OFF	Digital OUT Follows Scaling
OFF	ON	Digital OUT is Forced SD
ON	OFF	Digital OUT is Forced HD
ON	ON	Digital OUT is a copy of Digital Input

Switch Bank 3 – Analog Output

The third switch bank controls the analog encoder's configuration. Both the HD and SD analog outputs are configured by these switches. Additional analog configuration is available using the interior switches as described in the Internal Switch Setting section.

8021 Switch Settings: The 8021 auto-detects the input standard and applies the conversion according to the user settings below.


Conversion Mode Switch 1		Aspect Control Switch 2			Analog Output Switch 3			Reticule (Overlay) Switch 4		
1	2	1	2	3	1	2	3	1	2	
ON	OFF	ON	ON	ON	ON	ON	ON	Digital Out Reticules	ON/OFF	
OFF	ON	OFF	OFF	ON	ON	OFF	ON	SD Analog Out Reticules	ON/OFF	
OFF	OFF	OFF	ON	OFF	OFF	ON	ON	HD Analog Out Reticules	ON/OFF	
ON	ON	ON	OFF	ON	ON	OFF	OFF	4 Center Cross (+)	ON/OFF	
3	4	5	6	7	4	5	6	5	4x3 Safe Area	ON/OFF
ON	OFF	OFF	ON	ON	ON	ON	ON	6	4x3 Full Aperture	ON/OFF
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	7	15x9 Safe Area	ON/OFF
OFF	OFF	OFF	ON	ON	ON	ON	ON	8	User Reticule vs. Default	ON/OFF
ON	ON	ON	OFF	OFF	OFF	OFF	OFF	9	Reticule Color WHT/ON-BLK	ON/OFF
6	7	8	9	10	8	9	10	10	Reticule Follows Zoom	ON/OFF
ON	OFF	OFF	ON	ON	ON	ON	ON	LED STATUS		
OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	Locked and Operating	
ON	ON	ON	ON	ON	ON	ON	ON	OFF	No Power	
ON	ON	ON	ON	ON	ON	ON	ON	Blink Slow	No Input Signal	
ON	ON	ON	ON	ON	ON	ON	ON	Blink Fast	Bad signal/mis-configuration	
8	9	10	1	2	3	4	5	* Dual Rate Analog - See Owner's Manual		
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	** Only one component signal HD/SD at a time		
10	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Video conversion chart for normal modes (S-1: 6-OFF; 7-OFF)		

Conversion Mode Examples:	S1	1	2	3	4	5	6	7
NTSC to 1080i 29.97		OFF	ON	X	X	X	OFF	OFF
NTSC to 720p 59.94		ON	OFF	X	X	X	OFF	OFF
1080i 29.97 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
720p 59.97 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 29.97 to 720p 59.94		X	X	OFF	ON	OFF	OFF	OFF
720p 59.94 to 1080i 29.97		X	X	OFF	ON	OFF	OFF	OFF
1080p/sF 23.98 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 23.98 to 1080i 29.97		X	X	OFF	ON	OFF	OFF	OFF

1080 > PAL	i25 > i25; p25 > i25
1080i <-> 720p	i30 <-> p60; i29.97 <-> p59.94; 25i <-> 50p
1080p <-> 720p	30p <-> 30p; 29.97p <-> 29.97p; 25p <-> 25p
All > XGA	Auto > p60; p59.95, p50, p48(3.2 on 24/23.98)
1080 <-> NTSC	23.98sF/p > i29.97; i/p29.97 > i29.97
720 <-> NTSC	p29.97 > i29.97; 59.94 > i29.97

1080 > PAL	p25 > i25; p50 > i25
NTSC > 1080	i29.97 > i29.97
NTSC > 720	i29.97 > p59.94
PAL > 1080	i25 > i25
PAL > 720	i25 > p50

0.10 ON ↑ S1 Conversion Mode 1 2 3 4 5 6 7 8 9 10 S2 Aspect Control 1 2 3 4 5 6 7 8 9 10 S3 Analog Output 1 2 3 4 5 6 7 8 9 10 S4 Reticule (Overlay) ↓ 1 2 3 4 5 6 7 8 9 10 OFF



The SD analog output type is selected by the first three switches of S3.

Switch Bank 3 - Analog Output Configuration – SD Setup			
S3-1	S3-2	S3-3	Function - SD Analog Configuration
ON	ON	ON	SD Composite – 3 copies
ON	OFF	ON	SD Composite and Y/C
OFF	ON	ON	SD YPbPr BetaCam(tm) levels **
OFF	ON	OFF	SD YPbPr MII (tm) levels **
OFF	OFF	ON	SD YPbPr SMPTE levels **

** The HD/SD analog encoder can support dual composite and component operation but not dual component at the time. Thus, if both the analog HD15 port and BNC ports are used simultaneously, only one port can be set to component encoding. If SD component encoding is selected for the SD BNC outputs and the unit is not in dual-rate analog mode, then the HD outputs (HD-15 connector) are shut down until the SD output is reconfigured for Composite or Y/C.

However in dual-rate analog mode for the HD15 connector, the SD BNCs are shut down and component HD and SD are available on the HD15 port. This is possible because only one format, HD or SD is available on this port at a time. The dual-rate analog mode is designed for dual-rate analog monitors that accept both HD and SD inputs on the same input connector. When in Dual-rate analog mode, only analog

component and HD component outputs are allowed on the HD-15 connector. The types of component analog outputs are configured via Switch Bank 3.

In dual-rate analog mode, HD signals can be set to H&V sync or tri-level (also bi-level by the internal configuration switches). The SD signals will have normal SD bi-level sync.

Switch Bank 3 - Analog Output Configuration - SD Setup Continued	
S3-4	Function Color / Monochrome Mode
ON	SD color ON
OFF	SD color OFF – useful for driving B&W monitors

Switch Bank 3 - Analog Output Configuration - SD Setup Continued	
S3-5	Function Setup Control for NTSC
ON	SD Setup ON (NTSC signals only)
OFF	SD Setup OFF

Switch Bank 3 - Analog Output Configuration - SD Color Bars	
S3-6	Function Color Bars
ON	SD Analog Color Bars ON
OFF	SD Analog Color Bars OFF

Switch Bank 3 - Analog Output Configuration - HD/SD control	
S3-7	Function Dual-rate Analog Mode
ON	Force SD to HD port (HD15-XGA connector)
OFF	Keep SD on SD BNCs

The purpose of the analog dual-rate mode is to allow a single connection to a multi-rate broadcast monitor, rather than a two connections (HD & SD) that would force an end user to select a different monitor input as the input standard changes between HD and SD. In dual-rate analog mode, both HD and SD inputs are routed to the HD analog output connector (HD-15). Aspect ratio rules and overlays can be pre-configured and applied automatically.

The first production runs of the 8021, Revision A boards, can be upgraded to the latest dual-rate firmware. However in dual-rate analog output mode and only in this mode, the color difference BNCs on the HD break out cable must be reversed. The HD15 red cable is used for Pb or B and the blue cable for Pr R signals. Revision B and higher boards do not require this flip for dual-rate analog output mode.

Switch Bank 3 - Analog Output Configuration - HD/SD	
S3-8	Function Oversample Mode
ON	Oversample HD by 2x (SD by 4x)
OFF	Oversample SD by 16x (HD by 1x)

The oversample mode is only for the analog output encoder. Oversampling increases video quality and can only be applied to one of the two output banks, HD and SD. In dual-rate analog mode, only one bank (the HD bank) is used and the highest sampling rate for SD/HD is automatically configured (16x for SD and 2x for HD). In non-dual rate analog mode, the end user can choose which analog output group will have higher signal processing.

The last two analog output switches set up the HD color type (YPbPr or RGB) and sync type.

Switch Bank 3 - Analog Output Configuration - HD Setup	
S3-9	Function Color Type
ON	HD Component YPbPr
OFF	HD Component RGB

Switch Bank 3 - Analog Output Configuration - HD Setup	
S3-10	Function HD Sync selection
ON	Embedded Tri-level
OFF	H & V external

Sync can be either embedded on the HD video as tri-level or bi-level or as external H&V. To select bi-level you must use the internal rotary switches and change the embedded sync type to bi-level. The default embedded sync is tri-level and is on all three output HD channels (YPbPr or RGB).

If H&V external sync is selected, the embedded sync is removed for RGB signals and H&V are sent to the H&V connections on the HD-15 connector.

Switch Bank 4 – Reticule Overlay

The Fourth Bank of switches control the reticule overlays. This overlay engine is very flexible and can be enabled or disabled at any of the outputs (SDI, HD analog and SD analog) and can be user programmed with other aspect ratios via the internal rotary switches and saved in non-volatile memory. This allows the creation of film aspect ratios or video aspect ratios specific to the project at hand.

8021 Switch Settings: *The 8021 auto-detects the input standard and applies the conversion according to the user settings below.*

Conversion Mode Switch 1		Aspect Control Switch 2		Analog Output Switch 3		Reticule (Overlay) Switch 4	
1	2	1	2	1	2	1	2
ON	OFF	ON	ON	ON	ON	1	Digital Out Reticules ON/OFF
OFF	ON	OFF	OFF	ON	OFF	2	SD Analog Out Reticules ON/OFF
OFF	OFF	OFF	ON	OFF	ON	3	HD Analog Out Reticules ON/OFF
ON	ON	ON	OFF	OFF	ON	4	Center Cross (+) ON/OFF
3	4	3	4	3	4	5	4x3 Safe Area ON/OFF
ON	OFF	ON	ON	ON	OFF	6	4x3 Full Aperture ON/OFF
OFF	ON	OFF	OFF	OFF	ON	7	15x9 Safe Area ON/OFF
OFF	OFF	OFF	ON	OFF	OFF	8	User Reticule vs. Default ON/OFF
ON	ON	ON	OFF	OFF	OFF	9	Reticule Color WHT/ON-BLK/OFF
ON	ON	OFF	OFF	OFF	OFF	10	Reticule Follows Zoom ON/OFF
6	7	5	6	5	6	LED STATUS	
OFF	OFF	ON	ON	ON	ON	ON	Locked and Operating
OFF	ON	OFF	OFF	OFF	OFF	OFF	No Power
ON	ON	ON	ON	ON	ON	Blink Slow	No Input Signal
ON	ON	OFF	OFF	OFF	OFF	Blink Fast	Bad signal/mis-configuration
8	9	8	9	8	9	* Dual Rate Analog - See Owner's Manual	
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	** Only one component signal HD/SD at a time	
10	Reserved	10	Reserved	10	Reserved		

Conversion Mode Examples:	S1	1	2	3	4	5	6	7
NTSC to 1080i 29.97		OFF	ON	X	X	X	OFF	OFF
NTSC to 720p 59.94		ON	OFF	X	X	X	OFF	OFF
1080i 29.97 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
720p 59.97 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 29.97 to 720p 59.94		X	X	OFF	ON	OFF	OFF	OFF
720p 59.94 to 1080i 29.97		X	X	OFF	ON	OFF	OFF	OFF
1080p/sF 23.98 to NTSC		X	X	ON	OFF	OFF	OFF	OFF
1080p/sF 23.98 to 1080i 29.97		X	X	OFF	ON	ON	OFF	OFF

Video conversion chart for normal modes (S-1: 6-OFF; 7-OFF)	1080 > PAL	i25 > i25; p25 > i25
1080i<->720p	i30 <-> p60; i29.97 <-> p59.94; 25i <-> 50p	720 > PAL
1080p<->720p	30p <-> 30p; 29.97p <-> 29.97p; 25p <-> 25p	i29.97 > i29.97
All > XGA	Auto > p60; p59.95, p50, p48(3:2 on 24/23.98)	NTSC > 720
1080 <-> NTSC	23.98sF/p > i29.97; i/p29.97 > i29.97	i29.97 > p59.94
720 <-> NTSC	p29.97 > i29.97; 59.94 > i29.97	PAL > 1080
		i25 > i25
		PAL > 720
		i25 > p50


PAL settings are the same for PAL to PAL frame Rates

ON ↑ S1 Conversion Mode 1 2 3 4 5 6 7 8 9 10

S2 Aspect Control 1 2 3 4 5 6 7 8 9 10

S3 Analog Output 1 2 3 4 5 6 7 8 9 10

S4 Reticule (Overlay) ↓ 1 2 3 4 5 6 7 8 9 10 OFF



The overlay engine can be enable or disable for each type of 8021 output; HD/SD-SDI, HD Analog and SD Analog. This can allow a clean vs. dirty overlay feed. For example the 8021 can be used to create a digital to digital downconvert while outputting analog HD and analog SD with user overlays. Each output type can be enabled or disabled separately as shown in the table below.

Switch Bank 4 – Reticule Overlay - Output Enable			
S4-1	S4-2	S4-3	Function
ON			Enable overlays on dual-rate HD/SD SDI output
OFF			Disable overlays on dual-rate HD/SD SDI output
	ON		Enable overlays on analog SD output
	OFF		Disable overlays on analog SD output
		ON	Enable overlays on analog HD output
		OFF	Disable overlays on analog HD output

The next switches define what type of overlay is to be used. Each type can be enabled or disabled individually. The user can use the factory default settings or program their own and save those settings. Use the internal rotary switches, defined in the next section to program the user settings. Place S4-8 to user presets (ON). This feature gives a total of eight different overlays of which four can be used at one time.

Switch Bank 4 – Reticule Overlay - Overlay Type Selection					
S4-4	S4-5	S4-6	S4-7	S4-8	Function
ON					Center Cross Enable or User Preset
OFF					Center Cross Disable or User Preset
	ON				4 x 3 Safe Area Enable or User Preset
	OFF				4 x 3 Safe Area Disable or User Preset
		ON			4 x 3 Full Aperture Enable or User Preset
		OFF			4 x 3 Full Aperture Disable or User Preset
			ON		16 x 9 Safe Area Enable or User Preset
			OFF		16 x 9 Safe Area Disable or User Preset
				ON	User Presets Enabled (internal switches to configure)
				OFF	Factory Defaults Enabled

The next switch setting selects black or white reticules. The overlay can be User programmed, via internal switches, to be any color and saved as a user default. This user color would be present when the User Preset Enable switch (S4-8) is ON.

Switch Bank 4 – Reticule Overlay - Color Selection	
S4-9	Function
ON	Reticule color is White or User Preset
OFF	Reticule color is Black or User Preset

The last switch setting of group for controls the position of the reticules when the DVE function is enabled. The overlays can be locked to the display raster or configured to track the DVE expansion, contraction or PAN along with the video. For example, the tracking reticule mode would enable the User to zoom in on one size of the image and get a close view of the video with the overlay correctly positioned over the image.

Switch Bank 4 – Reticule Overlay - Tracking	
S4-10	Function
ON	Reticule tracks the DVE or ARC control
OFF	Reticule is locked to picture raster

Internal Switch Settings

The 8021 has additional configuration controls via internal register rotary selection and input (up/down) switches. To access these controls, disconnect power, remove the bottom cover and locate two rotary switches (S5, S6) and two push button (S7-UP, S8-Down) switches and reapply power.

Default convention: Use S7 (UP) to increment or turn function on. Use S8 (Down) to decrement or turn function off. On most functions, pressing both S7 & S8 (Up & Down) restores the default mode.

To save user settings, select 99 and press either the Up or Down switch.

S5S6

00: Normal User Mode

Restore to 00 prior to device use

10-19: Reserved

20-29: Reserved

30-39: Reserved

40: User H & V aspect zoom

Press both buttons to set aspect to 1 to 1

41: User H aspect zoom

Press both buttons to set aspect to 1 to 1

42: User V aspect zoom

Press both buttons to set aspect to 1 to 1

43: User H aspect pan

Press both buttons to center H-pan

44: User V aspect pan

Press both buttons to center V-pan

50-53: Reserved

54: Background color Y

Push both buttons default to black

55: Background Cb color

Push both buttons default to black

56: Background Cr color

Push both buttons default to black

57: Enable over sampling on Encoder

Default is on

58: Enable HD VBI

Default is on

59: Enable SD VB

Default is on

60: User Reticule Mode Vert bars size H

61: User Reticule Mode Vert bars thickness

62: User Reticule Mode 4x3 box Horz size

63: User Reticule Mode 4x3 box Vert size

64: User Reticule Mode 4x3 box Horz Thickness

65: User Reticule Mode 4x3 box Vert Thickness

66: User Reticule Mode 16x9 box Horz size

67: User Reticule Mode 16x9 box Vert size

68: User Reticule Mode 16x9 box Horz Thickness

69: User Reticule Mode 16x9 box Vert Thickness

70: User Reticule Mode Cross Horz size

71: User Reticule Mode Cross Vert size

72: User Reticule Mode Cross Horz Thickness

73: User Reticule Mode Cross Vert Thickness

74: User Reticule Mode Y Level

75: User Reticule Mode Cb Level

76: User Reticule Mode Cr Level

74-83, 86: Reserved

84: HD Analog Embedded SYNC

UP = tri-level (default)

Down = bi-level

85: SD-SDI/Analog Dejitter

UP = Filter ON

Down = Filter OFF

87: HD < > SD Color Matrix Bypass

UP = Bypass color matrix

Down = enable color matrix

88: Restore factory defaults

89-98: Reserved

99: Save current values

Make certain that the rotary switches are restored to 0, 0 before re-installing the bottom cover.

8021 Delay Characteristics

The processing delay varies with the type of conversion being performed. The charts below list the electrical length or processing time for the HD/SD-SDI and Analog HD/SD outputs. The first chart is for 1080 outputs, the second for 720 and the third for XGA and SD. Select the input rate on the left and the output rate and type on the top. The intersecting box contains the conversion time information.

f = field; F = Frame – Delay rates (in f or F) are shown with respect to the input signal.

From	→ To	HD 1080	(SDI or Analog Output)	HD 1080	(SDI or Analog Output)
1080	sF 23.98	i 29.97	1/13.32-1/11.99 sec – 3.6-4f	sF/p 23.98	1/11.99 sec – 4f
1080	p 23.98	i 29.97	1/13.32-1/11.99 sec – 1.8-2F	p/sF 23.98	1/11.99 sec – 2F
1080	sF 24	i 30	3/40-1/12 sec – 3.6-4f	p 24	1/12 sec – 4f
1080	p 24	i 30	3/40-1/12 sec – 1.8-2F	sF 24	1/12 sec – 2F
1080	i 25	i 25	1/25 sec – 2f	p 25	1/12.5 sec – 2f
1080	p 25	i 25	1/12.5 sec – 2F	p 25	1/12.5 sec – 2F
1080	i 29.97	i 29.97	1/30 sec – 2f	p 29.97	1/14.98 sec – 2f
1080	p 29.97	i 29.97	1/15 sec – 2F	p 29.97	1/14.98 sec – 2F)
1080	i 30	i 30	1/30 sec – 2f	p 30	1/15 sec – 4f
1080	p 30	i 30	1/15 sec – 2F	p 30	1/15 sec – 2F
720	p 25	i 25	1/12.5 sec – 2F	p 25	1/12.5 sec – 2F
720	p 29.97	i 29.97	1/14.98 sec – 2F	p 29.97	1/14.98 sec – 2F
720	p 30	i 30	1/15 sec – 2F	p 30	1/15 sec – 2F
720	p 50	i 25	1/25 sec – 2F	p 50	1/50 sec – 1F
720	p 59.94	i 29.97	1/29.97 – 2F	p 29.97	1/14.98 – 4F
720	p 60	i 30	1/30 sec – 2F	p 30	1/15 – 4F
486	i 29.97	i 29.97	1/29.97 – 2f	p 29.97	1/14.98 – 4f
575	i 25	i 25	1/25 – 2f	p 25	1/25 – 4f

f = field; F = Frame – Delay rates (in f or F) are shown with respect to the input signal.

From	→ To	HD 720	(SDI or Analog Output)	HD 720	(SDI or Analog Output)
1080	sF 23.98	----		p 59.94	1/13.32-1/11.99 sec – 3.6-4f
1080	p 23.98	----		p 59.94	1/13.32-1/11.99 sec – 1.8-2F
1080	sF 24	----		p 60	3/40-1/12 sec – 3.6-4f
1080	p 24	----		p 60	3/40-1/12 sec – 1.8-2F
1080	i 25	p 25	1/25 sec – 4f	p 50	1/25 sec – 2f
1080	p 25	p 25	1/12.5 sec – 2F	p 50	1/12.5 sec – 2F
1080	i 29.97	p 29.97	1/29.97 sec – 4f	p 59.94	1/29.97 sec – 2f
1080	p 29.97	p 29.97	1/14.98 sec – 2F	p 59.94	1/14.98 sec – 2F
1080	i 30	p 30	1/15 sec – 4f	p 60	1/15 sec – 4f
1080	p 30	p 30	1/15 sec – 2F	p 60	1/15 sec – 2F
720	p 25	p 25	1/12.5 sec – 2F	p 50	1/12.5 sec – 2F
720	p 29.97	p 29.97	1/14.98 sec – 2F	p 59.94	1/14.98 sec – 2F
720	p 30	p 30	1/15 sec – 2F	p 60	1/15 sec – 2F
720	p 50	p 25	1/12.5 sec – 4F	p 50	1/50 sec – 2F
720	p 59.94	p 29.97	1/14.98 sec – 4F	p 59.94	1/29.97 sec – 2F
720	p 60	p 30	1/15 sec – 4F	p 60	1/30 sec – 2F
486	i 29.97	p 29.97	1/14.98 sec – 4f	p 59.94	1/29.97 sec – 2f
575	i 25	p 25	1/12.5 sec – 4f	p50	1/25 sec – 2f

8021 Delay Characteristics (continued)

f = field; F = Frame – Delay rates (in f or F) are shown with respect to the input signal.

From → To	XGA 1024x768 (Analog output)	SD-SDI or SD-Analog Output 486 = NTSC & 575 = PAL
1080 sF 23.98	p 59.94 1/13.32-1/11.99 sec – 3.6-4f	486 i 29.97 1/13.32-1/11.99 sec – 3.6-4f
1080 p 23.98	p 59.94 1/13.32-1/11.99 sec – 1.8-2F	486 i 29.97 1/13.32-1/11.99 sec – 1.8-2F
1080 sF 24	p 60 3/40-1/12 sec – 3.6-4f	----
1080 p 24	p 60 3/40-1/12 sec – 1.8-2F	----
1080 i 25	p 50 1/25 sec – 2f	575 i 25 1/25 sec – 2f
1080 p 25	p 50 1/12.5 sec – 2F	575 i 25 1/12.5 sec – 2F
1080 i 29.97	p 59.94 1/29.97 sec – 2f	486 i 29.97 1/29.97 sec – 2f
1080 p 29.97	p 59.94 1/14.98 sec – 2F	486 i 29.97 1/14.98 sec – 2F
1080 i 30	p 60 1/15 sec – 4f	----
1080 p 30	p 60 1/15 sec – 2F	----
720 p 25	p 50 1/12.5 sec – 2F	575 i 25 1/12.5 sec – 2F
720 p 29.97	p 59.94 1/14.98 sec – 2F	486 i 29.97 1/14.98 sec – 2F
720 p 30	p 60 1/15 sec – 2F	----
720 p 50	p 50 1/50 sec – 2F	575 i 25 1/25 sec – 2F
720 p 59.94	p 59.94 1/29.97 sec – 2F	486 i 29.97 1/29.97 sec – 2F
720 p 60	p 60 1/30 sec – 2F	----
486 i 29.97	p 59.94 1/29.97 sec – 2f	486 i 29.97 1/29.97 sec – 2f
575 i 25	p50 1/25 sec – 2f	575 i 25 1/25 sec – 2f

Glossary

Aspect ratio:	Performing an aspect change on HD or SD raster, for example converting the image from 16x9 to 4x3 with letter box (0.75V) or non-letter box by expanding H by 1.333.
Downconvert:	Taking HD and down converting it to SD or XGA.
Format convert:	Taking HD from one resolution and crossing converting it over to another HD standard, for example (1080 to 720) or (720 to 1080). Sometimes this is referred to as crossconvert.
HD SDI:	High Definition – SMPTE 274M (1080) and 296M (720) 1.485-Gbit or 1.485/1.001-Gbit
i > p Output:	Used to convert interlaced images to progressive.
Safe area:	Adding an additional 10% aspect ratio reduction to the H and V axis to allow the image to be seen on a monitor that does not support safe area raster reduction. This applies mainly to CRT based devices as they are manufactured with intentional over scan.
SD SDI:	Standard Definition – SMPTE 259M-C 4:2:2 SDI 270-Mbit video in either NTSC (720x486 i30) or PAL (720x575 i25).
Upconvert:	Taking SD and up converting it to a HD or XGA.
XGA:	Extended Graphics Adapter running at 1024 x 786.
3:2:	Adding a copy of a field every fourth field to convert i 24/23.98 to i 30/29.97.

Specifications

DIGITAL INPUTS

Input – Dual-Rate SMPTE-292 HDSDI (10-bit) and SMPTE259M-C (10-bit)
◆ HD: 720 i25/29.97/30/59.94/60 and p/23.98/24: embedded in p59.94/60
◆ HD: 1080 i23.98.59.94/60/50 - p25/29.97/30 - p/sF 23.98/24
◆ SD: 486 i29.97 NTSC - 575 i25 PAL

Input Equalization: 330ft (100 Meters) Belden 1505A
Return Loss: > 15 dB

DIGITAL OUTPUTS

Active Loop Two HD or SD SDI reclocked copies of input (Dual-Rate)
Processed Dual SMPTE-292 HDSDI (10-bit) and SMPTE259M-C (10-bit)
◆ HD: 720 i25/29.97/30/59.94/60 and 24: embedded in 60P
◆ HD: 1080 i23.98.59.94/60/50
◆ HD: 1080 p25/29.97/30 23.98/24p/sF
◆ HD: 488 i30 NTSC
◆ HD 576 i25 PAL

Return Loss: > 15 dB

IMAGE PROCESSING

Scaling: 24-tap poly-phase with 10-bit processing
Resizing: Full zoom and pan functions (2-axis DVE)
Presets for Letterbox, Pillar Box and Center Cut
Film Modes: 3:2 pull down, i > p and p > i modes

ANALOG OUTPUTS

Output Signal: Both HD, SD and XGA Analog
HD – YPbPr or GBR
SD – Composite, Y/C or Component
XGA – 1024x768 at various frame rates

Frequency Response: HD/XGA: Y/GBR: 0-28 MHz +/- 0.25 dB
Pb/Pr: 0-13 MHz +/- 0.25 dB
SD: 0-5.2 MHz +/- 0.25 dB

Encoding Path: 12-bit encoding and DAC – 10-bit input
Return Loss: >36dB
Connectors: HD-HD15 with 5BNC breakout cable
SD- Three 75 Ohm BNCs
Sync: HD Bi/Tri-Level Sync on Video
XGA - H/V Sync
SD – Sync on Video

RETICULE OVERLAY

Types: 4x3, 16X9 Safe Area, 4x3 full aperture, and center cross - each type can be individually enabled and User size adjusted
Reticule Color: Black or White
Reticule Outputs: Individually enabled on all outputs (digital, HD-analog, SD-analog)
Options: Remote Reticule control

Operating Range: 40-100 degrees F. (non-condensing)
Input Power: 5VDC input: + 5 VDC @ 01.8A (9 watts)
12VDC input: + 6.5 to 18 VDC @ (9 watts)
Options: Anton Bauer Mod-Tap cable
Size: 10.3 x 5.9 x 1” (260 x 150 x 25mm)

This product is not authorized for use in life support systems. Product liability is limited only to the replacement of this unit. Cobalt Digital Inc. does not assume any liability for loss of use due to failure of this component.

Specifications subject to change without notice.

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