

ENSEMBLE

D E S I G N S

Serial Box™ Digital and Analog Convertors

For high quality conversion between
10 bit ITU-R 601 serial digital
component and analog video signals.

Technical Manual

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Serial Box Convertors

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Serial Box Overview

Serial Box Overview

The Serial Box family of products provides the tools necessary to interface with the component serial video bitstream. Serial Boxes give you the means of converting between ITU-R 601 and the analog world.

Serial Boxes allow conversion in both directions between analog video and ITU-R 601 ten bit component serial digital. The Serial Box family has been designed with capability and versatility in mind. Both color difference and RGB component formats are handled by built-in transcoders. There are provisions for 525 and 625 standards, with NTSC/PAL and S-Video outputs also available. Internal and External sync options and sync On/Off are provided where applicable.

Serial Box I & II have active loop through inputs giving the user a two output digital DA in addition to format conversion from 601 to component analog video. Following conversion from CAV to 601, Serial Box III provides four Serial Component Digital outputs to allow feeding several devices without need for added distribution amplifiers. Serial Box IV offers conversion from composite and Y/C (S-Video) to serial digital component.

10 Bits

With 10 bits for each of the components, this system provides nearly 1000 difference values for each component. This fine granularity in the values represented means that extremely subtle shading and detail can be recorded and reproduced. 10 bit systems are also superior in their ability to perform complex effects, delicate keying and layering with superb fidelity. Serial Box Convertors and the MultiBuffer DS-1 are 10 bit 601 products, as are most of the latest switchers, DVEs and tape machines in the market.

Video Standards

Serial Box Convertors offer you the best in digital and analog video conversion. For bringing analog video sources into a digital switcher or workstation, or for feeding digital video into analog VTRs or monitors, there is a Serial Box Converter to meet your needs.

Serial Box Overview

Beta, SMPTE and other formats

Since the inception of component analog video (CAV), formats encompassing a good many different Y, R-Y, B-Y levels have come upon the scene. One is the SMPTE standard in which a 100% color bar signal produces 700mV in the Y channel and 700mV p-p in the color difference channels while in the Beta format 75% color bars produce 700mV p-p levels.

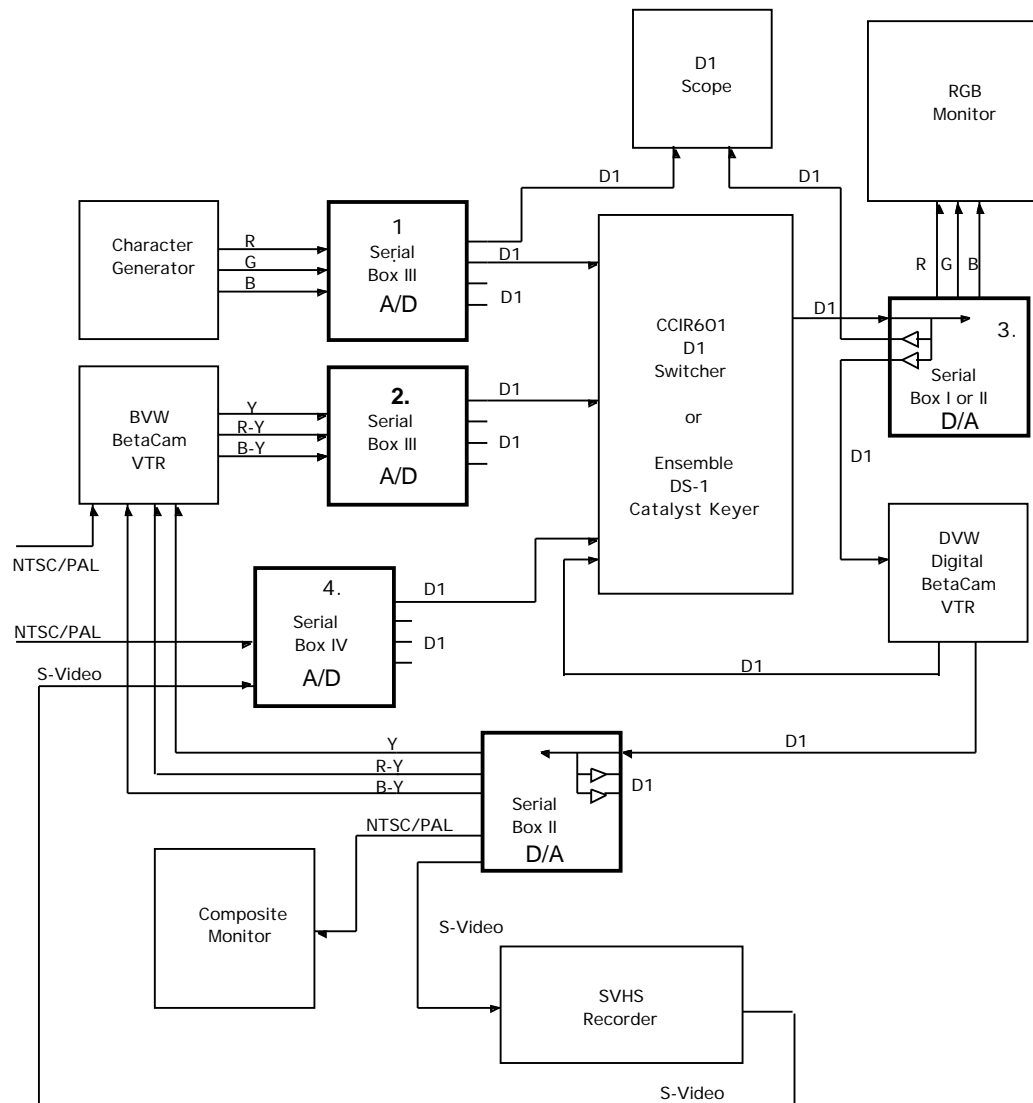
Serial Boxes normally leave the factory with the jumpers set to the Beta standard. Analog level adjustments are provided to allow the customer to set the Serial Box for other common standards.

Internal jumpers need to be set for the format you are using, RGB or Y, R-Y, B-Y (YUV). If you are running in Y, R-Y, B-Y (YUV), you will also need to choose between beta levels and SMPTE levels. Again, jumpers enable this selection. See the Jumper Diagram and Typical Jumper Settings in this manual to learn how to set jumpers for your application.



Serial Box Overview

Typical Usage Diagram



General Usage

The diagram which follows demonstrates ways in which Serial Boxes provide connectivity in integrating CAV (component analog video) devices into a component digital suite. Serial Box III (1) is used to generate serial component digital signals from the RGB output of a Character Generator or Paint Box.

With the Serial Box III (2) set for Y, R-Y, B-Y (YUV) input, signals from an analog BetaCam VTR can be delivered to a D1 switcher or other D1 device. In this application it may be desirable to select Setup Removal in the Serial Box III so as to remove setup from an NTSC input to the BetaCam. With four serial component digital outputs from each Serial Box III there is adequate capability to feed serial routers, serial monitoring equipment and the like.

Serial Box I or II (3) is used to generate component analog video signals from the D1 source. When set up to deliver RGB outputs, it allows high quality 10 bit component monitoring on an RGB monitor. Configured for YUV, Serial Box II (4) produces 10 bit conversion to analog for recording on the analog BetaCam or other analog component VTR. Simultaneously, a composite output is available to drive an NTSC or PAL monitor or VTR, and the S-Video jack can be used to provide input to a S-VHS recorder. This type input to the S-VHS machine provides superior performance compared to the NTSC alternative, as chroma crawl and similar encoding artifacts are eliminated. Serial Boxes can also act as 10 bit component input/output converters for a Digital BetaCam machine.

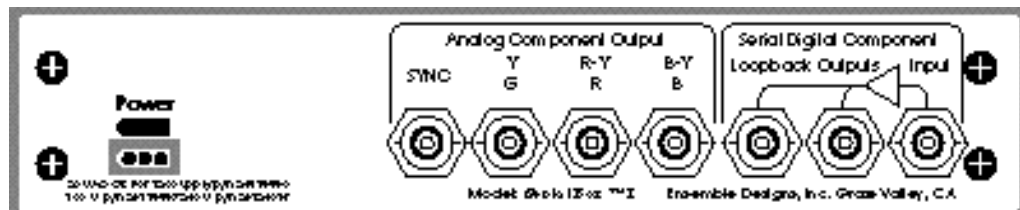
All Serial Box products are contained in half width single rack unit housings. Any pair of Serial Box devices can be mounted together to form a single RU package for rackmounting purposes.

Serial Box I

Serial Box I

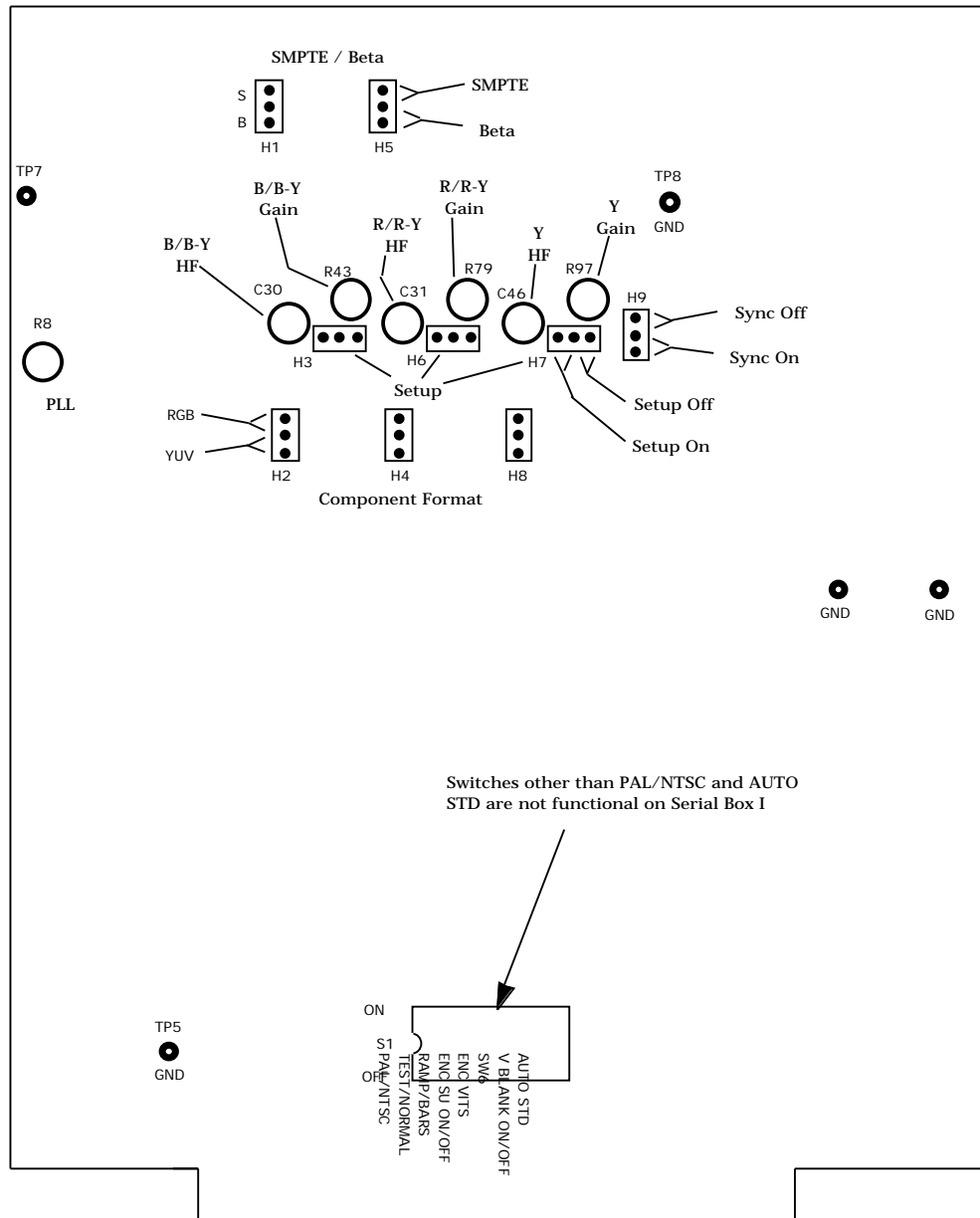
Description

Serial Boxes I and II both produce component analog video (CAV) output signals from a serial digital component input.



There are internal jumpers which can configure the output video as RGB or the native color difference, as well as jumpers to switch between SMPTE and Beta color formats. Sync on Y (G) is available where required and there is a separate sync output jack as well. Setup may be added to any or all of the three outputs. This can be convenient when matching a picture monitor with both composite and component inputs. All component signals have full 10 bit resolution. With two active loopthrough ITU-R 601 connectors, Serial Box I can also act as a two output serial digital video distribution amplifier.

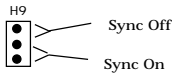
Jumper Location Guide for Serial Box I



Serial Box I

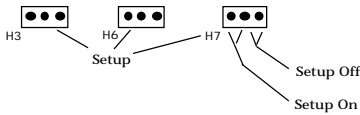
Jumper Info

The Configuration Jumpers legend is near the power connector on the board.



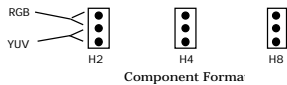
Sync is added to the Y or G channel when H9 is in the ON position.

Setup may be added to each of the component channels on an individual basis.



H3	B-Y/B
H6	R-Y/R
H7	Y/G

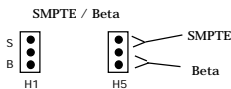
Choose the color difference position or the RGB position. The Serial Box decodes the serial bit stream to the Y, R-Y, G-Y color difference format. Jumpers are provided to obtain a matrixed RGB output. To produce meaningful output all three of these jumpers must be in either the color difference position or the RGB position.



H2	B-Y/B
H4	R-Y/R
H8	Y/G

When operating in the YUV mode SMPTE or Beta levels are selected by jumpers H1 and H5.

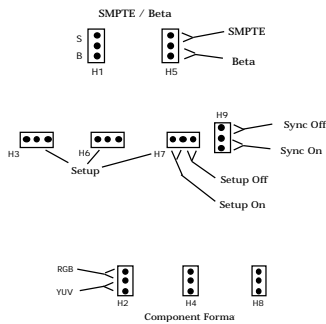
When operating in RGB H1 and H5 must be set to the SMPTE (S) position.



H1	B - Y/B
H5	R - Y/R

Typical Jumper Positions

Beta Output



For example, if you are feeding a BetaCam VTR, Y, R-Y, B-Y (YUV).

H1	B	H3	B-Y Setup OFF
H5	B	H6	R-Y Setup OFF
H2	YUV	H7	Y Setup ON, OFF for PAL
H4	YUV	H9	Y Sync ON, OFF for Japan
H8	YUV		

SMPTE Output

If you are feeding to a Y, R-Y, B-Y (YUV) monitor.

H2	YUV	H3	B-Y Setup OFF
H4	YUV	H6	R-Y Setup OFF
H8	YUV	H7	Y Setup OFF
H1	S	H9	Y Sync ON
H5	S		

RGB Output

If you are feeding to an RGB component monitor.

H2	RGB	H3	B Setup OFF
H4	RGB	H6	R Setup OFF
H8	RGB	H7	Y Setup OFF
H1	S	H9	Y Sync ON
H5	S		

Serial Box I

Adjustments

Input PLL

Monitor TP7 with a DVM. With a ITU-R 601 serial digital signal connected to input jack J1, turn R8 CCW so that video lock is lost. Turn R8 slowly CW until video appears at the composite or component output. Note the voltage on TP7. Continue turning R8 CW until the TP7 voltage has increased 200mV to 250mV.

If a meter is not available: With a ITU-R 601 serial digital signal connected to input jack J1, adjust R8 so that video appears at a component or composite output. Set R8 to the center of the range which produces output video.

Level and Response

HF response is factory set and will not normally require adjustment. See Output Amplitudes for level adjustments.

<u>Channel</u>	<u>Level</u>	<u>HF Response</u>
Y/G	R97	C46
R-Y/R	R79	C31
B-Y/B	R43	C30

DIP Switch

S1. PAL/NTSC: Selects PAL/625 standard or NTSC/525 standard.

S7. (U5 version 2.0xx & later) Vertical Blanking ON/OFF. The incoming End of Blanking bit is ignored, and component End of Blanking occurs at Line 10 when S7 is in the ON position.

S8. (U5 version 2.0xx & later) Auto Standard ON/OFF. NTSC/PAL is selected automatically when S8 is ON and S1 is in the NTSC position.

Other switches have no functionality on Serial Box I.

Component Output Amplitudes

Normally Serial Boxes are shipped set for color difference or Y, R-Y, B-Y, sometimes called YUV. This would be appropriate for use with a beta deck.

Color Difference

SMPTE, EBU, MII - Color Bars, No Setup

<u>Channel</u>	<u>75% Bars</u>	<u>100%</u>	<u>Bars</u>
Y	700mV	700mV	Blanking to peak white
R-Y	525mV	700mV	Peak to Peak
B-Y	525mV	700mV	Peak to Peak

Beta SP, Beta - Color Bars with Setup

Place jumper H7 in the SETUP ON position

<u>Channel</u>	<u>75%</u>	<u>Bars</u>
Y	714mV	Blanking to peak white
R-Y	700mV	Peak to Peak
B-Y	700mV	Peak to Peak

RGB- Color Bars, No Setup

<u>Channel</u>	<u>75%</u>	<u>Bars</u>
G	75 IRE	Blanking to peak of color
R	75 IRE	Blanking to peak of color
B	75 IRE	Blanking to peak of color

<u>Channel</u>	<u>100%</u>	<u>Bars</u>
G	100 IRE	Blanking to peak of color & white
R	100 IRE	Blanking to peak of color & white
B	100 IRE	Blanking to peak of color & white

Serial Box I

Product Specifications

Analog Component Output

Standards	525 or 625 Line, strappable
Format	RGB or Y/R-Y/B-Y, SMPTE or Beta, strappable Setup ON/OFF, strappable Sync on Y/G output, strappable
Levels	0.7 / 1.0 V p-p Non-Comp / Comp
Sync Output	1 V p-p Composite H & V
Response	Y Chan: 6 MHz Bandwidth, 0.25dB to 5 MHz
Color Diff	2.5 MHz Bandwidth
2T K Factor	<1% Y Channel
D to A	10 bit sampling of all components

Serial Digital Component Inputs

SMPTE 259M / ITU-R 601 / CCIR 656, 10 bit words at 270 Mbits/sec.
Active loop-through from Serial Input provides 2 independently buffered, re-clocked outputs.

Mechanical & Power

Size	8.5" W, 1.75" H, 10" D
Weight	3 lbs

Two units can be rack mounted side by side using optional rack ears
Chassis is completely enclosed
20VAC, 50/60 Hz, less than 10 VA
Power is supplied by a UL and CSA listed wallmount transformer
Specify either 100, 120 or 230 volts

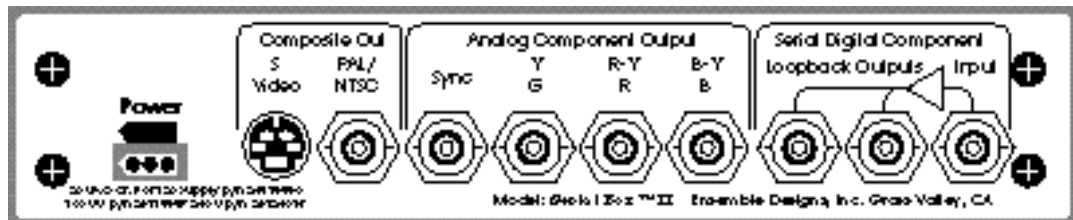


Serial Box II

Serial Box II

Description

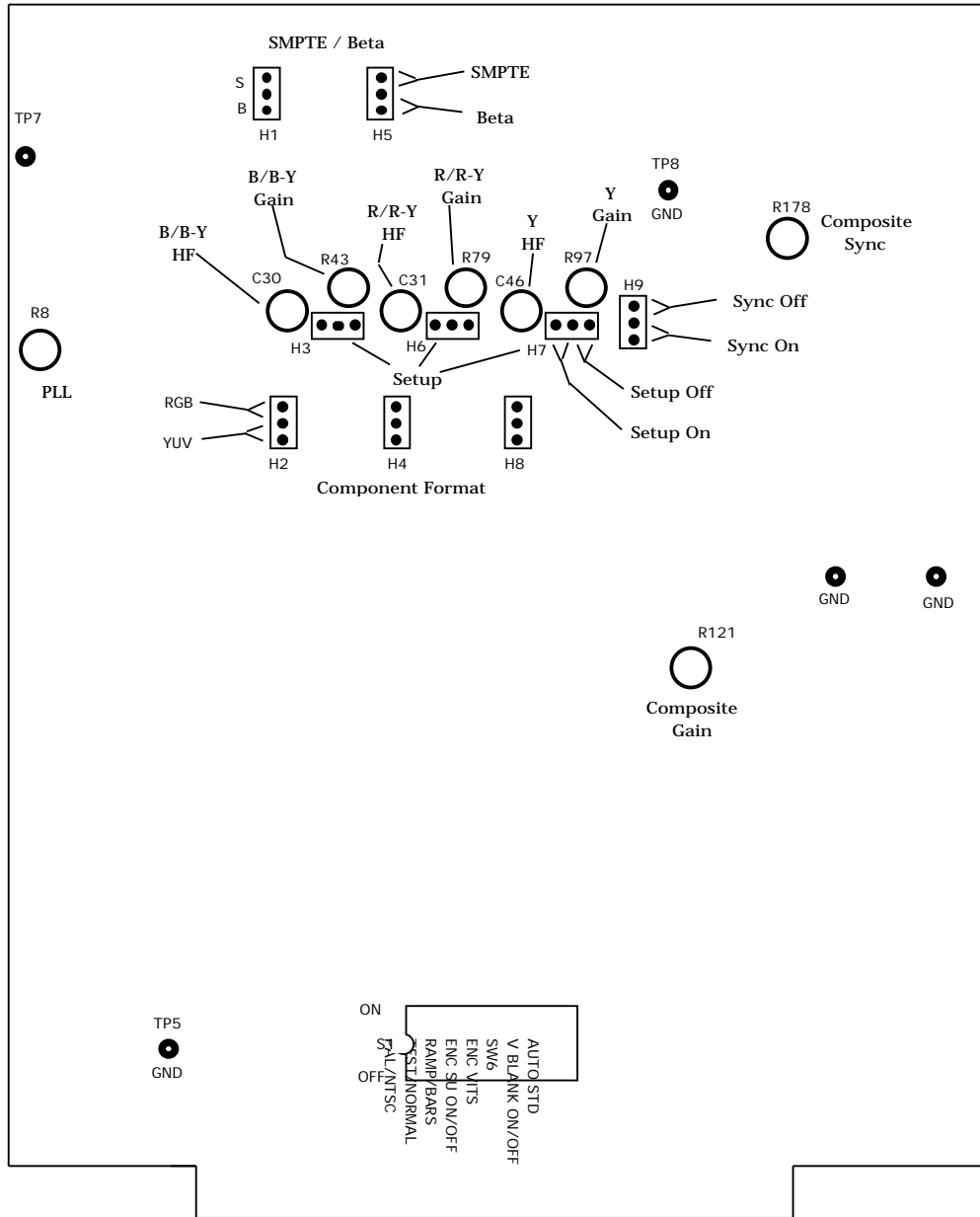
Serial Box II has all the features of Serial Box I, plus composite and S-video (Y/C) outputs. See the information on page 12 for more on its component analog output.



In addition to component output, Serial Box II also generates a digitally encoded NTSC output when operated in the 525 mode, and a PAL output when in the 625 domain. All component signals have full 10 bit resolution, while the composite output only is limited to the eight bit resolution of most composite digital VTR's. S-VHS output is also available from the Serial Box II.

The Serial Box II composite output is digitally encoded from the original digital component signals resulting in accurate colorimetry and signal levels. With two active loopthrough ITU-R 601 connectors, Serial Box I and II can also act as a two output serial digital video distribution amplifier.

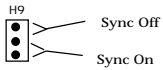
Jumper Location Guide for Serial Box II



Serial Box II

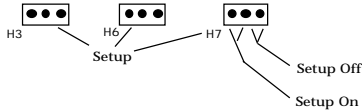
Jumper Info

Refer to the Configuration Jumpers legend near the power connector.



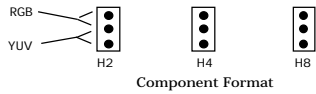
Sync is added to the Y or G channel when H9 is in the ON position.

Setup may be added to each of the component channels on an individual basis.

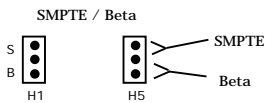


H3	B-Y/B
H6	R-Y/R
H7	Y/G

Choose the Color Difference Position or RGB Position. The Serial Box decodes the serial bit stream to the Y, R-Y, G-Y color difference format. Jumpers are provided to obtain a matrixed RGB output. To produce meaningful output all three of these jumpers must be in either the color difference position or the RGB position.



H2	B-Y/B
H4	R-Y/R
H8	Y/G

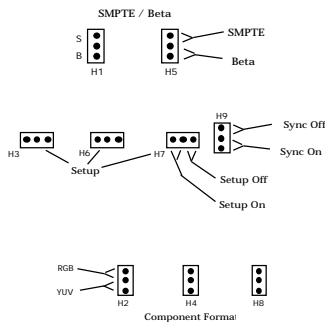


When operating in the YUV mode SMPTE or Beta levels are selected by jumpers H1 and H5.

When operating in RGB H1 and H5 must be set to the SMPTE (S) position

Typical Jumper Positions

Beta Output



For example, if you are feeding a BetaCam VTR, Y, R-Y, B-Y (YUV).

H1	B	H3	B-Y Setup OFF
H5	B	H6	R-Y Setup OFF
H2	YUV	H7	Y Setup ON, OFF for PAL
H4	YUV		
H8	YUV	H9	Y Sync ON

SMPTE Output

If you are feeding to a Y, R-Y, B-Y (YUV) monitor.

H2	YUV	H3	B-Y Setup OFF
H4	YUV	H6	R-Y Setup OFF
H8	YUV	H7	Y Setup OFF
H1	S	H9	Y Sync ON
H5	S		

RGB Output

If you are feeding to an RGB component monitor.

H2	RGB	H3	B Setup OFF
H4	RGB	H6	R Setup OFF
H8	RGB	H7	Y Setup OFF
H1	S	H9	Y Sync ON
H5	S		

Serial Box II

Adjustments

Input PLL

Monitor TP7 with a DVM. With a ITU-R 601 serial digital signal connected to input jack J1, turn R8 CCW so that video lock is lost. Turn R8 slowly CW until video appears at the composite or component output. Note the voltage on TP7. Continue turning R8 CW until the TP7 voltage has increased 200mV to 250mV.

If a meter is not available: With a ITU-R 601 serial digital signal connected to input jack J1, adjust R8 so that video appears at a component or composite output. Set R8 to the center of the range which produces output video.

Level and Response

HF response is factory set and will not normally require adjustment. See Output Amplitudes for level adjustments. Note: When changing Standards R178 can be adjusted for optimum sync level.

<u>Channel</u>	<u>Level</u>	<u>HF Response</u>
Y/G	R97	C46
R-Y/R	R79	C31
B-Y/B	R43	C30
Encoded Video	R121	—
Encoded Sync	R178	—

Output Amplitudes

Color Difference

SMPTE, EBU, MII - Color Bars, No Setup

<u>Channel</u>	<u>75% Bars</u>	<u>100% bars</u>	
Y	700mV	700mV	Blanking to peak white
R-Y	525mV	700mV	Peak to Peak
B-Y	525mV	700mV	Peak to Peak

Beta SP, Beta - Color Bars with Setup

Place jumper H7 in the SETUP ON position

<u>Channel</u>	<u>75% Bars</u>	
Y	714mV	Blanking to peak white
R-Y	700mV	Peak to Peak
B-Y	700mV	Peak to Peak

RGB - Color Bars, No Setup

<u>Channel</u>	<u>75% Bars</u>	
G	75 IRE	Blanking to peak of color
R	75 IRE	Blanking to peak of color
B	75 IRE	Blanking to peak of color

<u>Channel</u>	<u>100% bars</u>	
G	100 IRE	Blanking to peak of color & white
R	100 IRE	Blanking to peak of color & white
B	100 IRE	Blanking to peak of color & white

Composite

It is necessary to make these adjustments when standards are changed.
Adjust R121 for 100 IRE of video as monitored at the composite output.
Then adjust R178 for 40 IRE of sync.

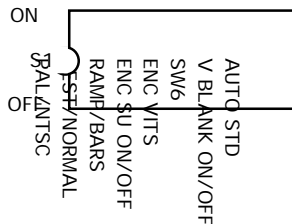
Serial Box II

DIP Switch

The various switch positions function as follows:

S1. PAL/NTSC: Selects PAL/625 standard or NTSC/525 standard.

S2. TEST/NORMAL: Produces a test signal at the encoded outputs when in the Test position. Note: These test signals do not appear at the component outputs.



S3. RAMP/BARS: Selects Ramp or Color Bars as the composite test signal. Note: These test signals do not appear at the component outputs.

S4. ENC SU ON/OFF: Turns setup ON or OFF for the encoded outputs.

S5. (U5 version 1.7xx & later and board 45003514 or later) ENC VITS. Allows passage of VITS to the Composite output with S5 in the ON position.

S7. (U5 version 1.7xx & later) Vertical Blanking ON/OFF. The incoming End of Blanking bit is ignored, and component End of Blanking occurs at Line 10 when S7 is in the ON position.

S8. (U5 version 1.5xx & later) Auto Standard ON - OFF. NTSC/PAL is selected automatically when S8 is ON and S1 is in the NTSC position.

Switches, cont.

Here is a summary of the Serial Box 2 Vertical blanking switches:

<u>Switch Name</u>	<u>Component</u>	<u>Composite</u>
<u>VBLANK ENC VITS</u>	<u>Output</u>	<u>Output</u>
S1-7 OFF, S1-5 OFF	follows Vbit	wide blanking
S1-7 ON, S1-5 OFF	narrow blanking	wide blanking
S1-7 ON, S1-5 ON	narrow blanking	narrow blanking
S1-7 OFF, S1-5 ON	follows Vbit	follows Vbit

The Vbit is b5 of the fourth word (XY) of the sync sequence, FF 00 00 XY. It is set by the originating device during vertical blanking, and is zero elsewhere. If the originating device is generating VITS it will clear the Vbit just after the second set of vertical equalizing pulses. If the originating device specifies the vertical interval is to be blanked the Vbit will not be cleared until the start of active picture.

With both S1-5 and S1-7 OFF the component output will follow the Vbit, while composite output will have wide blanking. On Serial Box 2's with 50003513 boards and earlier, the switches were not yet implemented and the SB2 functions as though both S1-5 and S1-7 are OFF.

Serial Box II

Product Specifications

Analog Component Output

Standards	525 or 625 Line, switchable or auto select
Format	RGB or Y/R-Y/B-Y, SMPTE or Beta, strappable Setup ON/OFF, strappable, Sync on Y/G ou tput, strappable
Levels	0.7 / 1.0 V p-p Non-Comp / Comp
Sync Output	1 V p-p Composite H & V
Response	Y Chan: 6 MHz Bandwidth, 0.25dB to 5 MHz
Color Diff	2.5 MHz Bandwidth
2T K Factor	<1% Y Channel
D to A	10 bit sampling of all components

Analog Composite Outputs

Format	NTSC/PAL and Y/C (follows line rate), Digitally Encoded
Response	0.25dB to 5 MHz
2T K Factor	<1%
Diff Gain	<1.5%

Serial Digital Component Inputs

SMPTE 259M / ITU-R 601 / CCIR 656, 10 bit words at 270 Mbits/sec.
Active loop-through from Serial Input provides 2 independently buffered, re-clocked outputs

Mechanical & Power

Size 8.5" W, 1.75" H, 10" D
Weight 3 lbs
Two units can be rack mounted side by side using optional rack ears
Chassis is completely enclosed
20VAC, 50/60 Hz, less than 10 VA
Power is supplied by a UL and CSA listed wallmount transformer
Specify either 100, 120 or 230 volts

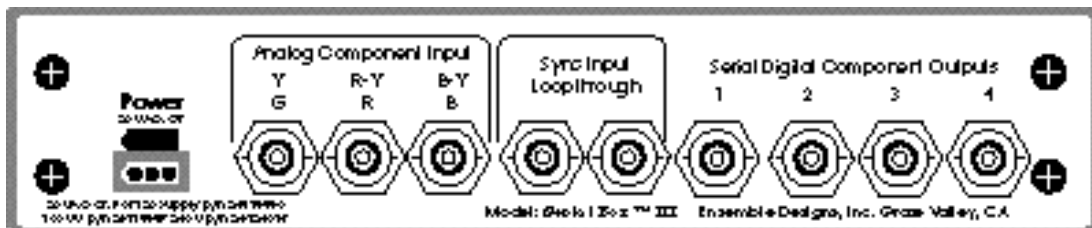


Serial Box III

Serial Box III

Description

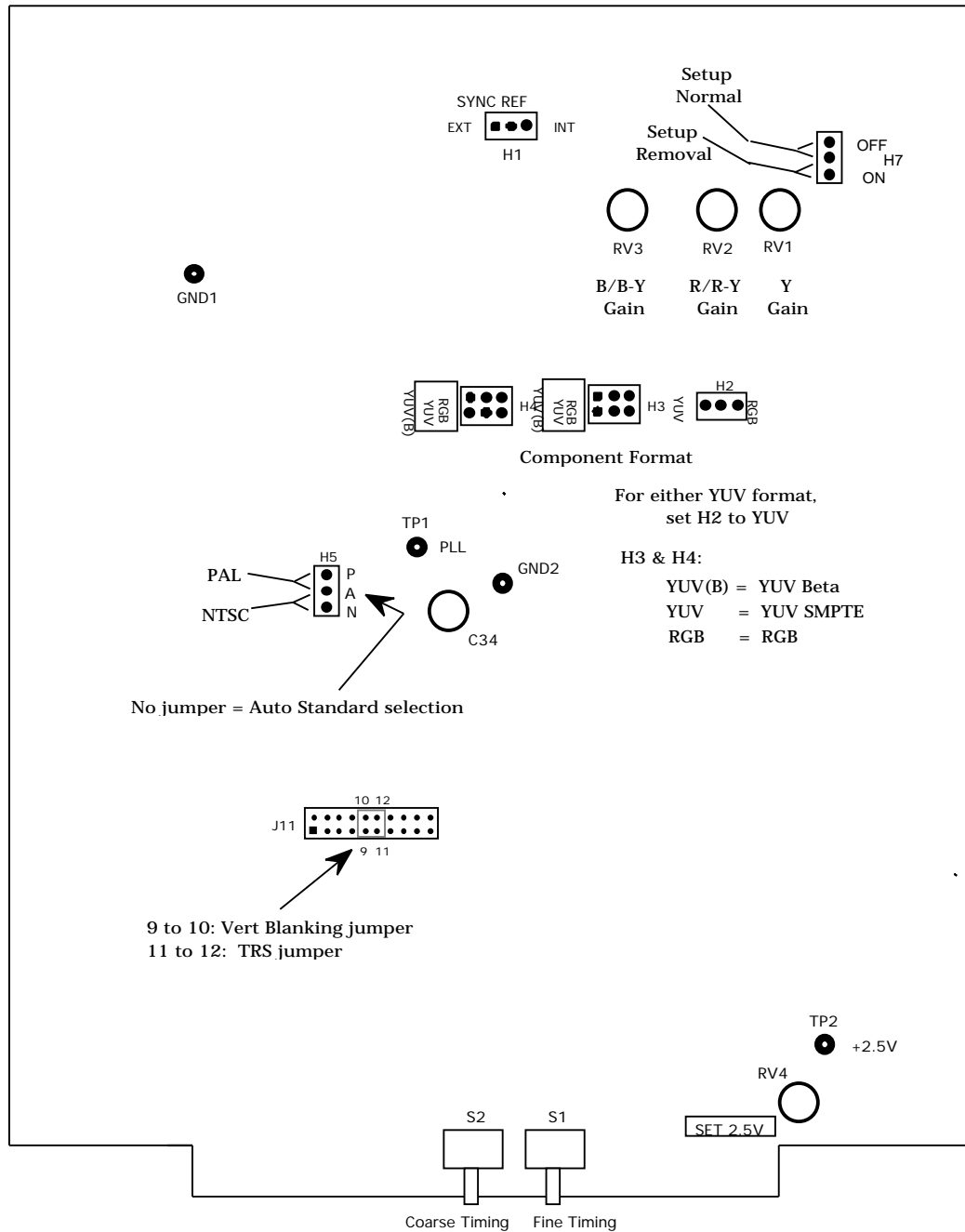
Serial Box III provides the reverse transformation wherein component analog video inputs produce a ITU-R 601 serial digital output signal.



There are four serial digital output jacks allowing distribution to multiple loads. Again, jumpers are provided to allow either color difference or RGB inputs. Sync may be derived from the Y (G) channel or taken from the Sync Input jack.

Serial Box III is a full 10 bit convertor utilizing 2x oversampling to maintain the widest possible bandwidth free of digital sampling artifacts. A proprietary automatic digital DC clamp circuit reduces the number of adjustments in the unit and eliminates a significant source of analog drift. A setup removal mode is also provided. This is useful when the input material contains setup and you desire to return to the no-setup ITUR-R 601 world. Front panel controls permit adjustment of sync-to-video timing. Operates in the 525 or 625 standard.

Jumper Location Guide for Serial Box III



Serial Box III

Switches

Timing switches are provided to adjust picture timing relative to sync. The principal purpose is to allow for EXTERNAL sync which is not exactly in time with incoming video. In the INTERNAL sync mode these timing switches may also be used to perform precise horizontal picture positioning.

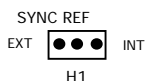
S1. Fine Timing. Adjusts fine timing of output video relative to sync. There are 16 active settings available, with position zero being the 9 o'clock position. A small arrow on the shaft end is the indicator.

S2. Coarse Timing. Adjusts coarse timing of output video relative to sync. There are 4 active settings available, with position zero being the 9 o'clock position. Rotating the switch further causes a repeat of the 4 timing settings. A small arrow on the shaft end is the indicator.

Nominal settings for these controls when using INTERNAL Sync:

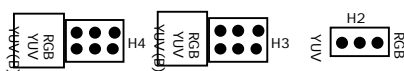
<u>Standard</u>	<u>Coarse</u>	<u>Fine</u>
525	1	9
625	2	A

Jumper Info

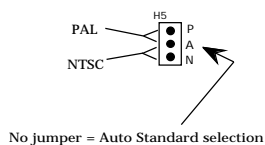


Sync is derived from the Y (or G) channel when jumper H1 is in the INT position. With H1 in the EXT position sync is taken from Sync Input jacks J5 and J6.

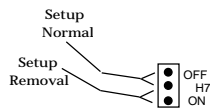
Choose the Color Difference Position or RGB Position. Serial Box III encodes the serial bit stream from the Y, R-Y, B-Y (YUV) color difference format. Jumpers are provided to allow an RGB input which is then matrixed to color difference. To produce meaningful results all three of these jumpers must be in either a YUV position, or the RGB position.



	SMPTE	Beta	RGB
	<u>YUV</u>	<u>YUV</u>	<u>RGB</u>
H2	YUV	YUV	G
H3	YUV	YUV(B)	R
H4	YUV	YUV(B)	B



Selection of 525 or 625 standard is controlled by jumper H5. With N (NTSC) jumpered to the center pin A the 525 standard is selected. Jumpering P (PAL) to A gives 625 operation. With the jumper removed standards selection is Automatic.

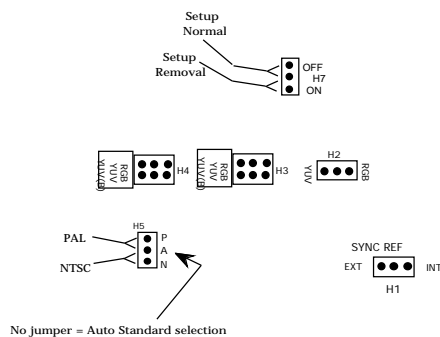


Setup removal is enabled by jumper H7. With the jumper in the OFF position, setup is unaffected. Placing the jumper in the ON position, causes setup on the incoming signal to be deleted. This is desirable when processing video from some Beta sources.

Serial Box III

Typical Jumper Positions

Beta Input



For example, if you are feeding a BetaCam VTR, Y, R-Y, B-Y, (YUV).

H7	Setup Removal ON
H2	YUV
H3	YUV(B)
H4	YUV(B)
H5	No Jumper (automatic standard selection)
H1	INT (if there is sync on Y), or EXT (if sync is fed on a separate cable)

SMPTE Input

If you are using a SMPTE format CAV (component analog video) switcher, Y, R-Y, B-Y or YUV.

H7	Setup Removal OFF
H2	YUV
H3	YUV
H4	YUV
H5	No Jumper (automatic standard selection)
H1	INT (if there is sync on Y), or EXT (if sync is fed on a separate cable)

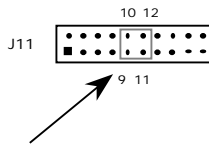
RGB Input

If you are using an RGB camera or character generator.

H7	Setup Removal OFF
H2	RGB
H3	RGB
H4	RGB
H5	No Jumper (automatic standard selection)
H1	INT (if there is sync on G), or EXT (if sync is fed on a separate cable)

Narrow Blanking Instructions for Serial Box III

With PROM 1.5b1 and later, blanking can be narrowed to allow passage of Vertical Interval signals. This function is enabled by selective grounding of pin 57 and pin 79 of U16. The grounding of these pins can be accomplished with a 4 pin header in J11. (If there is no header in J11 it will be necessary to use wire jumpers and solder them in place.) Viewed from the front panel of the Serial Box III, J11-9,10 is to the left and J11-11,12 is to the right.



9 to 10: Vert Blanking jumper
11 to 12: TRS jumper

J11-9,10 (U16-57, 58)	open	wide blanking, wide TRS (normal mode)
	shorted	narrow blanking, narrow TRS
J11-11,12 (U16-79, 80)	open	TRS as above
	shorted	wide TRS

The narrow TRS puts the end of blanking just after the serrated vertical sync pulses. Any following equipment whose blanking end is controlled by the TRS will also pass VITC, VITS and other vertical interval signals. 525 standards allow for the TRS in this position while 625 standards have no provision for TRS in this location. However it may be necessary, in some cases, to be "illegal" in 625 and place the TRS here so that following equipment will pass the vertical interval signals.

The wide TRS leaves the TRS at (or near) the end of vertical blanking. If following equipment controls its own blanking end, and this produces narrow blanking, vertical interval signals will pass. If it uses the TRS to establish the end of blanking, vertical interval signals will be blanked and will not pass. This TRS location is permissible under both 525 and 625 standards.

Serial Box III

Adjustments

Phase Locked Loop

Sync input is required to make this adjustment. This is obtained either by feeding a video signal with sync to the Y/G input jack with jumper H1 set to INT, or by feeding a 2V p-p sync signal to the Sync Input with H1 in the EXT position. If using EXT sync be certain to terminate the Sync loopthrough. Adjust C34 for 5.0V on TP1, PLL.

A/D Reference

With a Digital Voltmeter connected to TP2, SET 2.5V, adjust RV4 for 2.50V. Adjustment of the A/D Reference will affect gain. Check the level adjustments below after changing the A/D Reference adjustment.

Input Levels

These are factory set and will not normally require adjustment if SMPTE or Beta standards are in use. Please note that there is very little headroom in the SMPTE 259M / ITU-R 601 standard. If input level adjustments are to be made, use accurately calibrated equipment. Excessive input levels will cause flat-topping with loss of high luminance detail and will produce improper hues in some of the saturated colors.

To set the input level adjustments, feed a calibrated Y, R-Y, B-Y color bar Test Signal to the input jacks with the H2, H3 & H4 jumpers set to the YUV position, or the YUV(B) position if the Beta standard is in use. The amplitudes, setup, etc. of the Test Signal must conform to the format you will be using with the Serial Box III. Connect the Serial Box III output to a serial digital scope, such as a Tektronix 601, which is set up for Y, R-Y, B-Y operation. Set the Serial Box III input adjustments to produce 700mV p-p waveforms.

<u>Channel</u>	<u>Level Adjustment</u>
Y/G	RV1
R-Y/R	RV2
B-Y/B	RV3

Serial Box III

Product Specifications

Analog Component Input

Standards	525 or 625 Line, switchable or auto select
Format	RGB or Y/R-Y/B-Y, SMPTE or Beta, strappable RS170A / CCIR 470-1, Setup removal, strappable Sync on Y/G or External Sync Input, strappable
Levels	0.7 / 1.0 V p-p Non-Comp / Comp, Internally Terminated
External Sync	0.25V to 4 V p-p Composite H & V, loop through input
Response	Y Chan: 6 MHz Bandwidth, 0.25dB to 5 MHz
Color Diff	2.5 MHz Bandwidth
2T K Factor	<1% Y Channel
A to D	10 bit sampling of all components, 2x Oversampling

Serial Digital Component Outputs

SMPTE 259M / ITU-R 601 / CCIR 656, 10 bit words at 270 Mbits/sec.
4 each, independently buffered Serial Digital Component outputs
Optional 4:4:4 support

Mechanical & Power

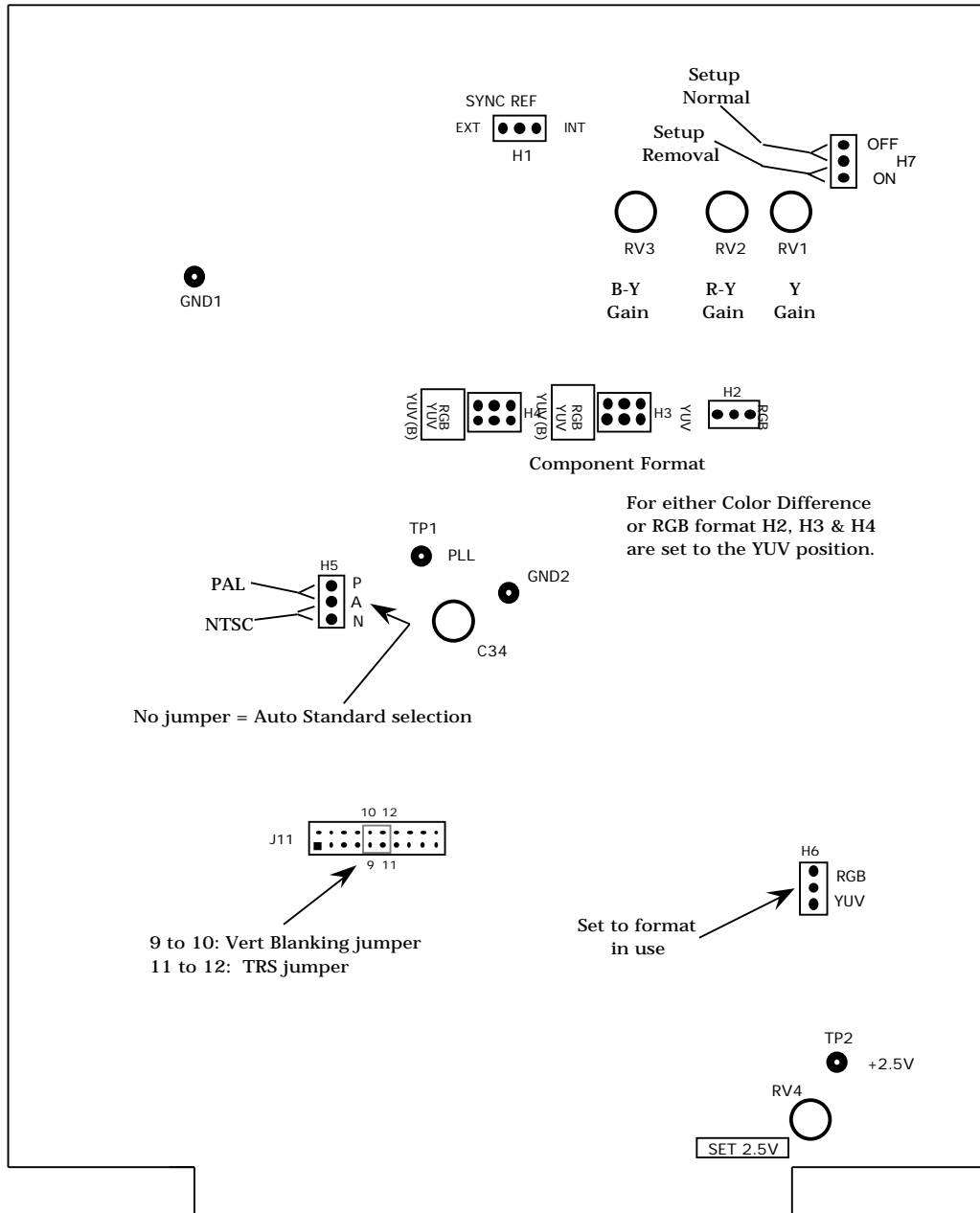
Size:	8.5" W, 1.75" H, 10" D
Weight:	3 lbs

Two units can be rack mounted side by side using optional rack ears.
Chassis is completely enclosed
20VAC, 50/60 Hz, less than 10 VA
Power is supplied by a UL and CSA listed wallmount transformer
Specify either 100, 120 or 230 volts



Serial Box III 4:4:4

Jumper Location Guide for Serial Box III 4:4:4



Jumper Info

Sync is derived from the Y (or G) channel when jumper H1 is in the INT position. With H1 in the EXT position sync is taken from Sync Input jacks J5 and J6.

Serial Box III encodes the serial bit stream from the Y, R-Y, B-Y (YUV) color difference format, or from an analog RGB input. Jumpers, which are used in the standard 4:2:2 Serial Box III to allow a matrixed RGB input to produce a color difference serial output, always remain in the YUV position in the Serial Box III 4:4:4. Thus, a 4:4:4 RGB analog input produces an output 4:4:4 serial stream encoded in the RGB format.

	I/O Format		Function
	<u>YUV</u>	<u>RGB</u>	
H2	YUV	YUV	Y/G
H3	YUV	YUV	R-Y/R
H4	YUV	YUV	B-Y/B
H6	YUV	RGB	Clamp Bias

Selection of 525 or 625 standard is controlled by jumper H5. With N (NTSC) jumpered to the center pin A the 525 standard is selected. Jumpering P (PAL) to A gives 625 operation. With the jumper removed standards selection is Automatic.

Setup removal is enabled by jumper H7. With the jumper in the position nearest the BNC connectors at the rear of the board, setup is unaffected. Placing the jumper in the position toward the front of the board, and thus away from the BNC connectors, causes setup on the incoming signal to be deleted.

Serial Box III 4:4:4

Adjustments

Phase Locked Loop

Sync input is required to make this adjustment. This is obtained either by feeding a video signal with sync to the Y/G input jack with jumper H1 set to INT, or by feeding a 2V p-p sync signal to the Sync Input with H1 in the EXT position. Adjust C34 for 5.0 volts on TP1, PLL. Note: If using EXT sync be certain to terminate the Sync loophrough BNC.

A/D Reference

With a Digital Voltmeter connected to TP2, SET 2.5V, adjust RV4 for 2.50 volts. Adjustment of the A/D Reference will affect gain. Check the level adjustments that follow after changing the A/D Reference adjustment.

Input levels

These are factory set and will not normally require adjustment. Please note that there is very little headroom in the SMPTE 259M / ITU-R 601 standard. If input level adjustments are to be made, use accurately calibrated equipment. Excessive input levels will cause flat-topping with loss of high luminance detail and will produce improper hues in some of the saturated colors.

To set the input level adjustments, feed a calibrated Y, R-Y, B-Y color bar Test Signal to the input jacks with the H2, H3 & H4 jumpers set to the YUV position. The amplitudes, setup, etc. of the Test Signal must conform to standards. Connect the Serial Box III output to a serial digital scope, such as a Tektronix 601, which is set up for Y, R-Y, B-Y operation. Set the Serial Box III input adjustments to produce 700mV p-p waveforms.

<u>Channel</u>	<u>Level Adjustment</u>
Y/G	RV1
R-Y/R	RV2
B-Y/B	RV3

Serial Box III 4:4:4

Product Specifications

Analog Component Input

Standards	525 or 625 Line, strappable
Format	Y/R-Y/B-Y or RGB, 4:4:4 Setup removal, strappable Sync on Y/G or External Sync, strappable
Levels	0.7 / 1.0 V p-p Non-Comp / Comp, Internally Terminated
External Sync	4 V p-p Composite H & V, loop through
Response	Y Chan: 6 MHz Bandwidth, 0.25dB to 5 MHz Color Chans: 6 MHz Bandwidth, 0.25dB to 5 MHz
2T K Factor	<1% Y Channel
D to A	10 bit sampling of all components, 2x Oversampling

Serial Digital Component Outputs

SMPTE 259M / CCIR601, 10 bit words at 270 Mbits/sec.
4 each, independently buffered Serial Digital Component outputs

Mechanical & Power

Size: 8.5" W, 1.75" H, 10" D
Weight: 3 lbs
Two units can be rack mounted side by side using optional rack ears.
Chassis is completely enclosed.
18VAC, 50/60 Hz, less than 10 VA
Power is supplied by a UL and CSA listed wallmount transformer, specify either 100, 115 or 230 volts

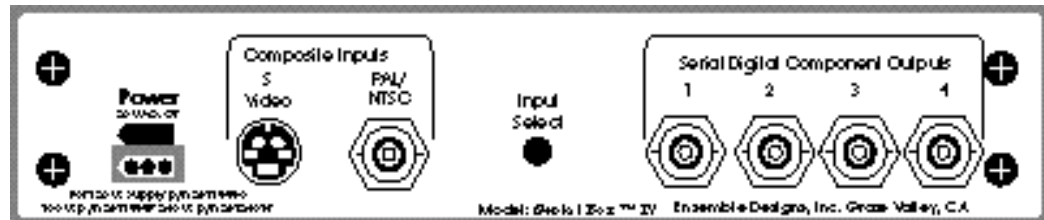


Serial Box IV

Serial Box IV

Description

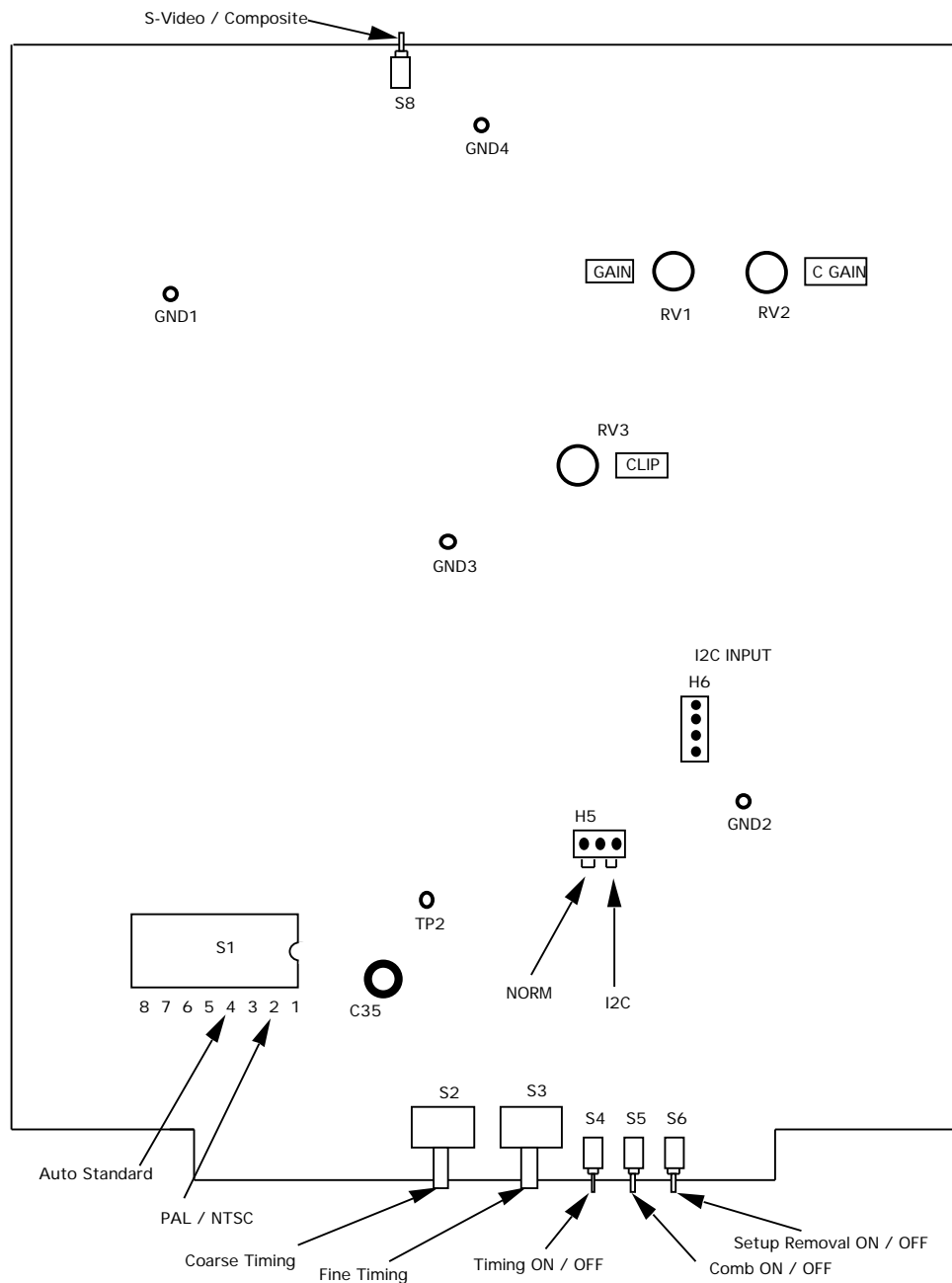
Serial Box IV has a composite analog video input and a Y/C (S-Video) input and produces a ITU-R 601 serial digital output signal.



A switch on the unit designates which of the two inputs is used. Four serial digital buffered, reclocked output jacks allow distribution to multiple loads. Operation with either the 525 or 625 standard is provided.

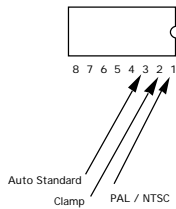
Serial Box IV is a full, 10 bit analog to serial digital component convertor utilizing 2 times oversampling to maintain the widest possible bandwidth free of digital sampling artifacts. The optional comb filter reduces chroma-crawl and can be switched on or off from the front panel. An optional SmartStore buffer can be added to enable timing adjustment up to +/- 5 lines.

Jumper Location Guide for Serial Box IV



Serial Box IV

Switches



S1. Only positions 1, 2 and 3 are used.

	<u>Off</u>	<u>On</u>
S1-1	NTSC	PAL

S1-2 Dig Clamp Enabled Dig Clamp Disabled

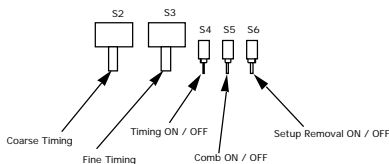
Applies when the 22153 in U10 is a “G” revision part, or when there is a 22153A in this location. Requires version 2.1b1 or later software in U18, and version SB4e22b1 or later in U13 .

DIP Switch S1-2 controls the digital clamp in the 22153 IC. With this switch in the OFF position the digital clamp is enabled. This is the normal operating mode. With S1-2 in the ON position the digital clamp is disabled.

In most cases use of the digital clamp is to be preferred. With certain noisy input signals it may be desirable to turn off the digital clamp. With the digital clamp turned off the analog clamp provides clamping. However, it is not as accurate at maintaining DC level as is the digital clamp.

	<u>Off</u>	<u>On</u>
S1-3	S1-1 sets Std	Auto Std (w/S1-1 off)

Note: S1-3 functions with 1.3b3 and later PROM, board rev “F” or later.



S2. Coarse Timing. Adjusts coarse timing of output video and sync relative to sync on the incoming analog signal. Operative only if a SmartStore module is installed in P1.

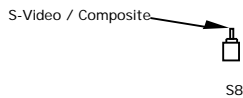
S3. Fine Timing. Adjusts fine timing of output video and sync relative to sync on incoming analog signal. Operative only if a SmartStore module is installed in P1.

Switches, cont.

S4 Timing ON / OFF. UP enables operation of S2 and S3. Operative only if a SmartStore module is installed in P1.

S5. Comb ON / OFF. UP enables the three line comb filter. This switch will be in the UP position for most applications.

S6. Setup Removal ON / OFF. UP enables setup removal. This switch will be in the UP position for American NTSC. It will be in the DOWN position for PAL and Japanese NTSC.

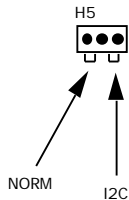


S8. Composite / S-Video. This switch will be in the DOWN position for composite input and in the UP position for S-Video input.

Note: Only one input cable may be connected at any time. Connecting both composite and S-Video cables at the same time will produce unwanted interference.

Serial Box IV

Jumper Info



H5 must remain in the NORM position. Header H6 is for factory use only.

Adjustments

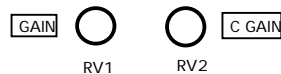
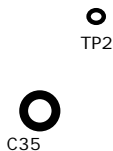
With S-Video / Composite switch S8 in the DOWN (Composite) position, feed 1 volt p-p composite color bars from a Test Generator to the Composite Input BNC connector. View the ITU-R 601 output on a D1 scope, such as a Tek 601. If a D1 scope is not available a Serial Box I or Serial Box II may be used to feed the individual component signals to an analog scope or waveform monitor. Assure that all this equipment is properly calibrated.

1. PLL Tuning, C35: Connect a Digital Voltmeter to TP2 with the DVM common lead going to one of the GND test points. Adjust C35 for a reading of approximately 5 volts.

2. GAIN, RV1: Rotate CLIP, RV3, Fully CW. Adjust GAIN, RV1, for a Y signal of 700mV p-p on the test scope. R-Y and B-Y should also be seen at 700mV p-p.

3. CLIP, RV3: From a fully CW position, rotate CCW until clipping is observed on the test scope. Rotate RV3 approximately 20 degrees CW from the position where clipping was first observed.

4. GAIN, RV2: Remove the BNC cable from the input connector. Connect a calibrated source of S-Video to the S-Video input connector and move S8 to the UP position. Adjust RV2 for 700 mV p-p of R-Y and B-Y output.



Product Specifications

Analog Composite Input

Standards	NTSC or PAL, switchable or auto select
Format	Composite or Y/C (S-Video), RS170A / CCIR 470-1
Levels	1.0 V p-p Composite, Internally Terminated
Response	6 MHz Bandwidth, 0.25dB to 5 MHz
2T K Factor	<1%
D to A	10 bit sampling of all components, 2x Oversampling
Timing	70ns resolution Without optional SmartStore: 1 line delay
Panel Controls	Timing Coarse, Fine, ON/OFF Comb ON/OFF, Setup ON/OFF
Internal Controls	NTSC/PAL/AUTO, Gain, Clip, Standards

Serial Digital Component Outputs

SMPTE 259M / ITU-R 601 / CCIR 656, 10 bit words at 270 Mbits/sec
4 each, independently buffered Serial Digital Component outputs

Mechanical & Power

Size: 8.5" W, 1.75" H, 10" D
Weight: 3 lbs

Two units can be rack mounted side by side using optional rack ears
Chassis is completely enclosed
20VAC, 50/60 Hz, less than 10 VA
Power is supplied by a UL and CSA listed wallmount transformer
Specify either 100, 120 or 230 volts

Serial Box V

Description

Precise Conversion

Serial Box V is a serial digital component to analog convertor with simultaneous component, composite and Y/C outputs. Genlock reference input and timing controls ensure ease of integration into every facility. Serial Box V's Second Channel Option offers Full Chroma Bandwidth and Key Channel support. Serial Box V is full 10 bit 601 with colorspace conversion done at 12 bit precision for pristine video output.

Convenient Video and Key Conversion

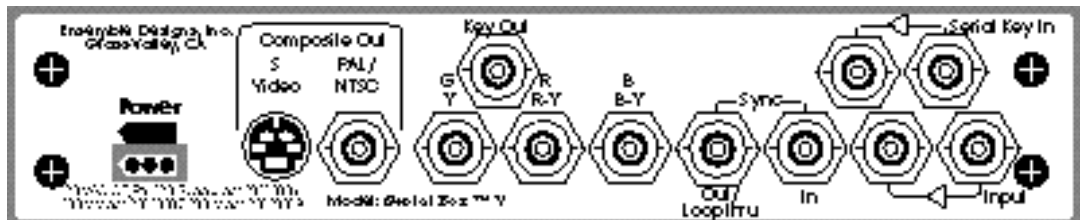
Serial Box V offers the convenience of converting both video and key signals all in one package. The Second Channel Option offers key channel conversion for proper 4:2:2:4 support.

Genlock & Timing

Serial video and key inputs are independently auto-timed to the genlock reference for proper video and key alignment at routers and production switchers. Accurate timing control over Serial Box V's analog outputs makes it easy to meet timing requirements of analog destinations.

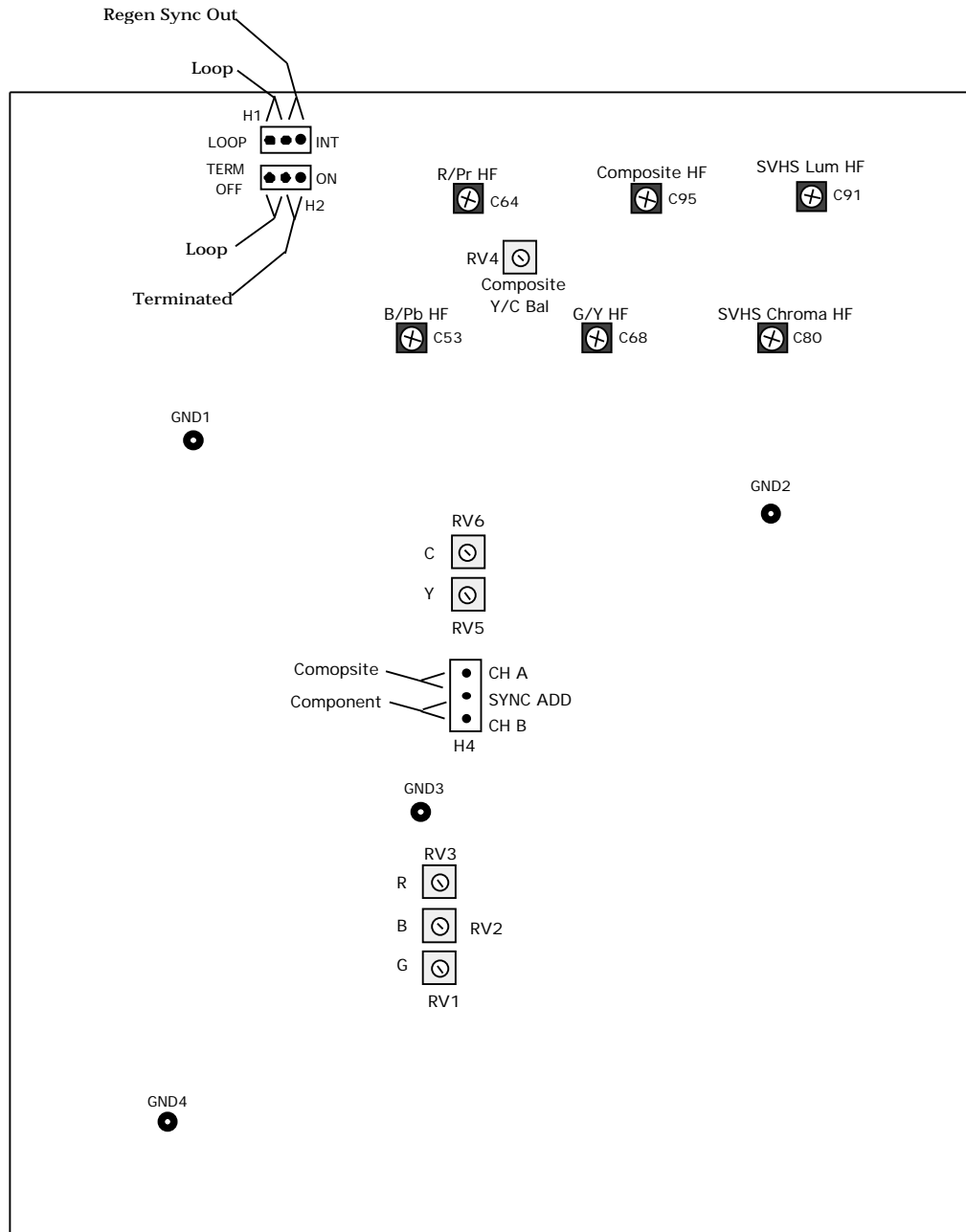
Increased Image Quality

Serial Box V is a full bandwidth conversion solution for use with digital component sources. Support of RP-175 Dual Link is provided with simultaneous inputs for both the Link A and Link B signals. Both the composite and component outputs benefit from increased image quality when operating in Dual Link mode. 4:4:4 and 4:4:4:4 operation make Serial Box V a great fit for telecine, chroma keying, and virtual sets.

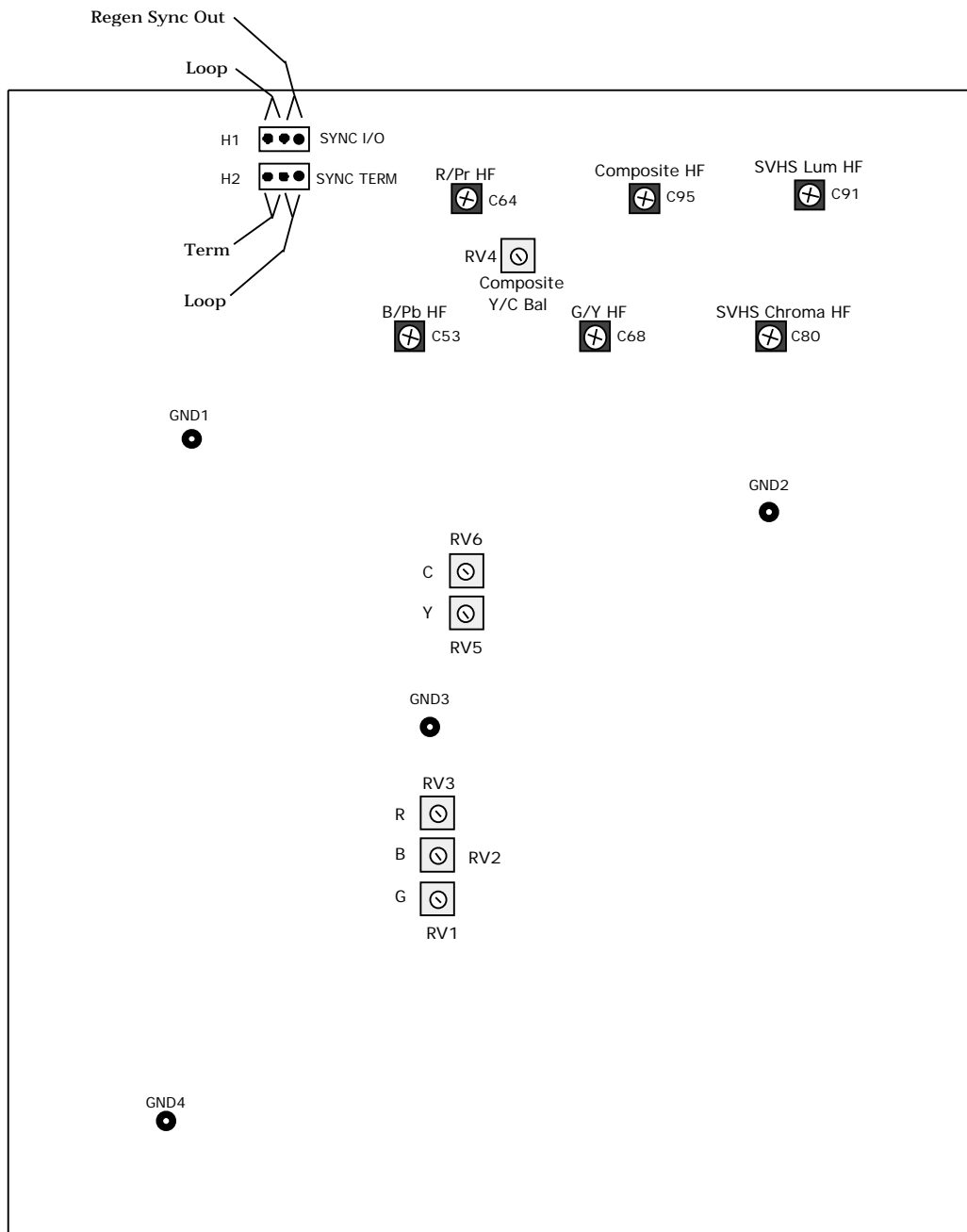


Serial Box V

Jumper Location Guide for Serial Box V Board Vers 3553

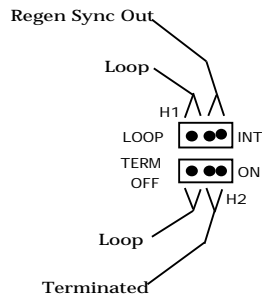


Jumper Location Guide for Serial Box V Board Vers 3552



Serial Box V

Jumper Info



H1 - Sync Output Jumper

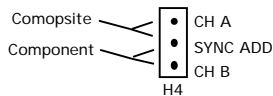
Regen Sync Out - connects regenerated sync to the Sync Out / Loopthru jack

Loop - connects the Sync In jack to the Sync Out / Loopthru jack

H2 - Sync termination jumper

Term - Terminates the sync input with a 75 Ω resistor

Loop - Sync input is unterminated



H4 - Sync Timing Jumper

Ch A - Key Sync and Sync Out are timed to the composite output

Ch B - Key Sync and Sync Out are timed to the component output

Adjustments

Output format is set to R-Y, B-Y, Beta

<u>Adjustment</u>	<u>Designator</u>	<u>Scope Sync</u>	<u>Monitor</u>	<u>TSG422 Generator</u>
G Gain	RV1	Int	Y	75% Color Bars
R Gain	RV3	Ext	R-Y	
B Gain	RV2	Ext	B-Y	
B/Pb HF	C53	Ext	B-Y	Sweep
R/Pr HF	C64	Ext	R-Y	
G/Y HF	C68	Int	Y	
Composite HF	C95	Int	Composite	Sweep, B&R OFF
Composite Chroma Gain	RV6	C	Composite	75% Bars, all ON
Composite Lum Gain	RV5	Y	Composite	
Note: It may be necessary to adjust RV4, Composite Y/C Bal. Start with it centered.				
SVHS Lum HF	C91	Int	SVHS	75% Color Bars
SVHS Chroma HF	C80	Int	SVHS	

Serial Box V

Dual Link

Under Dual Link it takes two cables to supply the full signal in all of its bandwidth. The first cable, called Link A, has the normal full bandwidth Luminance (Y) in its normal position. Then the R-Y and B-Y positions (which represent the 2:2 portion of the 4:2:2 signal) are used to hold the full bandwidth samples of R-Y and B-Y which would line up with the first of every two Y signals.

The second cable, called Link B, has the alpha signal (if there is one) in the Y position, and the R-Y and B-Y positions carry the color difference signals. The two cables combined carry the information needed for full 4:4:4 or 4:4:4:4.

Front Panel Control

Format, line standard, and timing are all controlled from Serial Box V's front panel. System configuration is stored in non-volatile memory. Front panel controls make Serial Box V easy to adjust whenever needed.

Firmware Version

In the home menu, when the menu button is off, press and hold both the right and left arrow keys to display current panel Firmware version.

Menu Functions

Menu Functions are enabled by pressing the Menu Func button. It will illuminate (in Red) to indicate that a menu function is active. These functions can be turned off by pressing Menu Func a second time.

Menus are:

Output format

Genlock

Line Standard

Color Lock

Vert Timing

Hor Timing

SC phase

Key Delay

Input format

Vertical Blanking

Engr Setup

Serial Box V

How to use the Menus

1. Press the Menu Func button so it is on, the red light will be lit.
2. Use the right and left arrow keys to find the desired menu.
3. Press the Enter button or down arrow to select that Menu.
4. Use the left and right arrow keys to select the desired setting or to change the parameters.
5. Press the Menu Func button to turn it off, the red light will be off.

Menu Detail

Output format

Select the desired format for the component outputs:

<u>525</u>	<u>625</u>
RGB sync on G	RGB sync on G
RGB no-sync	RGB no-sync
Y/ R-Y/ B-Y S NSU	YUV EBU
Y/ R-Y/ B-Y SMPTE	
Y/ R-Y/ B-Y Beta	
Y/ R-Y/ B-Y B NSU	

Genlock

Select the desired mode:

Digital Input

Select when you want Serial Box V to lock to the digital input.

Auto Sensing

Serial Box V will automatically lock to the external Sync reference input if it is present, otherwise it will lock to the digital input.

Line Standard

Select the desired standard:

525 60Hz

625 50Hz

Auto Sensing

Color Lock

The composite output signal can be locked to the external reference in two field or four field mode for proper ScH operation. Four field lock can be either Normal or Invert to deal with all ScH scenarios. As the 601 digital signal contains only 2 field information, Serial Box V reverts to 2 field operation (no color framing) when the reference is the digital input signal. In 625 mode there are selections for the 4 fields.

Serial Box V

Vert Timing

Adjust vertical timing with the right and left arrow keys. The display shows the vertical timing relative to the timing reference. Vertical timing is in units of video lines. Negative values correspond to timing advance. Positive values indicate timing delay. For example, a setting of -2 indicates the output is two lines earlier than the reference.

Press and hold for faster incremental adjustment. Press and hold both arrow buttons to reset vertical timing to zero.

Hor Timing

Adjust horizontal timing with the right and left arrow keys. Horizontal timing is adjusted in increments of the 601 clock frequency.

Press and hold for faster incremental adjustment. Press and hold both arrow buttons to reset horizontal timing to zero.

SC Phase

Set SC Phase with the right and left arrow keys. Press and hold for faster incremental adjustment. Press and hold both arrow buttons to reset SC Phase to zero.

Key Delay

Set Key Delay with the right and left arrow keys. Press and hold for faster incremental adjustment. Press and hold both arrow buttons to reset Key Delay to zero. Please note: Key Delay moves only key video, not key sync.

Input Format

(Panel Software Version 1.3.4 and higher) Select the Serial Digital Input format using the arrow buttons. Choices are:

4:2:2 YCrCb

4:2:2:4 YCrCbA

4:4:4 YCrCb

4:4:4 RGB

No composite output.

4:4:4:4 YCrCbA

4:4:4:4 RGBA

No composite output.

4:4:4 RGBin -> CPST

Composite output from G BNC. Y/C from B&R BNC's. No component outputs.

Vertical Blanking

Choose Vertical Blanking Width using the arrow buttons.

Choices are:

Wide

Narrow/Vbit

In the Wide mode the entire vertical interval is blanked.

In the Narrow/Vbit mode component vertical blanking ends at the end of the vertical sync block.

In the Narrow/Vbit mode composite vertical blanking is controlled by the Vbit of the TRS signal. Vertical blanking will occur only on the lines where this bit is set. Most originating devices either can select this bit to be set for narrow blanking, or will set it to the narrow mode when vertical interval signals are originated.

Serial Box V

Engr Setup

Use the arrow buttons to turn Test Bars On or Off.

Product Specifications

Serial Digital Component Input

Standard

SMPTE 259M / ITU-R 601 / CCIR 656
10 bit words at 270 Mbits/sec.

Active loop-through from Serial Input
provides one independently buffered,
re-clocked output.

525 or 625 line, auto select.

Optional Second Channel

Provides key signal input or
SMPTE RP-175 Dual Link operation.
Full chroma bandwidth support
4:2:2:4, 4:4:4, and 4:4:4:4

Active loop-through with
one re-clocked output.

Genlock & Timing

Genlock reference input, looping.
Output timing control of sync and subcarrier.
Alternately, one connector can serve as sync output.

Serial Box V

Analog Composite Output

NTSC/PAL and Y/C (follows line rate).
10 bit, Digitally Encoded.
2x oversampled.

Optional Second Channel

Provides increased image quality when operating in RP-175 Dual Link.

Response	±0.25dB to 5.5 MHz
2T K Factor	<1%
Diff Gain	<1.5%
D to A	10 bit output

Analog Component Outputs

Standard RGB or Y/R-Y/B-Y, SMPTE or Beta levels, selectable
Setup ON/OFF, selectable
Sync on Y/G output, selectable

Optional Second Channel

Full bandwidth chroma (4:4:4) in either Y/R-Y, B-Y or true RGB operation

Levels	0.7 / 1.0 V p-p , Non-Comp/Comp
Sync Output	1 V p-p Composite H & V
Response	Y Chan: 6 MHz Bandwidth, ±0.25dB to 5.5 MHz
Color Diff	0.25 dB to 2.75 MHz
2T K Factor	<1% Y Channel
D to A	10 bit output

Key Signal Output

Optional Second Channel

Analog key signal derived from second channel serial input. Supports 4:2:2:4 and 4:4:4:4 operation depending on input signals.

Response	6 MHz Bandwidth, ±0.25dB to 5.5 MHz
D to A	10 bit output

Mechanical & Power

Size: 8.5" W, 1.75" H, 10" D / 215 x 44.5 x 254 mm
Weight: 3 lbs / 1.4 kgs.

Two units can be rack-mounted side by side using optional rack ears. Chassis is completely enclosed.

20VAC, 50/60 Hz, less than 10 VA

Power is supplied by a UL and CSA listed wallmount transformer. Specify either 100, 120 or 230 volts.

CE Compliant.

All signal control accessed from the front panel.

Trouble Shooting

No video output...

Is the video input on the right connector and not on the loop back output jack? If you bypass the Serial Box, do you see video? Do you have the correct power supply - 100v, 120v or 230v?

Video Outputs Looks Wrong...

Determine if the equipment you are working with is set for RGB or Y, R-Y, B-Y (YUV) and be sure the jumpers are set correctly inside of your Serial Box. If colors look completely wrong, definitely check these format jumpers. Look at the Typical Jumper Positions section in this manual. Be certain component cables have not been swapped.

Check if you need to have sync on green or on a separate channel. Is sync turned ON? Is the sync jumper in the proper position, INT or EXT? Have the component cables been accidentally swapped?

If video is out of sync, rolling, or torn up, check that the standard (PAL/NTSC or 625/525) is set correctly.

Colors are Washed Out...

If colors from Serial box I or Serial Box II appear washed out on a RGB component monitor, check that jumpers H1 and H5 are set to the SMPTE "S" position.

How To Get Additional Assistance

For more information or assistance contact us at:

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