Instruction Manual

Tektronix

SMS 8103A
Component Digital to Component Analog Video Converter

071-0456-00

First Printing: August 1993
Revised Printing: October 1998

Customer Support

Tektronix Grass Valley Products is committed to providing the most responsive and professional product support available. We have a fully staffed, highly trained support team ready to respond to anything from a simple question to an emergency repair. Support is available via telephone or email. For new and updated customer support documents, as well as new product information, check the Tektronix web site and Grass Valley Product's web page.

Telephone Numbers	Web Addresses	Postal Addresses
North America: Phone: (800) 547-8949 Fax: (530) 478-3181 Elsewhere: Distributor or sales office from which equipment was purchased.	Email Support: GVGSERVICE@tek.com Grass Valley Products Web Page: http://www.tek.com/Grass_Valley Tektronix Web Site: http://www.tek.com	Mail: Tektronix Grass Valley Products P.O. Box 1114 Grass Valley, CA 95945 Shipping: Tektronix Grass Valley Products 400 Providence Mine Rd., Nevada City, CA 95959

Copyright © Tektronix, Inc. All rights reserved. Printed in U.S.A.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications and price change privileges reserved. TEKTRONIX, TEK, Grass Valley Group, Borderline, E-MEM, TEN-X, Wavelink, and ⟑ are registered trademarks, and Air Link, Auto Match, Doubletake, E-Disk, Eagle V, Emphasys, EZ-Link, 409, Grass Valley, Horizon, Jogger, Kadenza, Kaleidoscope, K-Mask, Key-Layer, Key-Link, Krystal, MASTER System, Master 21, MAX, Omni-Key, Performer, Programmed Motion, Silhouette, Softset, SqueezeBack, Streamline, Super Edit, TEN-20, 20-TEN, Trace, TrailBlazer, VideoDesktop, Flex-Time, and XEDL are trademarks of Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000 U.S.A.

The information in this manual is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by Tektronix, Inc. Tektronix assumes no responsibility or liability for any errors or inaccuracies that may appear in this publication.

Tektronix, Inc., Video and Networking Division, P.O. Box 1114 Grass Valley, California 95945 U.S.A.

Contents

Important Safeguards

Injury Precautions v
Use Proper Power Cord v
Ground the Product v
Do Not Operate Without Covers v
Use Proper Fuse vi
Do Not operate in Wet/Damp Conditions vi
Do Not Operate in an Explosive Atmosphere vi
Avoid Exposed Circuitry vi
Product Damage Precautions vi
Use Proper Power Source vi
Use Proper Voltage Setting vi
Provide Proper Ventilation vi
Do Not Operate With Suspected Failures vii
Safety Terms and Symbols vii
Terms in This Manual vii
Terms on the Product vii
Symbols on the Product vii

SMS 8103A Component Digital to Component Analog Video Converter

Introduction 1
Functional Description 2
Signal Processing 4
Timing Signal Generation 5
Specifications 6
Installation 9
Module Configuration 9
8/10 Bit Input Selection 10
GBR Format Sync Add Selection 11
Composite Sync Output Level Selection 12
External Reference Source Selection 13
Vertical Blanking Width Selection 14
Horizontal Blanking Narrow/Normal Selection 15
MII/BETA Format US/Japan Selection 16
Module Installation 17
Rear Connectors 17
Inputs/Outputs 17
Front Panel Controls/Displays 18
Front Panel 18

Output Format 19
Autotiming ON/OFF Switch 20
Delay Adjust Controls 20
Bar Graph Display 21
Video Present LED 21
Reference Present LED 21
System Timing Adjustment (Using Autotiming Mode) 22
Initial Installation (Source Timing is Adjustable) 22
Output Timing Adjustment 22
Serial Digital Input Timing 22
Output Timing Adjustment After Initial Installation 23
Initial Installation (Source Timing is Fixed) 23
Output Timing Adjust After Initial Installation 23
System Timing Adjustment (Not Using Autotiming Mode) 24
Module Alignment 25
Alignment Equipment 25
Deserializer Free Run Frequency Adjustment 26
Y Output Adjustments 27
B-Y and R-Y Output Adjustments 28
B-Y and R-Y to Y Relative Timing Adjustments 29
GBR Matrix Adjustments 29
Service 30

Index

Important Safeguards

Please read and follow the important safety information listed below, noting especially those instructions related to risk of fire, electric shock or injury to persons. Additional specific warnings not listed here may also be found throughout the manual.

WARNING **Any instructions in this manual that require opening the equipment cover or enclosure are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.**

Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse

To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry

To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Use Proper Voltage Setting

Before applying power, ensure that the line selector is in the proper position for the power source being used.

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:

WARNING **Warning statements identify conditions or practices that can result in personal injury or loss of life.**

CAUTION Caution statements identify conditions or practices that can result in damage to the equipment or other property.

Terms on the Product

These terms may appear on the product:

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

WARNING indicates a personal injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product



DANGER. High voltage. Presence of dangerous voltage within the equipment enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



ATTENTION. Refer to manual. Presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.



The fuse referenced in the text must be replaced with one having the ratings indicated.



Protective grounding terminal. Such a terminal must be connected to earth ground prior to making any other connections to the equipment.



External protective grounding terminal. Such a terminal may be connected to earth ground as a supplement to an internal grounding terminal.



Equipment contains static sensitive components. Use anti-static grounding equipment whenever handling or servicing modules and components. When circuit modules are removed from the frame, place them on a flat static controlled surface. Failure to follow this precaution can result in component damage due to electrostatic discharge.

SMS 8103A Component Digital to Component Analog Video Converter

Introduction

The SMS 8000 product line consists of a 1RU frame which holds up to 4 modules. The modules provide such functions as video delay and format conversion. Modules are selected by the user to suit their particular requirements.

The SMS 8103A Component Digital to Component Analog Video Converter module accepts a 270Mb/s serial component digital input per SMPTE 259M/EBU Tech 3267 (525 or 625 line) and converts it to a component analog video (CAV) output.

Features for the 8103A are:

- Autotiming of the CAV output to color black reference video
- Adjustable CAV output timing with respect to the reference
- Front of module autotiming delay indicator
- Autotiming over-range indicator
- Manual timing mode with adjustable delay
- Automatic selection between 525 and 625 lines
- Ten bit D/A Conversion
- Selectable 8 or 10 bit input
- Digital filtering
- CAV outputs selectable as GBR, EBU N10, BETA, or MII

- Composite sync output
- 525/625 Vertical Blanking Width (Narrow or Wide)

Functional Description

This description is divided into two sections:

- Signal Processing
- Timing Signal Generation

Refer to the simplified block diagram in Figure 1 while reading the pages that follow.

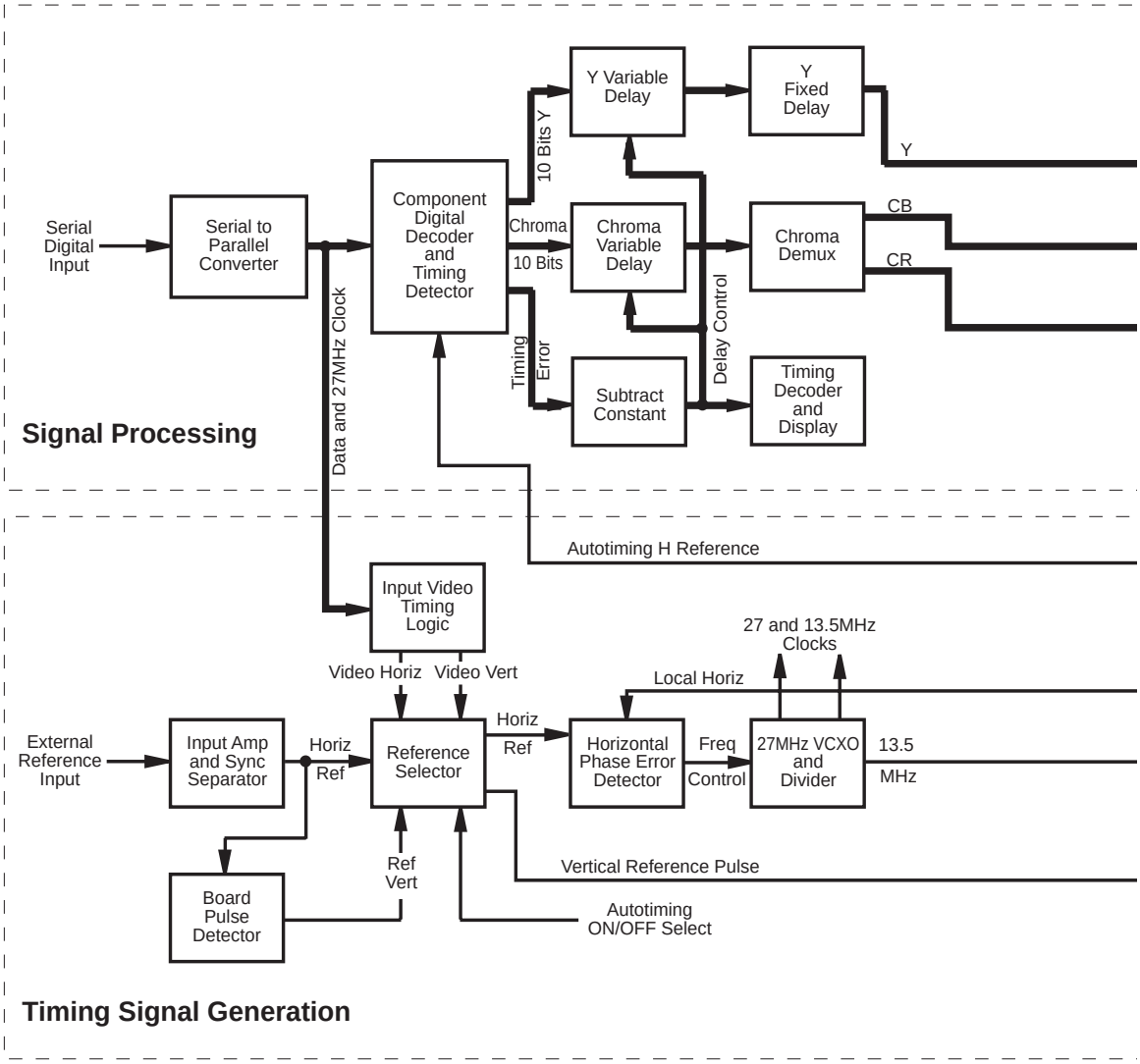
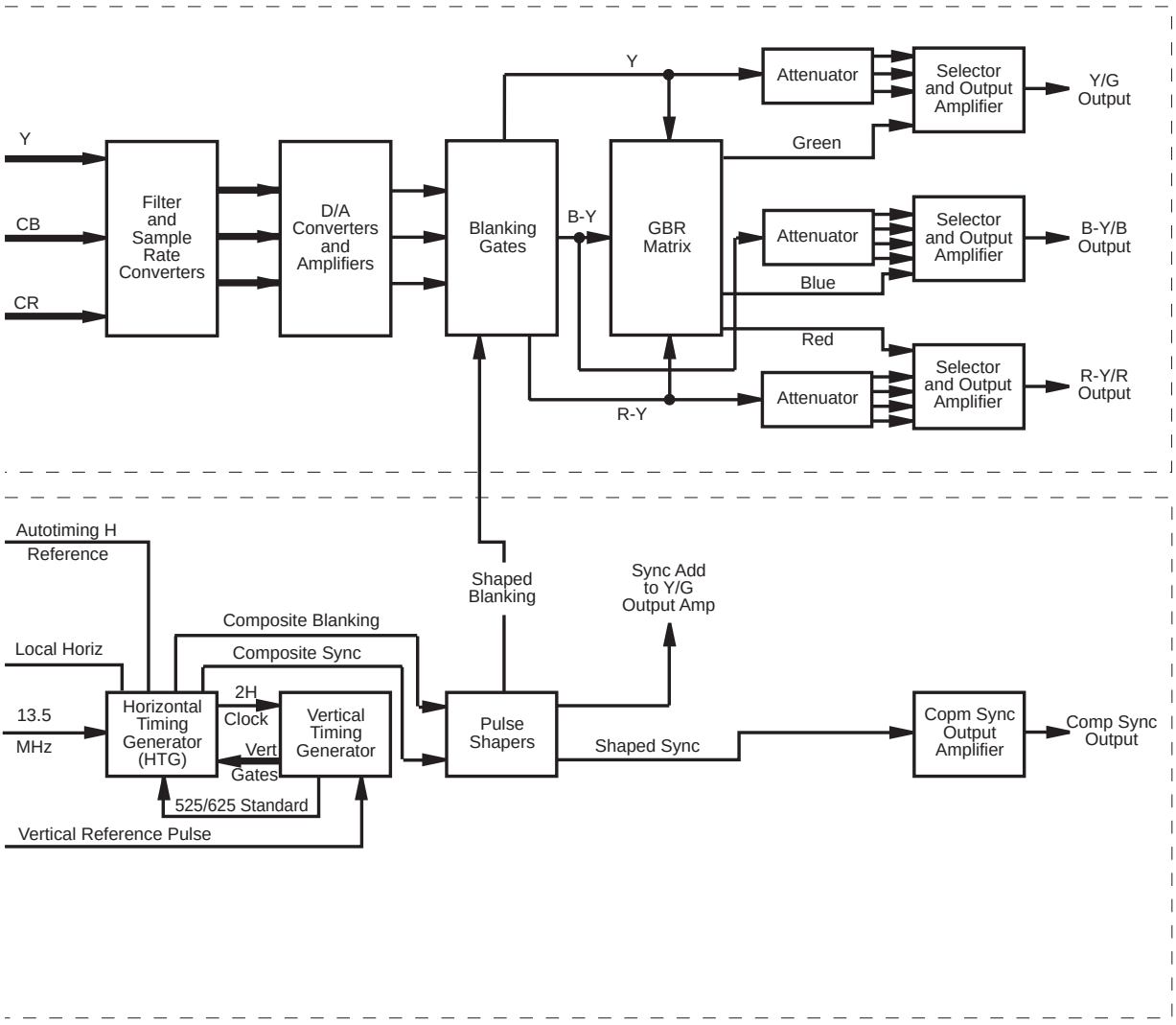


Figure 1. 8103A Block Diagram


Y
CB
CR
Filter and Sample Rate Converters
D/A Converters and Amplifiers
Blanking Gates
B-Y
R-Y
Y
GBR Matrix
Green
Blue
Red
Attenuator
Attenuator
Attenuator
Selector and Output Amplifier
Selector and Output Amplifier
Selector and Output Amplifier
Y/G Output
B-Y/B Output
R-Y/R Output
Autotiming H Reference
Local Horiz
13.5 MHz
Horizontal Timing Generator (HTG)
2H
Clock
Vert
Gates
Vertical Timing Generator
525/625 Standard
Vertical Reference Pulse
Composite Blanking
Composite Sync
Shaped Blanking
Pulse Shapers
Sync Add to Y/G Output Amp
Shaped Sync
Copm Sync Output Amplifier
Comp Sync Output

Signal Processing

The serial digital input signal feeds a Serial to Parallel Converter which deserializes the input to form a 10 bit parallel signal and 27MHz clock.

This parallel signal and clock drive a Component Digital Decoder and Timing Detector. The decoder separates the Y and chroma components of the video signal and converts them from the input clock to a local 13.5MHz clock. Also within this block is a timing detector which compares the horizontal timing of the input signal against a local horizontal reference. The result of this comparison is a digital output which indicates the relative timing.

The value of the timing error digital word is reduced, by subtracting a constant from it, to form a delay control word. This delay value is used to control the Y and chroma signal delays in the Y Variable Delay and Chroma Variable Delay blocks. At the output of the variable delay blocks the signal timing is held constant with respect to the local horizontal reference.

A Timing Decoder and Display decodes the delay control value to light a bar graph display. This allows the video delay correction being introduced to be observed.

The Y component is then delayed by the Y Fixed Delay block. Delayed Y feeds a digital low pass filter and sample rate converter. The sample rate converter doubles the signal's sampling rate to 27MHz.

A D/A Converter changes the digital signal to an analog signal. This analog signal is filtered and amplified to drive the Blanking Gate. The blanking gate adds blanking and if required, setup to the signal. An attenuator working in conjunction with a selector then controls the signal level feeding an output amplifier to support the various CAV formats the module can produce.

The chroma signal from the Chroma Variable Delay is demultiplexed into separate CB and CR components. Each of these signals is processed in a similar manner to the Y channel except at half the sample rate to create the two chroma output channels.

Each of the three channels also drives a GBR Matrix which converts the signals to the green, blue, and red format. These signals appear as inputs to the selectors so the output format can be supported.

Timing Signal Generation

The timing signal generating portion of the module can lock to either of two references. When the module is operating in the autotiming mode the reference is an external color black input. And when autotiming is not being used the reference is the module's serial digital video input.

The color black reference video input passes through an input amplifier to a sync separator. Separated sync drives a Broad Pulse Detector which provides a vertical reference pulse output. The digital video input signal, after being converted to parallel, drives the Input Video Timing Logic. This logic produces horizontal and vertical pulses derived from input video digital timing information. A Reference Selector routes the horizontal and vertical pulses from either the external reference or video input to the timing signal generating circuits depending upon whether autotiming is on or off.

A 27MHz VCXO provides the master clock for the module. This frequency is divided in half to provide a 13.5MHz clock which among its other destinations feeds a Horizontal Timing Generator (HTG). The HTG counts this clock to create numerous H related signals including the video autotiming reference. A Vertical Timing Generator Counts 2H rate pulses from the HTG to create vertical rate timing pulses.

Among the HTG's outputs is a local horizontal pulse which is phase compared against the selected horizontal reference in a Horizontal Phase Error Detector. The result of this phase comparison is used to control the frequency of the 27MHz VCXO. The loop thus created locks the VCXO frequency and all HTG outputs to the selected H reference.

Selected reference vertical pulses feed the Vertical Timing Generator to lock it to the desired reference. A Pulse Shaper converts composite blanking from the HTG to the required ramped edge signal needed to drive the blanking gates. The composite sync generated by the HTG is shaped to create sine squared edges. This shaped sync is added to the video signal at the Y/G output amplifier input. It also drives a Comp Sync Output Amplifier to provide the module's sync output.

Specifications

Specifications are subject to change without prior notice.

Table 1. SMS8103A Specifications

Component Digital Video Input	
Input Signal Type	8 or 10 bit serial digital video conforming to proposed SMPTE 259M and EBU Tech 3267
Input Impedance	75Ω (terminating)
Input Return Loss	>15dB (5 to 270MHz)
Connector Type	75Ω BNC
Cable Equalization	Automatic for <300 meters Belden 8281 or equivalent type coaxial cable
Reference Input (autotiming mode only)	
Input Signal Type	Color Black
Signal Level	300mV ±6dB (sync)
Return Loss	>38dB to 5.5MHz
Output	
Output Signal Type	CAV and Composite sync One CAV output (3 BNC connectors) One sync output (1 BNC)
CAV Output Formats	Selectable with front of module switch between GBR, EBU, N10, BETA, and MII. US/Japan versions of BETA/MII selected via jumper on module
GBR Format Output	All channels, 700mV p-p video with 300mV sync on G output selectable on/off
Comp Sync Output Level	Selectable 2/4 volts
Sync Rise Time Video and Comp Sync Out	150±20ns (10-90%)
Impedance (all outputs)	75Ω
Return Loss	(Video Outputs) >40dB to 5.5MHz Comp sync output (2V) >40dB Comp sync output (4V) >30dB

Performance	
Response	(Y) to 6.0MHz, ±0.1dB ref. 100KHz (R-Y, B-Y) to 3.0MHz, ±0.1dB ref. 100KHz
Group Delay Error	(Y) 10Hz to 5.5MHz, <5ns (R-Y, B-Y) 10Hz to 2.75MHz, <5ns
Relative Timing of CAV Outputs	Y to B-Y and R-Y within 5ns
Horizontal Blanking	Selectable narrow/normal
Vertical Blanking	(525) selectable 9 lines (Narrow) or19 lines (Wide) (625) selectable 9 lines (Narrow) or 25 lines (Wide)
Standard Selection	Automatic 525/625
Video Output Timing (autotiming mode)	
Video Output with respect to reference	Continuously adjustable from 25µs advanced to 50µs delayed via front module controls
Module Front Controls	Coarse phase 15 steps of 4.74µs each Fine phase 15 steps of 296ns each Vernier phase potentiometer with 390ns total range
Video Input Timing (Autotiming Mode)	
Automatic Timing Correction Window	Serial digital video input must be between 6.5µs and 67µs advanced with respect to analog video output timing
Non-autotiming Mode Delay	
Serial Digital In to CAV Out	Adjustable to any value from 6µs to 67µs with three front panel controls
Front Panel Indicators	
Input Presence	Reference present LED Video input present LED
Delay Indicator (autotiming mode only)	Ten segment LED bar graph display showing video input timing with respect to automatic timing correction range. Center 8 segments in 7.7µs steps, first and last segments indicator 1µs or less remaining range to correction limit.
Over-range Indication	Blinking first or last segment of LED bar graph display indicates that automatic timing correction range has been exceeded at corresponding limit

Modes	
Operating Mode Selection	Autotiming front panel switchable on/off
Video Output and Comp Sync Output	Output sync derived from reference video input in autotiming mode
Fault Modes	Video output will contain sync only if reference present but no serial digital video input present in autotiming mode. No output present if reference input and video input both absent. Module will revert to non-autotiming mode if reference input not present
Module	
Power	<17W from frame power supply
Environmental	Equipment operates over ambient temperature range of 0 to 50°C, relative humidity to 95% noncondensing Specifications valid 0 to 50°C
EMI	Complies with FCC and VDE requirements

Installation

This section contains:

- Module Configuration
- Module Installation
- Rear Connector
- Front Panel Controls/Displays
- System Timing Adjustment (Using Autotiming Mode)
- System Timing Adjustment (Not Using Autotiming Mode)

Module Configuration

When installing the 8103A module, check and/or set the following seven jumpers:

- 8/10 Bit Input Selection
- GBR Format Sync Add Selection
- Composite Sync Output Level Selection
- External Reference Source Selection
- Vertical Blanking Width Selection
- Horizontal Blanking Narrow/Normal Selection
- MII/BETA Format US/Japan Selection

8/10 Bit Input Selection

JP2 selects between 8 and 10 bit digital video inputs. In the 8 bit position the two least significant bits are inhibited. In the 10 bit position all 10 bits are utilized in the D/A conversion function. See Figure 2 below for the location and settings of JP2.

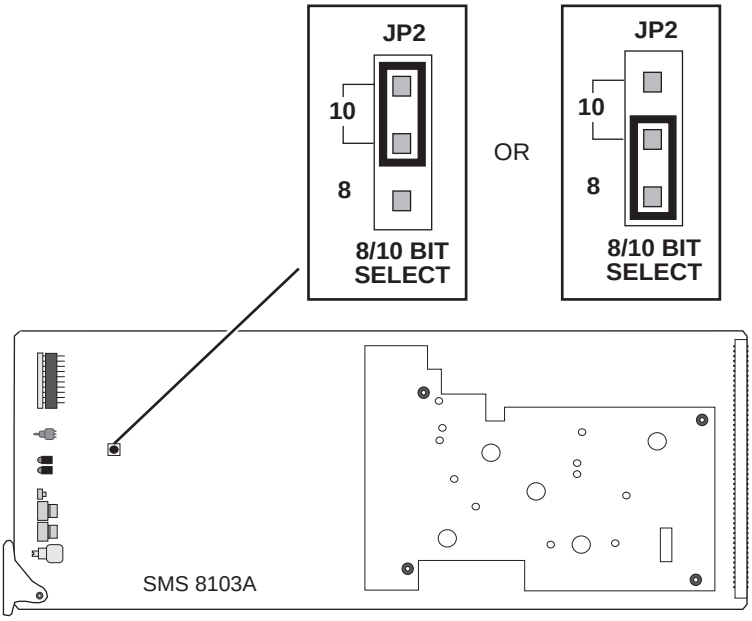


Figure 2. JP2 Jumper Settings

GBR Format Sync Add Selection

JP701 determines whether sync will be present on the green channel when the GBR output CAV format is selected. See Figure 3 below for the location and settings of JP701.

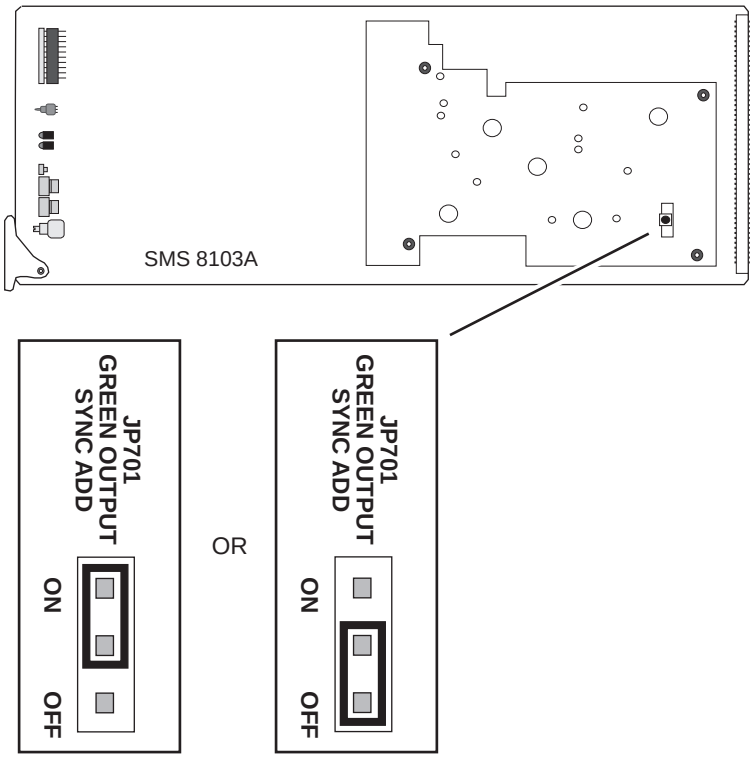


Figure 3. JP701 Jumper Settings

Composite Sync Output Level Selection

JP702 selects between a signal level of 2V and 4V at the composite sync output connector. See Figure 4 below for the location and settings of JP702.

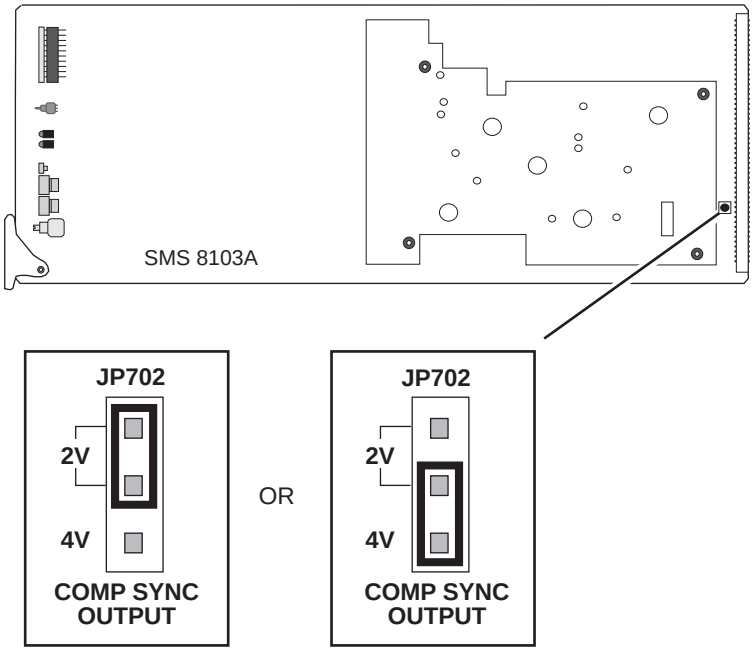


Figure 4. JP702 Jumper Settings

External Reference Source Selection

JP801 determines the source of external reference video to be used by the module in the autotiming mode of operation. Position A selects the loop-through frame reference. Position B selects a terminating reference input used for this module only.

If a common reference can be used for all modules in the frame that require a reference, JP801 should be placed in position A.

Alternately, if a separate reference is required, JP801 should be placed in *Position B.* For example, if modules needing 525 and 625 line standard references are both present in a single frame, *Position B* should be used on modules needing the alternate reference source. See Figure 5 below for the location and settings of JP801.

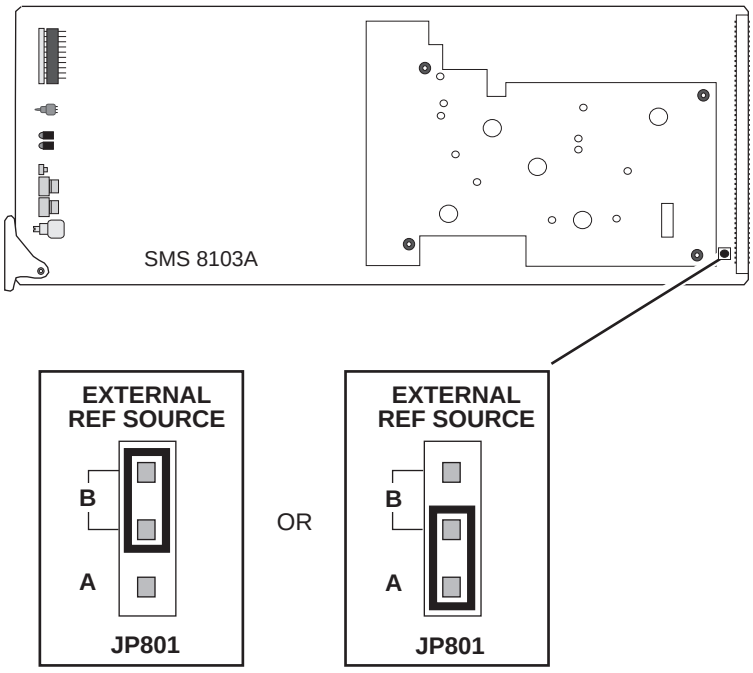


Figure 5. JP801 Jumper Settings

Vertical Blanking Width Selection

JP901 selects between vertical blanking width of 9 lines (Narrow) or 19 lines (Wide) for 525 and 7 lines (Narrow) or 25 lines (Wide) for 625.

See Figure 6 below for the location and settings of JP901.

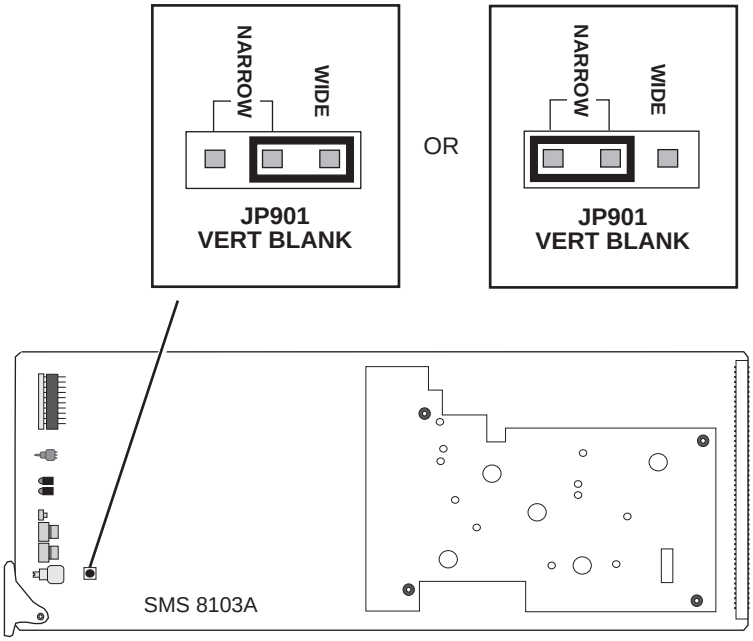


Figure 6. JP901 Jumper Settings

Horizontal Blanking Narrow/Normal Selection

JP902 determines whether the horizontal blanking added by the module will have a width which is nominal for the line standard in use or narrower than nominal.

Selection of the narrow position will allow the blanking edges present on the digital input signal to be passed to the CAV output. See Figure 7 below for the location and settings of JP902.

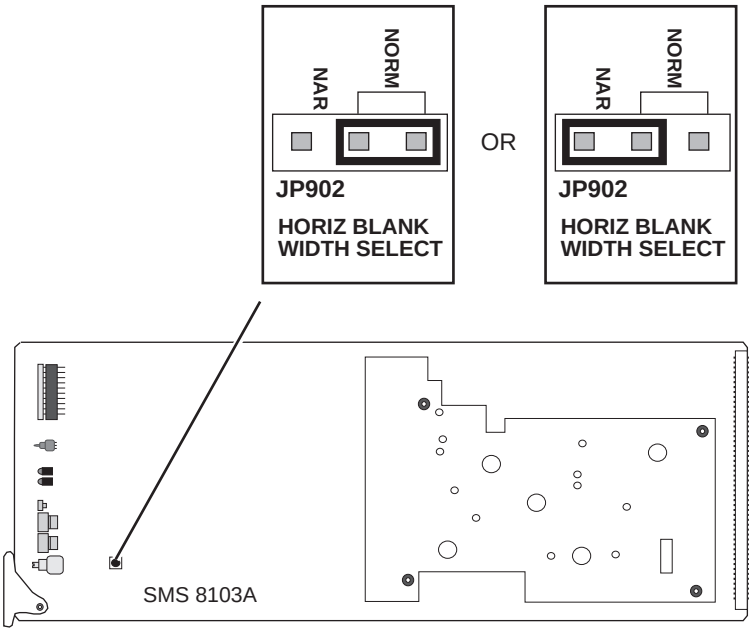


Figure 7. JP902 Jumper Settings

MII/BETA Format US/Japan Selection

JP903 alters the parameters associated with the BETA and MII output CAV format selections. It provides selection of US (setup present) or JAPAN (no setup) versions of the 525 line BETA and MII CAV formats.

See Figure 8 below for the location and settings of JP903.

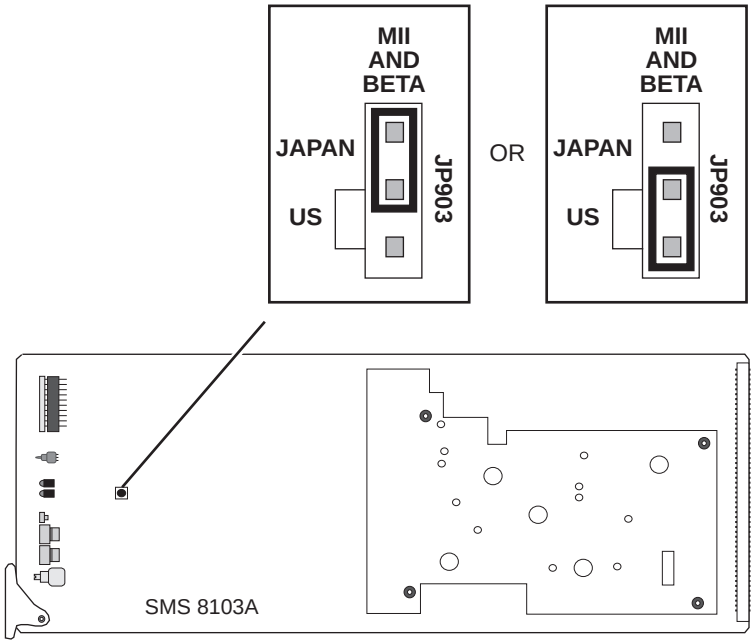


Figure 8. JP903 Jumper Settings

Module Installation

Follow the steps listed below to install a module into the SMS 8000 Frame.

1. Insert the module into the frame so that the left and right edges of the module slide inward between the card guides.

2. Press the front-panel retaining/ejecting tab in to lock the module in place.

Additional information concerning the frame and power supply installation is located in the *SMS 8000 Frame and Power Supply Manual, part number TP3465.*

Rear Connectors

Inputs/Outputs

The frame rear panel for each module consists of six BNCs, and one 9-pin D connector. Each module uses a unique overlay which labels the connector set appropriately for the function of the module.

For the 8103A, one BNC is the serial digital video input and three BNCs are the CAV output. The composite sync output appears on a fifth BNC and the sixth BNC is a reference input. The 9-pin D connector is unused for this module.

Ensure that the rear connector overlay, on the rear of the frame is in the correct location. Figure 9 illustrates the 8103A rear connector overlay.

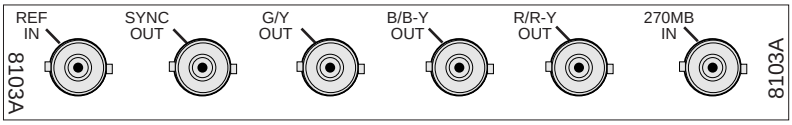


Figure 9. 8103A Rear Connector Overlay

Front Panel Controls/Displays

The 8103A Front Panel Controls and Displays are discussed in the seven categories listed below:

- Front Panel
- Output Format
- Autotiming ON/OFF Switch
- Delay Adjust controls
- Bar Graph Display
- Video Present LED
- Reference Present LED

Front Panel

The 8103A Front Panel consists of one potentiometer, two 16 position rotary switches, an eight position rotary switch, a two position toggle switch, signal present LED, reference present LED, a bar graph display, and two test points (+5V and -5V). The front panel is illustrated in Figure 10.

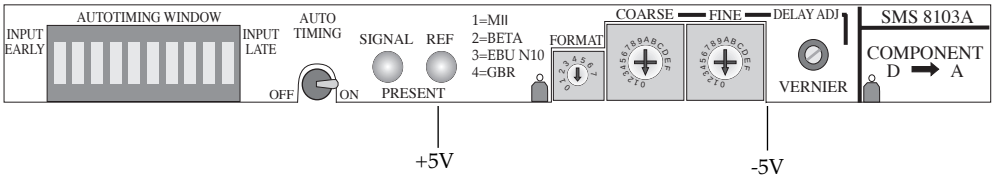


Figure 10. 8103A Front Panel

Output Format

Output Format Switch S2 selects which CAV output format will be generated by the 8103A. Table 2 lists the format selections.

Table 2. Format Selection

Output Format Selection
1 = MII (525 line only)
2 = BETA (525 line only)
3 = EBU N10
4 = GBR

Note Refer to M//BETA Format US/Japan Selection text for information on configuring M// and BETA output formats.

Table 3 lists the nominal output signal levels for each format selection with a 100% saturated/100% luminance color bar signal.

Table 3. Signal Levels

Format	Y Channel Level	Peak to Peak Chroma
MII (US)	647.5mV video plus 52.5mV setup	647.5mV
MII (Japan)	700mV	700mV
BETA (US)	660.4mV video plus 53.6mV setup	933.3mV
BETA (Japan)	714mV	1009mV
EBU N10	700mV	700mV
GBR	G, B, R channels, all 700mV	

Autotiming ON/OFF Switch

Switch S1 provides ON/OFF selection for the autotiming operating mode. When autotiming is enabled the 8103A output video timing will lock to the external reference video input. The output video timing can be continuously adjusted from advanced to retarded with respect to the external reference. Video signal delay within the module will be automatically adjusted to keep the output signal timing fixed with respect to the reference.

The serial digital video input timing can vary over a total of almost one line with no change in the CAV output timing. Because the 8103A can only delay the video signal to achieve this fixed output timing, the input must be advanced with respect to the output timing established by the timing controls. Timing jitter present on the serial input will be eliminated at the CAV output in this mode. If no external reference signal is present, the module will revert to the non-autotiming operating mode as described below regardless of the position of S1.

When autotiming OFF is selected, no external reference is required. In this mode the signal delay within the module will not be automatically adjusted. The signal delay can be adjusted with the same front panel controls used to adjust output timing in the autotiming mode. With autotiming OFF selected, the autotiming circuitry is still operating but is using input video as an output timing reference. Because the output timing is locked with a phase locked loop to the video input timing, the module output will follow changes in input timing. This loop will reduce any high frequency jitter present at the video input, thus the CAV output will have less timing jitter than the input.

Delay Adjust Controls

The function of the three delay adjust controls is dependent on whether autotiming is being used. If autotiming is in use, the controls will adjust the video and sync output timing with respect to the external reference. In this mode the output timing can be adjusted from 25μs advanced to 50μs retarded with respect to the external reference.

Coarse delay adjust control S4 provides timing adjustment in 4.74μs steps. Fine delay adjust control S3 provides 296ns steps. Vernier delay control R853 has a total range of 390ns. Setting both timing adjust switches to *Position 5* will produce an output timing which coincides with the reference input timing within the range of the vernier delay control.

When operating in the non-autotiming mode, the three delay controls will adjust the video signal delay through the 8103A. The controls will continue to operate with the timing step sizes described previously. Delay will be minimum with both timing switches set to *Position O* and will increase as the switch settings are incremented higher. Maximum delay will be

reached when the Coarse and Fine Delay Switch settings reach *Position C* and *F* respectively. Incrementing the settings higher than this value will result in no further delay increase.

Bar Graph Display

The bar graph display operates in the autotiming mode only. It shows the video input signal timing within the autotiming operating window.

Each of the center eight bar graph segments represents approximately 7.7μs. The first or last segments will light if the timing is within approximately 1μs of the corresponding autotiming limit. These end segments provide a warning that little timing margin remains. If the input timing moves outside the bounds of the autotiming operating window, the first or last bar graph segment will blink to indicate over-range and in which direction. If an over-range condition exists, the video output will continue to be correctly timed horizontally with respect to the output sync but will be shifted vertically.

Input signal timing should be set so that one of the center eight segments is lit. Operation with either of the end segments lit can result in incorrect or non-repeatable output picture position with respect to output sync. A small amount of hysteresis exists between bar graph segment boundaries. An input timing that is near a segment boundary can result in either of the segments being lit after a disturbance. No change in output picture position will result from this change.

Video Present LED

A Video present LED indicates that a serial digital video input is present. When operating in the autotiming mode, if no input is present the module output will be composite sync only. When operating with autotiming turned off, no video input will result in no output video or sync.

Reference Present LED

The Reference present LED indicates that a reference video source is present. A reference source is required for operation in the autotiming mode only. If no reference is present, the module will revert to the non-autotimed operating mode regardless of the position of the autotiming on/off switch.

System Timing Adjustment (Using Autotiming Mode)

Note Autotiming "ON" Selected and External Reference Present.

Initial Installation—Source Timing Adjustable

For applications where the digital source timing is adjustable, follow the procedures listed below:

Output Timing Adjustment

Adjust front panel Coarse, Fine, and Vernier delay controls, to time the output sync at the signal destination. (A good initial starting point is a setting of "5" on both coarse and fine timing control switches which will set the output timing to coincide with the reference input timing.)

Check the vertical timing to verify that it is correct. If the vertical timing is not correct, try another setting of the delay controls that will result in correct vertical and horizontal timing. The adjustment range is greater than one line.

Serial Digital Input Timing

The timing of the serial digital video input signal fed to the module must be at least 6.5μs and less than 67μs advanced with respect to the established analog output timing to be within the timing range of the module.

The front panel bar graph display gives a useful indication of the delay being added by the autotiming circuits. It also indicates via blinking first or last segments when the automatic correction range has been exceeded at the corresponding limit.

Adjust the input signal timing, if required, so that one of the center eight bar graph display segments is lit. If either the first or last segment is continuously lit, the input timing is 1μs or less from the correction range limit, and the input signal's timing should be adjusted.

If the first or last segment is blinking the correction range has been exceeded and the output video will be shifted vertically with respect to output sync.

Refer to the Bar Graph Display text for more information.

Output Timing Adjustment After Initial Installation

After system timings have been established at initial installation, minor adjustment of the analog output timing can be made as required so long as the adjustment does not force the autotiming range limits to be exceeded.

Output analog video timing can be adjusted, as required, to maintain system timing without changing the timing of the source of the serial digital signal.

Initial Installation—Source Timing Fixed

For applications where the digital source timing cannot be advanced, follow the procedures listed below:

If the serial digital source cannot be advanced as required in the previous procedure, the output timing control must be adjusted so that the analog output is later in time than the digital input by at least 6.5μs. This is the minimum signal delay through the module.

Adjust front panel Coarse, Fine, and Vernier delay controls, to time the output sync at the signal destination so long as the output timing is later, by at least 6.5μs and less than 67μs than the video input.

As the output timing is changed the autotiming circuitry will add or subtract signal delay of the input video signal to keep it timed to the output sync. This can be observed on the bar graph display.

The output timing must be adjusted so that one of the center 8 bar graph display segments is lit.

If either the first or last segment is continuously lit the timing is 1μs or less from the correction range limit and the delay controls should be adjusted.

If the first or last segment is blinking, the correction range has been exceeded and the output the video will be shifted vertically with respect to output sync. Refer to Bar Graph Display test for more information.

Output Timing Adjust After Initial Installation

After system timings have been established at initial installation, minor adjustment of the analog output timing can be made as required so long as the adjustment does not force the autotiming range limits to be exceeded.

Output analog video timing can be adjusted as required to maintain system timing without changing the timing of the source of the serial digital signal.

System Timing Adjustment—No Autotiming Mode

Note Autotiming "OFF" Selected or No Reference Present

When autotiming mode is not used, the video signal delay through the module can be adjusted with the front panel delay controls to any value desired between 6μs and 67μs. In this operating mode no external reference is required.

If minimum delay is desired, the coarse and fine delay switches should be set to position zero and the vernier delay control set fully counter-clockwise. In this mode, any timing changes present at the serial digital input will appear at the analog outputs.

Module Alignment

This Section contains:

- Alignment Equipment
- Deserializer Free Run Frequency Adjustment
- Y Output Adjustments
- B-Y and R-Y Outputs Adjustments
- GBR Matrix Adjustments

Alignment Equipment

The 8103A is fully aligned at the factory and normally requires no adjustments in the field. If adjustments are necessary, they should be attempted only by qualified technicians using, at a minimum, the following equipment (or equivalents):

- Tektronix TSG-422 Digital Component Generator
- Tektronix 2465B Oscilloscope

Note SMS 8000 Series extender module, assembly 160007, may be used to position a module outside the frame during adjustments.

Deserializer Free Run Frequency Adjustment

To adjust the Free Run Frequency, follow the steps listed below:

1. Place the module on an extender board and connect to a serial digital video input source. (Allow at least 5 minutes to reach operating temperature)
2. Move shorting jack JP1 jumper to the TEST position, see Figure 11.
3. Connect oscilloscope to test point 16.
4. Adjust R206 to obtain a signal period of 37ns as observed on oscilloscope.
5. Observe period as JP1 is moved back to the OPERATE Position. If the period changes make small adjustments to R206 as required to obtain the same period for both JP1 positions.
6. Leave JP1 in the OPERATE Position and remove the oscilloscope.

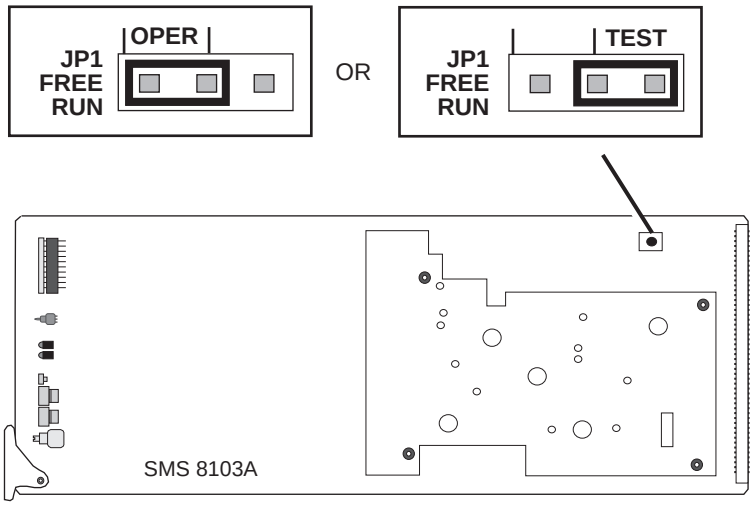


Figure 11. JP1 Jumper Settings

Y Output Adjustments

To adjust the Y channel, follow the steps listed below.

1. Place the module on an extender board.
2. Connect digital test signal generator to module video input and select 100% level full field color bar test signal.
3. Connect oscilloscope to module Y/G output.
4. Move front of module output format switch S2 to the EBU N10 position (3) and select autotiming OFF with front panel switch S1.
5. Adjust Y Channel Offset R402 to make video black level and blanking level coincide as observed on oscilloscope.
6. Adjust Y Channel Video Level R403 to obtain 700mV p-p measured from video black to peak white.
7. Adjust Video Output Sync Level R780 to obtain a sync level of 300mV p-p.
8. Move output format switch S2 to the BETA position (2) and US/JAPAN select shorting jack JP903 to the US position.
9. Adjust Video Setup R453 to obtain a black level setup of 54mV.
10. Change test signal to line sweep.
11. Adjust Y Channel Response C403 to obtain flat frequency response.
12. Remove test equipment and restore Autotiming ON/OFF switch S1, Output Format switch S2, and JP903 to positions desired for normal operation.

B-Y and R-Y Output Adjustments

To adjust the B-Y and/or R-Y outputs, follow the steps listed below.

Note Adjustment of the B-Y and R-Y channels are similar; adjustment control designations for both will be included in this procedure.

1. Place the module on an extender board.
2. Connect digital test signal generator to module video input and select 100% level full field color bar test signal.
3. Connect oscilloscope to module B-Y output for B-Y adjustments or R-Y output for R-Y adjustments.
4. Move front of module output format switch S2 to the EBU N10 position (3) and select autotiming OFF with front panel switch S1.
5. Adjust B-Y Channel Video Level R521 or R-Y Channel Video Level R537 to obtain an output level of 700mV p-p as observed on oscilloscope.
6. Adjust B-Y Channel Offset R530 or R-Y Channel Offset R519 to make chroma black level (white bar or black bar time) match blanking level.
7. Change test signal to line sweep.
8. Adjust B-Y Channel Response C561 or R-Y Channel Response C510 to obtain flat response.
9. Remove test equipment and restore Autotiming ON/OFF switch S1 and Output Format switch S2 to positions desired for normal operation.

B-Y and R-Y to Y Relative Timing Adjustments

1. Place the module on an extender board.
2. Connect digital test signal generator to module video input and select a Bowtie relative timing test signal.
3. Move the output format switch S2, on the front of module, to the EBU N10 Position (3) and select autotiming OFF with the front panel switch S1.
4. Connect the Y module output to the oscilloscope channel 1 input.
5. Connect the B-Y module output to the oscilloscope channel 2 input with the same length cable used for channel 1.
6. Set channel 2 of the oscilloscope to INVERT the signal and select ADD.
7. Set the two oscilloscope channel gains to 100mV/division and adjust position to view the Bowtie display.
8. Adjust B-Y delay control R428 to center the Bowtie on the largest timing marker.
9. Move the channel 2 cable to the R-Y output and adjust R-Y delay R444 to center the Bowtie.
10. Remove test equipment and restore Autotiming ON/OFF switch S1 and Output Format switch S2 to positions desired for normal operation.

GBR Matrix Adjustments

Note Prior to performing matrix adjustments, Y, B-Y, and R-Y levels should be verified as previously detailed.

To adjust the GBR Matrix, follow the steps listed below.

1. Place the module on an extender board.
2. Connect digital test signal generator to module video input and select 100% level full field color bar test signal.
3. Move front of module output format switch S2 to the GBR position (4) and select autotiming OFF with front panel switch S1.
4. Connect oscilloscope to module Y/G output.

5. Alternately adjust Green Channel R Balance R721 and Green Channel B Balance R706 to null higher frequency components to obtain a horizontal rate square wave green signal.

6. Move oscilloscope to module B-Y/B output.

7. Adjust Blue Channel Balance R718 to obtain an output which is a constant level square wave across the video line. (Waveform should not rise or fall with respect to blanking level)

8. Move oscilloscope to module R-Y/R output.

9. Adjust Red Channel Balance R663 to null higher frequency signal on the square wave red signal and to make red black level coincide with blanking level.

10. Remove test equipment and restore Autotiming ON/OFF switch S1 and Output Format switch S2 to positions desired for normal operation.

Service

The 8103A Component Digital to Component Analog Video Converter module makes extensive use of surface mount technology and programmable parts to achieve compact size and adherence to demanding technical specifications. Circuit modules should not be serviced in the field.

If your module is not operating correctly, proceed as follows:

- Check input signals
- Check cables and connections
- Check switch positions on front panel
- Verify source equipment is operating correctly
- Check output connections

If the module is still not operating correctly, replace it with a known-good spare and return the faulty module to a designated Tektronix Grass Valley Products repair depot. Call your Tektronix Grass Valley Products representative for depot location.

For jumper settings or adjustments, refer to the Module Configuration and Module Alignment sections of this manual.

Index

Numerics

8/10 Bit Input Selection 10
8103A Front Panel
Illustration 18
8103A Rear Connector Overlay
Illustration 17

A

Autotiming ON/OFF Switch 20

B

Bar Graph Display 21
BETA 16, 27
Blanking Gate 4
Block Diagram
Illustration 2
Block diagram 2
B-Y outputs 28

C

C403 27
C510 28
C561 28
Coarse delay 20
Color black reference 5
Component Digital Video Input 6
Composite Sync Output Level Selection 12

D

Decoder 4
Delay Adjust Controls 20
Delay block 4
Deserializer 26

E

EBU 27, 28, 29
External reference 20
External Reference Source Selection 13

F

Features 1
Fine delay 20
Format Selection
Table 19
Free Run Frequency 26
Front Panel Controls/Displays 18
Front Panel Indicators 7

G

GBR 29
GBR Format Sync Add Selection 11

H

Horizontal Blanking Narrow/Normal
Selection 15
Horizontal timing 22
Horizontal Timing Generator 5

I

Illustration
8103A Front Panel 18
8103A Rear Connector Overlay 17

Block Diagram 2
JP1 Jumper Settings 26
JP2 Jumper Settings 10
JP701 Jumper Settings 11
JP702 Jumper Settings 12
JP801 Jumper Settings 13
JP901 Jumper Settings 14
JP902 Jumper Settings 15
JP903 Jumper Settings 16
Input Video Timing Logic 5
Installation 9

J

JP1 26
JP1 Jumper Settings
Illustration 26
JP2 10
JP2 Jumper Settings
Illustration 10
JP701 11
JP701 Jumper Settings
Illustration 11
JP702 12
JP702 Jumper Settings
Illustration 12
JP801 13
JP801 Jumper Settings
Illustration 13
JP901 14
JP901 Jumper Settings
Illustration 14
JP902 15
JP902 Jumper Settings
Illustration 15
JP903 16, 27
JP903 Jumper Settings
Illustration 16

M

Master clock 5
MII 16
Modes 8
Module 8
Module Configuration 9
Module Installation 17

N

N10 27, 28, 29
Non-autotiming Mode Delay 7

O

Output Format Switch S2 19
Output sync 22
Output Timing 22

P

Parallel 4
Pulse Shaper 5

R

R206 26
R402 27
R403 27
R428 29
R444 29
R453 27
R521 28
R530 28
R663 30
R706 30
R718 30
R721 30
R780 27
Rear Connectors 17
Reference Input 6
Reference Present LED 21

Reference Selector 5
R-Y outputs 28

S

S1 28, 29
S2 28, 29
Serial 4
Serial Digital Input Timing 22
Service 30
Signal Levels
  Table 19
Source Timing 22
Specifications 6
Switch S1 20
Sync Output Amplifier 5
Sync separator 5
System Timing Adjustment 24

T

Table
  Format Selection 19
  Signal Levels 19
Timing detector 4
Timing Signal Generation 5

V

Vernier delay 20
Vertical Blanking Width Selection 14
Vertical timing 22
Vertical Timing Generator 5
Video Input Timing 7
Video Output Timing 7
Video Present LED 21

Y

Y channel 27