

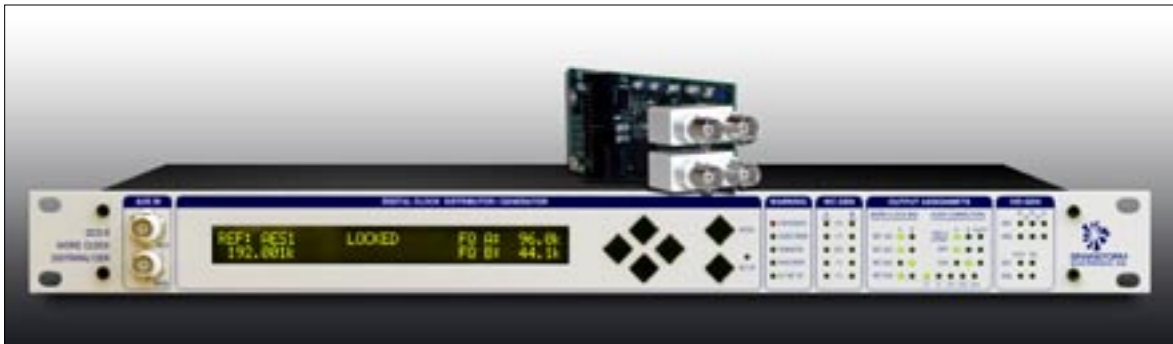
VSG-4

Video Sync Generator

For the Brainstorm DCD-8

Operations Manual

Software version 2.00



**BRAINSTORM
ELECTRONICS, INC.**

...Intelligent Solutions For The Recording Studio

VSG-4

Video Sync Generator for the DCD-8

Operations manual

Version 2.00

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1. Introduction

The VSG-4 generates analog tri-level and bi-level sync signals for HD and SD video applications. Up to 4 different sync formats can be generated simultaneously through its 4 BNC outputs, 2 HD and 2 SD. The VSG-4 operates either as a master clock generator or gen-locked to any of the references available to the DCD-8.

Designed as an option for the Brainstorm DCD-8 Word Clock Distripalyzer, the VSG-4, combined with the DCD-8, delivers a complete solution for all sync requirements in the post-production, recording and broadcast environments.

2. Installation

2.1. UNPACKING

When unpacking the VSG-4 the following items should be in the shipping carton:

- VSG-4 board
- (3) screws
- (1) 34 pin interconnect cable
- Owner's Manual & Registration card

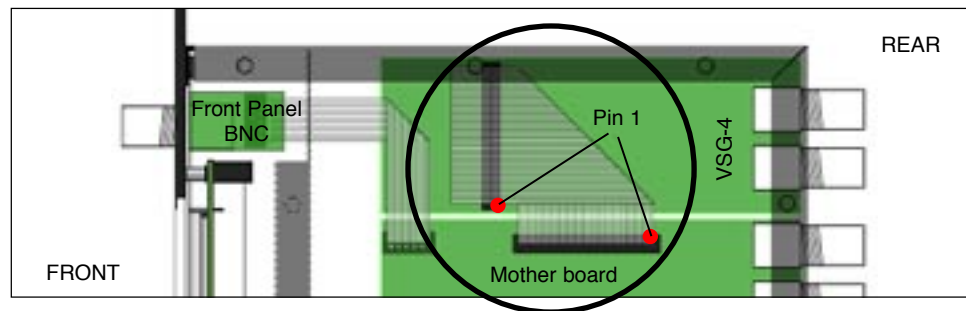
2.2. INSTALLING THE VSG-4

The VSG-4 is a 2" x 5.4" circuit board designed to be installed inside the DCD-8. Installation should be performed carefully, using usual precautions.

1. Turn off DCD-8 by unplugging the power cord.
2. Remove the top panel screws and remove the top panel.
3. Inside the chassis, locate the area for the VSG-4: left of the mother board, behind the front panel BNC
4. Remove the hole covers for the 4 BNC connectors on the rear panel
5. On the mother board side, unplug the ribbon cable connecting the front panel BNC's so it is out of the way

6. Feed the 4 BNC connectors on the VSG-4 into the 4 rear panel BNC holes and slide the VSG-4 PCB on top of the 3 stand offs. You'll need to angle the PCB appropriately to find its way into proper position.
7. Secure the PCB in place with the 3 screws provided.
8. Reconnect the front panel BNC's into the mother board.
9. Connect the VSG-4 to the mother board using the 34 pin cable provided. This cable needs to be folded twice as shown on the illustration below.

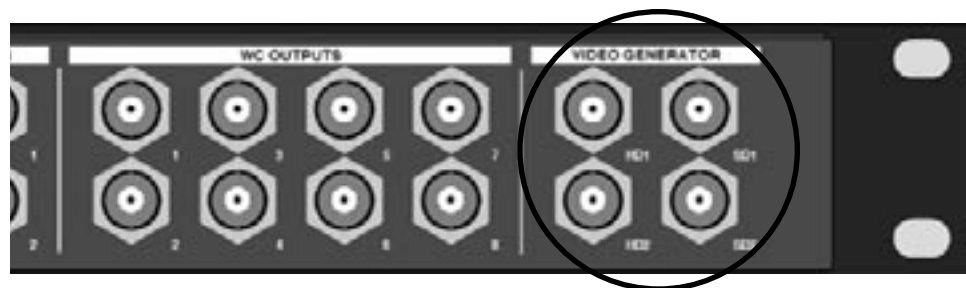
CAUTION: Be absolutely certain pin 1 is in the right place on both ends of the cable before powering on. Failure to do so will cause damage to the unit.



2.3. POWER ON

Once the VSG-4 is installed properly, power on the DCD-8. The front panel LED's located on the far right under "VID SYNC GEN" should light up, indicating the current selection.

3. Connecting the VSG-4



The VSG-4 has 4 BNC output connectors. Two of those are for HD Sync, the other two for SD . They are labeled as such on the rear panel (HD1, HD2, SD1, SD2).

Use standard 75Ω video cables on those outputs.

3.1. DAISY-CHAINING

SD: On the SD outputs, if absolutely necessary, it is acceptable to daisy chain multiple devices on a single connector. However, make sure that the last one in the chain, and only the last one, has a 75Ω termination.

HD: On the HD outputs, do not daisy chain. Connect only 1 device per output and make sure it is properly terminated (75Ω).

4. Menus Description

4.1. MENU 51: VID OUT HD 1&2



The VSG-4 provides stable HD clock rates over long periods of time by making use of the DCD-8's B Domain PLL. Which means that, with HD enabled, the DCD-8 no longer has access to Domain B for word clock.

With SD only enabled, the VSG-4 uses Domain A and both domains are available for word clocks. However, Domain A cannot be VSO'd.

Therefore, the VSG-4 gives you 3 choices for the Video Outputs, in menu 51:

- Enable HD & SD
- Enable SD only
- Disable

Here is what happens under each circumstances:

ENABLE HD & SD:

- the HD and SD outputs are active
- Domain B is used by the VSG-4, and is thus unavailable for audio use
- the HD and SD outputs are referenced as selected in Menu 52
- Menu 21 (RATE B) will show "Using Rate A"
- Menu 22 (REF B) will be skipped

ENABLE SD ONLY:

- the HD output connectors are grounded
- the SD outputs are active and are referenced to REF A
- Menus 52 & 53 will be skipped
- Domains A & B are available for audio use
- Menu 2 (REF A) does not offer the VSO option.

DISABLE:

- the HD and SD output connectors are grounded
- Menus 52, 53 & 54 will be skipped
- No restrictions on the DCD-8: Domains A & B are available for word clocks and can both be VSO'd.

4.2. MENU 52: VIDEO OUT REF



This menu is only available when HD & SD Video have been enabled in menu 51.

Menu 52 operates in the same way as the "REF B" menu, and sets up a separate reference for all Video Outputs (HD and SD). When 'Use REF A' is selected, the video and the audio share a common reference, the one selected in menu 02.

As with menu 22 (REF B), when necessary, the Video Reference can be different than the REF A. Any of the available inputs can be selected. There are 2 choices for

the rate of the reference: SET or LEARN (for more information, see chapter 11 in the DCD-8 manual).

```

52 VID OUT REF: WClk 1 [WClk 1]
rate: Learn 176400 +4.3% [183930]
  
```

CAUTION: When selecting a separate reference for the video output, i.e. different than 'Use REF A', the audio and video outputs may not have the same reference.

4.3. MENU 53: HD OUT

```

53 HD OUT 1: >1080i/24
HD OUT 2: > 720p/59.94
  
```

Menu 53 sets the HD Video output formats and rates. Each of the 2 HD outputs are set individually and can have a different format and rate.

Selections available are:

| | | |
|-------------|---------------|---------------|
| 720p/23.976 | 1080i/25 | 1080p/23.976 |
| 720p/24 | 1080i/25 295M | 1080p/24 |
| 720p/25 | 1080i/29.97 | 1080p/25 |
| 720p/29.97 | 1080i/30 | 1080p/29.97 |
| 720p/30 | 1080sF/23.976 | 1080p/30 |
| 720p/50 | 1080sF/24 | 1080p/50 |
| 720p/59.94 | 1080sF/25 | 1080p/50 295M |
| 720p/60 | 1080sF/29.97 | 1080p/59.94 |
| | 1080sF/30 | 1080p/60 |

p stands for 'Progressive'; i stands for 'Interlaced'; sF stands for Segmented Frame
295M stands for SMPTE standard 295M

4.4. MENU 54: SD OUT

```

54 SD OUT 1: > 525i/29.97 NTSC
SD OUT 2: > 625i/25 PAL
  
```

Menu 54 sets the SD Video output formats and rates. Each of the 2 SD outputs are set individually and can have a different format and rate.

Selections available are:

| | |
|-------------|------------|
| 525i/29.97 | NTSC |
| 525i/30 | monochrome |
| 625i/23.976 | slow PAL |
| 625i/24 | slow PAL |
| 625i/25 | PAL |

5. Notes on genlocking

5.1 FORMS OF GENLOCK

There are three forms of genlock:

1. INTER-OUTPUT SYNC

Output formats are divided into two groups, pulldown and non-pulldown, and within each group the relationship between the output frame edges is fixed.

In the non-pulldown group, frame edges for video rates of 30, 25, 24, 60 and 50 Hz will all be coincident once per second (1Hz), and the 30, 24, 60 rates will be further coincident at a 6Hz rate.

The pulldown group – 29.97, 23.976, 59.94 – is similarly synchronized.

2. SYNC TO VIDEO INPUT

When the Video Output Reference (Menu 52, and Menu 02 REF A if Menu 52 is set to "Use REF A") is set for "Video", the Video Output waveforms will be tightly synchronized to the Video Input waveform.

Note however that edge synchronization will not cross the pulldown/non-pulldown barrier – in other words, a non-pulldown output will not edge align with a pulldown input, although its long term rate will be derived from that input.

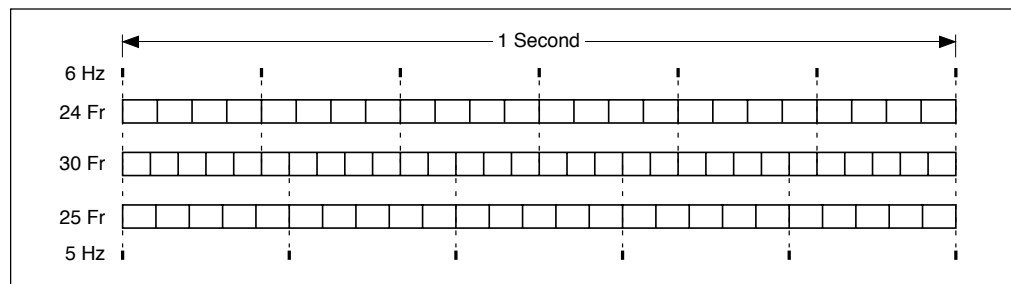
3. SYNC TO WORDCLOCK 'RATE A' OUTPUT

When the Video Output Reference is set to anything other than "Video", then the Video Output waveforms will be correctly aligned with the DCD-8 "RATE A" Output waveforms (i.e. wordclock rising edge coincident with video start of line 1) under the following circumstances:

- (a) Non-pulldown video outputs will edge align to RATE A rates of 48000, 44100, 32000 and their multiples.
- (b) Pulldown video outputs will edge align to RATE A rates of 48000, 47952, 44056 and their multiples.
- (c) REF A (Menu 02) and the Video Output Reference (Menu 52) must be identically set. This is most easily achieved by setting Menu 52 to "Use REF A".

5.2 EDGE COINCIDENCE BETWEEN DIFFERENT FRAME RATES

The following illustration shows the relationship between 24, 25 and 30f/s.



With 24 and 30 f/s, edge coincidence occurs 6 times per second (6 Hz); with 25 and 30, it occurs 5 times per second (5Hz); with 24 and 25, it occurs 1 time per second (1 Hz).

A similar relationship exists for the pulldown rates (23 & 29) with a frequency of 5.994Hz.

5.3 EDGE ALIGNMENT (GENLOCK) COMBINATIONS

The following table indicates when input to output edge alignment will occur.

Note that all video outputs are rate locked at all times, even when not edge aligned.

| | | Video Output Types and Rates | | | | |
|--|-----------|------------------------------|--------|----------------|-----------|--------------------|
| | | | PAL | Slow PAL 24 | NTSC | Slow PAL 23.976 |
| | | HD 30 | HD 25 | HD 24 | HD 29.97 | HD 23.976 |
| Ref Type | Ref Rate | 30.000 | 25.000 | 24.000 | 29.970 | 23.976 |
| DCD-8 Video Input | 30.000 | Y | (5Hz) | (6Hz) | | |
| | 29.970 | | | | Y | (5.994Hz) |
| | 25.000 | (5Hz) | Y | (1Hz) | | |
| | 24.000 | (6Hz) | (1Hz) | Y | | |
| | 23.976 | | | | (5.994Hz) | Y |
| | 60.000 | Y | (5Hz) | (12Hz) | | |
| | 59.940 | | | | Y | (11.988Hz) |
| DCD-8 RATE 'A' Wordclock Output | 50.000 | (10Hz) | Y | (2Hz) | | |
| | 32000.000 | (10Hz) | Y | (8Hz) | | |
| | 42293.706 | | | | | |
| | 42336.000 | | | | | |
| | 44055.944 | | | | Y | (11.988Hz) |
| | 44100.000 | Y | Y | (12Hz) | | |
| | 44144.100 | | | | | |
| | 45937.500 | | | | | |
| | 45983.438 | | | | | |
| | 46033.966 | | | | | |
| | 46080.000 | | | | | |
| | 47952.048 | | | | Y | Y |
| | 48000.000 | Y | Y | Y | (5.994Hz) | Y |
| | 48048.000 | | | | | |
| 50000.000 | | | | | | |
| 50050.000 | | | | | | |

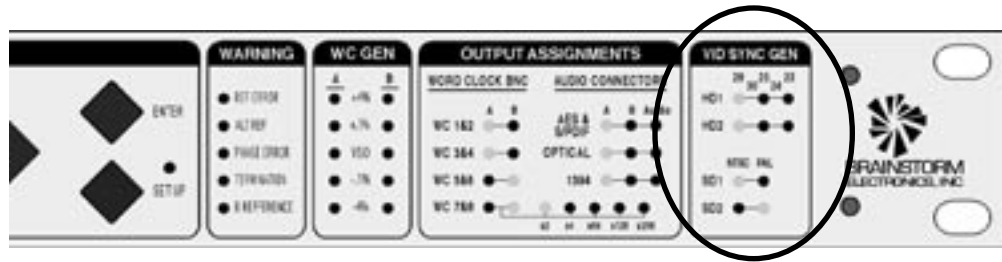
Hz values for edge coincidence are given where not every video output frame edge aligns to a corresponding reference edge.

5.4 COLOR FRAMING

The DCD-8 video path does not support color framing, so when for example an NTSC Video Output is genlocked to an NTSC Video Input the color framing sequence will not necessarily be reproduced. The same applies to PAL.

When the SD Video Reference is set to match the video output(s) - NTSC to NTSC, PAL to PAL..., the following warning message will be displayed for a couple of seconds on the LCD display: "Video Option: No Color Framing Servo"

6. Front panel LED's



There are ten LED's on the front panel related to the VSG-4. They indicate the formats currently selected for the 4 VSG-4 outputs.

For HD, there are 6 LED's, 3 per output. They indicate the selected frame rate:

| | |
|--------|---------------------|
| 29.97 | left LED only |
| 30 | left & center LED's |
| 25 | center LED only |
| 24 | center & right LED |
| 23.976 | right LED only |

For SD, there are 4 LED's, 2 per output. They indicate the selected format.

| | |
|------|-----------|
| NTSC | left LED |
| PAL | right LED |

These LED's also indicate the Lock status by flashing when the corresponding output is unsynchronized.

For complete format and rate information on the HD outputs, call up menu 53. For the SD outputs, call up menu 54.

7. Specifications

| | | |
|-------------------|---|--|
| Number of outputs | 4 (2 SD + 2 HD) | |
| Standards | 1080 | SMPTE 274M, RP211, 295M |
| | 720 | SMPTE 296M |
| | NTSC | RS170A |
| | PAL | Rec ITU-R BT.470-6 |
| Output Levels | Tri-level | 600mV p-p into 75Ω (+/-300mVDC sync tip) |
| | NTSC | 429mV p-p into 75Ω (-286mVDC sync tip) |
| | PAL | 450mV p-p into 75Ω (-300mVDC sync tip) |
| Waveforms | All rise and fall times per their respective standards | |
| References | Internal Xit, Video (HD & SD), WC, AES, S/PDIF, FireWire, ADAT, GPS | |
| Connectors | BNC - 75Ω - DC coupled | |
| Form Factor | 2" x 5.4" PCB - option for Brainstorm DCD-8 only | |
| DCD-8 domain | When generating HD sync, the VSG-4 uses the B Domain on the DCD-8. | |

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