SpectraCal VirtualForge Software Pattern Generator CalMAN Setup Guide

Thank you for purchasing the SpectraCal VirtualForge pattern generator software for Mac OS X or Windows. The VirtualForge software runs on any Mac or Windows workstation that, in addition to its standard graphics output adapter, controls a video output device (i.e. AJA or Blackmagic Design) to drive a TV video monitor (e.g. LCD/LED, OLED, plasma, projector, etc.).

The VirtualForge software is controlled by CalMAN to produce bit-accurate test patterns at any required triplet value, through the video output device to the video monitor, for accurate grayscale, CMS, or 3D LUT video display calibration. This allows a video monitor that is being driven through a video output adapter to be conveniently calibrated with CalMAN.

Mac OSX Requirements:

- Macintosh® OS X 10.8.1 or later
- Intel Core® Duo processor
- 2 GB RAM
- 2 GB available disk space
- Either PCIe or Thunderbolt™ support

Windows Requirements:

- Windows® Vista™ or later with latest OS updates installed (recommended: Windows 7® or later)
- 2 GHz processor (recommended: 2 GHz Dual Core Processor)
- 2 GB RAM
- 2 GB available disk space
- Either PCIe or Thunderbolt™ support

Note: Windows running under VMware Fusion is unable to access Thunderbolt ports.

VirtualForge Compatible Video Output Devices: (see Appendix B below for device details)

According to their respective software development kits, the following AJA and Blackmagic video output devices should be compatible with VirtualForge, although not all devices have been available for testing. The devices that have been tested are check marked below.

- ✓ **# AJA Io 4K** Thunderbolt™ 2 6G-SDI and HDMI I/O device
- ✓ **AJA Io XT** Thunderbolt™ SDI, HDMI and analog I/O device
- ✓ **AJA T-TAP** Thunderbolt™ SDI and HDMI output device (not under Windows on Mac Mini)
- ✓ **# AJA KONA 4** PCIe 2.0 6G-SDI and HDMI I/O device
- ✓ **AJA KONA 3G** PCIe SDI and HDMI I/O device
- ✓ **AJA KONA Lhi/2G** PCIe SDI and HDMI I/O device
- **AJA KONA LHe Plus** PCIe SDI I/O device
- ✓ **AJA KONA** cards above in a Sonnet Thunderbolt™ expansion chassis
- ✓ *** Blackmagic UltraStudio 4K** Thunderbolt™ 2 Dual Link 6G-SDI, HDMI and analog I/O device

- ✓ * **Blackmagic UltraStudio Express** Thunderbolt™ 3G-SDI and HDMI I/O device
- ✓ * **Blackmagic UltraStudio Mini Monitor** Thunderbolt™ 3G-SDI and HDMI output device
- ✓ * **Blackmagic DeckLink 4K Extreme 12G** PCIe Dual Link 12G-SDI, HDMI and analog I/O device
- ✓ * **Blackmagic DeckLink 4K Extreme** PCIe Dual Link 6G-SDI, HDMI and analog I/O device
- * **Blackmagic DeckLink Studio 4K** PCIe 6G-SDI /HD-SDI, HDMI and analog I/O device
- * **Blackmagic DeckLink SDI 4K** PCIe 6G-SDI I/O device
- ✓ * **Blackmagic DeckLink SDI** PCIe SDI/HD-SDI I/O device
- * **Blackmagic DeckLink Quad** PCIe SDI/HD-SDI I/O device
- * **Blackmagic DeckLink Optical Fiber** PCIe SDI/HD-SDI I/O device
- * **Blackmagic DeckLink Duo** PCIe SDI/HD-SDI I/O device
- * **Blackmagic DeckLink Mini Monitor** PCIe 3G-SDI and HDMI output device
- * **Blackmagic Intensity Pro 4K** PCIe HDMI I/O device

✓ Denotes compatible devices that have been directly tested.

 # If you are using an RGB-8 or RGB-10 pixel format with an AJA device that supports a LUT (e.g. AJA Io 4K or KONA 4), see the Pixel Format note under AJA General Information, in Appendix B.

** CalMAN support for Blackmagic SDI outputs, for sourcing VirtualForge calibration signals, is limited to the Blackmagic default YCrCb 4:2:2 10-bit pixel format, which the Blackmagic control app does not provide the option of changing.*
CalMAN does not support Blackmagic HDMI outputs for sourcing VirtualForge calibration signals. The Blackmagic HDMI outputs are clipped to SMPTE-legal levels, which CalMAN cannot control.

AJA Driver Requirements:

- Version 12.2.0 Hardware Driver, or newer

Blackmagic Design Driver Requirements:

- Version 10.4 Desktop Video, or newer

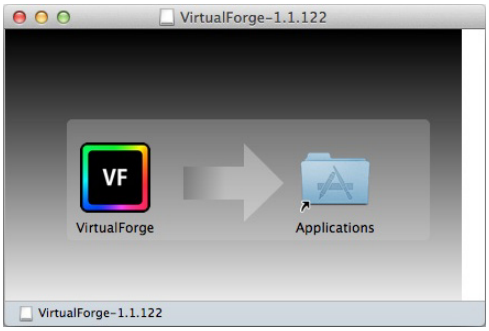
NOTE: Before launching the VirtualForge software, be sure to install the proper driver for the AJA or BMD output device.

VirtualForge Max OS X Software Installation:

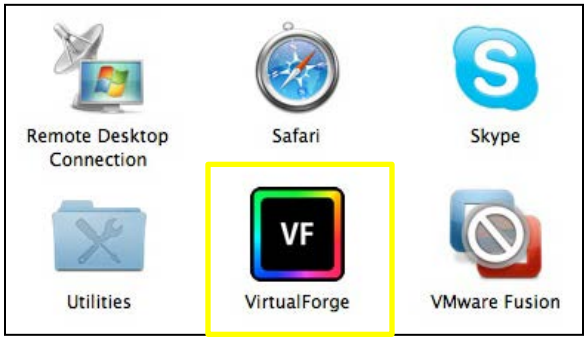
To install the VirtualForge software on a Mac workstation:

1. Download the VirtualForge disk image (.dmg) file, available on the SpectraCal website downloads page, to the Mac Desktop or Downloads folder.

2. Double-click the disk image icon to create a VirtualForge application shortcut.



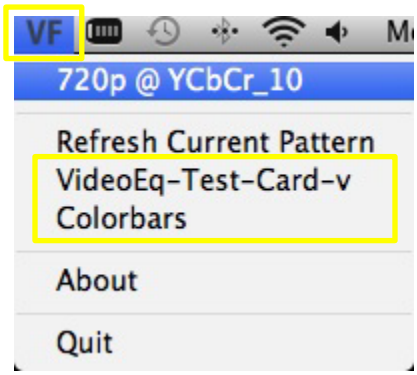
3. Drag the VirtualForge shortcut to the 'Applications' folder in Finder.



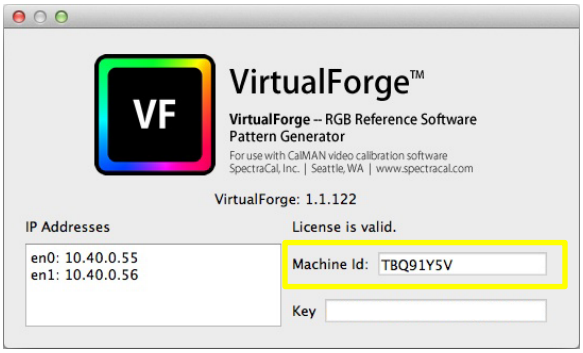
4. Double-click the VirtualForge shortcut in the 'Applications' folder to start the application.
   Note: You can now eject or delete the VirtualForge disk image (.dmg) file from the Desktop.

VirtualForge OS X Setup:

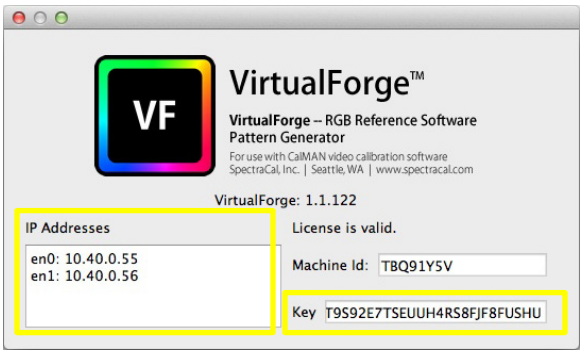
1. In the Mac menu bar, click the VirtualForge (VF) icon to open its menu. You can select the 'VideoEQ-Test-Card' or the 'Colorbars' test pattern to verify that VirtualForge is properly controlling the workstation video output device. These patterns function whether the VirtualForge software is licensed or not.
   Note: See the Appendix for details on using individual video output devices, including setting their output resolution and frame rate.



2. Select *About* from the VirtualForge menu. Record the Machine ID shown on the About page. Send the Machine ID to customerservice@spectracal.com with a request for a VirtualForge license key.



3. When you receive the license key, copy and paste the key into the Key field on the VirtualForge About page.



4. Record the workstation's IP address(es), shown on the About page, for use when connecting to VirtualForge in CalMAN.
5. Quit and restart the VirtualForge software to activate the license.

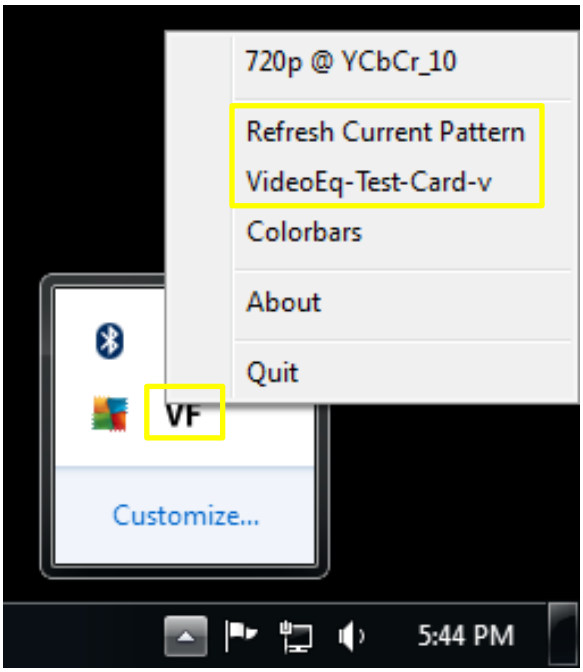
VirtualForge Windows Software Installation:

To install the VirtualForge software on a Windows workstation:

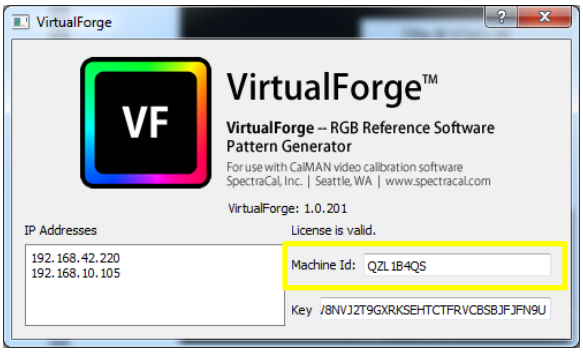
1. Download the VirtualForge Windows installation file, available on the SpectraCal website downloads page, to the Windows Desktop or Downloads folder.
2. Run the installatiion file to create a VirtualForge application shortcut.
3. Double-click the VirtualForge shortcut to start the application.

VirtualForge Windows Setup:

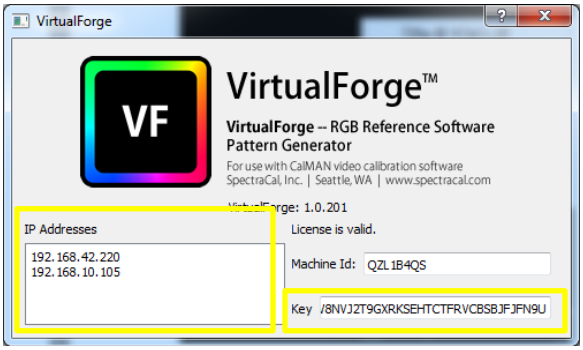
1. In the Windows System Tray (by the clock), click the VirtualForge (VF) icon to open its menu. You can select the 'VideoEQ-Test-Card' or the 'Colorbars' test pattern to verify that VirtualForge is properly controlling the workstation video output device. These patterns function whether the VirtualForge software is licensed or not.
   Note: See the Appendix for details on using individual video output devices, including setting their output resolution and frame rate.



2. Select *About* from the VirtualForge menu. Record the Machine ID shown on the About page. Send the Machine ID to customerservice@spectracal.com with a request for a VirtualForge license key.



3. When you receive the license key, copy and paste the key into the Key field on the VirtualForge About page.



4. Record the workstation's IP address(es), shown on the About page, for use when connecting to VirtualForge in CalMAN.
5. Quit and restart the VirtualForge software to activate the license.

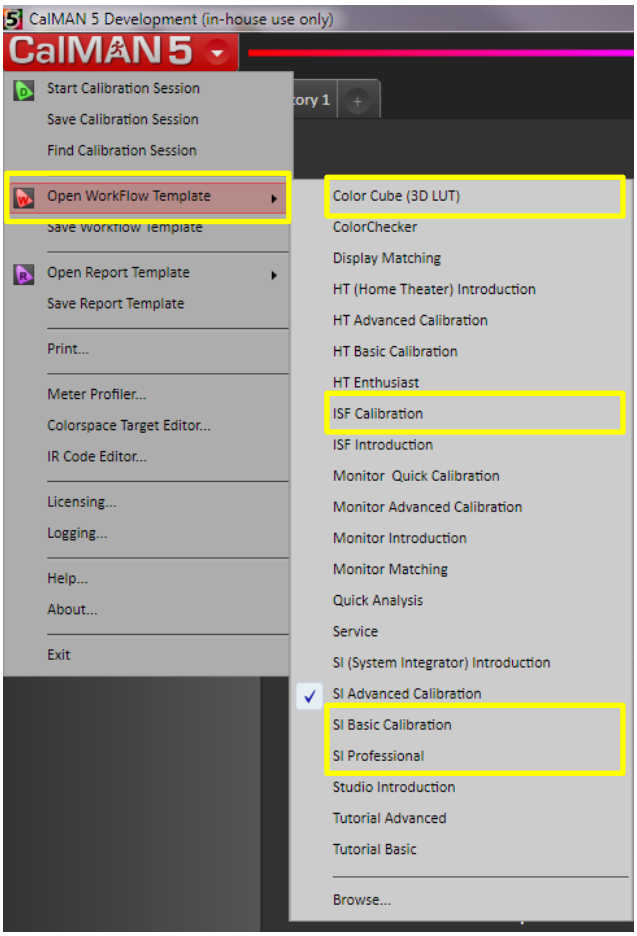
VirtualForge CalMAN Control:

Required CalMAN Version:

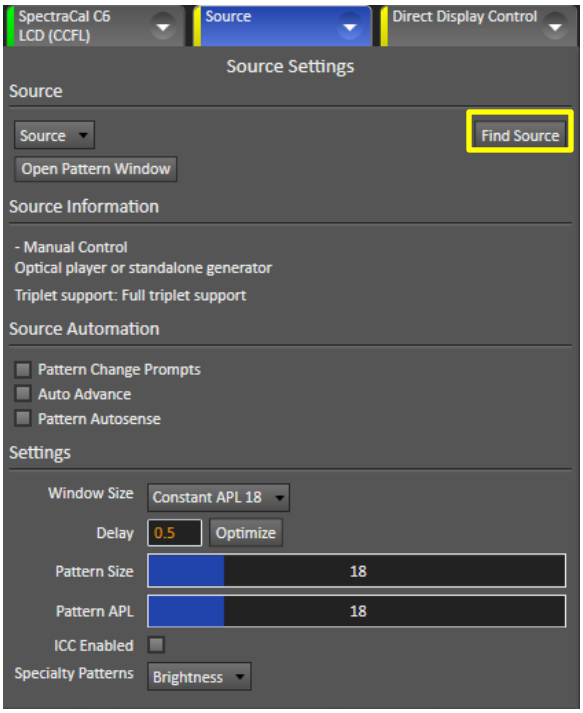
- Version 5.5.0 or newer

Connect CalMAN to VirtualForge:

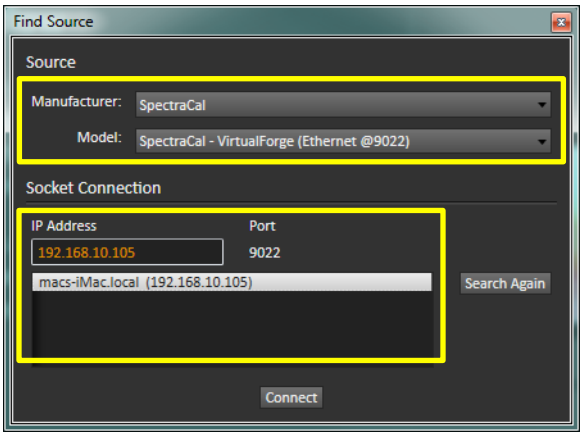
1. Start CalMAN 5.
2. On the main menu, select 'Open Workflow Template.'
   - To perform standard grayscale/CMS display calibration, select either the 'SI Basic Calibration' or the 'SI Advanced Calibration' workflow (Basic is 2 pt. grayscale only).
   - To perform 3D LUT calibration, select the 'Color Cube (3D LUT)' workflow.



3. On the CalMAN *Source Settings* tab, click *Find Source*.



4. From the *Manufacturer* drop-down, select 'SpectraCal.'
5. From the *Model* drop-down, select 'SpectraCal - VirtualForge (Ethernet @9022).'



6. Either select the desired VirtualForge IP address from the bottom search box or type in the VirtualForge IP address, from the VirtualForge *About* page, then click *Connect*.

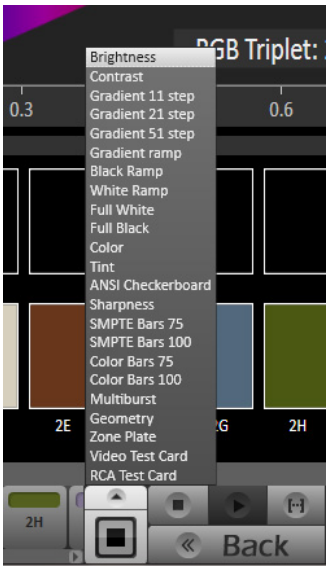
EXCEPTION: Mac versions of Virtual Forge prior to 1.1.300 connect under AVFoundry\VirtualForge.

As you proceed through your selected workflow, whenever display measurements or adjustments are performed, CalMAN controls the VirtualForge software to produce the required test pattern.

Appendix A – VirtualForge Test Patterns

The VirtualForge reference software pattern generator provides any RGB color in a full field or window pattern, as requested by CalMAN for display measurement and calibration (16.78 million 8-bit colors or 1.07 billion 10-bit colors).

VirtualForge also provides specialty test patterns for visual display performance testing or for optimizing the adjustment of display Picture controls (contrast, brightness, etc.). When CalMAN is connected to the VirtualForge software generator, these patterns are available from CalMAN's specialty pattern icon, as shown below.



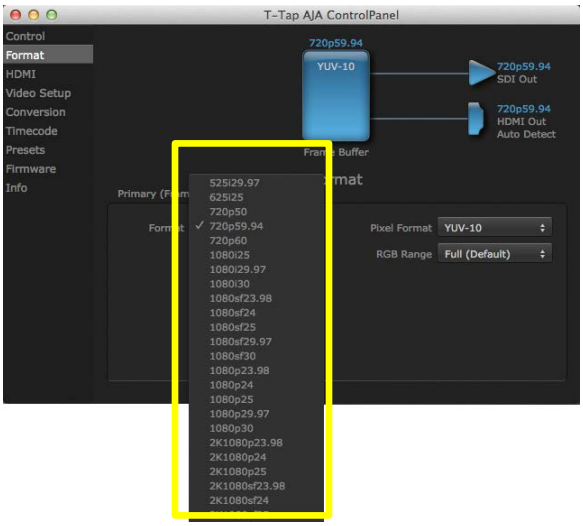
Following is a list of the VirtualForge specialty test patterns:

- Brightness
- Contrast
- Gradient 11 step
- Gradient 21 step
- Gradient 51 step
- Gradient ramp
- Black Ramp
- White Ramp
- Full White
- Full Black
- Color
- Tint
- ANSI Checkerboard
- Sharpness
- SMPTE Bars 75
- SMPTE Bars 100
- Color Bars 75
- Color Bars 100
- Multiburst
- Geometry
- Zone Plate
- Video Test Card
- RCA Test Card

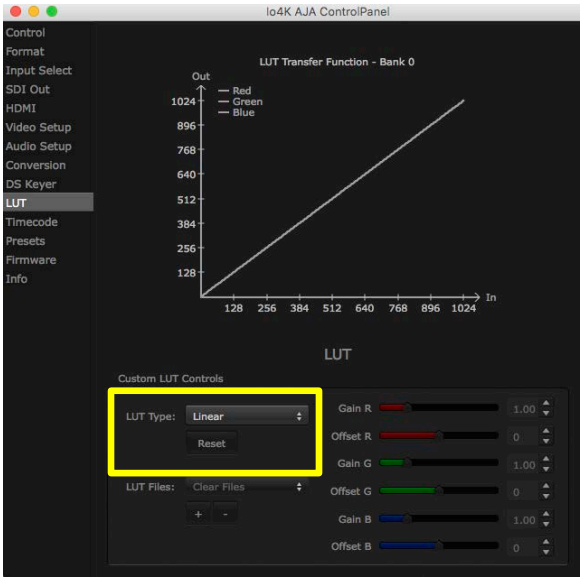
Appendix B – Video Output Devices

AJA General Information

- AJA ControlPanel app and unified device driver; Minimum Version: 10.6.x
  http://www.aja.com/en/support/software/
- Video output capabilities are determined by each AJA video output device and by the AJA ControlPanel app. Use the AJA ControlPanel to adjust AJA video I/O devices, including setting their output resolution and frame rate.



- If you change AJA device parameters, click the 'Refresh Current Pattern' link on the VirtualForge menu to update the device data in the VirtualForge software.
- If you are switching between multiple AJA devices, be sure to check the format selection after you switch to a new device (all devices don't support the same formats).
- If the AJA device supports a LUT (e.g. Io 4K and KONA 4), and if the AJA device's Pixel Format, is selected as "RGB-8" or "RGB-10" on the ControlPanel Format screen, select the ControlPanel LUT screen. Under *LUT Type:*, select "Linear."



AJA KONA 4

Video Formats

- 525i 29.97
- 525i 23.98*
- 625i 25
- 720p 23.98*, 24*, 25*, 29.97*, 30*, 50, 59.94, 60
- 1080i 25, 29.97, 30
- 1080PsF 23.98, 24, 25, 29.97, 30
- 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2K
  - 2048 x 1080P 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
  - 2048 x 1080PsF 23.98, 24, 25
  - 2048 x 1556p 15, 14.98
  - 2048 x 1556PsF 15, 23.98, 24
- 4K
  - 3840 x 2160P 23.98, 24, 25, 29.97, 50, 59.94, 60
  - 4096 x 2160P 23.98, 24, 25, 50, 59.94, 60
  - 3840 x 2160PsF 23.98, 24, 25
  - 4096 x 2160PsF 23.98, 24, 25

*Software-dependent formats, not normal ‘over-the-wire’ formats.

Video Output Digital

- 3G-SDI, SMPTE-259/292/296/424
- Single Link 4:2:2 or 4:4:4 (1 x BNC)
- Dual Link HD 4:4:4, (2 x BNC)
- 2K HSDL (High Speed Data Link) 4:4:4, (2 x BNC)
- 4K/UltraHD 4:2:2 and 4:4:4
- HDMI v2.0b, 30/36 bits/pixel, RGB or YUV, 2.25Gbps, SD, HD and UHD with HFR support up to 60p 4:2:0

AJA KONA 3G

Video Formats

- 525i 29.97
- 525i 23.98*
- 625i 25
- 720P 50, 59.94, 60
- 1080i 25, 29.97, 30
- 1080PsF 23.98, 24, 25, 29.97, 30
- 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2K
  - 2048 x 1080P 23.98, 24, 25, 29.97, 30, 50 and 60
  - 2048 x 1080PsF 23.98, 24, 25
  - 2048 x 1556p 15, 14.98
  - 2048 x 1556PsF 15, 23.98, 24
- 4K
  - 3840x2160P 23.98, 24, 25
  - 4096x2160P 23.98, 24, 25
  - 3840x2160PsF 23.98, 24, 25
  - 4096x2160PsF 23.98, 24, 25

*Software-dependent formats, not normal 'over-the-wire' formats.

Video Output Digital

- 3G/SD/HD SDI, SMPTE-259/292/296/424
- Single link 4:2:2 or 4:4:4 (1 x BNC)
- Dual link HD 4:4:4, (2 x BNC)
- 2K HSDL (High Speed Data Link) 4:4:4, (2 x BNC)
- 4K/QuadHD 4:2:2 or 4:4:4 (4 x BNC)
- HDMI v1.4, 30/36 bits/pixel, RGB or YUV, 2.25 Gb/s, SD, HD, 1080p-50/60

AJA KONA LHi

Video Formats

- 525i 29.97
- 625i 25
- 720p 50, 59.94, 60
- 1080i 25, 29.97, 30
- 1080PsF 23.98, 24
- 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2K
  - 2048 x 1080P 23.98, 24, 25, 29.97, 30
  - 2048 x 1080PsF 23.98, 24

Video Output Digital

- 3G/SD/HD SDI, SMPTE-259/292/296/424
- Single link 4:2:2 or 4:4:4 (1 x BNC)
- HDMI v1.3 30 bits/pixel, RGB or YUV, 2.25 Gb/s, SD, HD, 1080p-50/60

AJA KONA LHe Plus

Video Formats

- 525i 29.97
- 625i 25
- 720p 50, 59.94, 60
- 1080i 25, 29.97, 30
- 1080PsF 23.98, 24, 25, 29.97, 30
- 1080p 23.98, 24, 25, 29.97, 30

Video Output Digital

- SD SDI, SMPTE-259M, 10-bit
- HD SDI, SMPTE-292/296, 10-bit

AJA Io XT

Video Formats

- 525i 29.97
- 625i 25
- 720P 50, 59.94, 60
- 1080i 50, 59.94, 60
- 1080PsF 23.98, 24, 25, 29.97, 30
- 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2048 x 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2048 x 1080PsF 23.98, 24, 25, 29.97, 30
- 3840 x 2160P 23.98, 24, 25, 29.97, 30
- 3840 x 2160PsF 23.98, 24, 25
- 4096 x 2160P 23.98, 24, 25, 29.97, 30
- 4096 x 2160PsF 23.98, 24, 25

Video Output Digital

- 3G/SD/HD SDI, SMPTE-259/292/296/424, 8- or 10-bits
- Single Link 4:2:2 or 4:4:4 (1 x BNC)
- Dual Link HD 4:4:4 (2 x BNC)
- 2K HSDL (High Speed Data Link) 4:4:4, (2 x BNC)
- 4K/Quad HD 4:4:4 (4 x BNC)
- HDMI v1.4
    - 30/36 bits/pixel, RGB or YUV, 2.25 Gb/s
    - SD, HD, 1080p 50/60, 4K, 2K and stereoscopic HD support

AJA Io 4K

Video Formats

- 525i 29.97
- 525i 23.98*
- 625i 25
- 720p 23.98*, 24*, 25*, 29.97*, 30*, 50, 59.94, 60
- 1080i 25, 29.97, 30
- 1080PsF 23.98, 24, 25, 29.97, 30
- 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2Kx1080p 23.98, 24, 25
- 2Kx1080PsF 23.98, 24, 25

*Software-dependent formats, not normal ‘over-the-wire’ formats.

Video Output Digital

- 3G/SD/HD SDI, SMPTE-259/292/296/424
- Single link 4:2:2 or 4:4:4 (1 x BNC)
- Dual link HD 4:4:4, (2 x BNC)
- HDMI v1.4, 30/36 bits/pixel, RGB or YUV, 2.25 Gb/s

AJA T-TAP

Video Formats

- 525i 29.97
- 625i 25
- 720p 50, 59.94, 60
- 1080i 25, 29.97, 30
- 1080PsF 23.98, 24
- 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- 2K (4:2:2)
    - 2048 x 1080PsF 23.98, 24

Video Output Digital

- 3G/SD/HD SDI, SMPTE-259/292/296/424
- Single Link 4:2:2 or 4:4:4 (1 x 3G BNC)
- HDMI v1.3 30 bits/pixel, RGB or YUV, 2.25 Gb/s, SD, HD, 1080p-50/60

Blackmagic Design General Information

- Use the Blackmagic control app to select Blackmagic output signal options.
- Blackmagic SDI support in CalMAN, for sourcing VirtualForge calibration signals, is currently limited to the default YCrCb 422 10-bit pixel format, which the Blackmagic control app does not provide the option of changing.
- CalMAN does not support Blackmagic HDMI outputs for sourcing VirtualForge calibration signals. The Blackmagic HDMI outputs are range-compressed to SMPTE-legal levels, which CalMAN cannot control.

Blackmagic UltraStudio 4K

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 1080PsF23.98*, 1080PsF24*, 1080PsF25*, 1080PsF29.97*, 1080PsF30*, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94, 1080p60
- 2K - 2048 x 1080PsF23.98*, 2048 x 1080PsF24*, 2048 x 1080PsF25*, 2048 x 1080p23.98*, 2048 x 1080p24*, 2048 x 1080p25*
- 4K - 3840 x 2160p23.98, 3840 x 2160p24, 3840 x 2160p25, 3840 x 2160p29.97, 3840 x 2160p30, 3840 x 2160p50, 3840 x 2160p59.94, 3840 x 2160p60, 4096 x 2160p23.98, 4096 x 2160p24, 4096 x 2160p25
  *SDI only

Video Output Digital

- SDI/HD-SDI - SMPTE 292M, SMPTE 259M, SMPTE 296M, SMPTE 372M, SMPTE 425M Level A and B, ITU-R BT.656 and ITU-R BT.601
- HDMI – 4:2:2 and 4:4:4 (4K is 4:2:2)
- 10-bit YUV up to 4K, 12-bit RGB in HD and 2K output only

Blackmagic UltraStudio Express

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 1080PsF23.98, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30

Video Output Digital

- SDI/HD-SDI - 10-bit, 4:2:2, SMPTE 292M, SMPTE 259M, SMPTE 296M
- HDMI – 10-bit, 4:2:2, REC 601, REC 709

Blackmagic UltraStudio Mini Monitor

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 1080PsF23.98, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30

Video Output Digital

- SDI/HD-SDI - 10-bit, 4:2:2, SMPTE 292M, SMPTE 259M
- HDMI – 10-bit, 4:2:2, REC 601, REC 709

Blackmagic DeckLink 4K Extreme

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC, 525/23.98 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080p50, 1080i59.94, 1080p59.94, 1080i60, 1080p60
- 2K - 2048 x 1556PsF23.98, 2048 x 1556PsF24, 2048 x 1556PsF25, 2048 x 1556p23.98, 2048 x 1556p24, 2048 x 1556p25
- 4K - 3840x2160p23.98, 3840x2160p24, 3840x2160p25, 3840x2160p29.97, 3840x2160p30, 4096x2160p23.98, 4096x2160p24, 4096x2160p25, 4096x2160p29.97

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M/372M, ITU-R BT.656/BT.601, SD/HD/2K/4K
- HDMI – 10-bit, SD/HD/2K/4K

Blackmagic DeckLink Quad

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC, 525/23.98 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M/296M, SD/HD

Blackmagic DeckLink Studio

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC, 525/23.98 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M, SD/HD
- HDMI – 10-bit, SD/HD

Blackmagic DeckLink Optical Fiber

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC, 525/23.98 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI (BNC and fiber) - 10-bit, SMPTE 259M/292M, SD/HD

Blackmagic DeckLink Duo

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC, 525/23.98 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M, SD/HD

Blackmagic DeckLink SDI

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC, 525/23.98 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M, SD/HD

Blackmagic DeckLink Mini Recorder

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M, SD/HD

Blackmagic DeckLink Mini Monitor

Video Formats

- SD - 625/25 PAL, 525/29.97 NTSC
- HD - 720p50, 720p59.94, 720p60, 1080PsF23.98, 1080p23.98, 1080PsF24, 1080p24, 1080PsF25, 1080p25, 1080PsF29.97, 1080p29.97, 1080PsF30, 1080p30, 1080i50, 1080i59.94, 1080i60

Video Output Digital

- SDI/HD-SDI - 10-bit, SMPTE 259M/292M, SD/HD