Operation Manual

HDLink

Blackmagicdesign

Mac OS X™

Windows™

May 2009

HDLink Operation Manual

Blackmagicdesign

3 Welcome

Thank you for purchasing a HDLink. We hope you share our dream for the television industry to become a truly creative industry by allowing anyone to have access to the highest quality video.

Previously SDI monitoring required small and very expensive CRT displays which were unable to show the full detail of the video image. HDLink has changed all that and now full resolution SDI monitoring with pixel-for-pixel accuracy is affordable for everyone using large flat screen displays. We hope you get years of use from your new HDLink and have fun monitoring your video and film with full digital accuracy on a large display with DVI or HDMI connections.

This instruction manual should contain all the information you'll need on installing your HDLink. We think it should take you approximately 5 minutes to complete installation. Before you install HDLink, please check our website at **www.blackmagic-design.com** and click the support page to download the latest updates to this manual and HDLink driver software.

Lastly, please register your HDLink when downloading software updates. We would love to keep you updated on new software updates and new features for your HDLink. Perhaps you can even send us any suggestions for improvements to the software. We are constantly working on new features and improvements, so we would love to hear from you!

Grant Petty

CEO Blackmagic Design

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HDLink Operation Manual

How to use your HDLink

Installation

HDLink Utility enables you to update your HDLink with the latest firmware. Firmware updates may add new features, support new formats and standards, or provide increased compatibility with other video and audio hardware. It is always best to use the latest version of HDLink Utility so you receive all the latest updates for your HDLink.

The latest version of HDLink Utility can always be downloaded from **www.blackmagic-design.com/support/software/**.

HDLink Utility runs on the latest Tiger and Leopard versions of Mac OS X. On the Windows platform, HDLink Utility runs on both 32 and 64-bit versions of Windows XP and Windows Vista with the latest service packs installed. Testing on previous versions of these operating systems is not conducted and so it is always best to keep up to date with the latest versions of Mac OS X, Windows XP and Windows Vista.

Installation and Removal on Mac OS X

After downloading the latest HDLink software and unzipping the downloaded file, open the resulting HDLink Installer disk image to reveal its contents.

Launch the HDLink Installer and follow the on screen instructions and then restart your Mac when prompted. HDLink is now installed.

To remove HDLink from your Mac, open the HDLink Installer disk image and launch the Uninstall HDLink utility. Follow the on screen instructions to remove the software.

Installation and Removal on Windows

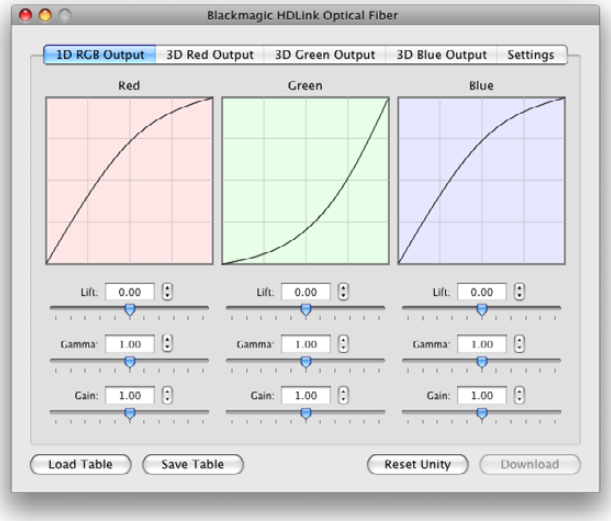
After downloading the latest HDLink software and unzipping the downloaded file, you should see a HDLink folder containing this PDF manual and the HDLink installer.

Double-click the installer and follow the on screen prompts to complete the installation. When the installation has finished, it will prompt you to restart the computer. The restart will load a USB driver for HDLink Utility so that it can communicate with any HDLink model. Click “restart” to complete the installation process. Once the computer has restarted, HDLink Utility will be fully installed and ready to use.

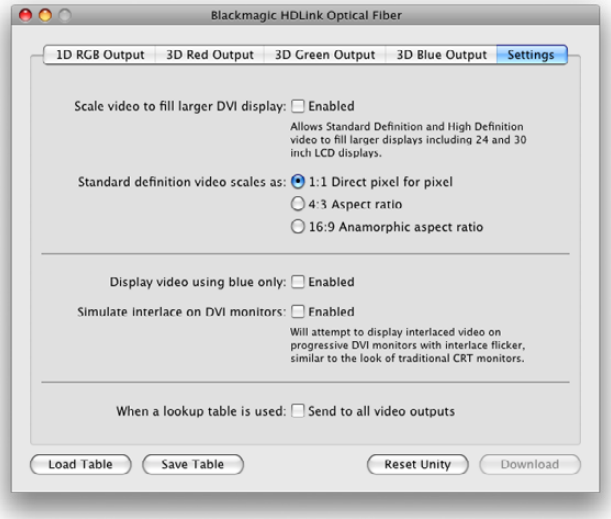
To remove HDLink from Windows XP, go to the Add or Remove Programs control panel, select Blackmagic HDLink and click on Remove.

To remove HDLink from Windows Vista, go to the Programs and Features control panel, select Blackmagic HDLink and click on Uninstall.

Using HDLink Utility



HDLink lookup table controls



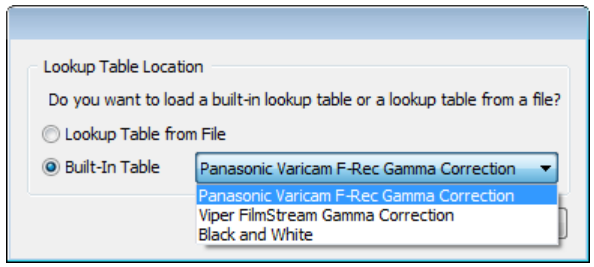
HDLink Settings

After running the HDLink software installer, a USB driver will be installed into your system and the HDLink Utility will be added to the Applications or Programs folder. To use the HDLink Utility, you will need to have an HDLink connected to your USB port as follows.

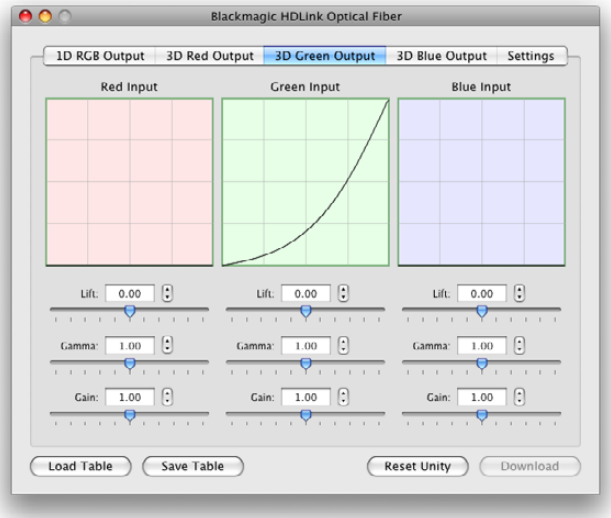
1. Connect the 12 volt power supply which was included with your model of HDLink. The white power lamp will illuminate.
2. Connect a USB cable. Most USB ports are now USB 2.0. The HDLink Utility software will usually work with slower USB 1.0 ports found on older computers and some USB keyboards.
3. Open the HDLink Utility and the settings should be adjustable. If they are disabled and unadjustable, check the USB connection to the HDLink, try another USB cable or try another USB port on your host computer.
4. If your version of the HDLink Utility contains newer firmware than is currently installed in the HDLink, you will see a message asking you to update the firmware. You must allow the firmware to be updated before you can use this version of HDLink Utility to configure the HDLink. Select 'download firmware' for the firmware to be updated.
5. If the firmware has been updated, it is important you unplug the power cable from HDLink, wait 5 seconds, and then plug in the power cable again. This ensures the HDLink is reset correctly.
6. HDLink Pro and HDLink Optical Fiber allow 3D LUTs (lookup tables) to be applied to DVI-D and HDMI displays. You can make changes to lift, gamma and gain settings for red, green and blue color, and import custom 3D lookup tables. These HDLink models will also import 1D tables created for the original HDLink. Changes to settings can be seen on the HDLink DVI-D or HDMI output in real time allowing accurate setup.
7. 3D lookup tables can be applied to the loop-through SDI and optical fiber SDI outputs, so you can use the outputs for inline video processing. Simply enable the *Send to all video outputs* checkbox in the Settings of HDLink Utility to enable 3D lookup table processing on all video outputs.
8. Changes made in the Settings tab of the HDLink Utility are updated immediately and don't need HDLink to be restarted.

The HDLink Utility interface is the same for all current models of HDLink on both Mac OS X and Windows platforms. Any features that are not applicable to your HDLink model will be grayed out and inactive.

Lookup Tables (LUTs)



Built-in lookup tables can be loaded for log to linear conversion



3D lookup table controls provide independent adjustments for the red, green and blue color channels

HDLink supports the use of LUTs to adjust the appearance of video on your monitor and optionally on the loop through SDI output. Lookup tables can be used for standard definition and high definition video as well as 2K film.

1D LUTs are useful for making quick adjustments to a video image but any adjustments to color will also affect brightness. They are often used when working with log video so that the image can be displayed on screen as normal linear video. Built-in 1D LUTs are provided for log to linear conversion when playing video captured from Panasonic Cinegamma™ and Viper Filmstream™ cameras. 1D LUTs are supported in all HDLink models.

3D LUTs provide the ability to increase and decrease the amount of color in each color channel, independently from brightness. This allows for precise color grading to ensure a video monitor matches the color printed to tape or film. 3D LUTs are supported in current HDLink models.

How to use Lookup Tables in HDLink

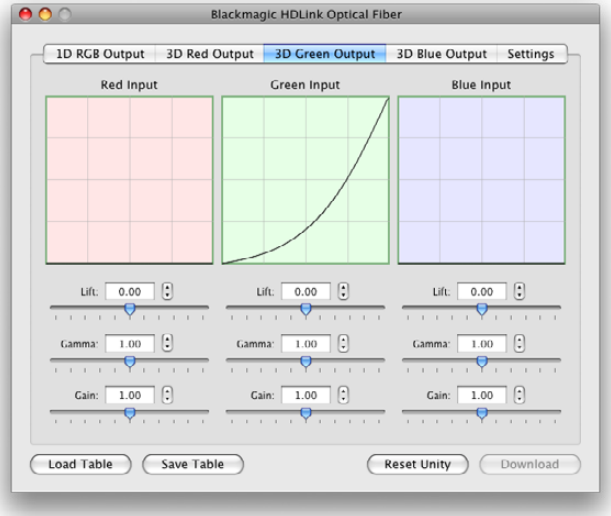
Connect a USB cable between the HDLink and your computer.

Launch the HDLink Utility from your Applications folder in Mac OS X or from Programs in Microsoft Windows. The HDLink interface should immediately be visible and adjustable. If the interface does not appear to be "active", check the USB connection, try another USB cable or try another USB port and it should become active.

The lookup table interface in HDLink Utility can be adjusted using a method similar to that used for image adjustment with the Curves feature in Adobe Photoshop™. The horizontal axis of each graph represents the original color input values and the vertical axis represents the new color output values. When first opened, each lookup table displays a straight diagonal line because the color values have not yet been changed.

Changes made to the lookup tables can immediately be seen on a monitor attached to the DVI/HDMI output of HDLink. Changes are saved to the HDLink hardware by clicking the Download button so that you don't need to leave HDLink connected to your computer via USB. Lookup tables can be reset to original values by clicking the Reset Unity button and this effectively disables the lookup tables. Click the Download button again if you wish to save the original values.

Lookup Tables (LUTs)



Load Table and Save Table buttons can be found in the lower left corner of the HDLink interface

Importing and exporting 3D LUTs

Current HDLink models support the popular Autodesk .3dl, IRIDAS .itx and IRIDAS .cube lookup table formats when importing 3D LUTs. Click the Load Table button to load lookup tables.

3D LUTs can also be exported from HDLink in the .cube format. HDLink uses the .cube format to store 3D LUTs internally as this is a most memory efficient way to store complex lookup tables. Both 3D LUTs created with curves in the lookup table interface, and 3D LUTs imported from .3dl, .itx and .cube files, are exported from HDLink in the .cube format. Click the Save Table button to save lookup tables.

The .cube file format is fully compatible with current and previous Blackmagic Design products which share the same LUT format: HDLink Optical Fiber, HDLink Pro, Multibridge Eclipse, Multibridge Pro (October 2007 model) and DeckLink HD Extreme 2.

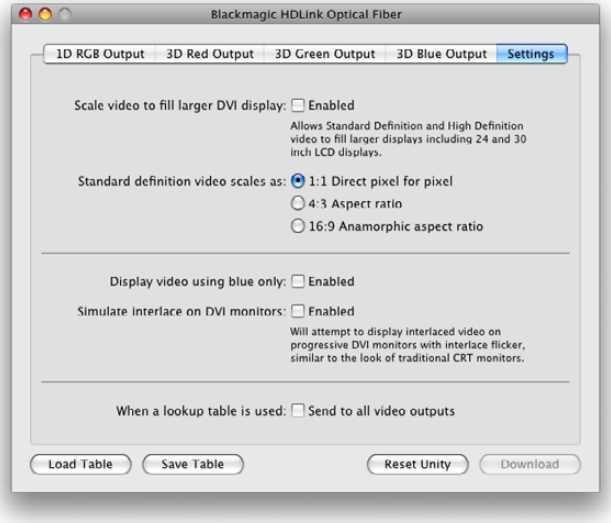
Importing and exporting 1D LUTs

All HDLink models can import 1D LUTs. The 1D file format is any tab-delimited text file with red, green and blue values for each record and the first line (title line) is skipped. Lookup tables need to be 1024 records long with the first line reserved for the title line. Check out the sample 1D lookup table accompanying the HDLink software installer. 1D lookup tables can be created in a spreadsheet program and then must be exported to a 'tab separated' text file prior to being imported in to HDLink Utility. Click the Load Table button to load lookup tables.

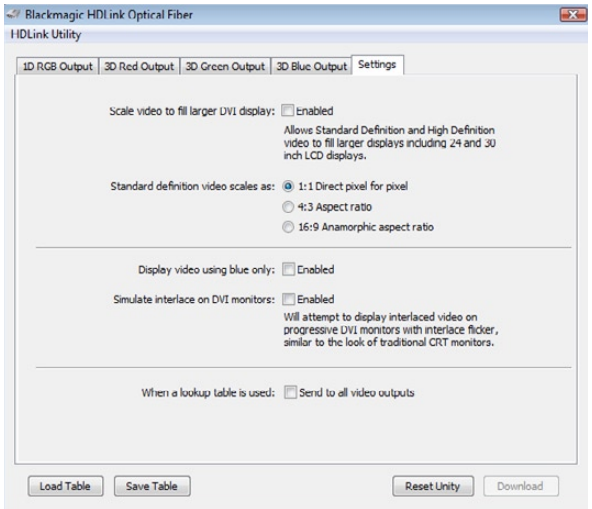
1D LUTs can also be exported from HDLink in the same text format mentioned above. Both 1D LUTs created with the curves in the lookup table interface, and 1D LUTs imported from text files, are exported from HDLink in the same text format. Click the Save Table button to save lookup tables.

The 1D LUT text file format is fully compatible with the following Blackmagic Design products which share the same LUT format: HDLink Optical Fiber, HDLink Pro, HDLink 2, HDLink, Multibridge Eclipse, Multibridge Pro (October 2007 model), Multibridge Extreme (DVI output), DeckLink HD Extreme 2 and DeckLink HD Pro 4:4:4 (PCI-X).

Settings



HDLink Settings pane in Mac OS X



HDLink Settings pane in Windows

HDLink Utility provides several settings for current HDLink models.

Scale video to fill larger DVI display.

Most HDMI displays automatically scale video to fill the screen so a PAL or NTSC image would automatically scale to fill the high definition display. By contrast, DVI displays rarely provide scaling. This option enables current HDLink models to scale smaller video formats to fill larger DVI displays and avoid thick black borders around the video. When this feature is used with SD video, the aspect ratio chosen below will also be applied.

Standard definition video scales as:

1:1 Direct pixel for pixel

This option allows for precise pixel-for-pixel viewing of standard definition video. However as HDLink uses square pixels, and standard definition video uses rectangular pixels, your video may seem squashed and circles may appear to be egg-shaped.

4:3 Aspect ratio

This option scales standard definition video in the traditional 4:3 aspect ratio so it will appear normally on your computer display via HDLink. Circles will appear as circles as expected but the image will no longer be presented pixel-for-pixel.

16:9 Anamorphic aspect ratio

This option scales widescreen standard definition video to appear in the expected 16:9 aspect ratio on the computer monitor attached to HDLink. The image will appear correctly but will no longer be presented pixel-for-pixel.

Display video using blue only

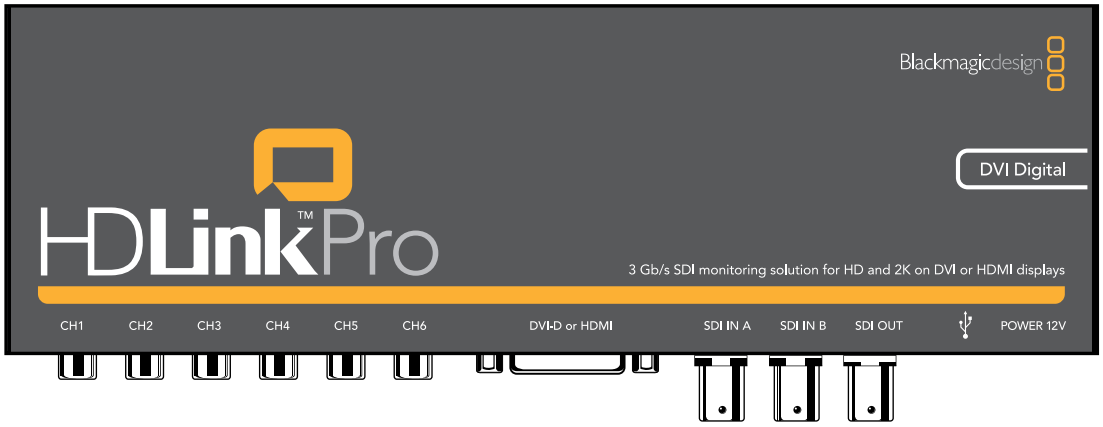
This option enables blue only mode which is very helpful in detecting noise in video.

Simulate interlace on DVI monitors

This option attempts to display interlaced video on progressive DVI monitors, with a similar look to traditional CRT monitors, and to avoid video tearing.

When a lookup table is used, Send to all video outputs.

This option sends the effect of any lookup tables to all HDLink outputs. It is very useful for inline color correction of an SDI signal as the effect of the LUTs will be seen on all SDI, optical fiber SDI and DVI/HDMI outputs of your HDLink model. If you want to leave the SDI output unchanged, and only apply the LUTs to the DVI/HDMI display, leave this option unchecked.



HDLink Pro is easy to use because any valid video signal received by the SDI input is sent to all outputs, i.e. DVI/HDMI and SDI outputs. HDLink Pro automatically detects the format of the incoming signal and displays the video on any supported DVI or HDMI-based monitor.

Check the HDLink verified compatibility matrix
www.blackmagic-design.com/support/detail.asp?techID=186

HDLink Pro features an indicator lamp to show the operational status of the unit:

- Off HDLink Pro is powered off.
- Dim HDLink Pro is powered on but is not receiving a valid, SDI video signal.
- Bright HDLink Pro is powered on and is receiving a valid, SDI video signal.

HDLink Pro

"Valid video signals" supported by HDLink Pro include 2K, HD1080, HD720, NTSC and PAL. Computer video formats are generally not supported unless they coincidentally match a TV format. Please see the following HDLink specifications link on the Blackmagic Design website for a full listing of current formats supported via DVI and HDMI displays. Check **www.blackmagic-design.com/products/hdlink/techspecs/**

HDLink is preconfigured for you, requiring no initial setup to connect. Your HDLink will simply run without changing any settings, however, if you would like to update the firmware, modify settings or load custom gamma tables, then use the HDLink Utility software. This can be downloaded from the Blackmagic Design web site support page. Check **www.blackmagic-design.com/support/**

HDLink Pro uses the same software as HDLink Optical Fiber and shares the same software interface for changing settings including 3D LUTs. 3D and 1D lookup tables can be applied to the DVI/HDMI output of HDLink Pro. If HDLink Pro is configured to send lookup tables to all video outputs, the lookup tables will be applied to the SDI output in addition to the DVI/HDMI output.

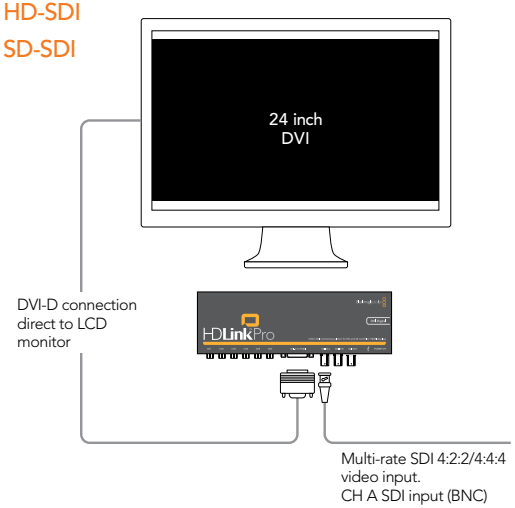
DVI-D monitors are shown in most of the diagrams shown in this manual. An HDMI display can be used in all cases except for 2K monitoring as HDMI displays do not provide enough pixels to display a full 2K image. HDMI displays are best for use with HD720p50 as most DVI displays do not support this format. The included DVI-to-HDMI adapter can be used to attach an HDMI display to the DVI output of HDLink.

HDLink Pro provides two SDI inputs which can be used for standard definition SDI, HD-SDI 4:2:2, Dual Link HD-SDI 4:4:4, 3 Gb/s HD-SDI 4:4:4 video or 3 Gb/s 2K film as shown in the connection diagrams of this manual.

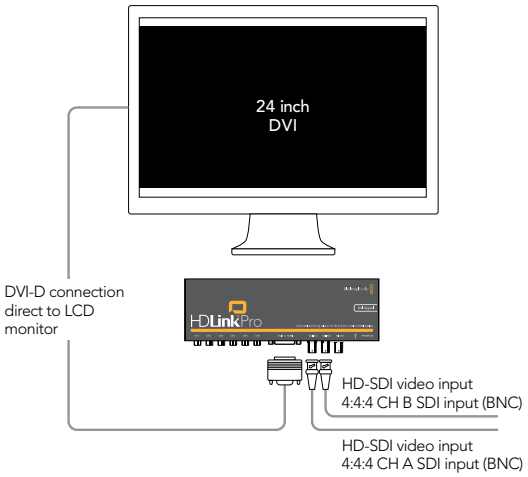
The consumer level analog audio outputs are fully compatible with a wide range of consumer HiFi equipment and are perfect for monitoring of stereo audio or even up to 6 channels of audio. 2 channel audio output via HDMI is provided for maximum compatibility with HDMI TV's and monitors.

HDLink Pro – Connection Diagrams

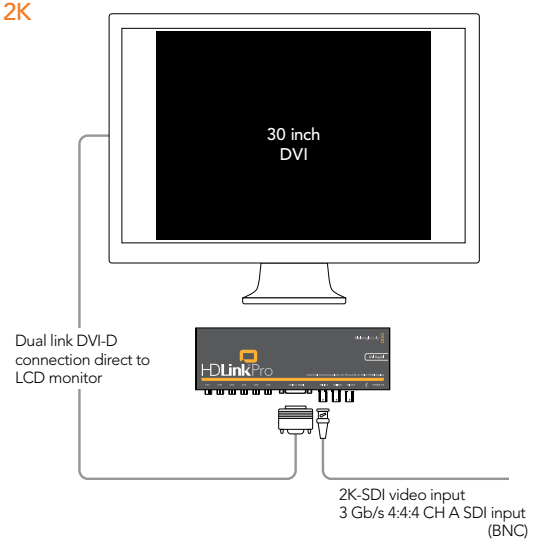
3 Gb/s HD-SDI
HD-SDI
SD-SDI



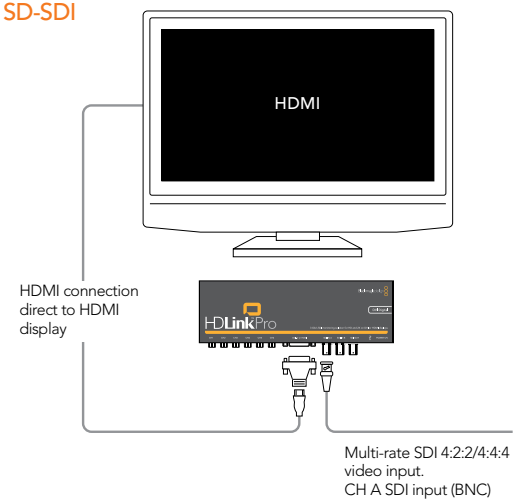
Dual Link HD-SDI 4:4:4



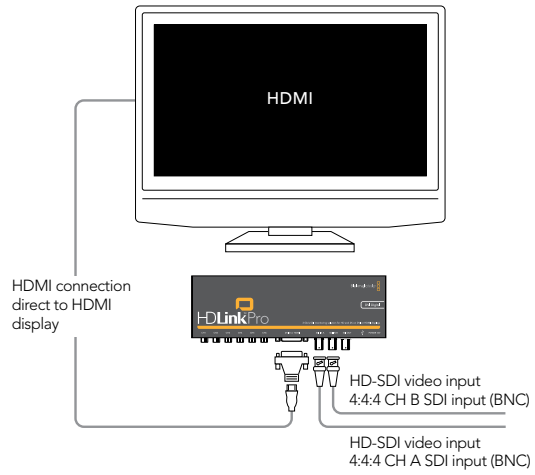
2K



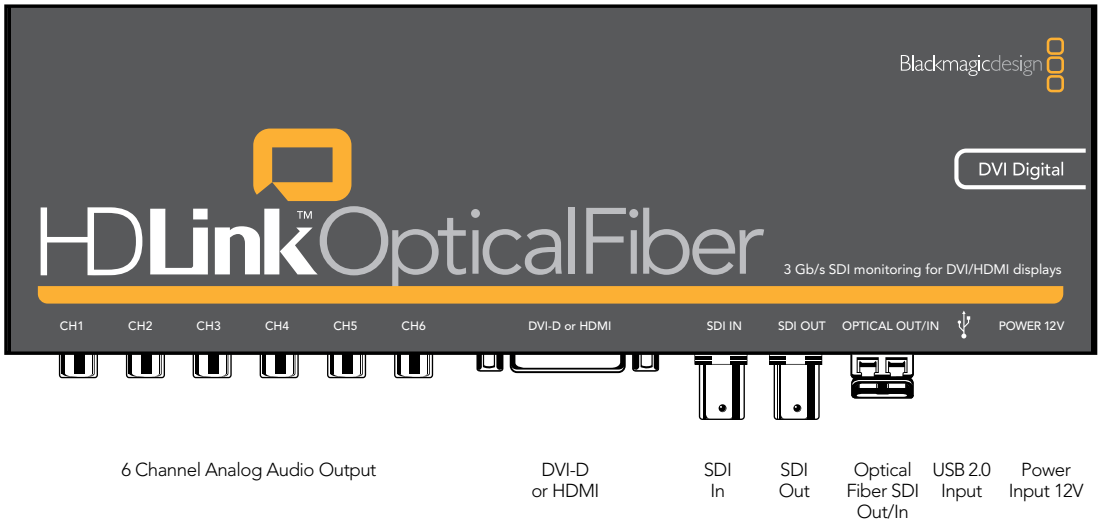
3 Gb/s HD-SDI
HD-SDI
SD-SDI



Dual Link HD-SDI 4:4:4



HDLink Optical Fiber



HDLink Optical Fiber is easy to use because any valid video signal received by the SDI or optical fiber SDI inputs is sent to all outputs, i.e. DVI/HDMI, SDI and optical fiber SDI outputs. HDLink Optical Fiber automatically detects the format of the incoming signal and displays the video on any supported DVI or HDMI-based monitor. Check the HDLink verified compatibility matrix at **www.blackmagic-design.com/support/detail.asp?techID=186**

HDLink Optical Fiber has two video input connections which means that one can be used as a redundant connection for the other in case a video feed is lost. If HDLink Optical Fiber receives valid video signals through both of the SDI and optical fiber SDI inputs, the first signal received will be displayed on the DVI/HDMI output and also sent to the SDI and optical fiber SDI outputs. Should the first signal be lost, the other will immediately replace it. For example if HDLink Optical Fiber was receiving video from a distant location via optical fiber SDI, and the link was unexpectedly cut, HDLink would automatically switch over to the SDI video input which could be from a nearby SDI source. Similarly HDLink would automatically switch to the optical fiber SDI source should the SDI input be unexpectedly lost.

Note: To switch between SDI input and Optical Fiber SDI input, ensure a video signal is being sent to the desired input and then simply stop the signal on the input which you no longer require. HDLink will automatically switch over and receive video from the desired input.

HDLink Optical Fiber

HDLink Optical Fiber features an indicator lamp to show the operational status of the unit:

- Off HDLink Optical Fiber is powered off.
- Dim HDLink Optical Fiber is powered on but is not receiving a valid, SDI video signal via either or both SDI and Optical Fiber SDI inputs.
- Bright HDLink Optical Fiber is powered on and is receiving a valid, SDI video signal via either or both SDI and Optical Fiber SDI inputs.

"Valid video signals" supported by HDLink Optical Fiber include 2K, HD1080, HD720, NTSC and PAL. Computer video formats are generally not supported unless they coincidentally match a TV format. Please see the following HDLink specifications link for a full listing of current formats supported via DVI and HDMI displays. **www.blackmagic-design.com/products/hdlink/techspecs/**

HDLink is preconfigured for you, requiring no initial setup to connect. Your HDLink will simply run without changing any settings, however, if you would like to update the firmware, modify settings or load custom gamma tables, then use the HDLink Utility software. This can be downloaded from the Blackmagic Design web site support page. Check **www.blackmagic-design.com/support/**

HDLink Optical Fiber uses the same software as HDLink Pro and shares the same software interface for changing settings including 3D LUTs. 3D and 1D lookup tables can be applied to the DVI/HDMI output of HDLink Optical Fiber. If HDLink Optical Fiber is configured to send lookup tables to all video outputs, the lookup tables will be applied to both the SDI and optical fiber SDI outputs in addition to the DVI/HDMI output.

DVI-D monitors are shown in most of the diagrams shown in this manual. An HDMI display can be used in all cases except for 2K monitoring as HDMI displays do not provide enough pixels to display a full 2K image. HDMI displays are best for use with HD720p50 as most DVI displays do not support this format. The included DVI-to-HDMI adapter can be used to attach an HDMI display to the DVI output of HDLink.

HDLink Optical Fiber provides SDI and optical fiber SDI inputs which can be used for standard definition SDI, HD-SDI 4:2:2, 3 Gb/s HD-SDI 4:4:4 video or 3 Gb/s 2K film.

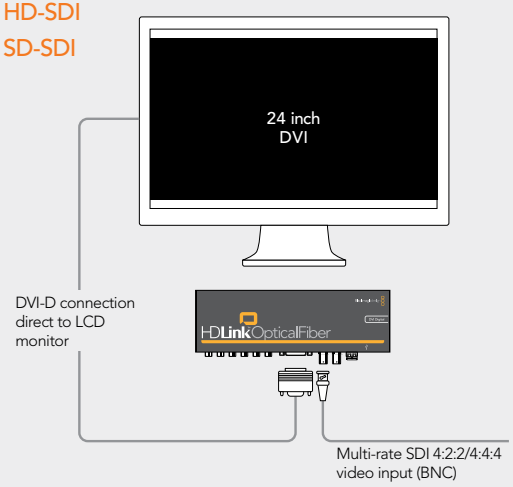
The fiber optic module, included with HDLink Optical Fiber, is a standard SFP transceiver module which includes an LC connector port for attaching fiber optic cables. While other kinds of optical connectors exist, the SMPTE standard for Optical Fiber SDI specifies that LC type optical fiber connectors be used and this makes it easy for all SMPTE compliant optical equipment to connect together.

The consumer level analog audio outputs are fully compatible with a wide range of consumer HiFi equipment and are perfect for monitoring of stereo audio or even up to 6 channels of audio. 2 channel audio output via HDMI is provided for maximum compatibility with HDMI TV's and monitors.

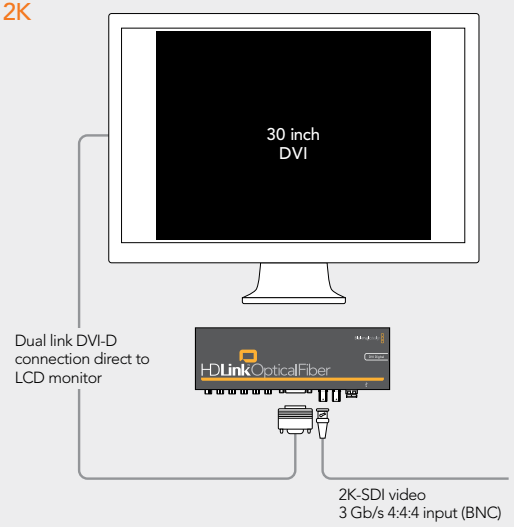
HDLink Optical Fiber– Connection Diagrams

SDI Input

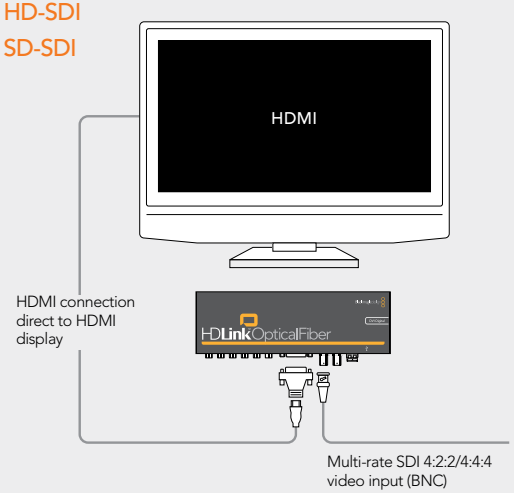
3 Gb/s HD-SDI
HD-SDI
SD-SDI



2K

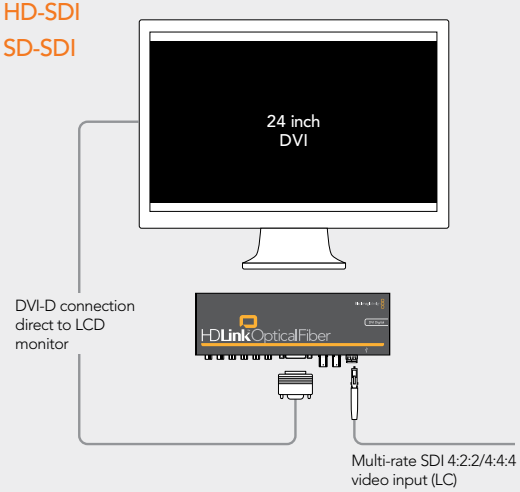


3 Gb/s HD-SDI
HD-SDI
SD-SDI

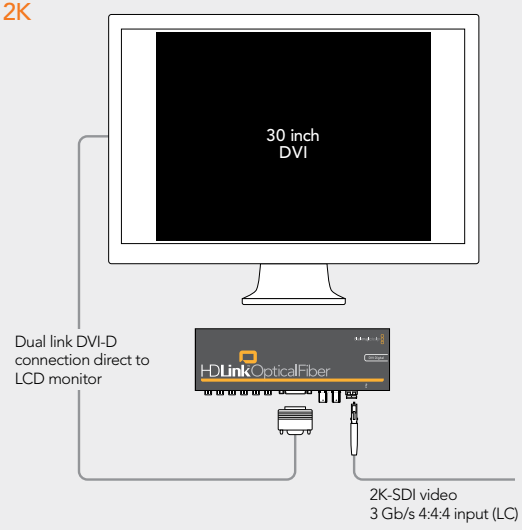


Optical Fiber SDI Input

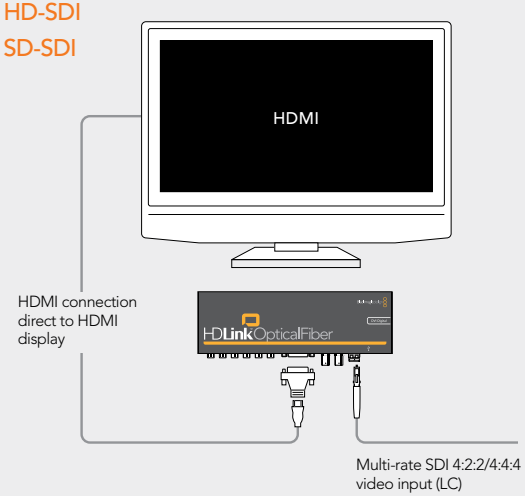
3 Gb/s HD-SDI
HD-SDI
SD-SDI



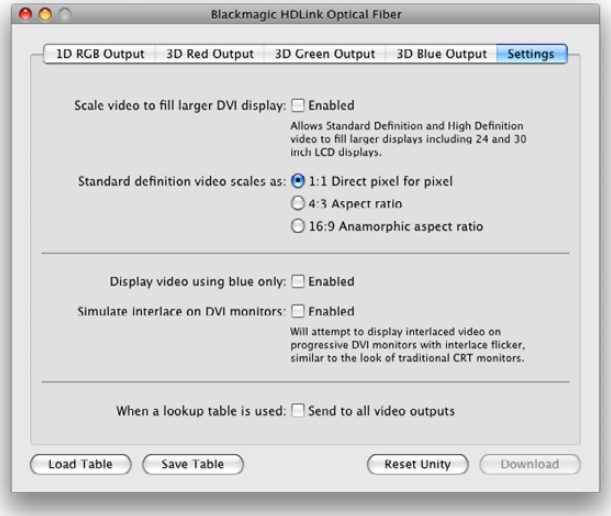
2K



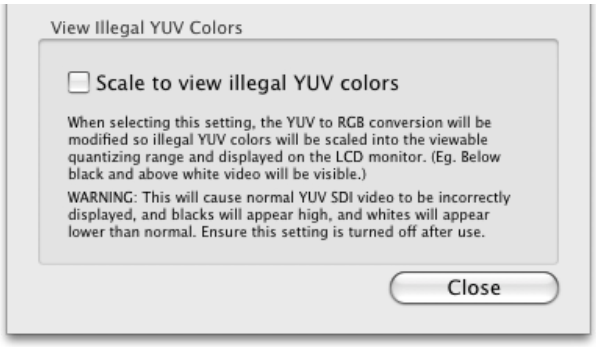
3 Gb/s HD-SDI
HD-SDI
SD-SDI



Troubleshooting



HDLink Settings can scale video to eliminate black borders and display SD video in a traditional aspect ratio



Why are there thick black borders around my video?

Most HDMI displays automatically scale video to fill the screen enabling PAL or NTSC video to automatically scale and fill a high definition display so you should not encounter thick black borders around your video.

By contrast, DVI displays rarely provide scaling. HDLink Utility provides an option named *Scale video to fill larger DVI display*. This option enables current HDLink models to scale smaller video formats to fill larger DVI displays and avoid thick black borders around the video.

Why do circles appear elliptical or egg-shaped via HDLink in standard definition?

HDTV uses square pixels for display as does your DVI-D based computer monitor or HDMI display. SDTV uses rectangular pixels for display which is different to your computer monitor. When HDLink is used to view standard definition video, and is set to scale video as *1:1 direct pixel for pixel*, circles will display egg-shaped.

If you want the standard definition picture to look as it would on an old CRT display, launch the HDLink Utility and select the *4:3 Aspect ratio* scaling option for standard definition video. This scaling option will scale the standard definition video to make it appear normal on an LCD display and circles will look like circles.

HD720p50 support

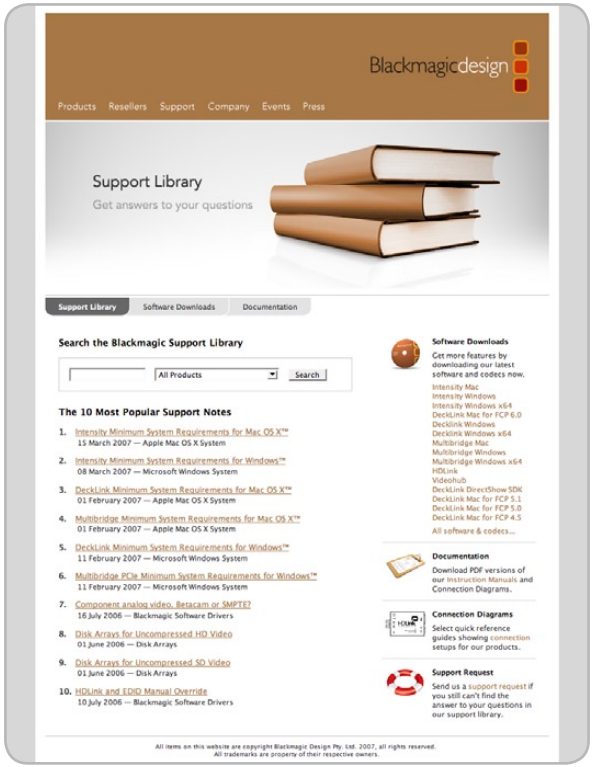
All models of HDLink support the HD720p50 standard. However there are very few DVI-D monitors which support this standard. Most new HDMI-based monitors and TV's purchased in PAL countries now include 720p50 support and should work well with any HDLink.

Strange colors on display

HDLink automatically prevents illegal YUV colors from being displayed on your LCD monitor when converted to the RGB colorspace. Enabling the option *Scale to view illegal YUV colors* will scale illegal YUV colors into the viewable quantizing range on an LCD monitor. This will cause YUV SDI video to be incorrectly displayed with black colors appearing higher than normal and white colors lower than normal. Ensure this setting is disabled after use.

This setting is available from the `HDLink Utility>Preferences` menu option in both Mac OS X and Windows.

Support



If things go wrong

There are three steps to getting help.

Step 1. Check out the Blackmagic Design web site **www.blackmagic-design.com** and click on the "Support" page for the latest support information.

Step 2. Call your dealer.

Your dealer will have the latest technical updates from Blackmagic Design and should be able to give you immediate assistance. We also recommend you check out the support options your dealer offers as they can arrange various support plans based on your workflow requirements.

Step 3. The next option is to email us with your questions using the web form at **www.blackmagic-design.com/support/contact**

Step 4. Phone a Blackmagic Design support office. Check our web site for current support phone numbers in your area. **www.blackmagic-design.com/company**.

Please provide us with as much information as possible regarding your technical problem and system specifications so that we may try to respond to your problem as quickly as possible.

Developer Information

Blackmagic 2K Format – Overview

The latest Blackmagic Design products use the new 3 Gb/s SDI video, which allows twice the data rate of traditional HD-SDI video. We thought it would be a really nice idea to add 2K film support, via this new 3 Gb/s SDI technology, so we could simplify feature film workflows. With the popularity of Blackmagic Design editing systems worldwide, now thousands of people can benefit from a feature film workflow revolution.

This information includes everything product developers need to know for building native 2K SDI equipment. Of course, all Blackmagic products can be updated, so if the television industry adopts an alternative SDI-based film standard, we can add support for that too!

Frame Structure

- Transmitted at 23.98, 24 or 25 frames per second as a Progressive Segmented Frame.
- Active video is 2048 pixels wide by 1556 lines deep.
- Total lines per frame : 1650
- Active words per line are 1535. One word consists of a 10-bit sample for each of the four data streams, i.e. a total of 40 bits. See the diagram named *Blackmagic 2K Format - Data Stream Format*.
- Total active lines : 1556
- Total words per line : 1875 for 23.98/24Hz and 1800 for 25Hz.
- Fields per frame : 2, 825 lines each
- Active lines located on lines 16-793 (field 1) and 841-1618 (field 2).

Transport Structure

- Based on SMPTE 372M Dual Link mapping and SMPTE 425M-B support for mapping SMPTE 372M into a single 3 Gb/s link.
- Timing reference signals, line number and line CRC insertion is the same as above.
- Optional ancillary data is inserted into both virtual interfaces.
- At present, only audio data is included: as per standard HD audio insertion (SMPTE S299M) the audio data packets are carried on data stream two and audio control packets are carried on data stream one.
- During active video, 10-bit Red, Green and Blue data is sent in the following sequence:

  Data stream1: Green_1, Green_2, Green_3, Green_5...Green_2047

  Data stream 2: Blue_1, Blue_2, Green_4, Blue_5...Green_2048.

  Data stream 3: Red_1, Blue_3, Blue_4, Red_5...Blue_2048.

  Data stream 4: Red_2, Red_3, Red_4, Red_6...Red_2048.

The diagram, *Vertical Timing Reference,* shows the vertical timing details with line numbers and Field, Vertical and Horizontal bits for the Timing Reference Signal codes.

The diagram, *Data Stream Format*, shows the data stream formats around the optional ancillary data section of the horizontal line. Note that each active pixel takes up three samples.

Blackmagic 2K Format – Vertical Timing Reference

		FIELD 1					ACTIVE					
F	1	0	0	0	0	0	0	0	0	0	0	0
V	1	1	1	1	1	1	0	0	0	0	1	1
LINE #	1650	1	2	…	14	15	16	…	792	793	…	825

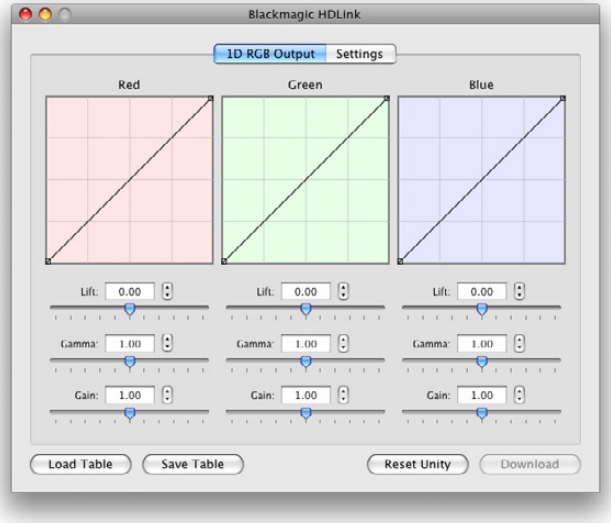
		FIELD 2					ACTIVE					
F	0	1	1	1	1	1	1	1	1	1	1	1
V	1	1	1	1	1	1	0	0	0	0	1	1
LINE #	825	826	827	…	839	840	841	…	1617	1618	…	1650

Blackmagic 2K Format – Data Stream Format

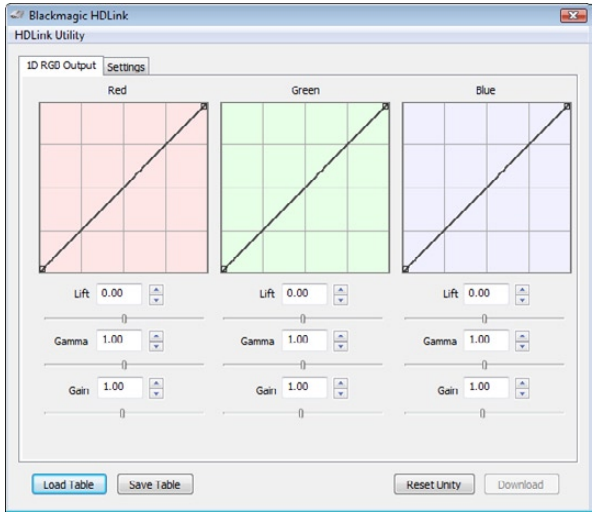
DATA STREAM 1	DATA STREAM 2	DATA STREAM 3	DATA STREAM 4	WORD# 23.98/24 PsF	WORD# 25 PsF
G2041	B2041	R2041	R2042	1870	1795
G2042	B2042	B2043	R2043	1871	1796
G2043	G2044	B2044	R2044	1872	1797
G2045	B2045	R2045	R2046	1873	1798
G2046	B2046	B2047	R2047	1874	1799
G2047	G2048	B2048	R2048	1875	1800
EAV(3FFh)	EAV(3FFh)	EAV(3FFh)	EAV(3FFh)	1	1
EAV(000h)	EAV(000h)	EAV(000h)	EAV(000h)	2	2
EAV(000h)	EAV(000h)	EAV(000h)	EAV(000h)	3	3
EAV(XYZh)	EAV(XYZh)	EAV(XYZh)	EAV(XYZh)	4	4
LN0	LN0	LN0	LN0	5	5
LN1	LN1	LN1	LN1	6	6
CRC0	CRC0	CRC0	CRC0	7	7
CRC1	CRC1	CRC1	CRC1	8	8
ANC/AUDIO DATA	ANC/AUDIO DATA	040	200	9	9
		...	...	...	...
		040	200	335	260
SAV(3FFh)	SAV(3FFh)	SAV(3FFh)	SAV(3FFh)	336	261
SAV(000h)	SAV(000h)	SAV(000h)	SAV(000h)	337	262
SAV(000h)	SAV(000h)	SAV(000h)	SAV(000h)	338	263
SAV(XYZh)	SAV(XYZh)	SAV(XYZh)	SAV(XYZh)	339	264
G1	B1	R1	R2	340	265
G2	B2	B3	R3	341	266
G3	G4	B4	R4	342	267
G5	B5	R5	R6	343	268

Previous HDLink models

Using HDLink Utility



HDLink lookup table controls in Mac OS X



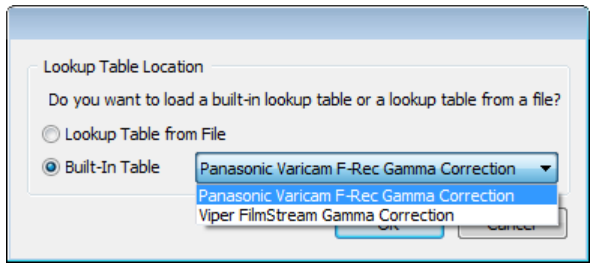
HDLink lookup table controls in Windows

After running the HDLink software installer, a USB driver will be installed into your system and the HDLink Utility will be added to the your Applications or Programs folder. To use the HDLink Utility you will need to have an HDLink connected to your USB port as follows.

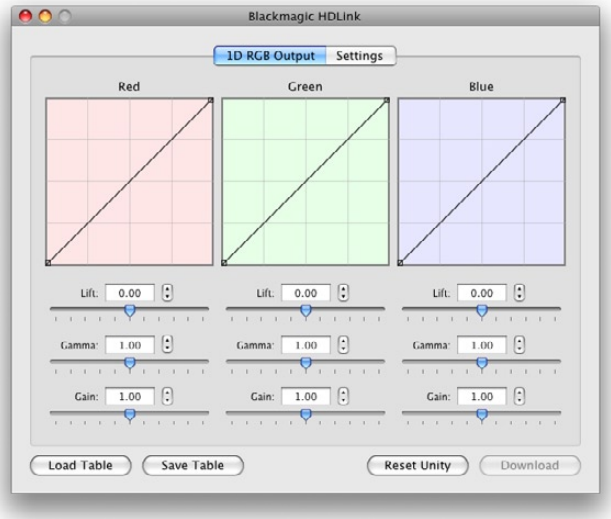
1. Connect the 5 volt HDLink™ power supply. The red power light will turn on.
2. Connect the USB cable. Most USB ports are now USB 2.0, however, the HDLink Utility software will usually work with slower USB 1.0 ports.
3. The red power light will flash indicating the USB has been connected.
4. Open the HDLink Utility and the settings should be adjustable. If they are 'grayed out', it indicates your computer is not communicating with HDLink™. In this case, check the USB connection or try another USB connection on your host computer.
5. If your version of the HDLink Utility contains newer firmware than is currently installed in the HDLink™ convertor, you will see a message asking you to update the firmware. You must allow the firmware to be updated before you can use this version of HDLink Utility to configure the HDLink™ convertor. Select 'download firmware' and, after a short delay, the firmware will be updated.
6. Once the firmware has been updated, it is important you unplug both the USB and power cables from HDLink™, wait 5 seconds, and then plug in the power and then USB cables in that order. This ensures the HDLink™ is reset correctly.
7. You can make changes to red, green and blue, lift, gamma and gain settings on HDLink™, and import custom gamma tables. Changes to settings can be seen on the HDLink™ DVI-D output in real time allowing accurate setup.
8. Gamma tables are loaded into HDLink™ at power up and so HDLink™ needs to be restarted if new tables are loaded. It is important to unplug both the USB and power cables from HDLink™, wait 5 seconds, and then plug in the power, and then USB cables in that order. This ensures the HDLink™ is reset and the gamma tables are loaded into the HDLink™ video path correctly.
9. Other settings at the bottom of the HDLink Utility window are updated immediately and don't need HDLink™ to be restarted.

The HDLink Utility interface is the same on both Mac OS X and Windows platforms. Any features that are not applicable to your HDLink model will be grayed out and inactive.

Lookup Tables (LUTs)



Built-in lookup tables can be loaded for log to linear conversion



Load Table and Save Table buttons can be found in the lower left corner of the HDLink interface

HDLink supports the use of LUTs to adjust the appearance of video on your monitor. Lookup tables can be used for standard definition and high definition video.

1D LUTs are useful for making quick adjustments to a video image but any adjustments to color will also affect brightness. They are often used when working with log video so that the image can be displayed on screen as normal linear video. Built-in 1D LUTs are provided for log to linear conversion when playing video captured from Panasonic Cinegamma™ and Viper Filmstream™ cameras. 1D LUTs are supported in all HDLink models.

How to use Lookup Tables in HDLink

Connect a USB cable between the HDLink and your computer.

Launch the HDLink Utility from your Applications folder in Mac OS X or from Programs in Microsoft Windows. The HDLink interface should immediately be visible and adjustable. If the interface does not appear to be "active", check the USB connection, try another USB cable or try another USB port and it should become active.

The lookup table interface in HDLink Utility can be adjusted using a method similar to that used for image adjustment with the Curves feature in Adobe Photoshop™. The horizontal axis of each graph represents the original color input values and the vertical axis represents the new color output values. When first opened, each lookup table displays a straight diagonal line because the color values have not yet been changed.

Changes made to the lookup tables can immediately be seen on a monitor attached to the DVI/HDMI output of HDLink. Changes are saved to the HDLink hardware by clicking the Download button so that you don't need to leave HDLink connected to your computer via USB. Lookup tables can be reset to original values by clicking the Reset Unity button and this effectively disables the lookup tables. Click the Download button again if you wish to save the original values.

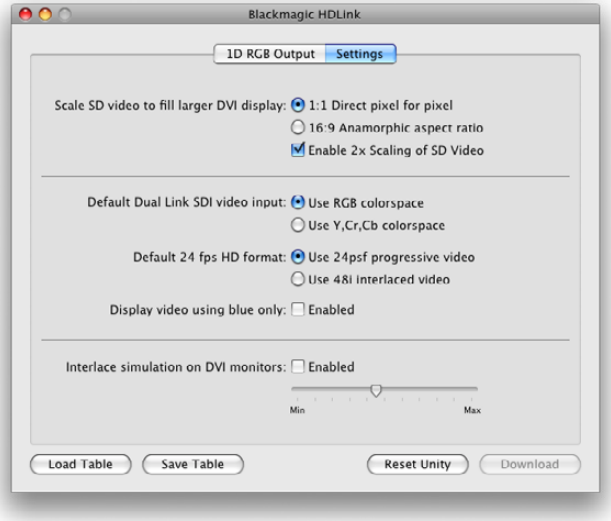
Importing and exporting 1D LUTs

All HDLink models can import 1D LUTs. The 1D file format is any tab-delimited text file with red, green and blue values for each record and the first line (title line) is skipped. Lookup tables need to be 1024 records long with the first line reserved for the title line. Check out the sample 1D lookup table accompanying the HDLink software installer. 1D lookup tables can be created in a spreadsheet program and then must be exported to a 'tab separated' text file prior to being imported in to HDLink Utility. Click the Load Table button to load lookup tables.

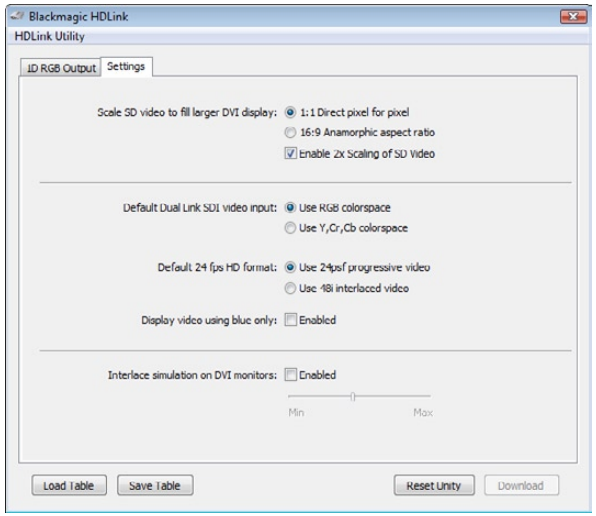
1D LUTs can also be exported from HDLink in the same text format mentioned above. Both 1D LUTs created with the curves in the lookup table interface, and 1D LUTs imported from text files, are exported from HDLink in the same text format. Click the Save Table button to save lookup tables.

The 1D LUT text file format is fully compatible with the following Blackmagic Design products which share the same LUT format: HDLink Optical Fiber, HDLink Pro, HDLink 2, HDLink, Multibridge Eclipse, Multibridge Pro (October 2007 model), Multibridge Extreme (DVI output), DeckLink HD Extreme 2 and DeckLink HD Pro 4:4:4 (PCI-X).

Settings



HDLink Settings in Mac OS X



HDLink Settings in Windows

HDLink Utility provides several settings for the HDLink and HDLink 2 models.

Scale SD video to fill larger DVI display.

HDLink and HDLink 2 models can scale standard definition video to fill larger DVI displays and avoid thick black borders around the video.

1:1 Direct pixel for pixel

This option allows for precise pixel-for-pixel viewing of standard definition video. However as HDLink uses square pixels, and standard definition video uses rectangular pixels, your video may seem squashed and circles may appear to be egg-shaped. See the troubleshooting section of this manual for more information.

16:9 Anamorphic aspect ratio

This option scales widescreen standard definition video to appear in the expected 16:9 aspect ratio on the computer monitor attached to HDLink. The image will appear correctly but will no longer be presented pixel-for-pixel.

Enable 2x Scaling of SD Video

This option will present NTSC or PAL video at double the original size on a monitor with a 1920 x 1200 resolution. This is useful for displaying standard definition video on 24" LCD computer monitors without the video image appearing as if it were a small postage stamp in the middle of a large black display.

Default Dual Link SDI video input

Usually when working with dual-link 4:4:4 HD-SDI video, the RGB colorspace will be used. In very rare cases, you might need to switch this to use the 4:4:4 Y,Cr,Cb colorspace. Only change this setting if you are sure that you need to use the 4:4:4 Y,Cr,Cb colorspace.

Default 24 fps HD format

When working with HD1080 video at 24 frames per second, it is necessary to tell HDLink whether it is receiving 24 PsF progressive video or 48i interlaced video.

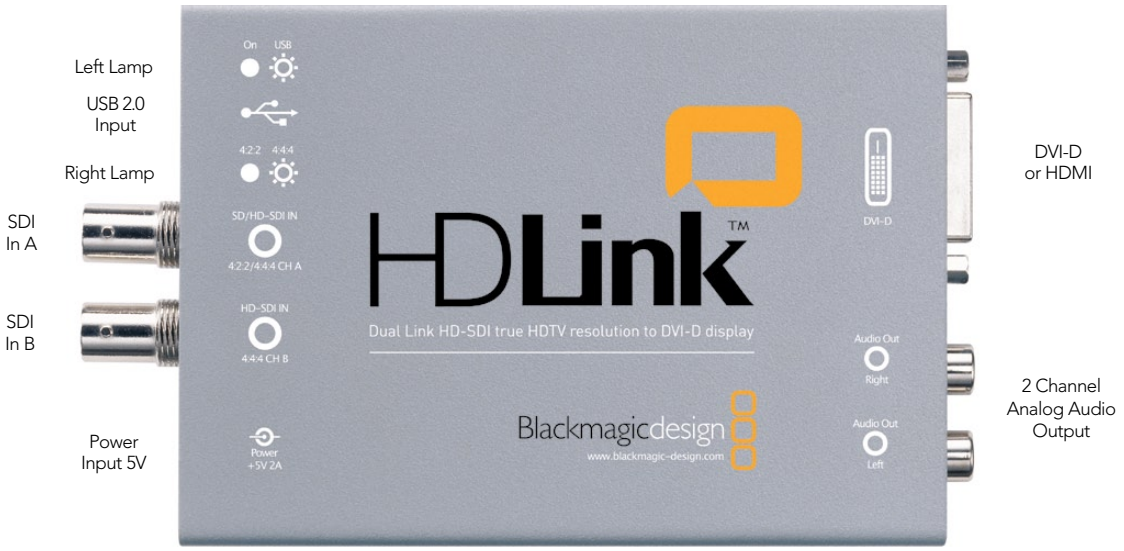
Display video using blue only

This option enables blue only mode which is very helpful in detecting noise in video.

Interlace simulation on DVI monitors

This option attempts to display interlaced video on progressive DVI monitors, with a similar look to traditional CRT monitors, and to avoid video tearing.

HDLink and HDLink 2



HDLink is easy to use because any valid video signal received by the SDI input is sent to the DVI output. HDLink automatically detects the format of the incoming signal and displays the video on any supported DVI or HDMI-based monitor. Check the HDLink verified compatibility matrix.
www.blackmagic-design.com/support/detail.asp?techID=186

HDLink features two, red, indicator lamps to show the operational status of the unit. The two lamps are located on either side of the USB port. The two lamps will independently vary between being on, off or flashing. Status information is printed on the top of the HDLink chassis.

- Both lamps off — HDLink is powered off.
- Left lamp on — HDLink is powered on.
- Left lamp flashing — HDLink has been connected to a computer via USB.
- Right lamp off — HDLink is not receiving a valid, SDI video signal.
- Right lamp on — HDLink is receiving a valid, SDI video signal.
- Right lamp flashing — HDLink is receiving a valid, dual-link, 4:4:4, HD-SDI video signal.

"Valid video signals" supported by HDLink include HD1080, HD720, NTSC and PAL when used with a DVI-based computer monitor. HDMI monitors can also be used for display of HD1080 and HD720 video signals. Computer video formats are generally not supported unless they coincidentally match a TV format.

HDLink and HDLink 2

HDLink is preconfigured for you, requiring no initial setup to connect. Your HDLink will simply run without changing any settings, however, if you would like to update the firmware, modify settings or load custom gamma tables, then use the HDLink Utility software. This can be downloaded from the Blackmagic Design web site support page. Check **www.blackmagic-design.com/support/**

1D lookup tables can be applied to the DVI/HDMI output of HDLink.

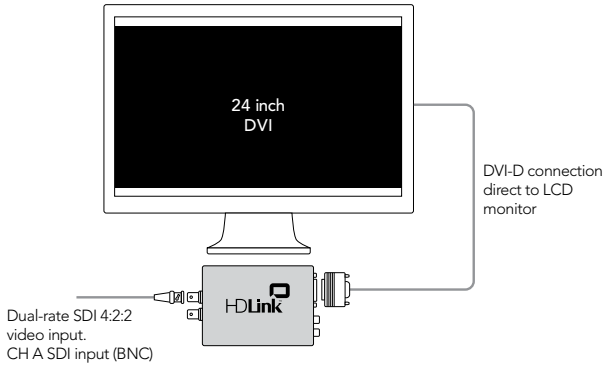
DVI-D monitors are shown in most of the diagrams shown in this manual. An HDMI display can be used in all cases except for standard definition monitoring. HDMI displays are best for use with HD720p50 as most DVI displays do not support this format. The included DVI-to-HDMI adapter can be used to attach an HDMI display to the DVI output of HDLink. Third party DVI to HDMI adapters can also be used if your HDLink shipped before the addition of HDMI support.

HDLink provides two SDI inputs which can be used for standard definition SDI, HD-SDI 4:2:2 and Dual Link HD-SDI 4:4:4 as shown in the connection diagrams of this manual.

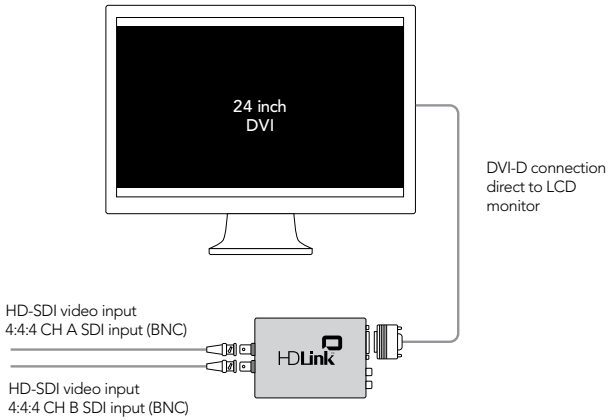
The consumer level analog audio outputs are fully compatible with a wide range of consumer HiFi equipment and are perfect for monitoring of stereo audio.

HDLink and HDLink 2– Connection Diagrams

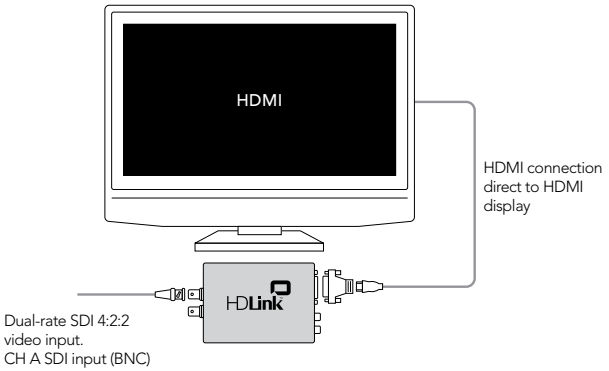
HD-SDI
SD-SDI



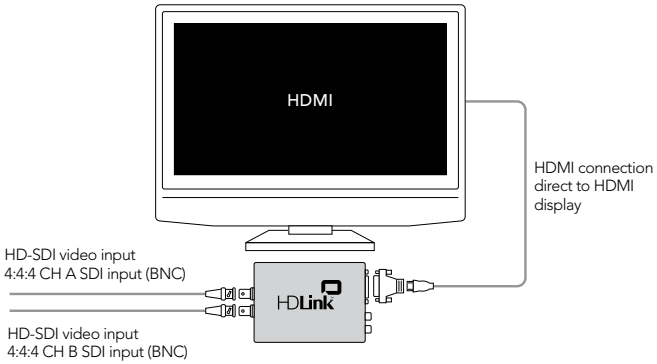
Dual Link HD-SDI 4:4:4



HD-SDI
SD-SDI



Dual Link HD-SDI 4:4:4



Troubleshooting

Q: Why can't I see standard definition on my HDMI-based TV?

A: The HDLink and HDLink 2 models were originally designed for use with DVI displays before HDMI was widely available. HDMI support was subsequently added with a HDLink software update which upgraded the firmware in both the HDLink and HDLink 2 models. This firmware update exclusively supported high definition video formats and not standard definition. If you need to monitor standard definition with these models of HDLink, you will need to use a DVI-based monitor. If your DVI monitor supports 1920 x 1200 resolution, you may wish to use the Enable 2x Scaling of SD Video setting in order to mostly fill the display with your video. This will minimize the black borders around your standard definition video. Blackmagic Design has newer HDLink models which support standard definition via HDMI.

Q: Why can't I hear audio on my HDMI TV?

A: The original HDLink and HDLink 2 were originally designed for use with DVI displays and the DVI standard does not support audio. That is why stereo, analog, RCA ports are provided on the HDLink for low cost, 2-channel monitoring of SDI audio. HDMI support was subsequently added with a HDLink software update which upgraded the firmware in both the HDLink and HDLink 2 models. This firmware update exclusively supported high definition video formats via HDMI but audio must still be monitored via the analog outputs. Analog audio can be connected to an amplifier for audio monitoring and some HDMI-based TV's also provide analog, RCA audio inputs which makes it even easier to connect the HDMI video and analog audio directly to the TV. Blackmagic Design has newer HDLink models which support 2-channel audio monitoring via HDMI.

Q: Why can't I use a 30" DVI monitor?

A: HDLink and HDLink 2 models connect to DVI-based monitors via a single-link DVI-D connection. This includes LCD computer monitors with a resolution of up to 1920 x 1200 pixels. Larger monitors, such as 30" LCD computer monitors, support higher resolutions but require a dual-link DVI-D connection. Blackmagic Design has newer HDLink models which support 30" dual-link DVI-D LCD computer monitors as well as smaller single-link DVI-D monitors.

Some or all video formats fail to work with a DVI display

The following information relates to the use of DVI-D displays with HDLink and HDLink 2. It does not apply to HDMI displays used with HDLink.

1. Check the DVI-D cable

DVI-D cables are usually reliable but there are many different brands and lengths and it is wise to test with another cable if you have poor video or no video output. Try using a good quality cable which is of a standard length, i.e. around 6 feet or 2 meters. While long DVI-D cables are available, some work better than others and so we recommend the use of the standard length cables, i.e. around 6 feet or 2 meters.

2. Check the specifications of your display.

HDLink supports single-link DVI-D displays. It does not support dual-link DVI-D displays such as the Apple Cinema HD 30" display. Blackmagic Design has newer HDLink models which support both single-link and dual-link DVI-D displays.

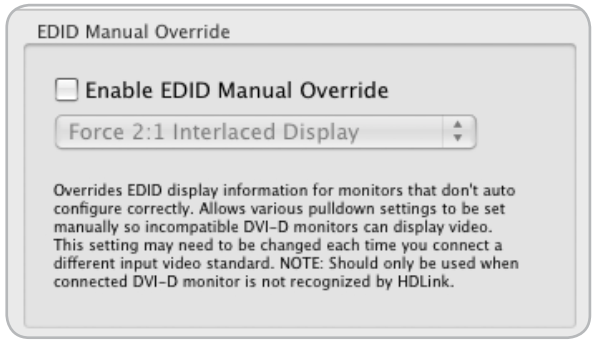
Next, check that your DVI-D display has an adequate resolution to support the video formats with which you work. HDLink is designed to display video pixel-for-pixel and does not scale down to fit lower resolution displays. HDLink supports video formats including:

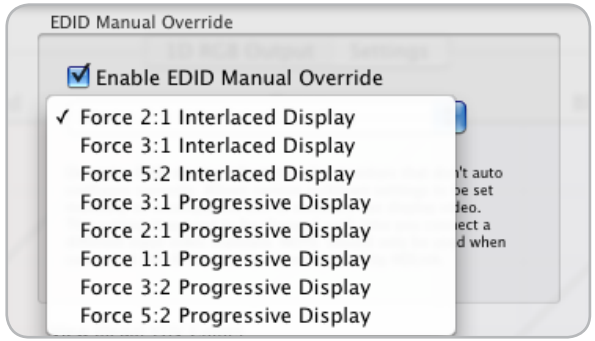
- NTSC, 720 x 486 pixels
- PAL, 720 x 576 pixels
- HDTV 720p, 1280 x 720 pixels
- HDTV 1080, 1920 x 1080

Numerous 23" and 24" DVI-D displays support 1920 x 1200 resolution and these are excellent for use with HDTV 1080 material. The resolution of these displays is high enough for HDLink to display NTSC and PAL at x2 resolution. This is nice as standard definition video almost fills these displays at x2 resolution.

If your display is of a lower resolution than the video format with which you are working, your video will not display correctly. For example, you cannot output 1920 x 1080 video to a 1280 x 720 display.

Similarly, a 1280 x 720 display is more than adequate to display NTSC and PAL video but it will not support x2 display of these formats.





The EDID Manual Override settings can be accessed by going to the HDLink Utility menu and choosing Preferences.

3. Try the EDID Manual Override settings

If you have verified that your display specifications are nominally adequate for the video formats with which you work, then the next step is to try the EDID Manual Override settings in HDLink and HDLink 2.

Every DVI-D display should include an EDID chip which provides information about the attributes of the display and which video formats it should support. HDLink interrogates the EDID chip and uses this information to present video on the display. If the EDID information is not present or is invalid, then HDLink cannot automatically display video correctly.

In this situation, connect the HDLink via USB to your Mac or PC and launch the HDLink Utility. Go to the HDLink menu and select Preferences.

Enable the EDID Manual Override option. From the pulldown menu, try the different options until you find one that works with your display.

If the video format is interlaced, you should only select an Interlaced Display option.

If the video format is progressive, you should only select a Progressive Display option.

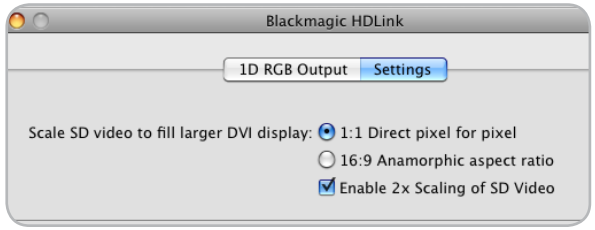
An override mode outputs video at a different frequency to the incoming video signal. For example, if you were to use the Force 5:2 Interlaced Display on PAL (25 Hz) video, you would need to multiply the video input frequency by the force factor to calculate the video output frequency, i.e. [25 Hz x (5 ÷ 2)] = 62.5 Hz. Therefore the HDLink would output 62.5 Hz. In the case of some displays which do not work with PAL video rates, forcing the HDLink output to 62.5 Hz will often allow PAL video to be viewed on the display.

Please note that if you are using more than one video format, e.g. 1080i50 and 1080i59.94, your monitor might require that you use different EDID override modes for the different video formats.

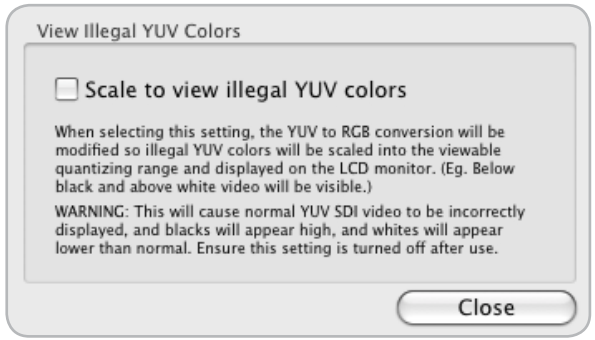
The EDID Manual Override settings are not available for use with newer models of HDLink as this process has been automated and so is no longer required.

HD720p50 support

HDLink and HDLink 2 both support the HD720p50 standard. However there are very few DVI-D monitors which support this standard. Most new HDMI-based monitors and TV's purchased in PAL countries now include 720p50 support and should work well with HDLink.



1:1 direct pixel for pixel scaling of standard definition video is technically correct but may make SD video appear squashed. Enabling 2x Scaling with HDLink 2 models will provide the video with a normal appearance when using a 1920 x 1200 resolution monitor.



Do I have a HDLink or HDLink 2 model?

To check if you have a HDLink 2, connect the HDLink unit via USB and then launch the HDLink utility. The title bar of the HDLink Utility will report either HDLink 2 or HDLink. There are some minor internal differences between the two models and HDLink 2 can also adjust for the difference between rectangular standard definition pixels and square pixels used on LCD computer monitors.

Why do circles appear elliptical or egg-shaped via HDLink in standard definition?

HDTV uses square pixels for display as does your DVI-D based computer monitor. SDTV uses rectangular pixels for display which is different to your computer monitor.

HDLink is primarily designed for display of HDTV. It uses square pixels and maps them perfectly, pixel for pixel, on to the screen.

HDLink can also be used for SDTV monitoring but there are some technicalities related to the fact that HDLink is displaying square pixels whereas standard definition uses rectangular pixels and that is why your circles may display egg-shaped.

The following solution exists for HDLink 2 units but not the original HDLink.

If you want the standard definition picture to look as it would on an old CRT display, download and install the latest HDLink software from the software downloads web page at **www.blackmagic-design.com/support/software/**. After installing this software and updating the firmware on the HDLink, launch the HDLink Utility and select the x2 scaling option for standard definition video. This scaling option will both double the size of the video and scale the standard definition video to make it appear normal on a 1920 x 1200 pixel display. Circles will look like circles.

To check if you have a HDLink 2, connect the HDLink unit via USB and then launch the HDLink utility. The title bar of the HDLink utility will report either HDLink 2 or HDLink.

Strange colors on display

HDLink automatically prevents illegal YUV colors from being displayed on your LCD monitor when converted to the RGB colorspace. Enabling the option *Scale to view illegal YUV colors* will scale illegal YUV colors into the viewable quantizing range on an LCD monitor. This will cause YUV SDI video to be incorrectly displayed with black colors appearing higher than normal and white colors lower than normal. Ensure this setting is disabled after use.

This setting is available from the `HDLink Utility>Preferences` menu option in both Mac OS X and Windows.

3 Year Limited Warranty

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Blackmagic Design warrants that this product will be free from defects in materials and workmanship for a period of 36 months from the date of purchase excluding user-servicable fiber optic modules which will be free from defects in materials and workmanship for a period of 12 months from the date of purchase. If a product proves to be defective during this warranty period, Blackmagic Design, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, you the Customer, must notify Blackmagic Design of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. The Customer shall be responsible for packaging and shipping the defective product to a designated service center nominated by Blackmagic Design, with shipping charges pre paid. Customer shall be responsible for paying all shipping changes, insurance, duties, taxes, and any other charges for products returned to us for any reason.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Blackmagic Design shall not be obligated to furnish service under this warranty: a) to repair damage resulting from attempts by personal other than Blackmagic Design representatives to install, repair or service the product, b) to repair damage resulting from improper use or connection to incompatible equipment, c) to repair any damage or malfunction caused by the use of non Blackmagic Design parts or supplies, or d) to service a product that has been modified or integrated with other products when the effect of such a modification or integration increases the time or difficulty of servicing the product. THIS WARRANTY IS GIVEN BY BLACKMAGIC DESIGN IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. BLACKMAGIC DESIGN AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. BLACKMAGIC DESIGN'S RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE WHOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER BLACKMAGIC DESIGN OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES. BLACKMAGIC DESIGN IS NOT LIABLE FOR ANY ILLEGAL USE OF EQUIPMENT BY CUSTOMER. BLACKMAGIC IS NOT LIABLE FOR ANY DAMAGES RESULTING FROM USE OF THIS PRODUCT. USER OPERATES THIS PRODUCT AT OWN RISK.