Matrox MXO2

Installation and User Guide

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Contents

Chapter 1	
Introducing Matrox MXO2	
Welcome to Matrox MXO2 2	
Matrox MXO2 system requirements 2	
Check our website for equipment information2	!
Battery requirements and guidelines for MXO2 2	
About this manual	3
Style conventions	5
How video formats are expressed	5
Last-minute information 4	•
Chapter 2	
Installing Your Matrox MXO2 Hardware	
Before you install your Matrox MXO2 hardware	;
Start with a functioning system6)
Avoid costly damage	;
Installing your Matrox PCIe adapter 6	;
Installing your PCIe host adapter (Mac Pro)7	•
Installing your PCIe host ExpressCard/34 adapter (MacBook Pro)7	•
Removing your PCIe host ExpressCard/34 adapter	5
Chapter 3	
Connecting External Devices to Matrox MXO2	
Available MXO2 connections10)
MXO2 video connections10	1
MXO2 audio connections10	1
Powering MXO210)
MXO2 power functionality10)
Connecting MXO2 to your Mac system12	
MXO2 RS-422 serial connection13	;
Typical Matrox MXO2 connections14	
Analog component video connections14	
Digital video connections15	j

vi

Chapter 4

Connecting External Devices to Matrox MXO2 Rack	
Available MXO2 Rack connections	18
MXO2 Rack video connections	18
MXO2 Rack audio connections	18
Rack mounting your MXO2 Rack	18
Powering MXO2 Rack	20
MXO2 power functionality	20
Connecting MXO2 Rack to your Mac system	21
MXO2 Rack RS-422 serial connection	22
Typical Matrox MXO2 Rack connections	23
Analog component video connections	23
Digital video connections	24

Chapter 5

Installing Your MXO2 Software and Configuring Your System	
Installing your Matrox MXO2 software	26
Updating your MXO2 firmware	26
Removing your Matrox MXO2 software	27
Removing MXO2 presets and Easy Setups from Final Cut Pro	27
Defining your settings in the Matrox MXO2 preferences window	28
Specifying your general settings	28
Specifying your genlock settings	29
Specifying your A/V input settings	30
Specifying your video output settings	33
Specifying your audio output settings	36
Viewing MXO2 information	37

Chapter 6 Calibrating Your HDMI Monitor for Video

Overview	40
Loading and displaying color bars	40
Calibrating your HDMI monitor	41

Chapter 7	
Using Matrox MXO2 with Supported Programs	40
Matrox MXO2 Easy Setups for Final Cut Pro	
Loading a Matrox MXO2 Easy Setup	
Greating a Matrox MXO2 Easy Setup	
Matrox MXO2 presets for Final Cut Pro	47
Creating and editing MXO2 sequence presets	
Creating and editing MXO2 capture presets	
Creating and editing MXO2 device control presets	
Specifying your video and audio output device settings	49
Specifying settings for Final Cut Pro	49
Specifying settings for Adobe After Effects	49
Ensuring frame-accurate capture and edit-to-tape using	
Final Cut Pro	50
Setting your capture settings	50
Setting your edit-to-tape settings	50
Appendix A	
Understanding Pulldown	
Overview	
2:3:2:3 pulldown (standard)	
2:3:3:2 pulldown (advanced)	55
Appendix B	
Matrox MXO2 Connectors	
Inputs	58
MXO2 inputs	58
MXO2 Rack inputs	59
Input connector descriptions	60
Outputs	62
MXO2 outputs	62
MXO2 Rack outputs	63
Output connector descriptions	64

vii

viii

Appendix C
Matrox MXO2 Supported Input and Capture Formats
Video formats supported on the MXO2 inputs68
Capture formats supported on MXO269
Appendix D
Matrox MXO2 Supported Output Formats
Video formats supported on MXO2 outputs72
Supported MXO2 main and SD video output formats73
Appendix E
Matrox MXO2 Specifications
Matrox MXO2 specifications
General
Connections
Environmental specifications80
Matrox MXO2 Rack specifications80
General
Connections
Environmental specifications
Matrox PCIe host adapter specifications85
Matrox PCIe host ExpressCard/34 adapter (for MacBook Pro)85 Matrox PCIe host adapter (for Mac Pro)85
Appendix F
Matrox MXO2 Customer Support
How to get Matrox MXO2 Customer Support88
Registration
Keep up to date with our website88
Contacting us
Index

1

Introducing Matrox MXO2

This chapter lists the MXO2 system requirements, details the battery requirements and guidelines, and describes the MXO2 documentation.

Welcome to Matrox MXO2

Matrox MXO2 connects to your Mac Pro or MacBook Pro to provide broadcast-quality input/output, monitoring, and up/down/cross conversion to streamline your workflow with Apple Final Cut Studio. MXO2 provides built-in surround sound monitoring, as well as the flexibility to map any audio track in Final Cut Pro to any audio output. Through the use of proc amp controls (hue, chroma, contrast, brightness, and blue-only), you can adjust and control your HDMI monitor exactly as you would a broadcast HD/SD monitor. This control turns your HDMI monitor into a true-color video display with accurate color representation so that you can use your HDMI monitor even for color grading.

Matrox MXO2 system requirements

Matrox MXO2 requires a Mac system with the following system configuration:

- Intel-based Mac Pro or MacBook Pro.
- Mac OS X v10.5 or later.
- One free PCIe slot on the Mac Pro to install the Matrox PCIe host adapter.
- One free ExpressCard/34 slot on the MacBook Pro to install the Matrox PCIe host ExpressCard/34 adapter.
- If using MXO2 with Final Cut Studio 2, 2 GB physical memory (RAM) when working with compressed HD and uncompressed SD sources, or 4 GB physical memory (RAM) when working with uncompressed HD sources.
- We recommend an HDMI monitor that supports 1920×1080 for previewing all HD formats, and "dot-by-dot" mode for 1:1 pixel mapping.

Check our website for equipment information

For up-to-date information about recommended computer systems, batteries, and other MXO2-compatible devices, check the Matrox MXO2 Support section of our website at www.matrox.com/video/support.

Battery requirements and guidelines for MXO2

Note This section does not apply to Matrox MXO2 Rack as it cannot be powered by a battery (see "Powering MXO2 Rack" on page 20).

As an alternative to using an AC outlet, you can use a battery to power Matrox MXO2. To avoid damage to your MXO2 system and peripheral devices when using a battery, please observe the following requirements and guidelines. For instructions on how to connect Matrox MXO2 to a battery, see "Powering MXO2" on page 10.

• Use a standard self-protected (fused) battery with a nominal voltage of 12V, 13.2V, or 14.4V. A higher-voltage battery will damage your MXO2 system.

- Disconnect MXO2 from the battery when not in use. Do not leave MXO2 connected to the battery when not in use as this may damage your MXO2 system and/or battery.
- Do not power your MXO2 using your vehicle's battery via the power socket.

Caution To avoid damage to your MXO2 system and peripheral devices, use a Matrox-recommended battery. For a list of batteries recommended for use with your MXO2, visit the Matrox MXO2 Support section of our website at www.matrox.com/video/support.

About this manual

This manual provides you with information about installing and using your Matrox MXO2 hardware and software, including how to configure your Matrox MXO2 for use with supported programs, such as Final Cut Pro and Adobe After Effects.

Style conventions

The following style conventions are used in this manual:

- The names of files, folders, and manuals appear in *italics*. For example:
 - The data is stored in the Sample Movie file.
 - The file is located in the *Clips* folder.
 - Please refer to your Final Cut Pro User's Manual.
- Menus and commands that you need to choose are displayed in the form Menu > Command. For example, File > Save means click File in the menu bar, then click Save in the menu that appears.

How video formats are expressed

With the exception of NTSC and PAL, all SD and HD video formats are expressed in the Matrox MXO2 documentation as follows:

VRp or i or PsF at n fps

Where:

- VR is the vertical resolution. For 1440×1080 video, however, both the horizontal and vertical resolutions are specified.
- **p** or **i** or **PsF** represents either progressive, interlaced, or progressive segmented frame video.
- **n fps** is the frame rate in frames per second.

Here are some examples:

• **486p** at **23.98 fps** Represents 720×486 progressive video at 23.98 frames per second.

- **720p** at **59.94 fps** Represents 1280×720 progressive video at 59.94 frames per second.
- **1440x1080i** at **29.97 fps** Represents 1440×1080 interlaced video at 29.97 frames per second. This format is used for HDV 1080i material.
- **1080i** at **29.97 fps** Represents full-size 1920×1080 interlaced video at 29.97 frames per second.

Last-minute information

Any important information that wasn't available for inclusion in this manual by publication time is provided to you in the *Matrox MXO2 Release Notes*.

2

Installing Your Matrox MXO2 Hardware

This chapter describes how to install the Matrox PCIe host adapter, and how to install and remove the Matrox PCIe host ExpressCard/34 adapter.

Before you install your Matrox MXO2 hardware

Read the following information carefully before attempting to install Matrox MXO2 hardware on your Mac system.

Start with a functioning system

Before attempting any Matrox MXO2 installation, you should have a Mac computer system with Mac OS X (Leopard) fully installed and functioning smoothly. This will avoid potential problems later on.

Avoid costly damage

Static electricity from your body can damage your Matrox PCIe host adapter or your computer. Although you may not notice it, static electricity is generated every time you move. It's often too small to cause a spark, but it can still cause damage to sensitive electronic components or at least reduce their lifespan.

To avoid damage, please observe the following precautions:

- Do not remove your Matrox PCIe host adapter from its antistatic bag until you're ready to install it. Before removing the card, place the package within easy reach of the area where you intend to perform the installation.
- You should avoid touching the chips and other components on the circuit board. Try to handle the card by its edges.
- Try to work in an area where the relative humidity is at least 50%.
- Do not wear wool or synthetic clothing. These fabrics tend to generate more static electricity than cotton, which is best for this kind of work.
- Turn off the power switches on your computer and its connected components.

Once you've opened your computer, drain static electricity from your body by touching a bare metal surface on your computer chassis before you install or remove any parts of your system. If you have a grounding wrist strap, use it while handling and installing any components in your computer.

Installing your Matrox PCIe adapter

The Matrox PCIe adapter is the interface between your MXO2 and Mac system. Matrox provides dedicated adapters for use with Mac desktops or laptops. Use the Matrox PCIe host adapter with your Mac Pro desktop, and the Matrox PCIe host ExpressCard/34 adapter with your MacBook Pro laptop.

Installing your PCIe host adapter (Mac Pro)

The Matrox PCIe host adapter is designed to operate in your Mac Pro's PCIe slot. For detailed instructions on how to perform the following steps, refer to your Mac documentation.

- 1 Shut down your Mac Pro, unplug the power cord and all the cables from the computer, and open the Mac Pro by removing the side panel.
- **2** Insert the Matrox PCIe host adapter in an available PCIe slot in your Mac Pro, and secure the adapter into place.
- **3** Replace your Mac Pro's side panel, and reconnect the power cord and all the cables to the computer. You can now supply power to MXO2 (see "Powering MXO2" on page 10, or "Powering MXO2 Rack" on page 20) and connect it to your Mac Pro (see "Connecting MXO2 to your Mac system" on page 12, or "Connecting MXO2 Rack to your Mac system" on page 21).

Installing your PCIe host ExpressCard/34 adapter (MacBook Pro)

The Matrox PCIe host ExpressCard/34 adapter is designed to operate in your MacBook Pro's ExpressCard/34 slot. You can install the Matrox PCIe host ExpressCard/34 adapter when your MacBook Pro is on or off. Connect the Matrox PCIe cable to the host ExpressCard/34 adapter (see "Connecting MXO2 to your Mac system" on page 12, or "Connecting MXO2 Rack to your Mac system" on page 21), and then insert the host adapter in your MacBook Pro's ExpressCard/34 slot until the adapter clicks into place. For details on how to safely remove your Matrox PCIe host ExpressCard/34 adapter from your MacBook Pro, see "Removing your PCIe host ExpressCard/34 adapter" on page 8.



Removing your PCIe host ExpressCard/34 adapter

You can remove the Matrox PCIe host ExpressCard/34 adapter from your MacBook Pro when your MacBook Pro is on or off. However, you must power off the card before removing it.



Important Do not disconnect the PCIe cable from the Matrox PCIe host ExpressCard/34 adapter when your MacBook Pro is running. Instead, remove the adapter from your MacBook Pro with the Matrox PCIe cable attached (see "Connecting MXO2 to your Mac system" on page 12, or "Connecting MXO2 Rack to your Mac system" on page 21).

- 1 From the menu bar, click the ExpressCard icon (
- 2 Click Power off Card.
- **3** Remove the Matrox PCIe host ExpressCard/34 adapter from your MacBook Pro's ExpressCard/34 slot.

3

Connecting External Devices to Matrox MXO2

This chapter shows how to supply power and connect external devices to Matrox MXO2.



Note This chapter details how to connect external devices to Matrox MXO2 only. For information on how to connect external devices to Matrox MXO2 Rack, see Chapter 4, "Connecting External Devices to Matrox MXO2 Rack."

Available MXO2 connections

Matrox MXO2 features a full compliment of professional inputs and output, and allows you to connect multiple devices for up to five user-selectable simultaneous video outputs.

MXO2 video connections

- One HD HDMI input and one HD/SD HDMI output, both with up to eight channels of embedded audio support. The HDMI input/output supports YUV and RGB devices.
- One HD/SD SDI input/output with up to eight channels of embedded audio.
- Second HD/SD SDI output with up to eight channels of embedded audio.
- One HD/SD analog component input/output, one S-Video input/output, and one composite input/output.
- Analog black burst reference input.

MXO2 audio connections

- Two balanced analog XLR inputs (stereo pair).
- Four balanced analog XLR outputs (two stereo pairs).
- One AES/EBU stereo input/output.
- Two unbalanced analog RCA inputs (stereo pair).
- Six unbalanced analog RCA outputs (for surround sound monitoring).

Powering MXO2

You can supply power to MXO2 using an AC outlet via the Matrox external power supply and a power cord, or using a battery via the Matrox battery power cable. Matrox MXO2 connects to the battery via a 4-pin XLR connector. For information on how to connect your battery to portable video equipment, such as Matrox MXO2, contact the battery manufacturer. Before connecting MXO2 to a battery, please read the "Battery requirements and guidelines for MXO2" on page 2.

MXO2 power functionality

MXO2 features a power button that you can use to manually turn the MXO2 on and off. However, when power is supplied to MXO2 and it is connected to your Mac system, the MXO2 will turn on or off automatically when you start up or shut down your Mac system. That is, when you shut down your Mac system, your MXO2 turns off. Starting up your Mac system turns your MXO2 on. To manually

Chapter 3, Connecting External Devices to Matrox MXO2

turn your MXO2 on, press the power button. To turn off your MXO2, press and hold the power button for at least two seconds.



Important When MXO2 is connected to a Mac system that is running, do not disconnect MXO2 from its power source, or power off MXO2. Shut down your Mac system before removing power from MXO2. If using a battery to power MXO2, ensure that the battery is sufficiently charged.



Powering MXO2

Connecting MXO2 to your Mac system

Connect MXO2 to your Mac Pro or MacBook Pro using the Matrox PCIe cable. For MXO2 to be detected on a Mac Pro system, power must be supplied to MXO2 (see "Powering MXO2" on page 10), and it must be connected to your Mac Pro before starting up your computer.

(i) Important Do not disconnect the Matrox PCIe cable from the adapter, or MXO2, when your Mac system is running. To safely remove the Matrox PCIe host Expresscard/34 adapter, see "Removing your PCIe host ExpressCard/34 adapter" on page 8.





MXO2 RS-422 serial connection

MXO2's RS-422 serial connector allows an application, such as Final Cut Pro, to control a device that uses the RS-422 SMPTE time code protocol, such as a VTR or digital disk recorder, to ensure frame-accurate capture and edit-to-tape. For details on how to ensure accurate device control with Final Cut Pro, see "Ensuring frame-accurate capture and edit-to-tape using Final Cut Pro" on page 50.



Typical Matrox MXO2 connections

In the following typical connection examples, we've connected a monitor to view the signal that will be recorded, and separate source and record decks. You may, however, use the same deck as both your source and record device by making the input and output connections to a single deck. For details on the Matrox MXO2 connectors, see Appendix B, "Matrox MXO2 Connectors."

Analog component video connections

In this illustration, we're using analog component connectors for video, XLR connectors for audio, and an HDMI connector for video monitoring. The video is genlocked using MXO2's internal genlock.



Chapter 3, Connecting External Devices to Matrox MXO2

Digital video connections

In this illustration, we're using SDI connectors for video and audio, an SDI connector for video monitoring, and we're monitoring the audio on a surround sound speaker system through RCA connectors. The video is genlocked using a tri-level sync generator.



Typical Matrox MXO2 connections

Your notes

4

Connecting External Devices to Matrox MXO2 Rack

This chapter shows how to rack mount, supply power, and connect external devices to Matrox MXO2 Rack.



Note This chapter details how to connect external devices to Matrox MXO2 Rack only. For information on how to connect external devices to Matrox MXO2, see Chapter 3, "Connecting External Devices to Matrox MXO2."

Available MXO2 Rack connections

Matrox MXO2 Rack features a full compliment of professional inputs and outputs, and allows you to connect multiple devices for up to five user-selectable simultaneous video outputs.

MXO2 Rack video connections

- One HD HDMI input and one HD/SD HDMI output, both with up to eight channels of embedded audio support. The HDMI input/output supports YUV and RGB devices.
- One HD/SD SDI input/output with up to eight channels of embedded audio.
- Second HD/SD SDI output with up to eight channels of embedded audio.
- One HD/SD analog component input/output, one S-Video input/output, and one composite input/output.
- One analog black burst reference input and loop-through output.

MXO2 Rack audio connections

- Four balanced analog XLR inputs (two stereo pairs).
- Eight balanced analog XLR outputs (four stereo pairs).
- Two AES/EBU stereo inputs/outputs.

Rack mounting your MXO2 Rack

Use the supplied rackmount brackets to mount your Matrox MXO2 Rack to a standard 19-inch rack. The rackmount brackets can be used to either front or rear mount your MXO2 Rack. You can also mount MXO2 Rack so that it's recessed to allow more space for cables. MXO2 Rack takes up two vertical rack unit spaces.

1 Unpack the two rackmount brackets and their eight mounting screws.



- **Caution** Use only the screws supplied with your MXO2 Rack to attach the rackmount brackets to your MXO2 Rack. If you use screws that are larger or longer than the ones supplied, you can damage your equipment.
 - 2 Depending if you want to front or rear mount your MXO2 Rack, position the rackmount brackets so that the bracket face is either towards the front (connector side) or the back of your MXO2 Rack.
 - **3** MXO2 Rack can be recess mounted to allow extra space for connectors and cables. Depending on your mounting needs, align the screw holes on each

rackmount bracket with the desired screw holes on either side of the MXO2 Rack.





Caution For stability and safety, whichever mounting method you choose, make sure to fasten each rackmount bracket to MXO2 Rack using all four supplied screws.

- 4 Using a hand screwdriver only (no power screwdrivers), carefully tighten each screw until snug. Do not overtighten!
- 5 Fasten your MXO2 Rack to the standard 19-inch rack as per your rack's instructions.

Powering MXO2 Rack

You can power MXO2 Rack using an AC outlet and an IEC-C13 power cord.

MXO2 power functionality

When power is supplied to MXO2 Rack and it is connected to your Mac system, the MXO2 Rack will turn on or off automatically when you start up or shut down your Mac system. That is, when you shut down your Mac system, your MXO2 Rack turns off. Starting up your Mac system turns your MXO2 Rack on.



Important When MXO2 Rack is connected to a Mac system that is running, do not disconnect MXO2 Rack from its power source. Shut down your Mac system before removing power from MXO2 Rack.



Connecting MXO2 Rack to your Mac system

Connect MXO2 Rack to your Mac Pro or MacBook Pro using the Matrox PCIe cable. For MXO2 Rack to be detected on a Mac Pro system, power must be supplied to MXO2 Rack (see "Powering MXO2 Rack" on page 20), and it must be connected to your Mac Pro before starting up your computer.

(i) Important Do not disconnect the Matrox PCIe cable from the adapter, or MXO2 Rack, when your Mac system is running. To safely remove the Matrox PCIe host Expresscard/34 adapter, see "Removing your PCIe host ExpressCard/34 adapter" on page 8.



Connecting MXO2 Rack to your Mac system

MXO2 Rack RS-422 serial connection

The Matrox MXO2 Rack RS-422 serial connector allows an application, such as Final Cut Pro, to control a device that uses the RS-422 SMPTE time code protocol, such as a VTR or digital disk recorder, to ensure frame-accurate capture and edit-to-tape. For details on how to ensure accurate device control with Final Cut Pro, see "Ensuring frame-accurate capture and edit-to-tape using Final Cut Pro" on page 50.



Typical Matrox MXO2 Rack connections

In the following typical connection examples, we've connected a monitor to view the signal that will be recorded, and separate source and record decks. You may, however, use the same deck as both your source and record device by making the input and output connections to a single deck. For details on the Matrox MXO2 Rack connectors, see Appendix B, "Matrox MXO2 Connectors."

Analog component video connections

In this illustration, we're using analog component connectors for video, XLR connectors for audio, and an HDMI connector for video monitoring. The video is genlocked using MXO2's internal genlock.



Recorder (Deck 2)

Typical Matrox MXO2 Rack connections

Digital video connections

In this illustration, we're using SDI connectors for video and audio, an SDI connector for video monitoring, and we're monitoring the audio on a surround sound speaker system through XLR connectors. The video is genlocked using a tri-level sync generator.



5

Installing Your MXO2 Software and Configuring Your System

This chapter explains how to install and remove the Matrox MXO2 software and how to configure your system in the Matrox MXO2 preferences window.

Installing your Matrox MXO2 software

You can install the MXO2 software on a computer with or without the MXO2 hardware connected. If you plan on working with Final Cut Pro, you should install Final Cut Pro before installing the MXO2 software. For information on installing Final Cut Pro, see your Final Cut Pro documentation.

To download and install the latest version of the MXO2 software, visit the MXO2 Support section of our website at www.matrox.com/video/support. You can also contact your MXO2 dealer for the latest software.

Updating your MXO2 firmware

When you install the MXO2 software while your MXO2 hardware is powered and connected to your Mac system, the MXO2 software installation automatically verifies the firmware on your MXO2 hardware and updates it if required. However, if you install the MXO2 software on your Mac system without a powered MXO2 connected, your MXO2 hardware may have a firmware version that is not supported by the installed MXO2 software. If your MXO2 hardware has an incompatible firmware version when you later connect the MXO2 hardware to your Mac system, the Matrox MXO2 preferences window options will be unavailable and a message regarding the incompatibility between the MXO2 software and MXO2 firmware will appear in the **Info** pane (see "Viewing MXO2 information" on page 37), along with a **Launch firmware updater** button.

To update the MXO2 firmware from the MXO2 preferences window, make sure your MXO2 hardware is powered and connected to your computer, and then click **Launch firmware updater** in the **Info** pane to run the Matrox Firmware Updater. You'll be required to shut down your system, with your MXO2 powered and connected to your computer, to complete the firmware update.

Alternately, you can update your MXO2 firmware by running the Matrox Firmware Updater from the Finder window as follows:

- 1 With your Mac system shut down, supply power to your MXO2, and connect it to your Mac system.
- 2 Start your computer.
- 3 In the Finder menu, choose File > New Finder Window.
- 4 Choose **Applications** > **Matrox MXO2 Utilities**, and double-click the firmware updater file to run the Matrox Firmware Updater. You'll be required to shut down your system, with your MXO2 powered and connected to your computer, to complete the firmware update.
Removing your Matrox MXO2 software

- 1 In the Finder menu, choose File > New Finder Window.
- 2 Choose Applications > Matrox MXO2 Utilities > MXO2 Software Uninstaller.
- **3** In the **Matrox MXO2 Software Uninstaller** dialog box, select or clear the **Delete the Matrox MXO2 user preferences** option. When selected, all current user settings in the Matrox MXO2 preferences window will be removed from your computer. Clear this option if you wish to keep your current MXO2 user settings for a future MXO2 software installation.
- 4 Click Continue.
- **5** Enter your administrator password, and click **OK** to remove the MXO2 software from your computer.

Removing MXO2 presets and Easy Setups from Final Cut Pro

After uninstalling the Matrox MXO2 software, the MXO2 presets (sequence, capture, device control) and Easy Setups may still appear in Final Cut Pro. Perform the following steps to remove the MXO2 presets and Easy Setups from Final Cut Pro.

) **Important** Final Cut Pro will return to default settings after removing the MXO2 presets and Easy Setups.

- 1 Quit Final Cut Pro.
- **2** In the **Finder** menu, choose Go > Home.
- **3** Choose Library > Preferences.
- **4** In *Preferences*, drag the *com.apple.FinalCutPro.plist* file to the Trash. If *com.apple.FinalCutPro.plist* does not appear in the *Preferences* folder, proceed to the next step.



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Important Do not empty the Trash until instructed to do so.

5 In *Preferences*, open the *Final Cut Pro User Data* folder.

- 6 In *Final Cut Pro User Data*, drag the *Final Cut Pro N Prefs.fcset*, *Final Cut Pro Obj Cache.fcmch*, and *Final Cut Pro Prof Cache.fcpch* files to the Trash.
- **Note** The *N* in *Final Cut Pro N Prefs.fcset* refers to Final Cut Pro's version number.
- **7** Open Final Cut Pro and ensure that it is running properly. If it is, empty the Trash.
- **8** Reset your Final Cut Pro settings, such as scratch disk, keyboard, and sequence settings.

Defining your settings in the Matrox MXO2 preferences window

The Matrox MXO2 preferences window allows you to specify various settings for working with MXO2. You can also view information about your MXO2, such as the serial number and software version.

Depending on your MXO2 hardware, some of the options described in this chapter may not be available, and your Matrox MXO2 preferences window may not appear exactly as shown.

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Important Before defining your settings, make sure that you've installed your MXO2 hardware, powered your MXO2, and connected your MXO2 to your Mac system.

Specifying your general settings

You can specify general settings for working with Matrox MXO2. These settings are applied to both the MXO2 video input and output.

- 1 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.
- 2 Click General.

00	Matrox MXO2	
Show All		Q
Show All	Genlock A/V Input Video Output Luminance Levels Allow super white Allow super black Setup Level Analog NTSC pedestal: 7.5 IRE	Audio Output

3 Under Luminance Levels, select Allow super white to allow the highest luminance level of your video to exceed the standard maximum white level. Select Allow super black to allow the lowest luminance level of your video to fall below the standard black level.



Note Super white and super black should not be allowed when producing your final video production for broadcast.

- **4** Under **Setup Level**, select the pedestal setting that you want for your NTSC analog video from the **Analog NTSC pedestal** menu:
 - **7.5 IRE** Applies the standard NTSC pedestal of 7.5 IRE.
 - 0 IRE Applies a pedestal of 0 IRE. You should select this option when working with a commercial DV device that uses the Japanese analog NTSC pedestal of 0 IRE. For example, if the video appears too bright when you play back DV clips on your NTSC monitor, you can change the pedestal to 0 IRE to output your DV clips at the correct brightness.

Note If your device has a different NTSC pedestal for input and output, you can switch the pedestal setting as needed before capturing or recording to tape.

Specifying your genlock settings

You can select the source to which you want to genlock all devices connected to your MXO2 system, as well as adjust the timing offset for all MXO2 video outputs.

- 1 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.
- 2 Click Genlock.

	All		Matrox M	1XO2			
Sn Sn	ow All					<u>u</u>	
	Info General	Genlock	A/V Inpu	t Video Ou	tput A	udio Output	
	Use external	genlock sou	rce (REF)				
		Genloc	k format:	720p 59.94	¢	(Locked)	
	Video Output	Timing Offs	set				
		Horizontal	(pixels):	0	Reset		
		Vertic	al (lines):	0	Reset		

3 Select **Use external genlock source (REF)** if you connected an external analog genlock source to MXO2's **REF/REF IN** connector, such as a bi-level analog black burst for SD or a tri-level sync for HD. If you don't

have an external genlock source connected to MXO2, clear this option to genlock to MXO2's internal reference signal during playback, and genlock to your capture source during capture (see "Specifying your A/V input settings" on page 30).

Note When capturing RGB material from a DVI source using MXO2's HDMI input, you must use an external genlock source.

To indicate whether or not MXO2 is presently locked to your external genlock source, the status will be displayed next to the **Genlock format** menu as **Locked** or **Not locked**.

4 From the **Genlock format** menu, select the video format of your external genlock source.

Important To ensure good output results, make sure that your genlock source's video format is compatible with the MXO2 video output format.

5 Use the horizontal and vertical settings under **Video Output Timing Offset** to adjust the timing of the video output relative to your external genlock source. This lets you compensate for cable delays within your system.

Specifying your A/V input settings

You can select the MXO2 video and audio inputs to be used as your capture source. Only one video and audio input source can be used at a time. You can also capture your video to a different format than your source video by enabling scaling on the input. For descriptions of the MXO2 inputs, see "Inputs" on page 58. For a list of the input and capture formats that are supported on MXO2, and to view the MXO2 input scaling options, see Appendix C, "Matrox MXO2 Supported Input and Capture Formats."



Note The HDMI video input does not support SD video for capture. When capturing RGB material from a DVI source using MXO2's HDMI input, you must use an external genlock source (see "Specifying your genlock settings" on page 29).

- 1 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.
- 2 Click A/V Input.

00	Matro	MXO2
Show All		٩
Info	General Genlock A/V In	put Video Output Audio Output
	Input Source	
	Video:	Component (Y, Pb, Pr)
	Audio:	Analog balanced XLR
	Scaling	
	Scale input for capture	
	Source format:	720p 🗘
	16:9 to SD aspect ratio:	Letterbox 🗘
	Reverse Pulldown	
	720p 59.94 to 23.98 offset:	
		0 1 2 3 4 5 6 7 8 9 (frames)

3 Under **Input Source**, select the type of input that you want to capture for **Video** and **Audio**.

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Important The **SDI embedded audio** option can be used only with the **SDI** video input option.

4 If the format to which you want to capture does not match the format of your source video, select Scale input for capture, and then specify your source video's format (see step 5). MXO2 will either upscale, downscale, or cross-convert to the desired capture format. For example, select Scale input for capture if your source video is 720p at 59.94 fps and you want to capture to 1080i at 59.94 fps. For a list of the input and capture formats that are supported on MXO2, and to view the MXO2 input scaling options, see Appendix C, "Matrox MXO2 Supported Input and Capture Formats."

Note If **Scale input for capture** is not selected, your capture format must match your source video's format. However, if you want to capture 720p at 23.98 fps video from a 720p at 59.94 fps source (MXO2 input), scaling on the input is not required, but you must specify a frame offset value (see step 7).

5 If you selected **Scale input for capture** in step 4, select the format of your source video (MXO2 input) from the **Source format** list:



Note Depending on the input type selected in step 3, some options may not be available.

- SD 4:3 Select this option for standard 4:3 NTSC or PAL video. When upscaling to HD, the video is captured in pillarbox format.
- SD 16:9 Select this option for widescreen 16:9 NTSC or PAL video.
 When upscaling to HD, the video is captured in anamorphic format.
- **720p** Select this option for 720p video.
- **1080** Select this option for 1080i or 1080PsF video.
- 6 From the **16:9 to SD aspect ratio** menu, select the aspect ratio conversion option to be used when capturing to SD from a 16:9 video source:
 - Letterbox Captures the widescreen 16:9 picture as letterbox video by adding black bars at the top and bottom of the picture for display on a standard 4:3 television screen.
 - Center cut Captures the widescreen 16:9 picture for display on a standard 4:3 television screen by evenly cropping the left and right edges of the picture.
 - Anamorphic Captures the widescreen 16:9 picture as horizontally compressed 4:3 video, which retains the picture's full vertical resolution for display on a widescreen television. To display the video with the correct proportions on an NTSC or PAL monitor, select the 16:9 display setting on the monitor.
- 7 If you're capturing 720p at 23.98 fps video from a 720p at 59.94 fps source that was originally acquired using a standard 2:3:2:3 pulldown, MXO2 performs a reverse 2:3:2:3 pulldown to reconstruct the original 23.98 fps video. For MXO2 to do so, you must specify where your capture In point is relative to the start of the pulldown sequence using the 720p 59.94 to 23.98 offset slider. In the following example, the capture In point is at the fourth frame of the sequence, therefore the frame offset value is 3.

Note If you're performing an open-ended capture without a specified In point, you may need to try different offset values before getting your desired results.



720p at 59.94 fps video frames (2:3:2:3 pulldown)

Specifying your video output settings

MXO2 features simultaneous video outputs that allow you to send your video to a variety of devices at the same time. MXO2 provides two separate video output channels to choose from: main channel and SD channel. The video output settings allow you to set the main channel's video format, assign a video channel to an MXO2 output, and define the channel's behavior. You can also select other settings such as the scrub and pause method, and calibrate your HDMI monitor for video.

For a list of the supported video output formats for the MXO2 main and SD channels, and the supported video formats for the MXO2 outputs, see Appendix D, "Matrox MXO2 Supported Output Formats."

1 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.

800	Matrox MXO2	
Show All		٩
Info General Ge	enlock A/V Input Video	Output Audio Output
Set main cha	nnel format to: Follow ap	plication
Channel Sele	ction	
	Analog output: SD channe	el 🗘
	SDI output: Main chan	inel ≑
	* HDMI always outputs the main	channel.
Channel Beha	avior	
Pu	Ildown method: 2:3:2:3	÷
16:9 to	SD aspect ratio: Letterbox	\$
Miscellaneou	15	
S	crub and pause: Both field	s 🗘
Set I	HDMI output to: YUV	•
Set compo	onent output to: YUV	
HDMI mon	nitor calibration: Calibra	ate

2 Click Video Output.

- 3 From the Set main channel format to menu, you can select the video output format that you want for the MXO2 main channel. For a list of the supported video output formats for the MXO2 main and SD channels, see "Supported MXO2 main and SD video output formats" on page 73.
 - Follow application Sets the main channel's video output to match your project's video output format, or to a compatible format for your project. For example, if your project's video output is NTSC, the MXO2 main channel will be set to NTSC as well. If your project's video output is 720p

at 23.98 fps, the MXO2 main channel will be set to the compatible 720p at 59.94 fps output format.

- SD Sets the main channel's video output to SD. This will be either NTSC or PAL, depending on your project's video output frame rate. For example, a 720p at 23.98 fps project will be output as NTSC, and a 720p at 25 fps project will be output as PAL.
- **720p** Sets the main channel's video output to 720p at a frame rate compatible with your project's video output frame rate.
- **1080** Sets the main channel's video output to a 1080i or 1080PsF format, depending on your project's video output format.
- 1080i 59.94 from 23.98 Use this option when your project's video output has a frame rate of 23.98 fps, and you want to set the main channel's video output to 1080i at 59.94 fps (a pulldown will be applied to the video output).

Note When a pulldown is required to convert 23.98 fps video for output, you can select the pulldown method that you want to use (see step 5).

- **4** Under **Channel Selection**, select the video channel (main or SD) that you want for your MXO2 analog (composite, S-Video, and component) and SDI outputs:
 - Main channel Outputs your project's video as defined for the main channel (see step 3).
 - **SD channel** Outputs your project's video as NTSC or PAL, depending on your project's video output frame rate.

Remarks

- The HDMI output always outputs the main channel. To output SD on the HDMI output, you must define the main channel in step 3 as SD.
- The SD channel is not available when outputting 1080PsF at 23.98 fps on the main channel (see "Supported MXO2 main and SD video output formats" on page 73).
- **5** Under **Channel Behavior**, select the **Pulldown method** that you want to be applied to the video output when required to convert 23.98 fps video. For information on the available pulldown methods, see Appendix A, "Understanding Pulldown."
- 6 Under Channel Behavior, select the 16:9 to SD aspect ratio conversion option to be used when downconverting 16:9 material to SD, or when outputting SD 16:9 material:
 - Letterbox Outputs the widescreen 16:9 picture in letterbox mode by adding black bars at the top and bottom of the picture for display on a standard 4:3 television screen.

- Center cut Outputs the widescreen 16:9 picture by evenly cropping the left and right edges of the picture for display on a standard 4:3 television screen.
- Anamorphic Outputs the widescreen 16:9 picture as horizontally compressed 4:3 video, which retains the picture's full vertical resolution for display on a widescreen television. To display the video with the correct proportions on an NTSC or PAL monitor, select the 16:9 display setting on the monitor.
- 7 Under Miscellaneous, select First field, Second field, or Both fields from the Scrub and pause menu to indicate whether you want to display both fields or only one field when pausing video playback or scrubbing the timeline in your project. For example, you may want to scrub the first or second field to eliminate the flickering that can be seen in your picture when you pause while scrubbing interlaced video.
- 8 From the **Set HDMI output to** menu, select **YUV** or **RGB** to set the type of video that is sent from MXO2's HDMI output. For example, select **RGB** if your MXO2's HDMI output is connected to an HDMI device that accepts an RGB signal.
- **9** From the **Set component output to** menu, select **YUV** or **RGB** to set the type of video that is sent from MXO2's component (Y, Pb, Pr) output. For example, select **RGB** if your MXO2's component output is connected to a device that accepts an RGB signal.
- 10 Click the Calibrate button to display proc amp controls that you can use to calibrate your HDMI monitor for video (see Chapter 6, "Calibrating Your HDMI Monitor for Video").

Specifying your audio output settings

MXO2's simultaneous audio outputs allow you to send your audio to a variety of devices at the same time. You can also map any audio track in your application to any MXO2 audio output. For descriptions of the MXO2 outputs, see "Outputs" on page 62.

- 1 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.
- 2 Click Audio Output.

	Matrox	MXO2	
Show All			٩
Info Genera	I Genlock A/V Inp	ut Video Output	Audio Output
	Enable audio mapping		
	MXO2 Outputs	Application Outputs	
	XLR 1/2	Pair 1/2	
	XLR 3/4	Pair 3/4 🛟	
	XLR 5/6	Pair 5/6 🛟	
	XLR 7/8	Pair 7/8	
	AES/EBU 1/2	Pair 1/2	
	AES/EBU 3/4:	Pair 3/4 🛟	
	SDI 1/2 and HDMI 1/2	Pair 1/2	
	SDI 3/4 and HDMI 3/4	Pair 3/4 🛟	
	SDI 5/6 and HDMI 5/6	Pair 5/6 😫	
	SDI 7/8 and HDMI 7/8	Pair 7/8 🛟	



Note The available MXO2 audio outputs depend on your MXO2 hardware.

- **3** Select or clear the **Enable audio mapping** option. If this option is cleared, your application's audio track outputs will be routed to the corresponding MXO2 audio outputs by default. For example, when you output audio tracks as Pair 3/4 from your application, the audio will be routed to the corresponding 3/4 MXO2 audio outputs.
- **4** If you selected the **Enable audio mapping** option, for each of the MXO2 outputs, select the desired audio pair from your application.

Viewing MXO2 information

To view your MXO2's serial number, firmware version, and software version:

- 1 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.
- 2 Click Info.





Note If a message appears indicating an unsupported firmware version on your MXO2 hardware, you must update the MXO2 firmware as explained in "Updating your MXO2 firmware" on page 26.

Your notes

6

Calibrating Your HDMI Monitor for Video

This chapter explains how to calibrate your HDMI monitor for use with NTSC, PAL, and HD video.

Overview

Matrox MXO2 turns your HDMI monitor into a true-color video display for use with NTSC, PAL, and HD video. Controls for hue, chroma, contrast, brightness, and blue-only let you adjust and control your HDMI monitor exactly as you would a broadcast HD/SD video monitor.

Note MXO2's HDMI output supports 1:1 pixel mapping for accurate monitoring of NTSC, PAL, 1280×720, and 1920×1080 video. However, your HDMI monitor must support 1920×1080 to preview all HD formats, and "dot-by-dot" mode for 1:1 pixel mapping.

HDMI monitor calibration requires you to:

- 1 Load and output NTSC, PAL, or HD color bars to your HDMI monitor.
- **2** Calibrate your HDMI monitor using MXO2's proc amp controls.

Loading and displaying color bars

Color bars are used to calibrate your HDMI monitor. Depending on the application that you use to output the color bars to your HDMI monitor, you can use either the Matrox MXO2 HD and SD color bars, or those supplied by a third-party application, such as Final Cut Pro.

- 1 Ensure that your HDMI monitor is connected to the HDMI output on your MXO2 (see "Outputs" on page 62), turn the HDMI monitor on, and allow it to warm up for about 20 or 30 minutes.
- 2 From an MXO2-supported QuickTime video application, such as Final Cut Pro or After Effects, depending on the video standard for which you want to calibrate your HDMI monitor, load and play back an NTSC, PAL, or HD color bars clip. You can choose one of the Matrox MXO2 calibration color bars found in Applications > Matrox MXO2 Utilities > Calibration Files, or one of the color bars supplied by the application.

Note For Final Cut Pro, you must select an MXO2 Easy Setup for your project and then make sure that the selected color bars clip matches your project's sequence setting. For more details, see Chapter 7, "Loading a Matrox MXO2 Easy Setup."

3 Set your application's video output device setting to output to MXO2 (see "Specifying your video and audio output device settings" on page 49).

Note In your application, select the output setting that matches your clip's format. For Final Cut Pro, select the MXO2 video playback setting that matches your project's sequence setting.

- **4** With the color bars clip visible on your HDMI monitor, pause the color bars clip in your application.
- **5** Calibrate your HDMI monitor as detailed in the next section.

Chapter 6, Calibrating Your HDMI Monitor for Video



Calibrating your HDMI monitor

Use the MXO2 proc amp controls to adjust and control your HDMI monitor's color temperatures for accurate color grading and monitoring of NTSC, PAL, and HD video.

- **1** Load and output color bars to your HDMI monitor as detailed in the previous section.
- 2 From the Apple menu, click System Preferences, and then click the Matrox MXO2 icon.
- 3 Click Video Output.
- 4 From the Set main channel format to menu, select Follow application.



5 Under Miscellaneous, click Calibrate.

- 6 For each of the Hue, Chroma, Contrast, and Brightness controls, click the **Reset** button, and ensure that the **Blue only** option is cleared.
- **7** Drag the **Chroma** slider all the way to the left so that the color bars are shades of black and white.
- 8 Before settings the black level, make sure that **Allow super black** is selected in your general settings (see "Specifying your general settings" on page 28). Set the proper black level by adjusting the **Brightness** control and looking at the three pluge bars (see Figure 1 on page 43). The middle and left pluge bars should be black and blend into one another, with no visible

dividing line between them, and the right pluge bar should be a barely-visible dark gray bar as shown below:



- **Note** The room lighting may affect your perception of this setting. Therefore, you may need to readjust the **Brightness** setting if the room lighting changes.
- **9** To set the proper white level, move the **Contrast** slider all the way up, and then back down until the white bar (see Figure 1 on page 43) just begins to change. The correct setting is the point just before the white bar goes from pure white to showing a hint of gray. You're now ready to calibrate the colors.
- 10 Click the **Reset** button beside **Chroma** to set the chroma to its midpoint.
- **11** Select **Blue only** to remove the red and green elements from the color bars. The color bars should now be alternating bars of gray and black (see Figure 2 on page 43).
 - **Note** You can also use the **Blue only** option to check for noise in a video clip.
- **12** Adjust the **Hue** control until the two middle gray bars are the same shade as their sub-bars (see Figure 2 on page 43).
- **13** Adjust the **Chroma** control until the two outer gray bars are the same shade as their sub-bars (see Figure 2 on page 43). The four gray bars and their sub-bars should be of equal intensity, and the three black bars and their sub-bars should be completely black.
- 14 Clear the **Blue only** option. If you're satisfied with the proc amp settings, click **Accept** to save them, or take a note of the settings for future use.

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Figure 1: Color bars

Figure 2: Calibrated color bars in blue-only mode



Your notes

7

Using Matrox MXO2 with Supported Programs

This chapter explains how to define various settings for using MXO2 with Final Cut Pro and other supported programs.

Matrox MXO2 Easy Setups for Final Cut Pro

The Matrox MXO2 QuickTime video output component for Final Cut Pro includes predefined MXO2 Easy Setups that you can load to immediately apply appropriate sequence, capture, device control, and A/V output preset settings for use with MXO2. You can also create a custom MXO2 Easy Setup for Final Cut Pro. For detailed information on Easy Setups, see your Final Cut Pro documentation.

Loading a Matrox MXO2 Easy Setup

- 1 Open Final Cut Pro and choose Final Cut Pro > Easy Setup.
- 2 From the drop down menu in the Easy Setup window, select the Matrox MXO2 Easy Setup that matches the format of your project. For example, if you're working with NTSC material, select Matrox MXO2 Uncompressed NTSC 10-bit 48kHz.
- 3 Click **Setup** to load the settings.

Creating a Matrox MXO2 Easy Setup

- 1 Open Final Cut Pro and choose Final Cut Pro > Audio/Video Settings.
- 2 On the Summary pane, select the settings for your new MXO2 project preset. To be compatible with Matrox MXO2, you must select a Matrox MXO2 preset for each of the easy setup options (Sequence Preset, Capture Preset, Device Control Preset, Video Playback, and Audio Playback). To create a new Matrox MXO2 sequence, capture, or device control preset, see "Matrox MXO2 presets for Final Cut Pro" on page 47.
- 3 Click Create Easy Setup.
- 4 Type a Name and Description, and then click Create.
- **5** In the **Save** dialog box, save the new MXO2 Easy Setup to a location on your computer.
- **Important** By default, the path is set to *Library**Application* Support*Final Cut Pro System Support**Custom Settings*. If you save your Easy Setup somewhere else on your computer, the Easy Setup will not appear in the Easy Setup list, and may be lost if MXO2 is re-installed.
 - 6 In the Audio/Video Settings window, click OK.

Matrox MXO2 presets for Final Cut Pro

You can create a new MXO2 sequence, capture, and device control preset, or edit an existing preset. For detailed information on presets, see your Final Cut Pro documentation.

Creating and editing MXO2 sequence presets

1 Open Final Cut Pro and choose Final Cut Pro > Audio/Video Settings.

- **2** Click the **Sequence Presets** tab.
- **3** Select the sequence preset that you want to use as a starting point for creating a new preset, or select the sequence preset that you want to edit.
- 4 Click **Duplicate** to create a new preset, or click **Edit**.



- 5 In the Sequence Preset Editor window, select your settings. To be compatible with Matrox MXO2, you must select 48 kHz and 24-bit under Audio Settings on the General pane.
- 6 Type an appropriate Name and Description.
- 7 Click OK.
- 8 If you're editing a sequence preset, click **OK** in the **Audio/Video Settings** window to save your edits.

Creating and editing MXO2 capture presets

- 1 Open Final Cut Pro and choose Final Cut Pro > Audio/Video Settings.
- 2 Click the **Capture Presets** tab.
- **3** Select the capture preset that you want to use as a starting point for creating a new preset, or select the capture preset that you want to edit.
- 4 Click **Duplicate** to create a new preset, or click **Edit**.
- **i Important** If you click **Edit**, the preset that you selected in step 3 will be overwritten.
 - **5** In the **Capture Preset Editor** window, select your settings. To be compatible with Matrox MXO2, the capture preset must have the following settings:
 - Under QuickTime Video Settings, select a Matrox Digitizer and Input setting that matches the format to which you want to capture. If the capture format does not match the format of your source video that is connected to MXO2's input, you must enable scaling on the input in MXO2 (see "Specifying your A/V input settings" on page 30). For a list of the capture formats that are supported on MXO2, see Appendix C, "Matrox MXO2 Supported Input and Capture Formats."

Note A General Error message may appear when you select the digitizer. If this occurs, you will not be able to set the **Input** option from the **Capture Preset Editor** window. To set the capture input option, close the error message, and under **QuickTime Video Settings**, click **Advanced**. In the **Video** window, click **Source**, select the Matrox MXO2 setting that matches the format to which you want to capture, and then click **OK**.

- Under QuickTime Audio Settings, from the Device menu, click Matrox MXO2 Audio Input.
- 6 Type an appropriate Name and Description.
- 7 Click OK.

a P

8 If you're editing a capture preset, click **OK** in the **Audio/Video Settings** window to save your edits.

Creating and editing MXO2 device control presets

A Matrox MXO2 device control preset is required only when using MXO2's RS-422 serial connector for device control (see "MXO2 RS-422 serial connection" on page 13).

- 1 Open Final Cut Pro and choose Final Cut Pro > Audio/Video Settings.
- 2 Click the **Device Control Presets** tab.
- **3** Select the device control preset that you want to use as a starting point for creating a new preset, or select the device control preset that you want to edit.
- 4 Click **Duplicate** to create a new preset, or click **Edit**.



Note If you click **Edit**, the preset that you selected in step 3 will be overwritten.

- **5** In the **Device Control Preset Editor** window, select your settings. To be compatible with Matrox MXO2, the device control preset must have the following settings:
 - From the Audio Mapping menu, click 8 Channels.
 - From the **Port** menu, click **Matrox MXO2 RS-422 Port**.
- 6 Type an appropriate Name and Description.
- 7 Click OK.
- 8 If you're editing a device control preset, click **OK** in the **Audio/Video Settings** window to save your edits.

Specifying your video and audio output device settings

The following sections explain how to specify your video and audio output device settings for Final Cut Pro and Adobe After Effects. Many programs share similar output device settings as Adobe After Effects, however, you should refer to your program's documentation for more details.

Specifying settings for Final Cut Pro

- 1 Open Final Cut Pro and choose **View > Video Playback**.
- 2 Select the **Matrox MXO2** setting that matches your project's sequence setting.
- 3 Choose View > Audio Playback, and select Matrox MXO2 Audio Output.



Note If **Audio Follows Video** is enabled in the **Audio Playback** menu, **Matrox MXO2 Audio Output** will be automatically enabled once you've selected an MXO2 setting for video playback.

4 Enable Final Cut Pro's external video by choosing View > External Video > All Frames.

Specifying settings for Adobe After Effects

1 Open Adobe After Effects and choose After Effects > Preferences > Video Preview.

Preferences	
Video Preview Output Device: Matrox Video Output Output Mode: Matrox MXO2 - NT	OK Cancel Previous
Frame Size: 720 x 486 Output Quality: Faster Output During: Previews Mirror on computer monitor Interactions Renders	(<u>Next</u>)
Video Monitor Aspect Ratio: Standard (4:3)	

2 From the Output Device menu, select Matrox Video Output.

Specifying your video and audio output device settings

- **3** From the **Output Mode** menu, select the setting that matches the format of your composition. For example, if you're working with an NTSC project, select **Matrox MXO2 NTSC YUV 8-bit**.
- 4 Under Output During, select Previews and Interactions.
- 5 Click **OK** to save your settings.

Ensuring frame-accurate capture and edit-to-tape using Final Cut Pro

Matrox MXO2 device control (see "MXO2 RS-422 serial connection" on page 13) lets you control an RS-422 device, such as a VTR or digital disk recorder, for frame-accurate capture and edit-to-tape. For detailed information on capture and edit-to-tape, see your Final Cut Pro documentation.

Setting your capture settings

For frame-accurate capture using Final Cut Pro with Matrox MXO2, set the capture settings as follows:

- **1** Open Final Cut Pro and choose **File > Log and Capture**.
- 2 In the Log and Capture window, click the Capture Settings tab.
- **3** From the **Device Control** menu, select a Matrox MXO2 device control preset. To create or edit an MXO2 device control preset, see "Creating and editing MXO2 device control presets" on page 48.
- **4** From the **Capture/Input** menu, select a Matrox MXO2 capture preset. To create or edit an MXO2 capture preset, see "Creating and editing MXO2 capture presets" on page 47.
- **5** To set your audio capture settings, including which MXO2 audio input channels you want to capture, click the **Clip Settings** tab and specify your settings in the **Audio** section. For information on how to set your audio channel settings for capture, see your Final Cut Pro documentation.

Setting your edit-to-tape settings

For frame-accurate edit-to-tape using Final Cut Pro with Matrox MXO2, set the edit-to-tape settings as follows:

- 1 Open Final Cut Pro and choose File > Edit To Tape.
- 2 In the Edit To Tape window, click the Device Settings tab.
- **3** From the **Device Control** menu, select a Matrox MXO2 device control preset. To create or edit an MXO2 device control preset, see "Creating and editing MXO2 device control presets" on page 48.
- **4** If you'll be performing an insert edit, from the **Capture/Input** menu, select a Matrox MXO2 capture preset that is compatible with your tape. This is required to allow you to preview your tape to see what the edit will look like

Chapter 7, Using Matrox MXO2 with Supported Programs

in Final Cut Pro's **Edit to Tape** window. To create or edit an MXO2 capture preset, see "Creating and editing MXO2 capture presets" on page 47.

- **Note** To preview video from your tape, you must connect video and audio outputs from your recorder to the corresponding inputs on MXO2, and then set the MXO2 A/V input settings accordingly (see "Specifying your A/V input settings" on page 30).
- 5 To avoid having black frames recorded at the end of an insert edit, make sure that Editing, instead of Mastering, is selected as the edit-to-tape mode. To do this, click the Video tab, and then select Editing from the Mode menu.
- **6** When performing an edit-to-tape on some RS-422 devices, a delay may occur between the time that Final Cut Pro starts to play back your project and the time the device starts recording. To ensure that your edit-to-tape does not miss any frames, you can delay the playback of your project by adjusting the **Playback Offset** setting for the device control preset that you selected in step 3 (see "Creating and editing MXO2 device control presets" on page 48).

Your notes



Understanding Pulldown

This appendix describes the available MXO2 pulldown methods.

Overview

Depending on your project's video output format, a pulldown may be required to convert 23.98 fps video to 29.97 fps or 59.94 fps video for output on MXO2 (see "Supported MXO2 main and SD video output formats" on page 73). When a pulldown is required for your video output, Matrox MXO2 performs either a standard 2:3:2:3 pulldown or an advanced 2:3:3:2 pulldown. You can select your desired pulldown method in MXO2's video output settings (see "Specifying your video output settings" on page 33).

2:3:2:3 pulldown (standard)

2:3:2:3 pulldown, also known as standard 2:3 pulldown, is often used as part of the telecine process to transfer 24 fps film footage to 29.97 fps interlaced video. This pulldown method is also used to convert any 23.98 fps progressive video to 29.97 fps interlaced video, such as for converting 486p @ 23.98 fps video to NTSC.

In order to convert 24 fps film or 23.98 progressive video to 29.97 fps interlaced video, additional video frames, and more specifically video fields, must be created and added to the video sequence. For example, to convert a sequence of four film or progressive frames, five frames of video are needed for a total of 10 video fields. Therefore, one additional video frame or two video fields must be created. To accomplish this, the first and third frames of a four-frame film or progressive video sequence are each converted to two video fields. The second and fourth frames of the sequence are converted to three video fields to make up a total of five interlaced video frames.

The following diagram demonstrates the process:



Film frames @ 24 fps or progressive frames @ 23.98 fps

Standard 2:3:2:3 pulldown is accomplished by representing the first frame of film or progressive video (frame A) as two fields of video (fields **a1** and **a2**), the

Appendix A, Understanding Pulldown

second frame (frame B) as three fields of video (fields **b1**, **b2**, and **b3**), the third frame (frame C) as two fields (fields c1 and c2), and the fourth frame (frame D) as three fields (fields d1, d2, and d3). This sequence repeats six times each second.

2:3:3:2 pulldown (advanced)

2:3:3:2 pulldown, also known as advanced 2:3:3:2 pulldown, was developed as an alternative to the 2:3:2:3 pulldown method for making frame rate conversions in DV video. It is used to convert 486p @ 23.98 fps video to NTSC (486i @ 29.97 fps) video. This conversion is used when video footage is acquired by a DV camera at 23.98 fps and recorded to DV tape with the recorder set for advanced pulldown (called 24PA or 24P Advanced mode on some devices). 2:3:3:2 pulldown differs from 2:3:2:3 pulldown in that the two middle frames of the video sequence are each converted to three video fields.

The following diagram demonstrates the process:



Advanced 2:3:3:2 pulldown is accomplished by representing the first frame of progressive video (frame A) as two fields of video (fields a1 and a2), the second frame (frame **B**) as three fields of video (fields **b1**, **b2**, and **b3**), the third frame (frame C) as three fields (fields c1, c2, and c3), and the fourth frame (frame D) as two fields (fields d1 and d2).

Your notes

B

Matrox MXO2 Connectors

This appendix describes the Matrox MXO2 and MXO2 Rack inputs and outputs.

Inputs

The following sections detail the MXO2 and MXO2 Rack inputs.



MXO2 inputs

MXO2 Rack inputs



Input connector descriptions

This section describes the Matrox MXO2 and MXO2 Rack inputs. For input specifications, see "Matrox MXO2 specifications" on page 76. You can select the video and audio inputs to be used as your capture source in the MXO2 preferences window (see "Specifying your A/V input settings" on page 30). For a list of the input and capture formats that are supported on MXO2, see Appendix C, "Matrox MXO2 Supported Input and Capture Formats."

Note Depending on your MXO2 hardware, some of the following connectors may not be available or may be available in a limited capacity only. Some connectors on your MXO2 hardware may not appear exactly as shown below.



(i)

External reference (REF) Allows you to genlock all devices connected to your MXO2 system to an external genlock source (bi-level analog black burst for SD, or analog tri-level sync for HD). MXO2 Rack features an additional REF OUT connector with loop through that allows you to daisy chain the genlock reference input to another device's reference input.

Important If you connected an external genlock source to MXO2 Rack's REF IN connector, and you're not using the REF OUT connector, you must terminate the reference signal by connecting a BNC 75-ohm terminator to REF OUT.

To compensate for cable delays, timing-offset controls that align your video output relative to your external genlock source are available (see "Specifying your genlock settings" on page 29).



HDMI Provides an input for HD HDMI video (either YUV or RGB), and up to eight channels of embedded audio, from a digital HDMI device. HDCP sources and SD video are not supported on this input. Connect a standard HDMI video/audio cable from a camera, VTR, or other video input source.



SDI Provides an input for use with a digital SDI device. This input supports HD-SDI and SD-SDI video, and up to eight channels of embedded audio. Connect an SDI video/audio cable from a camera, VTR, or other video input source.



Component video (Y, Pb, Pr) Provide inputs for use with an analog component device, and support HD and SD video. Connect component Y, Pb, Pr video cables from a camera, VTR, or other video input source.



Y/C (S-Video) Provides an input for use with an analog S-Video device (SD only). Connect an S-Video cable from a camera, VTR, or other video input source.



Composite video (CVBS) Allows you to input SD video from an analog NTSC or PAL device. Connect a composite video cable from a camera, VTR, or other video input source.



AES/EBU digital audio Allows you to input stereo digital audio. Connect a coaxial BNC audio cable from a camera, VTR, audio mixer, or other audio input source.



Analog audio (balanced) Allows you to input balanced stereo analog audio. Connect XLR cables from a camera, VTR, audio mixer, or other audio input source.



Analog audio (unbalanced) Allows you to input unbalanced stereo analog audio. Connect RCA cables from a camera, VTR, audio mixer, or other audio input source.

Outputs

The following sections detail the MXO2 and MXO2 Rack outputs.

MXO2 outputs


MXO2 Rack outputs



Outputs

Output connector descriptions

This section describes the Matrox MXO2 and MXO2 Rack outputs. For output specifications, see "Matrox MXO2 specifications" on page 76. HD to SD downscaling, SD to HD upscaling, and cross conversion are supported on all video outputs simultaneously. To select your video output settings, see "Specifying your video output settings" on page 33. You can also map any audio track in Final Cut Pro to any MXO2 audio output (see "Specifying your audio output settings" on page 36). For a list of the video formats that you can output from the MXO2 outputs, see "Video formats supported on MXO2 outputs" on page 72.



Note Depending on your MXO2 hardware, some of the following connectors may not be available or may be available in a limited capacity only. Some connectors on your MXO2 hardware may not appear exactly as shown below.



HDMI Provides an output for HD/SD HDMI video, and up to eight channels of embedded audio, to a digital HDMI device. HDCP is not supported on this output. This output supports 1:1 pixel mapping for accurate monitoring on your HDMI display of NTSC, PAL, 1280×720, and 1920×1080 video. Connect a standard HDMI video/audio cable to an HDMI monitor, VTR, or other digital HDMI device. You can also connect directly to a home theatre system for 5.1 surround sound monitoring.



Note The HDMI output supports YUV and RGB devices. To set the HDMI output type, see "Specifying your video output settings" on page 33.

HDMI monitor calibration is available through this output. Using proc amp controls (hue, chroma, contrast, brightness, and blue-only), you can calibrate your HDMI monitor as you would a broadcast HD/SD video monitor (see Chapter 6, "Calibrating Your HDMI Monitor for Video").



SDI A and SDI B Provide two simultaneous outputs of the same HD-SDI or SD-SDI video, with up to eight channels of embedded audio. For each output, connect an SDI video/audio cable to a video monitor, VTR, or other SDI device. You can also perform 5.1 surround sound monitoring through the SDI output by connecting to a third-party device, such as an SDI audio de-embedder.



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Component video (Y, Pb, Pr) Allows you to output HD or SD video to an analog component device. Connect component Y, Pb, Pr video cables to a video monitor, VTR, or other component device.

Note The component output supports YUV and RGB devices. To set the component output type, see "Specifying your video output settings" on page 33.



Y/C (S-Video) Provides an output for SD video to an analog S-Video device. Connect an S-Video cable to a video monitor, VTR, or other S-Video device.



Composite video (**CVBS**) Allows you to output SD video to an analog NTSC or PAL device. Connect a composite video cable to a video monitor, VTR, or other NTSC or PAL device.



AES/EBU digital audio Allows you to output stereo digital audio. Connect a coaxial BNC audio cable to a VTR, audio mixer, speakers, or other audio device.



Analog audio (balanced) Allows you to output balanced stereo analog audio. Connect XLR cables to a VTR, audio mixer, speakers, or other audio device.



Analog audio (unbalanced) Provide outputs for unbalanced analog audio channels one to six, or three stereo pairs suitable for 5.1 surround sound monitoring. Connect RCA cables to a VTR, audio mixer, speakers, or other audio device.

Your notes



Matrox MXO2 Supported Input and Capture Formats

This appendix provides information on the video input and capture formats that are supported on MXO2.

Video formats supported on the MXO2 inputs

The following table lists the video formats that are supported on the various MXO2 inputs. For descriptions of the MXO2 inputs, see "Inputs" on page 58, and for a list of the supported capture formats, see "Capture formats supported on MXO2" on page 69."

	Matrox MXO2 input						
Source video format (MXO2 input)	HDMI	SDI	Component (Y, PB, Pr)	S-Video (Y/C)	Composite (CVBS)		
NTSC	_	1	1	✓	1		
PAL	_	1	1	1	1		
720p at 50 fps	1	1	1	—			
720p at 59.94 fps	1	✓	1	_			
1080i at 50 fps	1	✓	1	—			
1080i at 59.94 fps	✓	1	1	_			
1080PsF at 23.98 fps		\	1	_			

Capture formats supported on MXO2

The following table lists the capture formats that are supported on MXO2 based on the format of your source video. If the format to which you want to capture does not match the format of your source video, you must enable scaling on the input in MXO2 (see "Specifying your A/V input settings" on page 30). For a list of the video formats that are supported on the different Matrox MXO2 inputs, see "Video formats supported on the MXO2 inputs" on page 68.

	Capture format							
Source video format (MXO2 input)	NTSC	PAL	720p at 23.98 fps	720p at 50 fps	720p at 59.94 fps	1080PsFat 23.98 fps	1080i at 50 fps	1080i at 59.94 fps
NTSC	✓	_		_	\checkmark^1			\checkmark^1
PAL	—	1	_	\checkmark^1	_	_	\checkmark^1	_
720p at 50 fps	—	\checkmark^1	_	~		_	\checkmark^1	
720p at 59.94 fps	\checkmark^1	_	\checkmark^2	_	1	_	_	\checkmark^1
1080i at 50 fps	—	\checkmark^1	_	\checkmark^1	_	_	~	_
1080i at 59.94 fps	\checkmark^1	_	_	_	\checkmark^1	_	_	1
1080PsF at 23.98 fps	_					~		

¹ You must enable **Scale input for capture** in the MXO2 preferences window (see "Specifying your A/V input settings" on page 30).

² You must specify a frame offset value in the MXO2 preferences window (see "Specifying your A/V input settings" on page 30).

Your notes

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Matrox MXO2 Supported Output Formats

This appendix provides information on the video output formats that are supported on the MXO2 outputs, and the MXO2 main and SD channels.

Video formats supported on MXO2 outputs

The following table lists the video formats that you can output from the various Matrox MXO2 outputs. The listed video output formats are those that are supported on the MXO2 main and SD channels (see "Supported MXO2 main and SD video output formats" on page 73). To assign either the main or SD channel to an MXO2 output, see "Specifying your video output settings" on page 33. For descriptions of the MXO2 outputs, see "Outputs" on page 62.

	Matrox MXO2 output								
Video output format	HDMI	SDI	Component (Y, PB, Pr)	S-Video (Y/C)	Composite (CVBS)				
NTSC	486p at 59.94 fps	NTSC	NTSC	NTSC	NTSC				
NTSC 16:9	486p at 59.94 fps 16:9	NTSC 16:9	NTSC 16:9	NTSC 16:9	NTSC 16:9				
PAL	576p at 50 fps	PAL	PAL	PAL	PAL				
PAL 16:9	576p at 50 fps 16:9	PAL 16:9	PAL 16:9	PAL 16:9	PAL 16:9				
486p at 59.94 fps	486p at 59.94 fps	NTSC	NTSC	NTSC	NTSC				
486p at 59.94 fps 16:9	486p at 59.94 fps 16:9	NTSC 16:9	NTSC 16:9	NTSC 16:9	NTSC 16:9				
576p at 50 fps	576p at 50 fps	PAL	PAL	PAL	PAL				
576p at 50 fps 16:9	576p at 50 fps 16:9	PAL 16:9	PAL 16:9	PAL 16:9	PAL 16:9				
720p at 50 fps	720p at 50 fps	720p at 50 fps	720p at 50 fps		_				
720p at 59.94 fps	720p at 59.94 fps	720p at 59.94 fps	720p at 59.94 fps	_	_				
1080i at 50 fps	1080i at 50 fps	1080i at 50 fps	1080i at 50 fps						
1080i at 59.94 fps	1080i at 59.94 fps	1080i at 59.94 fps	1080i at 59.94 fps						
1080PsF at 23.98 fps ¹	1080p at 23.98 fps	1080PsF at 23.98 fps	1080PsF at 23.98 fps						
1080PsF at 25 fps	1080PsF at 25 fps	1080PsF at 25 fps	1080PsF at 25 fps		_				
1080PsF at 29.97 fps	1080PsF at 29.97 fps	1080PsF at 29.97 fps	1080PsF at 29.97 fps		_				

¹ The SD channel is not available when outputting 1080PsF at 23.98 fps on the main channel (see "Supported MXO2 main and SD video output formats" on page 73).

Supported MXO2 main and SD video output formats

The following table lists the supported video output formats that are available on the MXO2 main and SD channels based on your project's video output format. You can select the main channel's video output as explained in "Specifying your video output settings" on page 33. For a list of the video formats that are supported on the Matrox MXO2 outputs, see "Video formats supported on MXO2 outputs" on page 72.

Project's	Main channel output						
video output format	t Follow at application		720p	1080	1080i 59.94 from 23.98	channel output	
NTSC	NTSC	NTSC	720p at 59.94 fps	1080i at 59.94 fps		NTSC	
NTSC 16:9	NTSC 16:9	NTSC	720p at 59.94 fps	1080i at 59.94 fps		NTSC	
PAL	PAL	PAL	720p at 50 fps	1080i at 50 fps	_	PAL	
PAL 16:9	PAL 16:9	PAL	720p at 50 fps	1080i at 50 fps	_	PAL	
486p at 23.98 fps ¹	486p at 59.94 fps	NTSC	720p at 59.94 fps	10 80PsF at 23.98 fps ²	1080i at 59.94 fps	NTSC	
486p at 23.98 fps 16:9 ¹	486p at 59.94 fps 16:9	NTSC	720p at 59.94 fps	1080PsF at 23.98 fps ²	1080i at 59.94 fps	NTSC	
486p at 29.97 fps	486p at 59.94 fps	NTSC	720p at 59.94 fps	1080PsF at 29.97 fps		NTSC	
486p at 29.97 fps 16:9	486p at 59.94 fps 16:9	NTSC	720p at 59.94 fps	1080PsF at 29.97 fps		NTSC	
576p at 25 fps	576p at 50 fps	PAL	720p at 50 fps	1080PsF at 25 fps		PAL	
576p at 25 fps 16:9	576p at 50 fps 16:9	PAL	720p at 50 fps	1080PsF at 25 fps		PAL	
720p at 23.98 fps ¹	720p at 59.94 fps	NTSC	720p at 59.94 fps	1080PsF at 23.98 fps ²	1080i at 59.94 fps	NTSC	
720p at 25 fps	720p at 50 fps	PAL	720p at 50 fps	1080PsF at 25 fps		PAL	
720p at 29.97 fps	720p at 59.94 fps	NTSC	720p at 59.94 fps	1080PsF at 29.97 fps		NTSC	
720p at 50 fps	720p at 50 fps	PAL	720p at 50 fps	1080i at 50 fps	_	PAL	
720p at 59.94 fps	720p at 59.94 fps	NTSC	720p at 59.94 fps	1080i at 59.94 fps	_	NTSC	
1080i at 50 fps	1080i at 50 fps	PAL	720p at 50 fps	1080i at 50 fps	_	PAL	

Project's	Main channel output					
video output format	Follow application	SD	720p	1080	1080i 59.94 from 23.98	channel output
1080i at 59.94 fps	1080i at 59.94 fps	NTSC	720p at 59.94 fps	1080i at 59.94 fps	—	NTSC
1080PsF at 23.98 fps ¹	1080PsF at 23.98 fps ²	NTSC	720p at 59.94 fps	1080PsF at 23.98 fps ²	1080i at 59.94 fps	NTSC
1080PsF at 25 fps	1080PsF at 25 fps	PAL	720p at 50 fps	1080PsF at 25 fps	_	PAL
1080PsF at 29.97 fps	1080PsF at 29.97 fps	NTSC	720p at 59.94 fps	1080PsF at 29.97 fps	_	NTSC

¹ A pulldown is applied for 23.98 fps video when outputting 59.94 fps. To set the pulldown method, see "Specifying your video output settings" on page 33.
² The SD channel is not available when outputting 1080PsF at 23.98 fps on the main channel.

Ε

Matrox MXO2 Specifications

This appendix provides specifications for the Matrox MXO2, MXO2 Rack, and Matrox PCIe host adapters.

Matrox MXO2 specifications

General

- Video formats NTSC, PAL, NTSC-EIAJ, 1080p/i/PsF, 720p, 576p, 486p
- Regulatory compliance
 - FCC Class A, CE Mark Class A, C-Tick Mark, VCCI
 - RoHS Directive 2002/95/EC

• Dimensions

- Length 13"
- Width 9.5"
- Height 2"

• External AC/DC adapter

- 100-240 VAC 50-60 Hz
- Input: IEC320-C14 inlet
- Output: +12V DC, 3A max
- Dimensions: 4.1" (L) × 1.8" (W) × 1.4" (H)
- Total power consumption 15 watts

Connections

- Genlock reference input
 - HD analog tri-level sync or SD analog bi-level black burst
 - BNC connector (75 Ω), terminated
- **RS-422** D-sub connector (9 pins)

Video

• HDMI

- HD input and output

- HDMI Y,Cb,Cr 4:2:2 (10-bit)
- Eight channels of embedded audio
- Standard Type A HDMI connector (19 pins)
- SD output
 - HDMI Y,Cb,Cr 4:2:2 (10-bit)
 - Eight channels of embedded audio
 - Standard Type A HDMI connector (19 pins)
- SDI
 - HDTV input
 - · HD-SDI with eight channels of embedded SDI audio

Appendix E, Matrox MXO2 Specifications

- 24-bit, 48 kHz
- Compliant with SMPTE 292M, SMPTE 299M
- BNC connector (75 Ω), terminated
- · Equalized input for maximum cable length support

- HDTV output

- · HD-SDI with eight channels of embedded SDI audio
- 24-bit, 48 kHz
- Compliant with SMPTE 292M, SMPTE 299M
- BNC connector (75 Ω)

SDTV input

- · SD-SDI with eight channels of embedded audio
- 24-bit, 48 kHz
- BNC connector (75 Ω), terminated
- · Equalized input for maximum cable length support
- Compliant with SMPTE 259M-C, SMPTE 272M
- SDTV output
 - · SD-SDI with eight channels of embedded audio
 - 24-bit, 48 kHz
 - BNC connector (75 Ω)
 - Compliant with SMPTE 259M-C, SMPTE 272M

S-Video and composite video input

- SDTV input
 - PAL, NTSC, NTSC-EIAJ
 - BNC connector for composite (75 Ω), terminated
 - 4-pin mini-DIN S-Video connector (75 Ω), terminated
 - 12-bit ADC
 - 2x oversampling
 - Anti-aliasing filtering
 - Automatic gain control

- SDTV output

- PAL, NTSC, NTSC-EIAJ
- BNC connector for composite (75 Ω)
- 4-pin mini-DIN S-Video connector (75 Ω)
- 12-bit DAC
- 8x oversampling

- HDTV input
 - EIA-770.3 compliant
 - BNC connectors (75 Ω)
 - 12-bit ADC
 - Anti-aliasing filtering

- HDTV output

- EIA-770.3 compliant
- BNC connectors (75 Ω)
- 12-bit DAC
- 2x oversampling

- SDTV input

- Betacam, Betacam SP (NTSC and NTSC-EIAJ)
- SMPTE/EBU N10 (PAL)
- BNC connectors (75 Ω)
- 12-bit ADC
- 4x oversampling
- Anti-aliasing filter

- SDTV output

- Betacam, Betacam SP (NTSC and NTSC-EIAJ)
- SMPTE/EBU N10 (PAL)
- BNC connectors (75 Ω)
- 12-bit DAC
- 8x oversampling

• Analog video performance

- HDTV analog component video (passthrough)

- Frequency response Y: +/- 1.0 dB max to 28 MHz
- Frequency response Pb, Pr: +/- 1.0 dB max to 12 MHz
- Component channel delay: < 8 ns
- Component S/N (Y, Pb, Pr): > 50 dB, unified weighted
- SDTV S-Video and composite video (passthrough)
 - Amplitude error: < 4%
 - Frequency response: +/- 0.5 dB max to 5 MHz
 - 2T pulse response: 1.0% max
 - Diff. Gain and Diff. Phase: < 2%

Appendix E, Matrox MXO2 Specifications

• S/N: > 58 dB, unified weighted

- SDTV analog component video (passthrough)

- Frequency response Y: +/- 0.5 dB max to 5 MHz
- Frequency response Pb, Pr: +/- 1.0 dB max to 2 MHz
- Component channel delay: < 8 ns
- Component S/N (Y, Pb, Pr): > 54 dB, unified weighted

Audio

- Unbalanced analog audio inputs
 - 1x stereo pair
 - RCA connectors
 - Input impedence: Hi-Z
 - Line level with 18 db headroom (max level)

• Unbalanced analog audio outputs

- 3x stereo pair
- RCA connectors
- Output impedence: 100Ω
- Line level with 18 db headroom (max level)

• Balanced analog inputs

- 1x stereo pair
- 2x XLR female connectors
- Nominal levels: +4 dBu (+4 dBm)
- Input impedence: Hi-Z
- Headroom (max level): 18 db

• Balanced analog outputs

- 2x stereo pair
- 4x XLR male connectors
- Nominal levels: +4 dBu (+4 dBm)
- Output impedence: 50 Ω
- Headroom (max level): 18 db
- Unbalanced digital (AES/EBU) input
 - 1x stereo pair
 - BNC connector (75 Ω), terminated
 - Maximum input level: 5 V_{p-p}
- Unbalanced digital (AES/EBU) output
 - 1x stereo pair

- BNC connector
- Output impedence: 75 Ω
- Nominal output level: 1V_{p-p}
- · Balanced and unbalanced analog audio performance
 - Sampling frequency: 48 kHz (using 64x oversampling)
 - Quantization: 24 bits
 - S/N: > 85 db
 - THDN at 1 kHz, nominal level: < 0.05%

Environmental specifications

- Minimum/maximum ambient operating temperatures: 0 to 40° C
- Minimum/maximum storage temperature: -40 to 75° C
- Maximum altitude for operation: 3,000 meters
- Maximum altitude for transport: 12,000 meters
- Operating humidity: 20 to 80% relative humidity (non-condensing)
- Storage humidity: 5 to 95% relative humidity (non-condensing)

Matrox MXO2 Rack specifications

General

- Video formats NTSC, PAL, NTSC-EIAJ, 1080p/i/PsF, 720p, 576p, 486p
- Regulatory compliance
 - FCC Class A, CE Mark Class A, C-Tick Mark, VCCI
 - RoHS Directive 2002/95/EC
- Dimensions (without rackmount brackets)
 - Length 17.2"
 - Width 8.2"
 - Height 3.4" (two rack units)
- Dimensions (with rackmount brackets)
 - Length 19"
 - Width 8.2"
 - Height 3.5" (two rack units)
- AC power
 - 100-240 VAC 50-60 Hz
 - Input: IEC320-C14 inlet
 - Output: +12V DC, 3A max

Appendix E, Matrox MXO2 Specifications

• Total power consumption 15 watts

Connections

• Genlock reference input

- HD analog tri-level sync or SD analog bi-level black burst
- BNC connector (75 Ω)
- Genlock reference output
 - HD analog tri-level sync or SD analog bi-level black burst
 - Loop through
 - BNC connector (75 Ω)
- **RS-422** D-sub connector (9 pins)

Video

- HDMI
 - HD input and output
 - HDMI Y,Cb,Cr 4:2:2 (10-bit)
 - Eight channels of embedded audio
 - Standard Type A HDMI connector (19 pins)
 - SD output
 - HDMI Y,Cb,Cr 4:2:2 (10-bit)
 - Eight channels of embedded audio
 - Standard Type A HDMI connector (19 pins)
- SDI
 - HDTV input
 - · HD-SDI with eight channels of embedded SDI audio
 - 24-bit, 48 kHz
 - Compliant with SMPTE 292M, SMPTE 299M
 - BNC connector (75 Ω), terminated
 - · Equalized input for maximum cable length support

- HDTV output

- · HD-SDI with eight channels of embedded SDI audio
- 24-bit, 48 kHz
- Compliant with SMPTE 292M, SMPTE 299M
- BNC connector (75 Ω)

- · SD-SDI with eight channels of embedded audio
- 24-bit, 48 kHz
- BNC connector (75 Ω), terminated
- Equalized input for maximum cable length support
- Compliant with SMPTE 259M-C, SMPTE 272M
- SDTV output
 - SD-SDI with eight channels of embedded audio
 - 24-bit, 48 kHz
 - BNC connector (75 Ω)
 - Compliant with SMPTE 259M-C, SMPTE 272M
- S-Video and composite video input
 - SDTV input
 - PAL, NTSC, NTSC-EIAJ
 - BNC connector for composite (75 Ω), terminated
 - 4-pin mini-DIN S-Video connector (75 Ω), terminated
 - 12-bit ADC
 - 2x oversampling
 - Anti-aliasing filtering
 - Automatic gain control
 - SDTV output
 - PAL, NTSC, NTSC-EIAJ
 - BNC connector for composite (75 Ω)
 - 4-pin mini-DIN S-Video connector (75 Ω)
 - 12-bit DAC
 - 8x oversampling
- Analog component video input
 - HDTV input
 - EIA-770.3 compliant
 - BNC connectors (75 Ω)
 - 12-bit ADC
 - Anti-aliasing filtering
 - HDTV output
 - EIA-770.3 compliant
 - BNC connectors (75 Ω)

Appendix E, Matrox MXO2 Specifications

- 12-bit DAC
- 2x oversampling

- SDTV input

- Betacam, Betacam SP (NTSC and NTSC-EIAJ)
- SMPTE/EBU N10 (PAL)
- BNC connectors (75 Ω)
- 12-bit ADC
- 4x oversampling
- · Anti-aliasing filter
- SDTV output
 - Betacam, Betacam SP (NTSC and NTSC-EIAJ)
 - SMPTE/EBU N10 (PAL)
 - BNC connectors (75 Ω)
 - 12-bit DAC
 - 8x oversampling
- Analog video performance
 - HDTV analog component video (passthrough)
 - Frequency response Y: +/- 1.0 dB max to 28 MHz
 - Frequency response Pb, Pr: +/- 1.0 dB max to 12 MHz
 - Component channel delay: < 8 ns
 - Component S/N (Y, Pb, Pr): > 50 dB, unified weighted
 - SDTV S-Video and composite video (passthrough)
 - Amplitude error: < 4%
 - Frequency response: +/- 0.5 dB max to 5 MHz
 - 2T pulse response: 1.0% max
 - Diff. Gain and Diff. Phase: < 2%
 - S/N: > 58 dB, unified weighted
 - SDTV analog component video (passthrough)
 - Frequency response Y: +/- 0.5 dB max to 5 MHz
 - Frequency response Pb, Pr: +/- 1.0 dB max to 2 MHz
 - Component channel delay: < 8 ns
 - Component S/N (Y, Pb, Pr): > 54 dB, unified weighted

Audio

• Balanced analog inputs

- 2x stereo pair
- 4x XLR female connectors
- Nominal levels: +4 dBu (+4 dBm)
- Input impedence: Hi-Z
- Headroom (max level): 18 db

• Balanced analog outputs

- 4x stereo pair
- 8x XLR male connectors
- Nominal levels: +4 dBu (+4 dBm)
- Output impedence: 50 Ω
- Headroom (max level): 18 db

• Unbalanced digital (AES/EBU) input

- 2x stereo pair
- 2x BNC connector (75 Ω), terminated
- Maximum input level: 5 V_{p-p}

• Unbalanced digital (AES/EBU) output

- 2x stereo pair
- 2x BNC connector
- Output impedence: 75 Ω
- Nominal output level: 1V_{p-p}

• Balanced analog audio performance

- Sampling frequency: 48 kHz (using 64x oversampling)
- Quantization: 24 bits
- S/N: > 85 db
- THDN at 1 kHz, nominal level: < 0.05%

Environmental specifications

- Minimum/maximum ambient operating temperatures: 0 to 40° C
- Minimum/maximum storage temperature: -40 to 75° C
- Maximum altitude for operation: 3,000 meters
- Maximum altitude for transport: 12,000 meters
- Operating humidity: 20 to 80% relative humidity (non-condensing)
- Storage humidity: 5 to 95% relative humidity (non-condensing)

Matrox PCIe host adapter specifications

Matrox PCIe host ExpressCard/34 adapter (for MacBook Pro)

- Standard ExpressCard/34
- Dimensions: $3.8''(L) \times 1.3''(W) \times 0.5''(H)$

Matrox PCIe host adapter (for Mac Pro)

- Standard low-profile PCIe (x1)
- Dimensions:
 - adapter: 2.6" (L) × 2.7" (H)
 - adapter including bracket: 3.1" (L) × 4.75" (H)
 - overall thickness including components: 0.75"

Your notes

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Matrox MXO2 Customer Support

This appendix explains how you can register your Matrox MXO2 and obtain customer support.

How to get Matrox MXO2 Customer Support

If you have a problem that you're unable to solve by referring to your Matrox MXO2 documentation, please contact your Matrox MXO2 representative. He or she should be able to help you quickly correct any installation or system configuration problem.

If your representative is unable to solve your problem, contact Matrox for further information and assistance.

Registration

You can register your Matrox MXO2 in the Matrox MXO2 Support section of our website at www.matrox.com/video/support.

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Important Only registered users are entitled to customer support, software updates, special promotional offers, and access to our MXO2 user forum.

Keep up to date with our website

In addition to registering your Matrox MXO2, our website offers you up-to-the-minute information about Matrox products, and software updates. Be sure to place our site in your favorites or bookmarks: www.matrox.com/video/support.

Contacting us

Matrox is proud to offer worldwide customer support. Please use the Matrox MXO2 contact information for your area as provided on our website at www.matrox.com/video/support.

Index

Α

A/V input settings, MXO2 30 Adobe After Effects, specifying settings for 49 Advanced pulldown description of 55 *See also* Standard pulldown After Effects *See* Adobe After Effects Audio output device settings, Final Cut Pro 49 Audio output settings, MXO2 36

В

Battery connecting to MXO2 10 requirements and guidelines 2

С

Calibration. monitor See HDMI monitor calibration Capture MXO2 presets in Final Cut Pro 47 settings in Final Cut Pro 50 See also Device control Channels, MXO2 video output specifying settings for 33 supported formats 73 Computer system requirements 2 Connections AC power for MXO2 10 for MXO2 Rack 20 available on Matrox MXO2 10 available on Matrox MXO2 Rack 18 battery 10 MXO2 Rack to Mac system 21 MXO2 to Mac system 12 **RS-422** for MXO2 13 for MXO2 Rack 22 typical for MXO2 14 for MXO2 Rack 23 Customer support 88

D

Device control ensuring accurate capture and edit-to-tape in Final Cut Pro 50 MXO2 presets in Final Cut Pro 48 RS-422 connection for MXO2 13 connection for MXO2 Rack 22 specifying capture settings in Final Cut Pro 50 specifying edit-to-tape settings in Final Cut Pro 50

Ε

Easy Setups, MXO2 creating in Final Cut Pro 46 overview 46 Edit-to-tape MXO2 device control presets in Final Cut Pro 48 settings in Final Cut Pro 50 *See also* Device control ExpressCard *See* PCIe host ExpressCard/34 adapter

F

Final Cut Pro ensuring accurate capture and edit-to-tape 50 MXO2 Easy Setups creating 46 MXO2 presets capture 47 device control 48 overview 47 sequence 47 removing MXO2 presets and Easy Setups from 27 specifying capture settings in 50 specifying edit-to-tape settings in 50 specifying video and audio output settings in 49

G

Genlock specifying settings for MXO2 29 timing offset controls 30

90

Н

Hardware, MXO2 before you install 6 installing 6 safety precautions 6 HDMI monitor calibration 41 loading and displaying color bars 40 overview 40

Inputs AES/EBU audio 61 analog RCA audio 61 analog XLR audio 61 available on MXO2 58 available on MXO2 Rack 59 component (Y, Pb, Pr) 61 composite (CVBS) 61 HDMI 60 **REF** 60 reverse pulldown on 32 scaling on 31 SDI 60 specifying for MXO2 30 S-Video (Y/C) 61 Internet site, Matrox 88

L

License agreement i Luminance levels, setting for video input/output 28

Μ

Mac system connecting to your MXO2 12 connecting to your MXO2 Rack 21 Main and SD channels, video output formats on 73 Matrox contacting us 88 WWW site 88 Monitor calibration *See* HDMI monitor calibration

0

Outputs AES/EBU audio 65 analog RCA audio 65 analog XLR audio 65 available on MXO2 62 available on MXO2 Rack 63 component (Y, Pb, Pr) 65 composite (CVBS) 65 HDMI 64 SDI 64 specifying for MXO2 33, 36 supported video formats 72 supported video formats on MXO2 main and SD channels 73 S-Video (Y/C) 65

Ρ

PCIe host adapter connecting to MXO2 12 connecting to MXO2 Rack 21 installing 7 specifications 85 PCIe host ExpressCard/34 adapter connecting to MXO2 12 connecting to MXO2 Rack 21 installing 7 removing 8 specifications 85 Pedestal, setting for NTSC analog video 29 Power connecting to MXO2 10 connecting to MXO2 Rack 20 functionality in MXO2 10 functionality in MXO2 Rack 20 See also Battery Preferences window, MXO2 specifying A/V input settings 30 specifying audio output settings 36 specifying general settings 28 specifying genlock settings 29 specifying video output settings 33 viewing MXO2 information 37 Presets, Final Cut Pro creating and editing capture presets 47 creating and editing device control presets 48 creating and editing sequence presets 47 overview 47 Print-to-tape See Edit-to-tape

Proc amps, calibrating HDMI monitor using 41 Pulldown description of advanced 55 description of standard 54

R

Registering your Matrox MXO2 88 Returning procedure iv Reverse pulldown, on MXO2 inputs 32 RS-422 connection to MXO2 13 connection to MXO2 Rack 22 *See also* Device control

S

Scaling, on MXO2 inputs 31 Sequence presets, creating and editing in Final Cut Pro 47 Service, returns iv Settings, MXO2 A/V input 30 audio output 36 general 28 genlock 29 video output 33 Setup level See Pedestal Software, MXO2 installing 26 removing 27 removing MXO2 presets and Easy Setups from Final Cut Pro 27 Specifications host ExpressCard/34 adapter 85 Matrox MXO2 76 Matrox MXO2 Rack 80 PCIe host adapter 85 Standard pulldown description of 54 See also Advanced pulldown Style conventions 3 System requirements, MXO2 2

T

Technical support 88

V

Video formats expressed in MXO2 documentation 3 *See also* Video output device settings *See also* Video output formats, MXO2 Video output device settings in Final Cut Pro 49 specifying in Adobe After Effects 49 Video output formats, MXO2 supported on main and SD channels 73 supported on MXO2 outputs 72 *See also* Video formats *See also* Video output device settings Video output settings, MXO2 33

W

Warranty i WWW site, Matrox 88



92

Compliance Statements

USA

FCC Compliance Statement

Remark for the Matrox hardware products supported by this guide

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment. The use of shielded cables for connection of the equipment and other peripherals is required to meet FCC requirements.

Canada

(English) Industry Canada Compliance Statement

Remark for the Matrox hardware products supported by this guide

These digital devices do not exceed the Class A limits for radio noise emission from digital devices set out in the Radio Interference Regulation of Industry Canada.

(Français) Conformité avec les exigences de l'Industrie Canada

Remarque sur les produits matériels Matrox couverts par ce guide

Ces appareils numériques n'émettent aucun bruit radioélectrique dépassant les limites applicables aux appareils numériques de Classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par Industrie Canada.

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Europe

(English) European user's information - Declaration of Conformity

Remark for the Matrox hardware products supported by this guide

These devices comply with EC Directive 89/336/EEC for a Class A digital device. They have been tested and found to comply with EN55022/CISPR22 and EN55024/CISPR24. In a domestic environment these products may cause radio interference in which case the user may be required to take adequate measures. To meet EC requirements, shielded cables must be used to connect the equipment and other peripherals. These products have been tested in a typical class A compliant host system. It is assumed that these products will also achieve compliance in any class A compliant system.

(Français) Informations aux utilisateurs Européens - Déclaration de conformité

Remarque sur les produits matériels Matrox couverts par ce guide

Ces unités sont conformes à la directive communautaire 89/336/EEC pour les unités numériques de classe A. Les tests effectués ont prouvé qu'elles sont conformes aux normes EN55022/CISPR22 et EN55024/CISPR24. Le fonctionnement de ces produits dans un environnement résidentiel peut causer des interférences radio, dans ce cas l'utilisateur peut être amené à prendre les mesures appropriées. Pour respecter les impératifs communautaires, les câbles de connexion entre l'équipement et ses périphériques doivent être blindés. Ces produits ont été testés dans un système hôte typique compatible classe A. On suppose qu'ils présenteront la même compatibilité dans tout système compatible classe A.

(Deutsch) Information für europäische Anwender - Konformitätserklärung

Anmerkung für die Matrox Hardware-Produktunterstützung durch dieses Handbuch

Diese Geräte entsprechen EC Direktive 89/336/EEC für ein digitales Gerät Klasse A. Sie wurden getestet und entsprechen demnach EN55022/CISPR22 und EN55024/CISPR24. In einer Wohnumgebung können diese Produkte Funkinterferenzen erzeugen, und der Benutzer kann genötigt sein, entsprechende Maßnahmen zu ergreifen. Um EG-Anforderungen zu entsprechen, müssen zum Anschließen des ausrüstung und anderer Peripheriegeräte abgeschirmte Kabel verwendet werden. Diese Produkt wurden in einem typischen, der Klasse A entsprechenden, Host-System getestet. Es wird davon ausgegangen, daß diese Produkte auch in jedem Klasse A entsprechenden System entsprechend funktionieren.

(Italiano) Informazioni per gli utenti europei - Dichiarazione di conformità

Nota per i prodotti hardware Matrox supportati da questa guida

Questi dispositivi sono conformi alla direttiva CEE 89/336/EEC relativamente ai dispositivi digitali di Classe A. Sono stati provati e sono risultati conformi alle norme EN5502/CISPR22 e EN55024/CISPR24. In un ambiente domestico, questi prodotti possono causare radiointerferenze, nel qual caso all'utente potrebbe venire richiesto di prendere le misure adeguate. Per soddisfare i requisiti CEE, l'apparecchiatura e le altre periferiche vanno collegati con cavi schermati. Questi prodotti posota in un tipico sistema host conforme alla classe A. Inoltre, si dà per scontato che questi prodotti acquisiranno la conformità in qualsiasi sistema conforme alla classe A.

(Español) Información para usuarios europeos - Declaración de conformidad

Observación referente a los productos de hardware de Matrox apoyados por este manual

Estos dispositivos cumplen con la directiva de la CE 89/336/EEC para dispositivos digitales de Clase A. Dichos dispositivos han sido sometidos a prueba y se ha comprobado que cumplen con las normas EN55022/CISPR22 y EN55024/CISPR24. En entornos residenciales, estos productos pueden causar interferencias en las comunicaciones por radio; en tal caso el usuario deberá adoptar las medidas adecuadas. Para satisfacer las disposiciones de la CE, deberán utilizarse cables apantallados para conectar el equipo y demás periferios. Estos productos han sido sometidos a prueba en un típico sistema anfitrión que responde a los requisitos de la clase A. Se supone que estos productos cumplirán también con las normas en cualquier sistema que responda a los requisitos de la clase A.



www.matrox.com/video