

HD Express™

User's Guide for Mac OS X

MOTU

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SAFETY PRECAUTIONS AND ELECTRICAL REQUIREMENTS

CAUTION! READ THIS SAFETY GUIDE BEFORE YOU BEGIN INSTALLATION OR OPERATION. FAILURE TO COMPLY WITH SAFETY INSTRUCTIONS COULD RESULT IN BODILY INJURY OR EQUIPMENT DAMAGE.

HAZARDOUS VOLTAGES: CONTACT MAY CAUSE ELECTRIC SHOCK OR BURN. TURN OFF UNIT BEFORE SERVICING.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR OTHER MOISTURE.

CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: DO NOT PERMIT FINGERS TO TOUCH THE TERMINALS OF PLUGS WHEN INSTALLING OR REMOVING THE PLUG TO OR FROM THE OUTLET.

WARNING: IF NOT PROPERLY GROUNDED THE MOTU HD Express COULD CAUSE AN ELECTRICAL SHOCK.

The MOTU HD Express is equipped with a three-conductor cord and grounding type plug which has a grounding prong, approved by Underwriters' Laboratories and the Canadian Standards Association. This plug requires a mating three-conductor grounded type outlet as shown in Figure A below. If the outlet you are planning to use for the MOTU HD Express is of the two prong type, DO NOT REMOVE OR ALTER THE GROUNDING PRONG IN ANY MANNER. Use an adapter as shown below and always connect the grounding lug to a known ground. It is recommended that you have a qualified electrician replace the TWO prong outlet with a properly grounded THREE prong outlet. An adapter as illustrated below in Figure B is available for connecting plugs to two-prong receptacles.

Figure A

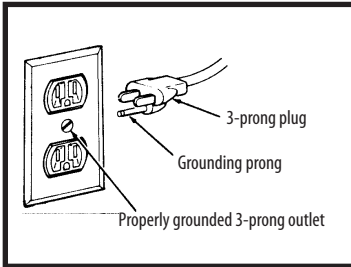
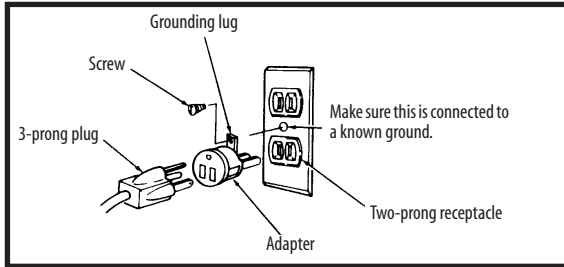


Figure B



WARNING: THE GREEN GROUNDING LUG EXTENDING FROM THE ADAPTER MUST BE CONNECTED TO A PERMANENT GROUND SUCH AS TO A PROPERLY GROUNDED OUTLET BOX. NOT ALL OUTLET BOXES ARE PROPERLY GROUNDED.

If you are not sure that your outlet box is properly grounded, have it checked by a qualified electrician. NOTE: The adapter illustrated is for use only if you already have a properly grounded two-prong receptacle. Adapter is not allowed in Canada by the Canadian Electrical Code. Use only three wire extension cords which have three-prong grounding type plugs and three-prong receptacles which will accept the MOTU HD Express plug.

IMPORTANT SAFEGUARDS

1. Read these instructions. All the safety and operating instructions should be read before operating the HD Express.
2. Keep these instructions. These safety instructions and the HD Express owner's manual should be retained for future reference.
3. Heed all warnings. All warnings on the HD Express and in the owner's manual should be adhered to.
4. Follow all instructions. All operating and use instructions should be followed.
5. Do not use the HD Express near water.
6. Cleaning - Unplug the HD Express from the computer and clean only with a dry cloth. Do not use liquid or aerosol cleaners.
7. Ventilation - Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Heat - Do not install the HD Express near any heat sources such as radiators, heat registers, stoves, or another apparatus (including an amplifier) that produces heat.
9. Overloading - Do not overload wall outlets and extension cords as this can result in a risk of fire or electrical shock.
10. Grounding - Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
11. Power cord - Protect the HD Express power cord from being walked on or pinched by items placed upon or against them. Pay particular attention to cords and plugs, convenience receptacles, and the point where they exit from the HD Express.
12. Power switch - Install the HD Express so that the power switch can be accessed and operated at all times.
13. Disconnect - The main plug is considered to be the disconnect device for the HD Express and shall remain readily operable.
14. Accessories - Only use attachments/accessories specified by the manufacturer.
15. Placement - Use only with the cart, stand, tripod, bracket or table specified by the manufacturer, or sold with the HD Express. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
16. Surge protection - Unplug the HD Express during lightning storms or when unused for long periods of time.
17. Servicing - Refer all servicing to qualified service personnel. Servicing is required when the HD Express has been damaged in any way, such as when a power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the HD Express, the HD Express has been exposed to rain or moisture, does not operate normally, or has been dropped.
18. Power Sources - Refer to the manufacturer's operating instructions for power requirements. Be advised that different operating voltages may require the use of a different line cord and/or attachment plug.
19. Installation - Do not install the HD Express in an unventilated rack, or directly above heat-producing equipment such as power amplifiers. Observe the maximum ambient operating temperature listed below.
20. Power amplifiers - Never attach audio power amplifier outputs directly to any of the unit's connectors.
21. Replacement Parts - When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original part. Unauthorized substitutions may result in fire, electric shock or other hazards.
22. Safety Check - Upon completion of any service or repairs to this MOTU HD Express, ask the service technician to perform safety checks to determine that the product is in safe operating conditions.

ENVIRONMENT

Operating Temperature: 10°C to 40°C (50°F to 104°F)

TO REDUCE THE RISK OF ELECTRICAL SHOCK OR FIRE

Do not handle the power cord with wet hands. Do not pull on the power cord when disconnecting it from an AC wall outlet. Grasp it by the plug. Do not expose this apparatus to rain or moisture. Do not place objects containing liquids on it.

AC INPUT

100 - 240VAC ~ • 50 / 60Hz • 20 Watts.



Contents

5	Quick Reference: HD Express Front Panel
6	Quick Reference: HD Express Rear Panel
7	Quick Reference: MOTU Video Setup
9	About the HD Express
11	Packing List and Mac System Requirements
13	Installing the HD Express Hardware
21	Installing the HD Express Mac OS X Software
23	HD Express Basics
25	MOTU Video Setup
33	Final Cut Pro
41	Troubleshooting
43	Video Formats
45	HD Express Specifications
47	Index

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This equipment has been type 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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications or television reception. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by any combination of the following measures:

- Relocate or re-orient the receiving antenna
 - Increase the separation between the equipment and the receiver
 - Plug the equipment into an outlet on a circuit different from that to which the receiver is connected
- If necessary, consult a dealer or experienced radio/television technician for additional assistance.

PLEASE NOTE: only equipment certified to comply with Class A (computer input/output devices, terminals, printers, etc.) should be attached to this equipment, and it must have shielded interfacable cables in order to comply with the Class A FCC limits on RF emissions.

WARNING: changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

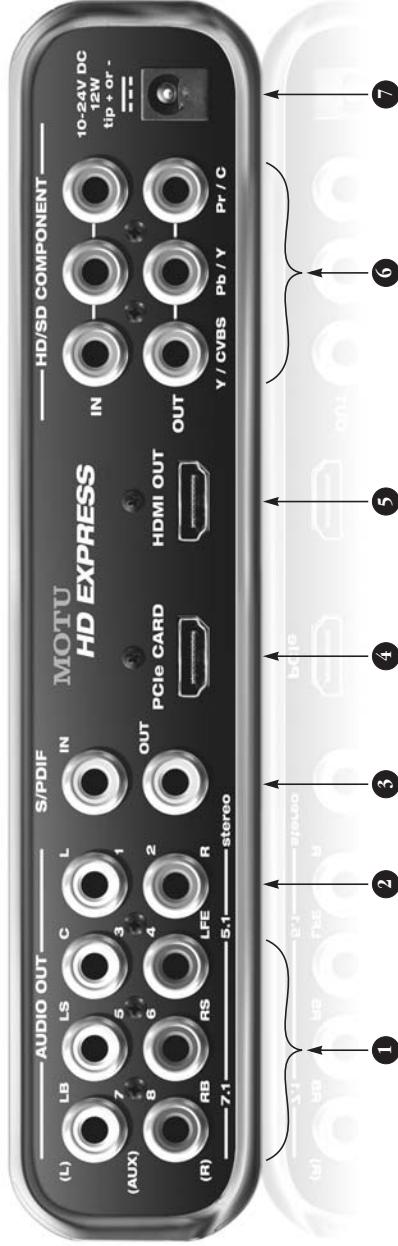


Quick Reference: HD Express Front Panel



1. Connect an SD source here, such as a camcorder, DVD player, set-top box, video game console, AV receiver or other HDMI device. Note that many consumer HDMI sources (such as DVD players) implement HDCP (High Bandwidth Digital Content Protection), which does not allow video capture of copy-protected signals via I/O devices like the HD Express.
2. This is a standard quarter-inch stereo headphone jack. Its output always matches analog outputs 1-2 on the rear panel. Use the volume knob to control its level. To monitor S/PDIF or HDMI input on this headphone jack, see "Downmix to Output 1-2 on Capture" on page 31.
3. The GENLOCK light glows when the HD Express has successfully locked to the currently selected clock source. The CAPTURE light glows when the HD Express is capturing or previewing video; the MONITOR light glows when the HD Express is playing back (whether still-framed or not).
4. The GENLOCK light glows when the HD Express has successfully locked to the currently selected clock source. The CAPTURE light glows when the HD Express is capturing or previewing video; the MONITOR light glows when the HD Express is playing back (whether still-framed or not).
5. The HOST light illuminates when the HD Express interface successfully establishes communication with the computer via the PCIe card or ExpressCard.
6. When the power switch is in the AUTO ON position, the HD Express powers up when you switch on your computer and powers down when you switch off your computer.
7. Keep this switch in the down position to enable AUTO ON mode. With this main power switch flipped to the AUTO ON position, the HD Express will power on and off with your computer.
 When using the HD Express rack-mount interface with the laptop ExpressCard adapter, operation is plug-and-play; you can disconnect and reconnect the interface, and freely switch it on or off as desired.
 When using the PCIe card adapter on a desktop machine, the HD Express rack-mount interface must be connected and switched on before starting up the computer. Similarly, you must shut down the computer before switching it off and/or disconnecting it. If the interface gets disconnected or switched off before computer shut-down, you'll need to restart the computer to bring the interface back on line.

Quick Reference: HD Express Rear Panel



1. These six RCA analog outputs provide 5.1 and 7.1 surround sound monitoring. Connect them to a surround speaker system, or to a mixer. They are equipped with 24-bit converters that support sample rates from 44.1 kHz up to 96 kHz.
2. Outputs 1-2 are the main stereo audio outputs.
3. These connectors provide stereo S/PDIF digital audio input and output.
4. Connect the HD Express to the computer here using any standard HDMI cable. If you are connecting the interface to an ExpressCard adapter for laptop operation, use a standard HDMI-to-mini-HDMI cable. In either case, it is recommended that you use the supplied cable. If you use another cable, the length should not exceed six feet, and use a high-quality cable.
5. Connect a plasma, LCD, DLP or other HDMI-equipped monitor here. Alternately, you can connect a DVI-equipped device with an adapter cable. The HD Express supports 8-channel PCM (uncompressed) embedded audio over HDMI, so you could also connect this output to an HDMI-equipped home theater receiver to deliver both picture and multi-channel audio.
6. Connect component HD or SD input and output here. The HD/SD Component section of the HD Express is equipped with 12-bit converters that deliver 10-bit capture and playback, with support for either RGB or YPbPr component color space. Alternately, you can connect a composite video (CVBS) input or output signal to the Y connectors or an S-Video input or output signal to the Y/C connectors.
7. The HD Express uses an external, 10-24 volt power supply that provides 12 watts of power. The connector can be either either tip-positive or tip-negative.

Quick Reference: MOTU Video Setup

Choose the video format that you wish to capture or play back.

The status area tells you what mode the HD Express hardware is in. It also provides helpful troubleshooting info.

When capturing video, choose the input source here. Also determines the clock source for playback, if the Playback Clock Source is set to Input Source.

MOTU Video Setup - MOTU HD Express

Video Format: 1080p 29.97

Capture mode

Input Source: Component YPbPr

Default Mode: Capture Playback

Reset to Defaults

Capture Clock Source: Input Source

Playback Clock Source: Input Source

HDMI Format: HDMI

Analog Output Format: Component YPbPr

Interface Pause Mode: Full Frame Field 1 Field 2

480i Setup: USA (7.5%)

480i Component Levels: Sony Beta

reset	Slope	Red 1.00	Green 1.00	Blue 1.00
	Offset	0.00	0.00	0.00
Sat 1.00	Power	1.00	1.00	1.00

Driver:1.0.1b2 Firmware:1.03 Bootloader:1.01

Input: 1080p 29.97

Setup | Preview | Audio

Genlock: On

Indicates the video format detected on the currently chosen video Input Source (above).

Click a tab to view its settings above. For complete details on the settings in these tabs, see chapter 6, "MOTU Video Setup" (page 25).

Indicates when the HD Express has successfully achieved lockup to the currently selected clock source, which could be the HD Express's internal clock or the current video input source.

CHAPTER 1 About the HD Express

OVERVIEW

The HD Express is a PCI Express video interface for Mac that provides broadcast-quality video capture and monitoring for Final Cut Pro.

The HD Express connects to a Mac desktop computer via a standard PCI Express card or a Mac laptop via an ExpressCard adapter and turns the computer into a powerful HD/SD video production workstation equipped with broadcast quality HD and SD video and audio capture and monitoring.

In Final Cut Pro, the HD Express supports full-raster 1920 x 1080 HD capture and playback using any video format supported natively by Final Cut Pro, including uncompressed, P2 (DVCProHD), XD CAM, HDV, and Apple's ProRes 422 codec in both standard and HQ modes. The HD Express is the ideal affordable video capture solution for any ProRes workflow.

The HD Express is ideal for any natively supported workflow because you can immediately play back clips (either imported or ingested) with no transcoding necessary. Conversely, you can connect any SD or HD video source such as an HDV camera, legacy video deck or DVD player and then capture it directly in the format of your choice in Final Cut. Many cameras now feed their uncompressed SDI or component output directly from the camera's optics and image sensor, before compression, for the best-possible picture quality during capture with the HD Express.

A wide range of video equipment can be connected to the HD Express, from legacy SD camcorders to the latest HD cameras, video decks, LCD reference monitors and plasmas.

The HD Express is housed in a rugged aluminum alloy chassis with a standard half-rack, mountable form factor. Included rack mounting brackets can easily be removed for convenient desktop operation.

The HD Express is designed to streamline your video production workflow, with unified control over all your video gear from the convenience of your computer desktop.

FEATURE HIGHLIGHTS

- HD/SD PCI Express video interface for Mac and Windows — provides HD and SD capture and playback for any current-generation PCI- or ExpressCard-equipped computer.
- Tower or laptop operation — connects to a Mac or PC tower via PCI Express for ultra-fast operation, or to a laptop via ExpressCard connectivity for mobile operation.
- Comprehensive video capture & monitoring — captures and plays uncompressed video in all standard SD and HD video formats up to and including 1080p30 (720p, 1080i, 1080p & 1080PsF).
- Supports Apple Final Cut Pro.
- Captures and plays uncompressed HD and SD — 10-bit 4:2:2 color depth and 1920 x 1080 resolution, all standard HD and SD formats up to and including 1080p30 (720p, 1080i, 1080p and 1080PsF).
- Support for ProRes and other popular codecs — capture and monitor full-raster (1920 x 1080 or 1280 x 720) Apple ProRes, ProRes HQ or other popular host-based codecs supported by Apple Final Cut Pro.

- Support for file-based workflows — lets you edit and monitor file-based workflow codecs supported natively in Final Cut Pro, including HDV, XD CAM, P2/DVCPRO, and others with no transcoding needed.
- Broadcast quality — 10-bit 4:2:2 signal path throughout.
- HDMI capture and monitoring — provides both HDMI in and out.
- Color grading — provides flexible, industry-standard color adjustment with separate controls for capture and playback.
- Comprehensive audio — capture stereo analog or 8-channel embedded HDMI digital audio. Monitor up to eight channels of surround audio via RCA analog or HDMI embedded at sample rates up to 96kHz.
- Half-rack form factor with dedicated connectors — no cable swapping or gangly, inconvenient breakout cables.

VIDEO I/O

The HD Express provides comprehensive video input and output connectivity.

The front panel provides convenient inputs for legacy SD capture and full 10-bit uncompressed HDMI capture from today's latest HD camcorders.

The component section provides both RGB and YPbPr, but can alternately serve as CVBS (composite) in/out or even Y/C (S-Video) in/out.

- 1 x HDMI in and out (4:2:2 10-bit, YUV)
- Support for DVI output with HDMI-to-DVI adapter (sold separately)
- 1 x HD/SD component in and out (10-bit, YPbPr or RGB) on RCAs
- 1 x composite in (10-bit) on RCA

- 1 x S-Video in (10-bit) on 4-pin mini-DIN
- 1 x composite in and out (10-bit CVBS) on shared RCA
- 1 x S-Video in/out (10-bit Y/C) on shared RCA

VIDEO FORMATS

- SD — 576i25 (PAL) and 486i29.97 (NTSC)
- HD — 720p23.976, 720p24, 720p25, 720p29.97, 720p30, 720p50, 720p59.94, 720p60, 1080p23.976, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080PsF23.976, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 1080i25, 1080i29.97, 1080i30
- Supported Final Cut Pro HD formats — Uncompressed HD (8-bit and 10-bit), Apple ProRes or DVCPROHD 720p at all eight frame rates listed above, plus full-raster (1920 x 1080) ProRes or DVCPROHD 1080 (1280 and 1440 rasters) at all 1080 frame rates listed above
- Supported Final Cut SD formats — Uncompressed 8-bit and 10-bit, Apple ProRes or DVCPRO and DVCPRO 50 at 486i29.97 and 576i25

AUDIO I/O

The HD Express provides stereo analog audio capture and surround sound monitoring with support for both 5.1 or 7.1 configurations. The HD Express also provides 8-channel capture and monitoring of embedded HDMI digital audio input and output.

- Supports all standard audio sample rates from 44.1 to 96kHz
- 2 x RCA analog input on the front panel for SD Composite/S-Video capture
- 2 x S/PDIF digital in and out on RCA connectors
- 8 x HDMI embedded audio in and out
- Front panel headphone jack with dedicated volume control

CHAPTER 2 **Packing List and Mac System Requirements**

PACKING LIST

The HD Express ships with the items listed below. If any of these items are not present in your HD Express box when you first open it, please immediately contact your dealer or MOTU.

- One HD Express with removable rack ears
- One HDMI cable
- One PCI card or ExpressCard adapter
- One power adapter
- HD Express Mac/Windows manuals
- One software installer CD
- Product registration card

MAC SYSTEM REQUIREMENTS

The HD Express system requires the following Mac system:

- A multi-processor Intel-based Mac equipped with at least one PCI Express slot or ExpressCard slot
- At least 1 GB (gigabyte) of RAM (2 GB or more is recommended)
- Mac OS X (version 10.5 or later)
- A large hard drive (preferably at least 500 GB)

PLEASE REGISTER TODAY!

Please register your HD Express today. There are two ways to register.

- Visit www.motu.com/registration to register online

OR

- Fill out and mail the included product registration card

As a registered user, you will be eligible to receive technical support and announcements about product enhancements as soon as they become available. Only registered users receive these special update notices, so please register today.

Thank you for taking the time to register your new MOTU products!

CHAPTER 3 Installing the HD Express Hardware

OVERVIEW

Here's an overview for installing the HD Express:

Precautions before you begin	13
Installing the PCI card adapter	13
Installing the ExpressCard adapter	14
Connect the HD Express to your computer	15
Power-up/power-down sequence	15
Connect video inputs and outputs	16
Example HD Express video connections	18
Connect audio inputs and outputs	19
Example HD Express audio connections	20

PRECAUTIONS BEFORE YOU BEGIN

Installing the HD Express hardware requires the handling of sensitive electronic components that can be easily damaged by static electricity, even in the very small amounts generated by our bodies every time we move. Please take these basic precautions before and during installation to avoid permanently damaging your HD Express hardware:

- Completely review the installation procedure on the following pages before you begin the installation.
- Avoid wool or synthetic clothing, which tends to generate much more static electricity than cotton.
- Static electricity occurs much more readily in dry climate conditions. If you can, perform the installation with a relative humidity of at least 50%.
- Leave the HD Express PCIe host adapter in its antistatic bag until you are ready to install it.
- When you are ready to begin installation, have the PCIe adapter, still in its anti-static bag, close by so it is in within easy reach during installation.

- Before you begin, turn off the computer and unplug it from any power source. Do the same for any connected components (hard drives, etc.)

- When handling the HD Express PCI card adapter, hold it by the silver bulkhead, or by the edges of the circuit board. Be careful not to touch the components on the circuit board or the metal contacts on the insert tab.

INSTALLING THE PCI CARD ADAPTER

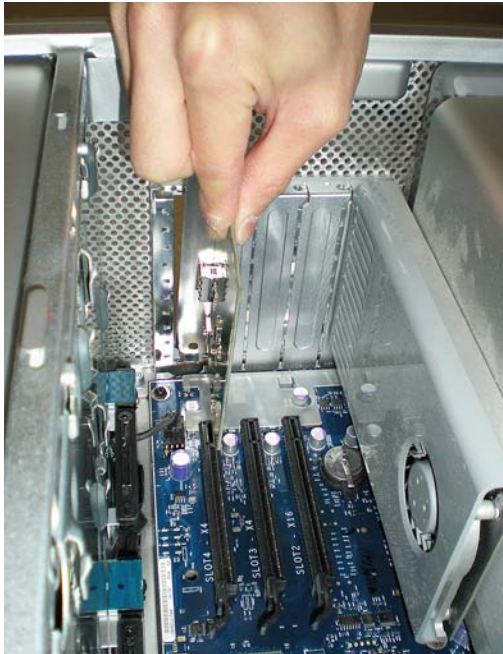
If you have a PCI Express card for the HD Express, install it as follows:

- 1 Switch off and unplug your computer.
 - ☛ Failure to do so may result in serious shock or injury.
- 2 Open your computer.
- 3 Find an available PCI slot.
- 4 Remove the slot cover, if necessary.
- 5 Before removing the HD Express PCI card from its anti-static bag, touch the power supply inside your computer to discharge any static electricity that may have built up on you.



- 6 Remove the HD Express PCI card from its anti-static bag.

- 7 Gently but firmly insert the card into any available PCI slot.



- 8 Secure the bulkhead of the card to the computer chassis with the bolt from the slot cover.

☛ We strongly recommend securing the HD Express PCI card in this manner. Doing so allows you to ensure secure connections to the card later on in the installation.

- 9 Place the cover back on your computer.

- 10 Reconnect the power cord to the computer before proceeding.

INSTALLING THE EXPRESSCARD ADAPTER

If you have a laptop ExpressCard adapter for the HD Express, you can install it as follows, with your laptop computer turned on or off:

- 1 Before removing the ExpressCard adapter from its anti-static bag, touch the metal chassis of your laptop computer to discharge any static electricity that may have built up on you.

- 2 Remove the ExpressCard adapter from its anti-static bag.

- 3 Insert the adapter into the ExpressCard slot on your laptop computer with the top of the ExpressCard (the side with the label on it) facing up and the mini-HDMI connector (the smaller of the two connectors) facing out.



- 4 Push the adapter into the slot until it clicks into place.

☛ Do not force the ExpressCard into the slot. If it does not easily slide into place, remove it and try again.

When the card is properly seated in the slot, it should be flush with the side of your laptop.

Removing the ExpressCard

To safely remove the ExpressCard adapter, first disconnect the HDMI cable, and then push the adapter inwards until you hear and feel it click. This releases it from its installed position and it should pop out of the slot far enough for you to grasp it and gently remove it. Immediately place it in its anti-static bag.

CONNECT THE HD EXPRESS TO YOUR COMPUTER

1 Plug one end of the supplied HDMI cable into the HDMI socket on the PCI card or ExpressCard adapter as shown below in Figure 3-1.



Figure 3-1: Connecting the HD Express to the computer.

☛ If you purchased the HD Express with an ExpressCard adapter, the included HDMI cable has a regular HDMI plug at one end and a smaller, mini-HDMI plug at the other end. Plug the mini-HDMI plug into the ExpressCard adapter.



2 Plug the other end of the HDMI cable into the HD Express I/O “PCIe CARD” jack as shown below in Figure 3-2.



Figure 3-2: Making the connection from the computer to the HD Express.



☛ When making the connection from the computer (Figure 3-1) to the interface (Figure 3-2), be sure to plug the HDMI cable into the jack labeled *PCIe CARD*, as shown in Figure 3-2. **DO NOT** plug it into the *HDMI OUT* jack. The computer must be connected to the *PCIe CARD* jack for proper operation.

POWER-UP/POWER-DOWN SEQUENCE

When using the HD Express rack-mount interface with the laptop ExpressCard adapter, operation is plug-and-play: you can disconnect and reconnect the interface, and freely switch it on or off as desired.

However, when using the PCIe card adapter on a desktop machine (connected to the PCIe card), the HD Express rack-mount interface must be connected and switched on before starting up the computer. Similarly, you must shut down the computer before switching off and/or disconnecting the HD Express. If the interface gets disconnected or switched off before computer shut-down, you'll need to restart the computer to bring the interface back on line.

CONNECT VIDEO INPUTS AND OUTPUTS

The HD Express provides a wealth of video input and output connectivity.

Support for both NTSC and PAL

The HD Express supports both NTSC and PAL formats on all inputs and outputs. It does not, however, convert between NTSC and PAL. Instead, it operates all inputs and outputs in one format or the other, as determined by the chosen video source. For details about choosing a video source, see “Input Source” on page 26.

S-video (Y/C) input

You have two choices for connecting S-video (Y/C) input: you can use the 4-pin mini-DIN jack on the HD Express front panel, or you can use the two RCA inputs on the rear panel labeled “Y” and “C”. Either way, be sure to make the corresponding Input Source setting in the software. See “Input Source” on page 26.

Connect any S-video source, including consumer or prosumer camcorders, desktop video converters, VTRs, etc. For best results, use standard, high-quality shielded RCA or 4-pin mini-DIN S-video cables.

You can connect the same device to both the input and output, or you can connect two separate devices (one to the input and the other to the output).

S-video (Y/C) output

Connect a monitor or other S-video output device to the RCA Y/C connectors on the rear panel. Be sure to make the necessary settings in the software to change the output of these connectors from component (the factory default format) to S-video. See “Analog Output Format” on page 28 for details.

Composite (CVBS) input

You have two choices for connecting composite (CVBS) input: you can use the RCA jack on the HD Express front panel labeled *VIDEO*, or you can use the RCA input on the rear panel labeled *CVBS*. Either way, be sure to make the corresponding Input Source setting in the software. See “Input Source” on page 26.

Connect any composite source, including consumer or prosumer camcorders, desktop video converters, VTRs, etc. For best results, use a standard, high-quality shielded video RCA cable. You can connect the same device to both the input and output, or you can connect two separate devices (one to the input and the other to the output).

Composite (CVBS) output

Connect a monitor or other composite output destination to the RCA CVBS connector on the rear panel. Be sure to make the necessary settings in the software to change the output of these connectors from component (the factory default format) to composite. See “Analog Output Format” on page 28 for details.



Figure 3-3: The HD Express video connectors.

Component

The *HD/SD Component* Section (Figure 3-3) provides either HD or SD component input and output. The HD Express provides 10-bit analog performance with 12-bit A/D and D/A converters. In general, component video signals tend to be higher quality than composite or S-video, so to take full advantage of the component format, be sure to use high quality shielded RCA cables.

Configuring the HD/SD Component section

The HD Express component input and output supports YPbPr or RGB operation, as shown by the labeling below the connectors in the *HD/SD Component* section. Accordingly, the input and output jacks in this section can be independently configured for one of three different analog video formats:

- Component RGB
- Component YPbPr
- Composite + S-video

This setting is made in the MOTU Video Setup software. For the component inputs, see “Input Source” on page 26. For the component outputs, see “Analog Output Format” on page 28. Be sure that the mode you choose for each bank matches the component video source or destination to which it is connected. If the device you are connecting supports both RGB and YPbPr, use YPbPr, as it is the standard for broadcast video.

☛ Analog YPbPr component video is sometimes referred to by other names, such as *YUV*, *Y/R-Y/B-Y* or *YCbCr*.

SD (480i) component formats

The HD Express supports four different SD component formats: SMPTE/EBU N10, Sony Beta, Sony Beta Japan and Panasonic MII. This setting is made in the MOTU Video Setup software. See “480i Component Levels” on page 29 and “480i Setup” on page 28. For PAL (576i) and HD component operation, the HD Express supports the industry standard SMPTE/EBU N10 specification.

HDMI

The HD Express provides HDMI input and output in professional, broadcast quality 10-bit 4:2:2 resolution. The input is ideal for capturing video from HDMI-equipped cameras, many of which send the video signal to their HDMI output before it is compressed in the camera.

The HDMI output can be connected to any device equipped with an HDMI input, such as a plasma screen, LCD screen or even a home theater receiver. The HD Express supports up to 8 channels of PCM (uncompressed) audio output via the HDMI connection for devices that can receive digital audio via HDMI.

DVI output

Using a HDMI-to-DVI cable, or a female HDMI-to-male DVI plug adaptor connected to one end of an HDMI-to-HDMI cable, you can connect the HD Express’s HDMI output to the DVI input of another device, such as a computer monitor. In addition to the cable connection, you also need to make a software setting that changes the HD Express’s HDMI output signal to the DVI format. See “HDMI format” on page 28.

EXAMPLE HD EXPRESS VIDEO CONNECTIONS

Here is an example of the types of video devices that you can connect to the HD Express. You can mix and match HD and SD sources and destinations, connect them all, and then choose the desired source from the MOTU Video Setup software.

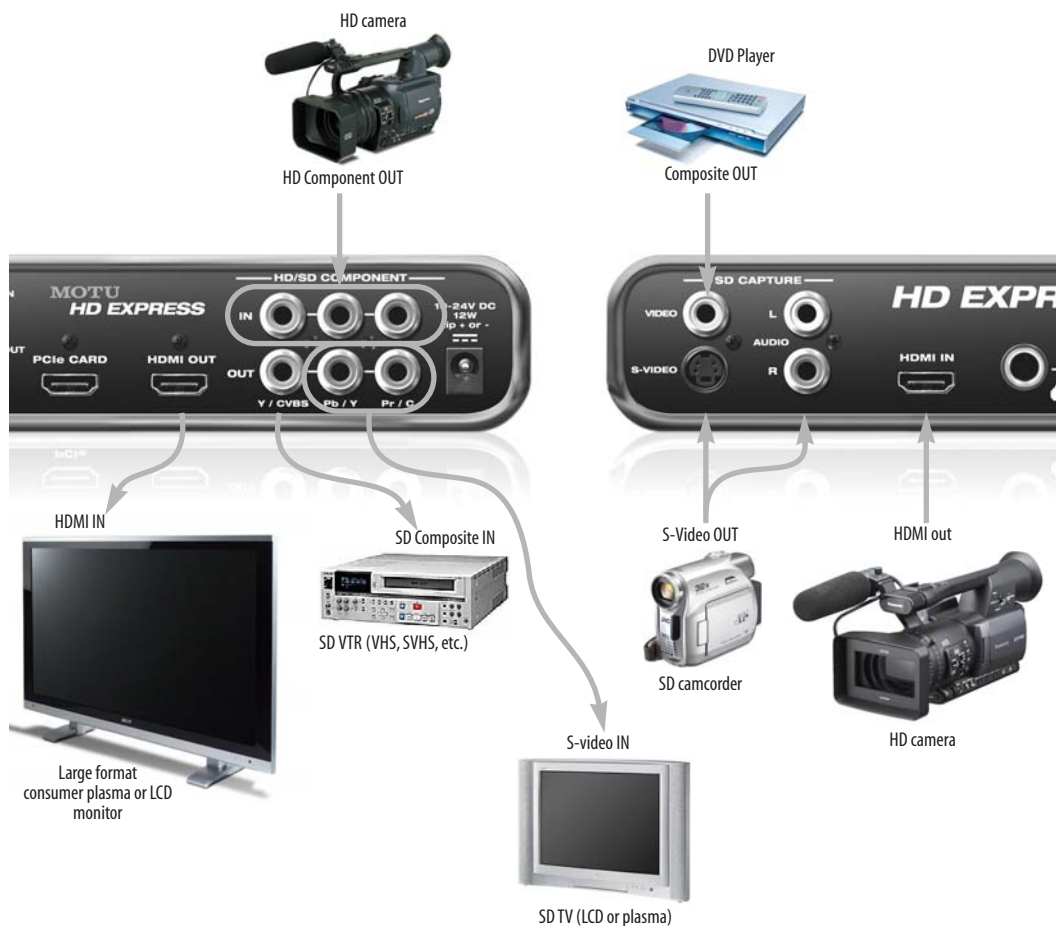


Figure 3-4: HD Express video connections.

CONNECT AUDIO INPUTS AND OUTPUTS

The HD Express provides the following audio input and output:

Audio format	Input channels	Output channels
96 kHz RCA analog	2	8
96 kHz S/PDIF digital	2	2
96 kHz embedded HDMI*	8	8

*HDMI audio is stereo at sample rates above 48kHz when playing or capturing SD video.

All twelve audio inputs are always active. For audio output, the HD Express provides two 8-channel banks (1-8 and 9-16). Both 8-channel output banks can be enabled at the same time, for a total of sixteen channels of simultaneous audio output. You can freely assign the 8-channel analog output, 8-channel HDMI output, and stereo S/PDIF output to either bank, as desired, for a total of sixteen channels of simultaneous audio output.

Analog audio I/O

The analog inputs are equipped with digitally controlled analog trims that provide +18 dB of gain and -10 dB of cut. To adjust these trims, see “Analog input trims” on page 31.

The eight RCA analog outputs (Figure 3-5) can be connected directly to powered speakers, a mixer or any other analog audio destination.

Stereo S/PDIF digital I/O

The stereo RCA S/PDIF input and output jacks provide digital audio input and output. Be sure to use digital audio-grade RCA cables.

Sample rate conversion (SRC)

The stereo S/PDIF input on the HD Express is sample-rate converted, so you do not need to worry about digital audio clocking issues when using it. Simply set the HD Express clock source as desired (see “Capture Clock Source” on page 27), and any digital audio transfers will be clean and trouble-free.

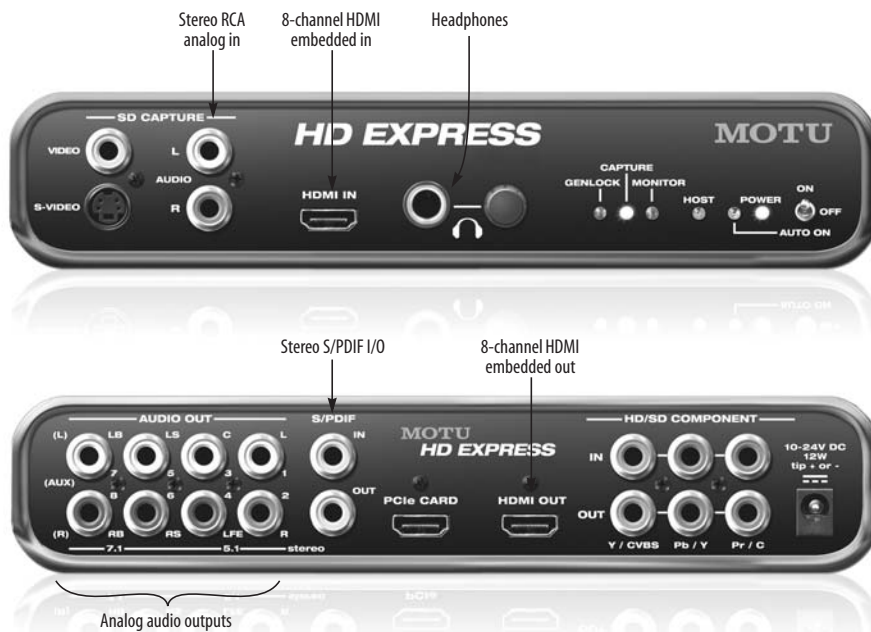


Figure 3-5: The HD Express audio connectors.

EXAMPLE HD EXPRESS AUDIO CONNECTIONS

Figure 3-6 shows an example of the types of audio connections you can make between other devices and the HD Express.



Figure 3-6: HD Express audio connections.

CHAPTER 4 Installing the HD Express Mac OS X Software

SOFTWARE INSTALLATION FOR MAC OS X

Install the HD Express software as follows:

- 1 Insert the HD Express Installer CD and launch the installer.
- 2 Follow the installer's directions.

What does the OS X installer do?

The installer checks the computer to make sure it satisfies the minimum system requirements for your MOTU PCI video interface. If so, the installer proceeds with the OS X installation. Drivers are installed, along with Final Cut Pro Easy Setups and several support applications, summarized in the table below.

HD Express Easy Setups for Final Cut Pro

Easy Setups are a convenient way to universally configure all of the crucial settings for the HD Express in Final Cut Pro, according to video format you choose for your project. The HD Express Easy Install option installs dozens of Easy Setups for your convenience.

Software component	Location	Purpose	For more information
MOTUPCIVideo.kext	/System/Library/Extensions	Driver for the HD Express. Provides support for video and audio.	-
MOTUVideo.component	/Library/Quicktime	Provides support for the HD Express's video features for QuickTime applications such as Final Cut Pro.	-
FCP MOTU RT Enabler.txt	/Library/Application Support/Final Cut Pro System Support/Plugins	Provides real time output to the HD Express's video outputs.	-
MOTU HD Express Easy Setups	Library/Application Support/Final Cut Pro System Support/Custom Settings/	Provides over 100 Easy Setups for Final Cut Pro's Easy Setup feature. These help you quickly configure Final Cut for the HD Express.	See "Easy setups" on page 34
MOTU Video Setup	Applications folder	Provides access to all of the HD Express's video and audio settings.	See chapter 6, "MOTU Video Setup" (page 25)

CHAPTER 5 HD Express Basics

TWO MODES

The HD Express provides two basic modes of operation:

- Capture
- Playback (monitor)

The current mode is clearly indicated by the Status area in MOTU Video Setup (Figure 6-1 on page 25), unless there is no genlock, in which case it will display a message explaining why not.

The HD Express is always either in Capture mode or Playback mode. If no application is actively capturing, previewing or playing back, the *Default Mode* setting (“Default Mode” on page 27) determines which mode the box is in.

CAPTURE

The HD Express is in *Capture* mode when it is successfully communicating with the computer (the HOST LED is illuminated) and video software has actively taken control of the HD Express hardware for the purposes of capturing video and audio from the HD Express. Here are some examples of when video software would put the HD Express into Capture mode:

- You open the Log and Capture window in Final Cut Pro. Or you use any Final Cut Pro feature, such as Edit to Tape, that involves capturing or previewing the live video input from the HD Express.
- You run the MOTU Video Setup software and click the Preview tab (Figure 6-1 on page 25, Figure 6-9 on page 30). This causes MOTU Video Setup to “take over” the video signal being supplied by the HD Express and display it in the preview window.

In capture mode, only one software application has access to the HD Express at a time. For example, you might use the MOTU Video Setup Preview tab to confirm that you have a good input signal, but when you then switch to Final Cut Pro and open its Log and Capture window, the Preview tab in MOTU Video Setup becomes inactive and will no longer display the input signal because Final Cut Pro has taken over video input. Closing Final Cut Pro’s Log and Capture window will re-activate the Preview tab. For further information, see “Preview tab” on page 30.

In Capture mode, the HD Express uses the Capture Clock Source setting (“Capture Clock Source” on page 27), and if it is set to Input Source, the input signal is passed through to the video outputs (SD in to SD out or HD in to HD out).

Even though the primary purpose of Capture mode is to feed video to the computer, the HD Express continues to send the source video signal to any video outputs that match the source format (HD or SD). This allows you to simultaneously monitor what you are capturing via the HD Express’s video outputs. You could even dub the source signal to a video deck or other video recorder during capture.

Live monitoring is only active when the Capture Clock Source setting (“Capture Clock Source” on page 27) is set to *Input Source*. When it is set to *Master (Internal)*, the HD Express outputs a black image (i.e. black burst) on all video outputs.

PLAYBACK (MONITOR)

The HD Express goes into *Playback* mode when an application is sending video to it. For example, Final Cut Pro puts the HD Express into playback

mode when *All Frames* or *Single Frames* is selected in the *External Video* sub-menu or when using *Print to Video*. When not playing or capturing, the HD Express reverts to the *Default Mode* setting (“Default Mode” on page 27).

In Playback mode, the HD Express uses the Playback Clock Source setting (“Playback Clock Source” on page 28), and if no application is playing back, will output black.

ONE SOURCE TO MANY OUTPUTS

The design of the HD Express allows you to choose a video input and the HD Express sends the signal to any outputs that match the input format (HD or SD). This allows you to simultaneously connect a number of input devices, such as cameras, video decks, DVD players, etc., along with a number of output devices, such as monitors, video decks and other destinations. Then choose the desired input device and the HD Express will feed that signal to all matching output destinations simultaneously.

Choosing the current video source

The MOTU Video Setup software lets you choose the current video source (input). For details, see “Input Source” on page 26.

Audio I/O and monitoring

On the audio side, the HD Express feeds audio input to the computer and plays audio back from the computer, so that you can easily capture and playback audio in Final Cut Pro.

The HD Express supports Final Cut Pro’s Preview feature (in the Clip Settings tab in the Capture window). When the *Preview* option is checked, incoming audio is “patched through” to the HD Express audio outputs. Make sure that the Mac system sound output device setting is set to the HD Express.

If you are capturing multi-channel audio and wish to monitor all channels on stereo headphones or speakers, you can enable the HD Express’s “Downmix to Output 1-2 on Capture” option (page 31).

CHAPTER 6 MOTU Video Setup

MOTU Video Setup (Figure 6-1) is installed in your Mac's Applications folder and provides convenient access to all HD Express settings from your computer desktop.

- Video format 26
- Input Source 26
- Status area 26
- Input status 26
- Genlock status 26
- Setup tab 27
- Preview tab 30
- Audio tab 31



Figure 6-1: MOTU Video Setup.

VIDEO FORMAT

The *Video Format* setting (Figure 6-1 on page 25) shows the format in which the HD Express is capturing or playing back video, and allows you to change the format manually. When capturing or playing video from Final Cut Pro, this setting will be changed automatically by the host application.

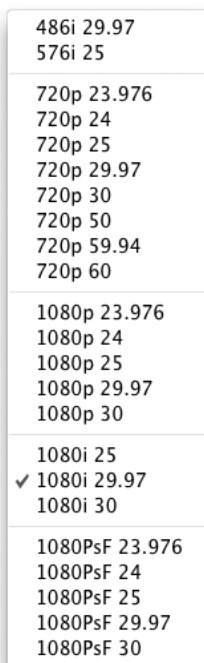


Figure 6-2: The Video Format menu.

INPUT SOURCE

The *Input Source* menu (Figure 6-1) is important because this is where you choose the video input from which the HD Express will capture. This input may also be used as the clock source for playback (see “Playback Clock Source” on page 28).

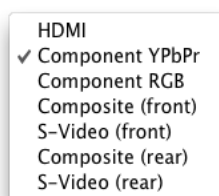


Figure 6-3: The Input Source menu.

The menu choices with *front* or *rear* in their names (Figure 6-3) refer to the video inputs on the front panel of the HD Express or the RCA video input connectors on the rear panel.

STATUS AREA

The Status area (Figure 6-1) displays what mode the HD Express is in. It also provides helpful status information and troubleshooting suggestions. For example, if there is no video signal because of a wrong setting, the Status area will tell you which setting(s) to check.

INPUT STATUS

The *Input Status* (Figure 6-1) indicates the video format detected on the currently chosen video Input Source.

GENLOCK STATUS

The *Genlock Status* (Figure 6-1) indicates when the HD Express has successfully achieved lockup to the currently selected clock source, which could be the HD Express’s internal clock or the current video input source.

SETUP TAB

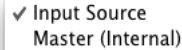
The *Setup* tab (Figure 6-4) provides several general settings for HD Express operation.

Default Mode

As explained in chapter 5, “HD Express Basics” (page 23), HD Express has two modes of operation: *Capture* and *Playback*. Your host video software determines the mode, depending on what you are doing (i.e. capturing or playing back the timeline). The *Default Mode* setting (Figure 6-1) lets you choose which mode the HD Express enters when the host relinquishes control over the HD Express hardware, such as when you quit or switch out of your host software. If you spend most of your time just monitoring or just capturing, operation will be faster if you set this to the mode you expect to use most.

Capture Clock Source

The *Capture Clock Source* setting (Figure 6-4) lets you specify the timing reference for the HD Express when it is in Capture mode. Two choices are provided in the menu, as shown below in Figure 6-5:



✓ Input Source
Master (Internal)

Figure 6-5: *Capture Clock Source* menu.

Input Source

Choose *Input Source* (Figure 6-5) when you wish to resolve the HD Express to the video signal being received on the currently chosen input in the *Input Source* menu (Figure 6-3).



Figure 6-4: *Setup* tab.

Color grading for playback

Master (Internal)

Choose *Master (Internal)* (Figure 6-5) to make the HD Express resolve to its own internal clock when capturing from a device (such as a deck) that is resolved to the HD Express's output. Because the deck is resolved to the HD Express, the video signal being captured from the deck is genlocked.

Playback Clock Source

The *Playback Clock Source* setting (Figure 6-1) lets you specify the timing reference for the HD Express when it is in Playback mode. Two choices are provided in the menu, as shown in Figure 6-6:

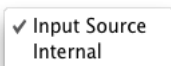


Figure 6-6: Playback Clock Source menu.

Input Source

Choose *Input Source* (Figure 6-6) when you wish to resolve the HD Express to the video signal being received on the currently chosen input in the *Input Source* menu (Figure 6-3) during playback.

Internal

Choose *Internal* (Figure 6-6) when you wish to resolve the HD Express to its own internal clock during playback.

Clock source when switching between Capture and Playback modes

When the HD Express switches its clock source, it may take a brief moment for it to resolve to the new source. If you need to frequently switch between Capture and Playback modes, set the capture and playback clock sources to one of these matching combinations:

Capture	Playback
Input Source	Input Source
Master (Internal)	Internal

With either of these combinations, you can switch back and forth between capture and playback without losing genlock. This ensures a smooth, quick, seamless transition when switching modes.

HDMI format

The *HDMI Format* menu (Figure 6-4) lets you choose the output format for the HDMI output on the rear panel of the HD Express. If you choose DVI, you'll need an HDMI-to-DVI cable or adapter.

Analog Output Format

The Analog Output Format menu (Figure 6-4) lets you configure the analog outputs as Composite and S-Video (*CVBS + S-Video Y/C*), Component YPbPr, or Component RGB.

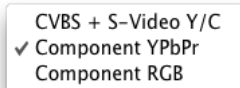


Figure 6-7: Analog Output Format menu.

Reset to Defaults

The *Reset to Defaults* button (Figure 6-4) restores all settings in the HD Express hardware to their original (factory) values.

Interlace Pause Mode

If you are working with an interlaced video format, the *Interlace Pause Mode* (Figure 6-4) lets you choose between viewing a *Full Frame* or individual *Fields* (1 or 2) when Final Cut Pro parks on a frame. Clicking on these buttons will not bring the MOTU Video Setup application to the front, so you can switch between fields, or between Full Frame and Single Fields modes, while Final Cut Pro is the front application.

480i Setup

The *480i Setup* option (Figure 6-4) lets you choose between *USA (7.5%)* and *Japan (0%)* for NTSC composite and S-video input and output.

480i Component Levels

The *480i Component Levels* option (Figure 6-4) lets you specify the voltage level standard for the HD Express's SD component inputs and outputs when running at 480i (NTSC). Choices are: EBU N10, Sony Beta, Sony Beta Japan and Panasonic MII. Choose the format that best matches the device(s) connected to the SD component input and output.

Color grading

In the *Color Grading* section (Figure 6-4), there are ten parameters which define a color transfer function, as defined by the *American Society of Cinematographers Color Decision List* (ASC CDL) specification.

The color grading controls in the Setup tab (Figure 6-4) define a transfer function which applies to the output on playback. The controls in the Preview pane (Figure 6-9) define a transfer function which applies to the input on capture. In this case, it affects pass through as well as capture.

The power switch icon (Figure 6-8) is an enable/bypass control. Click it to turn the color grading on or off.

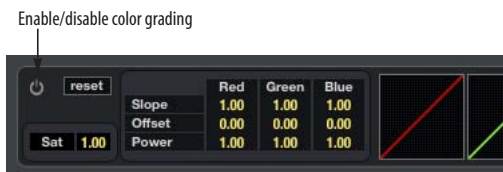


Figure 6-8: Color lookup table controls.

The *Reset* button resets the transfer function to its default, which passes through each pixel unchanged, and also switches to bypass mode.

Changing any control automatically enables the transfer function, but you can also toggle between *Enabled* and *Bypassed* by clicking on the enable/bypass control.

The *Sat* parameter is ASC CDL Saturation. A value of 1.0 passes each pixel through unchanged. Values below 1.0 will desaturate, with 0.0 resulting in a monochrome image. Values greater than 1.0 increases saturation. The maximum legal value is 10.0, which produces extreme results.

The *Slope*, *Offset*, and *Power* parameters for each component define a transfer function for that component, as per the ASC CDL specification. *Offset* ranges from -1 to +1, with a default of 0. *Power* and *Slope* range from 0.10 to 10.00, with a default of 1.0.

Each of the numeric controls may be modified in three ways:

- If the console window is in front, click on a control to select it, and type a new value
- Click and drag up or down
- Use the mouse wheel

The latter two methods will work even if the window is not in front (which is useful for adjusting playback controls, because it can be done while another application such as Final Cut remains the front-most application).

The capture color correction controls (in the Preview tab) only appear over the preview when the mouse is over the preview. The panel holding the capture color correction controls can be dragged around within the preview pane, allowing you to see any part of the preview while adjusting the controls. To drag it, click on any part of the panel other than one of the buttons or numeric controls.

PREVIEW TAB

The *Preview* tab (Figure 6-9) lets you preview the video signal being received from the currently selected input in the Input Source menu (Figure 6-3 on page 26).

If you don't see the source video signal

If you have trouble getting the source video signal to appear in the preview frame, make sure the Final Cut Pro Capture window isn't open in the background. If so, the Status area (Figure 6-1 on page 25) will alert you to the fact that the host application is currently capturing or previewing.

The Preview tab and Final Cut Pro

Final Cut Pro takes over the HD Express hardware when it is the front-most (active) application. Therefore, the preview window only works when MOTU Video Setup is active. In this case, Final Cut

Pro releases the HD Express hardware, so you won't be able to capture or play anything in Final Cut Pro while MOTU Video Setup is the active application.

To reestablish communication with Final Cut Pro, simply switch back into Final Cut Pro.

Color grading

See "Color grading" on page 29. You can drag this control panel anywhere you wish on the preview pane.

Brightness, Contrast and Hue

When previewing a Composite or S-Video signal, the *Preview* tab provides several settings for adjusting the *Brightness*, *Contrast* and *Hue*, as shown in Figure 6-9 below.



Figure 6-9: The Preview tab.

AUDIO TAB

The Audio tab (Figure 6-10) provides access to the HD Express's audio features. The HD Express provides 12 channels of audio input and 16 channels (two 8-channel banks) of simultaneous audio output. For a summary of audio bank formats, see “Connect audio inputs and outputs” on page 19.

Sample rate

Choose the audio sample rate (Figure 6-10) for capture or playback. Make sure this setting matches the rate of the audio being captured or played back. Sample rates up to 96 kHz are supported, with the following restriction:

☛ The HDMI input and output are stereo at sample rates above 48000 Hz when playing SD video.

You can alternately make the sample rate setting in Final Cut Pro.

Downmix to Output 1-2 on Capture

If *Downmix to Output 1-2 on Capture* is selected (Figure 6-10), all audio inputs are mixed down to outputs 1 and 2. This lets you monitor any/all input channels while capturing. For example, you could monitor S/PDIF input (channels 11-12) and/or HDMI input (channels 3-10) on headphones (and analog outs 1-2) while capturing in Final Cut Pro.

Analog input trims

Use the analog input trim controls (Figure 6-10) to apply up to +18 dB of gain or -10 dB of cut to each individual analog input.



Figure 6-10: Audio tab.

Outputs

Use the buttons provided to assign each audio output format to the desired HD Express output channel bank (1-8 or 9-16). You can assign two or more formats to the same bank, in which case the audio output is mirrored (duplicated) on each output format. For S/PDIF digital output, the stereo channels are assigned to either channels 1-2 or 9-10.

Mirroring output banks

To make two or more output banks produce the same audio output, simply assign them to the same output bank (either 1-8 or 9-16).

Disabling output banks

To disable a bank completely, click its *Off* button.

CHAPTER 7 Final Cut Pro

OVERVIEW

The HD Express serves as a powerful video capture and playback device for Apple Final Cut Pro. Operation is straightforward and follows the general workflow prescribed by Final Cut Pro. In addition to standard log and capture procedures and straightforward timeline playback, the HD Express also provides presets for Easy Setup, Sequences, and Capture.

The HD Express supports full-raster HD capture to uncompressed, Apple ProRes or any other codec of your choice.

Familiarity with Final Cut Pro	33
Before you launch Final Cut Pro	33
Getting started	33
Easy setups	34
Final Cut Pro Audio/Video Settings	34
Choosing a workflow	35
HD Express hardware settings	35
Log and capture	36
Playback and monitoring	37
HD Express audio settings	38
Audio capture	38
Audio playback	39
Refresh A/V Device	39

FAMILIARITY WITH FINAL CUT PRO

This chapter assumes that you have a working knowledge of basic Final Cut Pro operation.

BEFORE YOU LAUNCH FINAL CUT PRO

Before you launch Final Cut Pro, be sure to:

- Insert the HD Express Installer CD and run the Easy Install option.
- Install the HD Express hardware and connect your video devices to it as explained in chapter 3, “Installing the HD Express Hardware” (page 13).

- Switch on the HD Express and run MOTU Video Setup to make sure that installation has been successful. If MOTU Video Setup launches without any error messages, then Final Cut Pro should successfully communicate with the HD Express. If you see error messages, refer to Appendix A, “Troubleshooting” page (41).

GETTING STARTED

You are now ready to run Final Cut Pro.

- 1 Launch Final Cut Pro.
- 2 Create a new project using Final Cut Pro’s Easy Setup feature in the Final Cut Pro menu. See the next section for details about Easy Setups.



Figure 7-1: The HD Express ships with over 100 Easy Setups for the many formats and operating scenarios it supports.

EASY SETUPS

There are four settings in Final Cut Pro that directly impact HD Express operation:

- Sequence preset
- Capture preset
- Video Playback
- Audio Playback

Easy Setup (Figure 7-1) is a convenient way to universally configure all of these settings according to the video format you have chosen for your Final Cut Pro project. Once you've chosen a HD Express Easy Setup, you can modify it as needed in Final Cut Pro's *Audio/Video Settings* window (Figure 7-2).

FINAL CUT PRO AUDIO/VIDEO SETTINGS

To set up Final Cut Pro manually, without using an Easy Setup, or to adjust the settings for an Easy Setup, simply go to Final Cut Pro's *Audio/Video Settings* window (Figure 7-2) and individually select the HD Express's capture and sequence presets. The HD Express presets are identified by either *HD Express* or *MOTU* in their name. If you don't see a preset for the capture or playback scenario you need, this doesn't necessarily mean it's not supported. It probably is, and you can create your own. See "Creating capture/playback presets" on page 37.

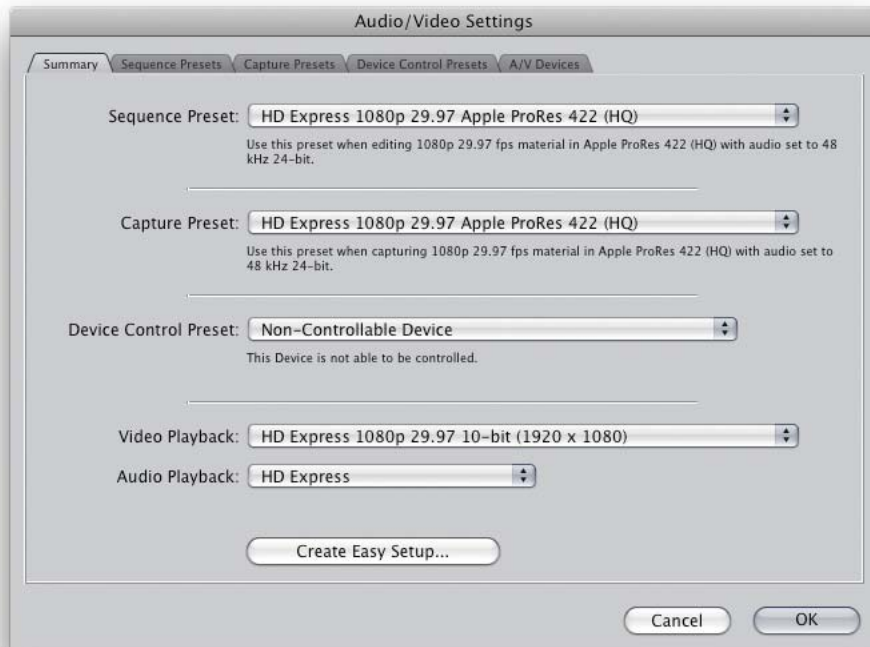


Figure 7-2: HD Express Easy Setup settings can be adjusted in Final Cut Pro's *Audio/Video Settings* window.

CHOOSING A WORKFLOW

The HD Express supports a range of SD and HD workflows. For uncompressed HD or SD, all DVCPro formats and Apple ProRes, the HD Express provides sequence and capture presets for all supported format/frame rate/codec combinations. Other codecs require that you make your own custom sequence settings. Refer to the following sections for further information regarding each workflow. Also see “Video encoding and CPU performance during capture” on page 36.

Uncompressed HD/SD

The HD Express supports 8-bit and 10-bit uncompressed HD or SD capture and playback in all supported HD and SD formats. Choose the sequence preset and capture preset that corresponds with the format you need to capture, edit and play back.

☛ Capture and playback of uncompressed HD requires a high-performance RAID array.

Apple ProRes 422

The HD Express supports Apple ProRes 422 capture and playback. When capturing ProRes, Final Cut Pro requires an Intel-based multi-processor Mac, and four or more processor cores are recommended. For ProRes operation, be sure to choose the *HD Express Apple ProRes 422* presets (for the sequence, capturing and playback) that correspond with the video format and frame rate you are working with. If your computer experiences performance issues during capture or playback, you may need a faster computer, a faster hard drive, or a capture drive with less disk fragmentation.

DVCPro25 / DVCPro50 / DVCProHD

The HD Express provides capture and playback of DVCPro25, DVCPro50 or DVCProHD. Choose the sequence and capture presets that correspond with the video format, frame rate and DVCPro format

you need to capture, edit and play back. To play back DVCPro codecs, be sure to select the 8-bit video playback preset for the corresponding video format. Or simply use the appropriate HD Express Easy Setup.

Other codecs

The HD Express supports capture and playback of any HD or SD codec supported by Final Cut Pro, including the file-based formats now supported by Sony, Panasonic and other camera manufacturers. To specify a codec other than ProRes or DVCProHD, choose the HD Express Apple ProRes preset that most closely matches the video format and frame rate you wish to use, duplicate it and then simply modify the duplicate preset, choosing a different codec from the *Compressor* menu. For further details about creating your own presets, see “Creating capture/playback presets” on page 37.

HD EXPRESS HARDWARE SETTINGS

Once you’ve chosen a workflow and the corresponding presets in Final Cut Pro’s Easy Setup and Audio/Video Settings windows (Figure 7-1 and Figure 7-2), open the MOTU Video Setup application (Figure 6-1 on page 25) to view the HD Express’s hardware settings and make any adjustments, if necessary.

Basic hardware settings

Check these basic hardware settings:

- “Video format” on page 26
- “Input Source” on page 26
- “Capture Clock Source” on page 27
- “Playback Clock Source” on page 28

Other input/capture settings

To access the HD Express’s capture settings, click the Setup tab (Figure 6-4 on page 27) and Preview tab (Figure 6-9 on page 30).

Playback settings

Click the Setup tab (Figure 6-4 on page 27) to view playback settings.

If you want Final Cut Pro to resolve to an external video source during playback, choose *Input Source* from the *Clock Source* menu (Figure 6-5 on page 27); otherwise, leave it set to *Internal*.

For details on other playback settings, review Chapter 6, “MOTU Video Setup” (page 25).

LOG AND CAPTURE

Once you’ve decided on a workflow, chosen the corresponding Easy Setup preset for your Final Cut Pro project and specified the video input you wish to capture in MOTU Video Setup, you are ready to log and capture video from the HD Express:

- 1 Choose Log and Capture from the File menu.

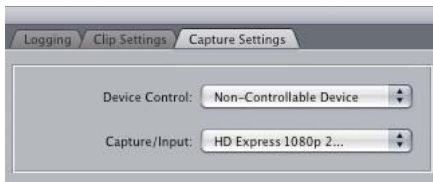


Figure 7-3: The Capture Settings tab with HD Express preset chosen.

- 2 Click the *Capture Settings* tab (Figure 7-3) and check the *Capture/Input* setting.

This setting is pre-configured if you created your Final Cut Pro project using a HD Express Easy Setup.

- 3 Click the *Now* button to start the capture.

Refer to Part IV of the Final Cut Pro manual for more information on advanced capture settings.



Figure 7-4: Click the 'Now' button to begin capture.

Video encoding and CPU performance during capture

If you are capturing uncompressed HD or SD, the uncompressed video stream goes straight to your hard drive, with no compression or encoding required along the way.

- The real-time capture of uncompressed HD requires very fast disk storage, such as a disk RAID array or fibre-optic drive array.

When you are capturing Apple ProRes 422, Final Cut Pro performs the encoding in real time during capture. Given today’s Intel processor speeds, ProRes requires approximately one Intel CPU core to perform this task, depending on the ProRes quality mode (standard or HQ), the speed of the processors, and other related factors. Your performance will vary, but generally speaking, ProRes 422 standard quality capture requires a computer with at least two Intel core processors; four cores or more are recommended. ProRes 422 HQ quality requires a computer with four Intel cores or more for reliable performance.

If you have chosen to capture to an HD codec other than Apple ProRes, such as DVCPRO, the situation is similar to ProRes capture, described above. Final Cut Pro does the work of compressing the video stream, and so the computer’s CPU performance must be good enough to handle the real-time encoding. Again, your performance will vary, depending on the codec you have chosen, core processor speeds, etc. If you have a four- or eight-core machine, however, you should be able to readily capture in just about any format you wish.

PLAYBACK AND MONITORING

To play back your Final Cut Pro project and view it on any monitor or other device connected to the HD Express's video outputs:

- 1 Choose *View menu > External Video >* and make sure that the All Frames item (command-F12) is checked.
- 2 Start playback.

Video decoding and CPU performance during playback

If you are playing uncompressed HD or SD from the Final Cut Pro timeline, the uncompressed video stream goes straight to the HD Express, with no compression or encoding required along the way.

When you play back an Apple ProRes 422 Final Cut Pro sequence, or any other codec, Final Cut Pro performs real-time transcoding. Given today's Intel processor speeds, ProRes requires approximately one Intel CPU core to perform this task, depending on the ProRes quality mode (standard or HQ), the speed of the processors, and other related factors. Your performance will vary, but generally speaking, ProRes 422 standard quality playback requires a computer with at least

two Intel core processors; four cores or more are recommended. ProRes 422 HQ quality requires a computer with four Intel cores or more.

When you play back a Final Cut Pro timeline with an HD codec other than ProRes, the situation is similar to ProRes playback, described above. Final Cut Pro does the work of transcoding the video stream, and so the computer's CPU performance must be good enough to handle the real-time transcoding. Again, your performance will vary, depending on the codec you have chosen, core processor speeds, etc. If you have a four- or eight-core machine, however, you should be able to play back just about any video format you wish.

CREATING CAPTURE/PLAYBACK PRESETS

If the capture or playback preset menus don't have the preset you are looking for, you can create your own presets.

To create capture presets, go to the Audio/Video Settings window, click the Capture Presets tab (Figure 7-2), select an existing HD Express preset (it doesn't matter which one) and click the *Duplicate* button. Modify the settings as desired.

The procedure for creating sequence/playback presets (in the Sequence Presets tab) is similar.

HD EXPRESS AUDIO SETTINGS

To access basic HD Express audio settings:

- 1 Choose *Final Cut Pro menu > Audio/Video Settings*.
- 2 Select the *A/V Devices* tab.
- 3 Choose the HD Express for audio playback.
- 4 Click the *Options* button to set the sample rate. This setting will modify the HD Express hardware so that it matches the setting in Final Cut Pro.

You can verify the HD Express's audio settings in the Audio tab (Figure 6-10 on page 31).

Choosing audio banks

The HD Express provides two 8-channel banks of simultaneous audio output: Bank A (channels 1-8) and Bank B (channels 9-16). Use the settings in the Audio tab (Figure 6-10 on page 31) to assigned the desired audio formats to each output bank.

In Final Cut Pro, the HD Express's channels are simply numbered 1, 2, 3, 4, etc. and correspond to the HD Express channel numbers 1-8 and 9-16. For example, you might make the following audio bank assignments in the Audio tab:

	Bank A (1-8)	Bank B (9-16)
Output	Analog (RCA)	HDMI embedded S/PDIF digital

In this example, Final Cut Pro outputs 1-8 are assigned to RCA analog, and outputs 9-16 are assigned to HDMI embedded, plus S/PDIF digital, which will output channels 9-10.

AUDIO CAPTURE

The HD Express provides twelve channels of input: stereo analog (on the front-panel RCA connectors), eight channels of HDMI embedded, and stereo S/PDIF digital input. To capture from these inputs in Final Cut Pro:

- 1 In Final Cut Pro's Log and capture window, click the *Clip Settings* tab.



Figure 7-5: Clip Settings tab.

The channels in the list (Figure 7-5) correspond to the HD Express inputs as follows:

Final Cut Pro input channels	HD Express inputs
1-2	Analog 1-2
3-10	HDMI embedded
11-12	S/PDIF digital

2 Use the arm/disarm buttons next to each channel number (Figure 7-5) to choose which HD Express audio inputs to record.

3 Enable the *Preview* check box in the Audio section (Figure 7-5). When the *Preview* option is checked, incoming audio is “patched through” to the HD Express audio outputs. Make sure that the Mac system sound output device setting is set to the HD Express for this to work.

4 If you are capturing multi-channel audio, or if you are capturing from the HDMI or S/PDIF inputs, and wish to monitor all channels on stereo headphones or speakers, enabled “Downmix to Output 1-2 on Capture” option (page 31).

AUDIO PLAYBACK

To play back audio:

1 Choose *View menu > Audio Playback > HD Express*.

2 In the Sequences window, select your sequence.

3 Choose *Sequence menu > Settings*.

4 Click the *Audio Outputs* tab and configure the outputs as needed. Consult your Final Cut Pro documentation for details.

5 Go to the Audio Mixer to assign each audio track to the desired HD Express audio output, or right-click on the *Toggle Auto Select* icon next to each audio track in the track Time Line window.

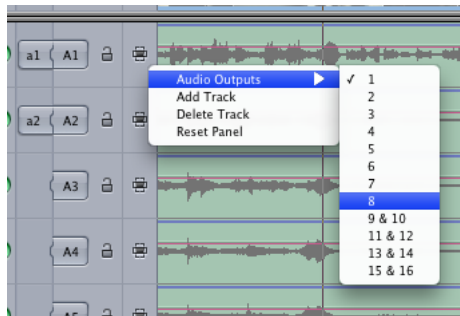
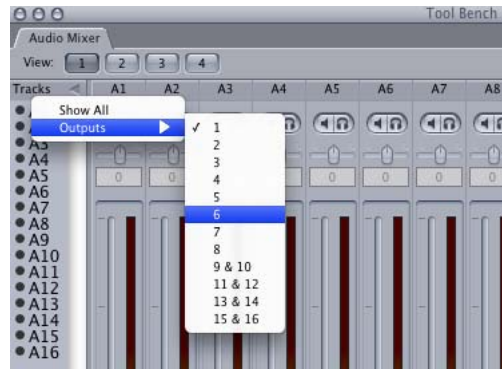


Figure 7-6: Assigning audio tracks to HD Express audio outputs.

REFRESH A/V DEVICE

If the connection with the hardware is disrupted for some reason, you can bring the HD Express back on line by choosing *View menu > Refresh A/V Devices*.

APPENDIX A Troubleshooting

USE THE STATUS DISPLAY

Use the Status display in MOTU Video Setup (Figure 6-1 on page 25) for help with various issues having to do with capture, playback, sync and other aspects of HD Express operation. MOTU Video Setup is engineered to detect problems and report them in the Status area. Most common issues can be resolved by following the instructions given by the Status display.

FREQUENTLY ASKED QUESTIONS

I see the following error message in Final Cut Pro: Unable to locate external device. Why?

If you see the error message below when operating the HD Express with Final Cut Pro, it means that Final Cut Pro has lost communication with the HD Express hardware. Check your HD Express hardware and cable connections, and then restart your Mac.

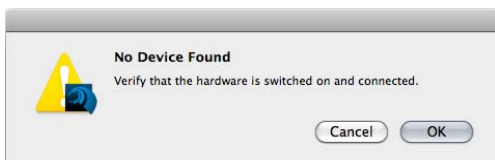


Figure A-1: If you see this message check your hardware and cable connections.

MOTU Video Setup cannot detect the HD Express. Why not?

Is the HD Express connected to the PCIe card adapter installed in a desktop computer? If so, did the HD Express breakout interface get disconnected or powered off while the computer is still powered on? In this case, you need to shut down the computer, plug in the interface, switch it on and then power up the computer. The breakout interface must remain connected and powered on while the computer is running. The HD Express's Auto On mode lets you leave the power switch on,

and the interface will power up and power down with your computer. See page 5 for details on Auto On mode.

Connecting or powering gear during operation

It is not recommended that you connect, disconnect, or power on/off devices connected to the HD Express while recording or playing back audio. Doing so may cause a brief glitch in the audio.

The HD Express is having trouble genlocking to my video deck.

Is the deck connected to a video output from the HD Express? If so, it could be a clock loop problem, where the deck is trying to resolve to its video input, while the HD Express is trying to resolve to video input from the video deck. See “Master (Internal)” on page 28.

I experience glitching in my video signal when switching between Capture and Playback.

See “Clock source when switching between Capture and Playback modes” on page 28.

My reference monitor(s) connected to the HD Express only displays single frames.

Make sure All Frames is selected in the View>External Video menu in Final Cut Pro.

My reference monitor(s) connected to the HD Express does not output any video.

Make sure the Final Cut Pro MOTU RT Enabler is properly installed in Library\Application Support\Final Cut Pro System Support\Plugins.

My HDMI output does not output any video.

Make sure the HDMI Format setting is set to HDMI, not DVI.

CUSTOMER SERVICE

We are happy to provide customer service to our registered users. If you haven't already done so, please take a moment to register on line at motu.com/register, or fill out and mail the registration card included with your HD Express. Doing so entitles you to technical support and notices about new products and software updates.

TECHNICAL SUPPORT

If you are unable, with your dealer's help, to solve problems you encounter with the HD Express system, you may contact our technical support department in one of the following ways:

- Tech support hotline: (617) 576-2760 (Monday through Friday, 9 am to 6 pm EST)
- Tech support 24-hour fax line: (617) 354-3068
- Online support: www.motu.com/support

Please provide the following information to help us solve your problem as quickly as possible:

- The serial number of the HD Express system. This is printed on a sticker placed on the bottom of the HD Express rack unit. You must be able to supply this number to receive technical support.
- A brief explanation of the problem, including the exact sequence of actions which cause it, and the contents of any error messages which appear on the screen.
- The pages in the manual which refer to the parts of the HD Express with which you are having trouble.
- Mac OS X version information.

We're not able to solve every problem immediately, but a quick call to us may yield a suggestion for a problem which you might otherwise spend hours trying to track down.

If you have features or ideas you would like to see implemented, we'd like to hear from you. Please visit motu.com/suggestions or write to the HD Express Development Team, MOTU Inc., 1280 Massachusetts Avenue, Cambridge, MA 02138.

APPENDIX B Video Formats

The HD Express supports these formats:

SD

480i 29.97 10-bit (720 x 480)

480i 29.97 8-bit (720 x 480)

486i 29.97 10-bit (720 x 486)

486i 29.97 8-bit (720 x 486)

576i 25 10-bit (720 x 576)

576i 25 8-bit (720 x 576)

720 HD

720p 23.976 10-bit (1280 x 720)

720p 23.976 8-bit (1280 x 720)

720p 24 10-bit (1280 x 720)

720p 24 8-bit (1280 x 720)

720p 25 10-bit (1280 x 720)

720p 25 8-bit (1280 x 720)

720p 29.97 10-bit (1280 x 720)

720p 29.97 8-bit (1280 x 720)

720p 3010-bit (1280 x 720)

720p 30 8-bit (1280 x 720)

720p 50 10-bit (1280 x 720)

720p 50 8-bit (1280 x 720)

720p 59.94 10-bit (1280 x 720)

720p 59.94 8-bit (1280 x 720)

720p 60 10-bit (1280 x 720)

720p 60 8-bit (1280 x 720)

1080 HD

1080i 25 10-bit (1920 x 1080)

1080i 25 8-bit (1920 x 1080)

1080i 29.97 10-bit (1920 x 1080)

1080i 29.97 8-bit (1920 x 1080)

1080i 30 10-bit (1920 x 1080)

1080i 30 8-bit (1920 x 1080)

1080p 23.976 10-bit (1920 x 1080)

1080p 23.976 8-bit (1920 x 1080)

1080p 24 10-bit (1920 x 1080)

1080p 24 8-bit (1920 x 1080)

1080p 25 10-bit (1920 x 1080)

1080p 25 8-bit (1920 x 1080)

1080p 29.97 10-bit (1920 x 1080)

1080p 29.97 8-bit (1920 x 1080)

1080p 30 10-bit (1920 x 1080)

1080p 30 8-bit (1920 x 1080)

1080PsF 23.976 10-bit (1920 x 1080)

1080PsF 23.976 8-bit (1920 x 1080)

1080PsF 24 10-bit (1920 x 1080)

1080PsF 24 8-bit (1920 x 1080)

1080PsF 25 10-bit (1920 x 1080)

1080PsF 25 8-bit (1920 x 1080)

1080PsF 29.97 10-bit (1920 x 1080)

1080PsF 29.97 8-bit (1920 x 1080)

1080PsF 30 10-bit (1920 x 1080)

1080PsF 30 8-bit (1920 x 1080)

APPENDIX C HD Express Specifications

VIDEO I/O

- 1 x HDMI in and out (4:2:2 10-bit, YUV)
- Support for DVI output with HDMI-to-DVI adapter (sold separately)
- 1 x HD/SD component in and out (10-bit, YPbPr or RGB) on RCAs
- 1 x composite in (10-bit) on RCA
- 1 x S-Video in (10-bit) on 4-pin mini-DIN
- 1 x composite in and out (10-bit CVBS) on shared RCA
- 1 x S-Video in and out (10-bit Y/C) on shared RCA

VIDEO FORMATS

- SD — 576i25 (PAL) and 486i29.97 (NTSC)
- HD — 720p23.976, 720p24, 720p25, 720p29.97, 720p30, 720p50, 720p59.94, 720p60, 1080p23.976, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080PsF23.976, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 1080i25, 1080i29.97, 1080i30
- Supported Final Cut Pro HD formats — Apple ProRes or uncompressed HD (8-bit or 10-bit), DVCPProHD 720p at all eight frame rates listed above, plus full-raster (1920 x 1080) ProRes or DVCPProHD 1080 (1280 and 1440 rasters) at all 1080 frame rates listed above
- Supported Final Cut SD formats — Uncompressed 8-bit and 10-bit, DVCPPro and DVCPPro 50 at 486i29.97 and 576i25

AUDIO I/O

- 12 channels of simultaneous audio input
- 16 channels of simultaneous audio output

- Supports all standard audio sample rates from 44.1 to 96kHz
- 8 x RCA out via direct connection (no breakout cable)
- 2 x RCA analog input on the front panel for SD Composite/S-Video capture
- 2 x S/PDIF digital in and out on RCA connectors
- 8 x HDMI embedded audio in and out
- Front panel headphone jack with dedicated volume control

POWER

- International auto-switching internal power supply

INCLUDED SOFTWARE AND COMPATIBILITY

- MOTU Video Setup software — provides complete control of all programmable features and settings.
- Supports Final Cut Pro 6.0.5 or later

- 3D LUT 29
- 480i
 - component 17
- Component Levels 29
- Setup option 28
- 96kHz operation
- S/PDIF 19

A

- Analog
 - audio connectors 19
 - connectors 6
 - input trims 31
 - video connectors 6
- Analog inputs/outputs 6
- Analog Output Format 28
- Apple ProRes 422 9, 35
- ASC CDL 29
- Audio
 - analog connections 19
 - capture in Final Cut Pro 38
 - connections 20
 - connectors 19
 - disabling banks 32
 - embedded 6
 - features 24
 - Final Cut Pro settings 38
 - input trims 31
 - mirroring outputs 32
 - monitoring 20
 - output 32
 - overview 24
 - playback from Final Cut Pro 39
 - S/PDIF connections 19
 - sample rate 31
 - sample rate conversion 19
 - tab 31
- Auto On 5

B

- Brightness option 30

C

- Cables
 - PCIe cable length 6
- Camcorders
 - connecting 18, 20
- Capture
 - Clock Source setting 27
 - LED (front panel) 5
 - supported video formats 43
- Capture mode 23, 27
- CDL 29
- Codecs
 - other 35
 - supported 35
- Color Decision List 29
- Component 17
 - analog format options 17
 - connectors 6
 - Levels 29
 - output color format settings 28
 - RGB 17
 - YPbPr 17
- Composite
 - connectors 6, 16
 - example 18
- Computer
 - connecting the HD Express 15
- Contrast option 30
- Customer support 42
- CVBS
 - connectors 16

D

- Default Mode 27
- DLP display
 - connecting 6
- Downmix to Output 1-2 on Capture 31
- DVCPro 35
 - supported formats 43
- DVD Player
 - connecting 18
- DVI
 - cable requirements 17
 - connector 6, 17
 - output 17
 - output setting 28

E

- Easy Setups 34
 - installing 21
- EBU N10 29
- Embedded audio
 - HDMI 6, 17
- ExpressCard
 - connecting to HD Express interface 6
 - installation 14
 - power-up/power-down 15
 - removal 14

F

- FCP MOTU RT Enabler.txt 21
- Field 1/2 options 28
- Final Cut Pro 33-39
 - audio 24
 - audio capture 38
 - audio playback 34, 39
 - audio settings 38
 - Audio/Video Settings 34
 - capture 23
 - capture presets 34
 - capture settings 35, 36
 - clock source during capture 27
 - clock source during playback 28
 - easy setups 21, 34
 - installing drivers & easy setups 21
 - Log and capture 36
 - monitoring 37
 - playback 23, 37
 - playback settings in HD Express hardware 27
 - preparation 33

- preview feature 24
- Refresh A/V Devices option 39
- Sequence presets 34
- supported video formats 43
- troubleshooting 41
- video playback 34

G

- Genlock
 - indicator (Video Setup software) 25, 26
 - LED (front panel) 5

H

- HD
 - Analog Output Format 28
 - component connectors 6
 - ExpressCard installation 14
 - ExpressCard power up/down 15
 - ExpressCard removal 14
 - supported formats 43
- HD Express
 - basic operation 24
 - capture clock source 27
 - capture mode 23
 - installing 13
 - playback clock source 28
 - playback mode 23
 - software installation 21
 - summary of features 9

- HDCCP 5

- HDMI

- DVI output 17
- embedded audio 17
- format menu 28
- HDCCP 5
- input 5, 17
- output 6, 17
- PCIe CARD connector 15

- Headphone jack 5

- Host LED 5

- Hue option 30

I

- Input
 - indicator (Video Setup software) 25, 26
 - source menu 26
- Input Source (Capture Clock option) 27
- Input Source (Playback Clock option) 28
- Inputs
 - analog 6
 - trims 31
- Installation
 - Easy Setups 21
 - hardware 13
 - precautions 13
 - software 21
- Interlace Pause Mode 28
- Interlaced Field When Paused options 28
- Internal (Playback Clock option) 28

J

Japan (0.0%) option 28

L

LCD display
example 18
Log and capture 36

M

Mac OS X
software installation 21
system requirements 11
Master (Internal) sync setting 28
Mirroring audio banks 32
MODE LEDs 5
Monitor
LED (front panel) 5
Monitoring
Final Cut Pro 37
Monitors
connecting 20
MOTU Easy Setups 34
installing 21
MOTU Video Setup 25-32
Audio tab 31
genlock indicator 25, 26
input indicator 25, 26
input source menu 26
installing 21
Preview tab 30
Setup tab 27
status area 26, 41
video format menu 26
MOTUPCIVideo.kext 21
MOTUVOOut.component 21

N

NTSC 16
Component Levels 29

O

Offset (color grading) 29
Outputs
analog 6

P

Packing list 11
PAL 16
Panasonic MII option 17, 29
PCIe
adapter installation 13
cable length 6
CARD connector 6

operation 15
Phones 5
Plasma display
connecting 6
example 18
Playback 23
audio from Final Cut Pro 39
Clock Source setting 28
Final Cut Pro 37
only mode 23
supported video formats 43
Playback mode 27
Power (color grading) 29
Power supply 6
Power switch 5, 15
Auto On 5
Preview tab 30
ProRes 422 9, 35

R

Refresh A/V Devices 39
Registration 11
Reset (3D LUT) 29
Reset to Defaults 28
RGB 17, 28

S

S/PDIF 6
connections 19
Sample rate 31
Sample rate conversion 19
Sat (saturation color grading setting) 29
SD
Analog Output Format settings 28
camcorder 18, 20
capture connectors 5
component 17
component connectors 6
Component Output Color Mode
settings 17
composite 18
monitor 18
supported formats 43
uncompressed 43
video deck 18

SDI

connectors 6
Setup tab 27
Single Field option 28
Slope (color grading) 29
SMPTE/EBU N10 17
Sony
Beta Japan option 17, 29
Beta option 17, 29

Speakers

connecting 20
SRC 19
Status 41
S-video
connectors 16
connectors (front panel) 5
connectors (rear panel) 6
Synchronization
sample rate conversion 19
System requirements
minimum 11
recommended computer 11

T

Technical support 42
Trim (audio input) 31
Troubleshooting 41-42
basic concepts 24
unable to locate external device 41
video glitching 28

U

Unable to locate external device 41
Uncompressed SD 35, 43
USA (7.5%) option 28

V

VHS deck
connecting 18
Video
capture mode 23
connections 16, 18
connectors (front panel) 5
format menu 26
input (choosing) 24
modes 23
playback mode 23
Setup application 25, 32
source menu 17, 24
status LEDs 5
supported formats 43

X

XLR
analog 6

Y

Y/C connectors 16
Y/R-Y/B 17
YCbCr 17
YPbPr 17, 28
YUV 17