

TIME MANAGEMENT

Offloading, transferring & transcoding in P2



Time Management

Offloading, Transferring & Transcoding Times in P2

This paper aims to answer some of the questions that have been posed regarding generalized times for offload, transcode and transfer of P2 media in the field and studio. Given that the turnaround to get a P2 card offloaded and back into the field can often have a significant impact on production, a baseline for such transfers is helpful in production planning.

Many factors affect offload times, including the speed of the connection to the hard drive, type of hard drive (i.e. FireWire 800, USB 2.0, eSATA), hard drive configuration (RAID, mirrored, etc), network traffic, as well as the speed of the hard drive and computer configuration. This paper is the result of specific Panasonic testing configurations (please see Methodology at the paper's end) and should be used as a guide to disk drive offload speeds. Due to a variety of factors mentioned, your results may vary.

In the area of card readers, internal PCMCIA card readers definitely offer a speed advantage over external card readers, but it is the speed of the connection to the destination hard drive that ultimately determines offload speed. In this area, eSATA offers significant advantages over USB and FireWire, while the latter two offer comparable speeds to each other.

TESTS:

The tests in this report reflect typical P2 production and postproduction circumstances. Both Mac and PC environments are covered with commonly used software and techniques. (Note: there may be certain proprietary technologies that could increase speeds utilizing specific hardware and software applications). Methods focus on typical real-world conditions. On a Mac, P2 files are copied to FireWire 800 drives (please note - you can copy using USB 2.0 on Mac; there is no speed difference). On a PC, P2 files are copied to USB drives. Also, both Mac and PC are tested for transfers to eSATA.

Transfer Methods used were:

- PC P2 CMS (P2 Content Management Software – Panasonic)
- PC Explorer (File Copy)
- Mac P2 CMS
- Mac HD Log (Imagine software)

AVC-Intra clips were used for all tests. For practical purposes there should be little difference between offload times for AVC-Intra or DVCPRO HD clips.

List of tests:

- Full card offload
- One-minute clip offload
- Export to P2 Card from CMS
- Final Cut Pro AVC-I to ProRes 422 (HQ) Transcode

(For more detailed notes on testing parameters see the methodology section at the end.)

P2 OFFLOAD & TRANSFER:

All tests were conducted with both 16 GB and 32 GB R-Series cards. There is no real-world difference in offloading clips from either a 16 GB or 32 GB card provided both have the R-Series designation. However, it is significant to note that software transfer modes using verification (i.e. Panasonic's P2 Contents Management Software, HD Log, P2 Genie, P2 Forge) can often yield differing times in offloading a given card.

It is highly recommended that P2 footage always be offloaded using a verified process.

This is a software-driven process (unless offload is done by the camera), and requires a separate application. For more on this process, see the Methodology section at the end.

FULL CARD OFFLOAD & TRANSFER TIMES:

Table A provides times to offload full P2 cards (R-series). The numbers listed are an average of results for reading from an internal PCMCIA slot and from an external reader (AJ-PCD20 USB 2.0 / 1394b P2 Drive). The destination drive was a standard 7200 rpm (FireWire (FW) 800, USB 2.0) or an eSATA mirrored RAID (RAID 1). The drive connections were all direct (i.e. PC Express to eSATA, etc) and there were no other software programs active on the computer besides MAC or PC CMS, Mac HD Log, or PC Explorer.

TABLE A: General P2 Offload Times for Full R-Series Cards

	16 GB (FW800 / USB 2.0)*	16 GB (eSATA)	32 GB (FW800 / USB 2.0)*	32 GB (eSATA)
Mac CMS	15 Min.	11 Min.	27 Min.	20 Min.
Mac HD Log	12 Min.	9 Min.	24 Min.	18 Min.
PC CMS	13 Min.	8 Min.	25 Min.	17 Min.
PC Explorer	11 Min.	7 Min.	26 Min.	14 Min.

- Mac offloaded to FW800 (1394b), PC Files offloaded to USB 2.0.
- (Mac Finder OS X: Panasonic does not recommend using finder to transfer P2 media. Only a verified offload ensures that files have been correctly copied.)

TABLE B: Amount of Recorded Time Offloaded per Minute

This table is useful in that it allows one to see how much recorded footage can be offloaded per minute. This information can be useful in planning the number of cards you'll need for a production or in planning total time for offload of a given project.

	Mac			PC		
Destination HDD	1394b (FW800)	1394	eSATA	USB 2.0	USB 2.0	eSATA
P2 Source	1394	PCMCIA	1394	USB 2.0	PCMCIA	USB 2.0
Device	PCD20	Duel Adapt.	PCD20	PCD20	PC SLOT	PCD20
Format:	<i>Values represent amount of footage (in minutes) offloaded every minute.</i>					
1080i 30/60	1.7	1.7	2.6	1.7	1.8	2.9
1080 24P	1.8	2.1	3.0	1.8	2.2	3.3
720 60	1.8	1.8	1.8	2.0	2.0	1.9
720 30P	2.9	3.1	3.6	2.4	3.1	3.0
720 24P	3.3	3.7	4.0	3.6	3.7	3.8

EXPORT CLIPS TO P2 CARD:

P2 CMS and certain other applications will allow clips to be exported back to P2 cards. A general standard (P2 CMS on Mac or PC) is that this process transfers almost exactly 1 GB per minute.

TABLE C: P2 CMS Export to P2 Card

Rec. Format	Bandwidth	Rec. P2 offload / Min.*
1080i 30/60	840	1.2
1080 24P	670	1.5
720 60	815	1.2
720 30P	430	2.3
720 24P	350	2.9

FINAL CUT PRO: AVC-Intra to ProRes 422 Ingest via Log & Transfer

Final Cut Pro ingests all P2 MXF media through the Log & Transfer window (FCP > FILE > Log & Transfer), and AVC-Intra clips are transcoded to Apple's ProRes codec for editing. Transcoding AVC-Intra clips to ProRes 422HQ is a lossless process as both codecs are 10 bit. The preferences panel within Log & Transfer allows the user to choose either ProRes 422HQ (lossless) or ProRes 422. The latter is a lossy codec yet still in 10 bit color space.

During testing, there was no significant difference in transcode times between ProRes HQ and ProRes writing to an eSATA drive.

Check that your NLE's version of FCP is at least 6.0.4 as this version and subsequent versions offer the fastest possible transcode.

ProRes HQ 220 Mbps target bit rate
ProRes 145 Mbps target bit rate

(Actual clip bit rates will vary depending on recording format.)

TABLE D: AVC-Intra to ProRes 422 Ingest in Final Cut Pro

(All times are presented as a fraction of recorded time (i.e. 2.75 = 2.75 times longer than real-time. In this instance every minute of AVC-I would require 2.75 min to transcode.)

Rec. Format	MBP 2.5 Ghz Duo	MP 8 Core 3.0
1080i 30/60	2.75	1.48
1080 24P	2.17	1.17
720 60	2.42	1.37
720 30P	1.37	0.73
720 24P	1.02	0.60

MBP = MacBook Pro

MP = MacPro Tower

METHODOLOGY

The tests were designed to simulate typical production conditions. While these test results aim to establish generalized guidelines, it is important to remember that real-world circumstances often vary and these times may not be exact for every environment. For example, in conducting these tests, each clip was transferred up to five times, and the transfer times often differed by up to 25 percent. For that reason, only median scores were kept and extreme (unique) results were discarded. PC Explorer copy remained fairly consistent but any verified software-driven offloads showed wide variation during the actual verification stage of the offload.

Software:

Though P2 clips are files, it is important to consider deficiencies in OS-based file transfer methods. While it is considered acceptable to use Explorer (PC) copy to transfer files from card to hard drive, this method is inadvisable on a Mac. On either platform the most reliable transfer method is to use a software program to do a verified offload. During this process, clips are copied to the hard drive and the actual data is verified to confirm that it is correct. A simple copy using the OS will yield a similar transfer time on either Mac or PC, and using a verified offload program will most likely increase the offload time. There are a wide variety of programs to manage a verified offload.

It is highly recommended that P2 footage always be offloaded using a verified process.

In addition to providing a managed offload, some of the software packages offer additional features such as logging, transcoding and database management. Please use the following list to research which verification and offload software best suits your needs.

Product / Company / Link:

- P2CMS Panasonic.....www.panasonic.com/broadcast and click on “popular downloads”
- HD LOG Imagine Products.....www.imagineproducts.com
- P2 Forge Lightstir.....www.lightstir.com/p2forge
- P2 Genie P2 Genie.....www.p2genie.com

Readers:

P2 cards were read using the following devices:

- AJ-PCD20 P2 Drive -- a 5-Card reader with USB 2.0 & FireWire 800 (1394b)
- Duel Systems Adapter -- Express card-to-PCMCIA adapter
- PC Internal PCMCIA reader

Hard Drives used in test:

Mac tests were conducted writing to FireWire 800 and eSATA drives. PC tests were conducted using USB 2.0 and eSATA drives. The hard drives met the following recommended parameters for P2 production.

- USB 2.0 / FW 800 Drive: 7200 rpm 16MB cache. Ventilated Aluminum chassis.
- eSATA Drive: 7200 rpm via eSATA controller. Single drive and hardware based mirrored (RAID 1) drives tested.

RECOMMENDED HARD DRIVES & FORMATS:

Formats:

Every production environment will have a most suitable hard drive format. PC platforms will favor Fat 32 or NTFS file systems, whereas Mac environments favor HFS. To ensure the utmost compatibility, Panasonic recommends using Fat 32 formatted hard drives in the field as they are accessible by both Mac and PC. However, Fat 32 drives do not function well as edit drives in a Mac environment (largely due to 4GB file size limit), nor are NTFS drives usable in most Mac environments. Similarly, P2 media offloaded to an HFS (Mac format) may not be readable in many PC environments. Ultimately, decisions regarding hard drive formats should take into consideration editorial requirements as well as the platforms of those needing to view such media.

Hard Drives:

While many of the external hard drives on the market today contain similar internal mechanisms, it is the housing and cooling mechanisms that define the field. Heat causes most hard drive failures, so it makes sense that drives that cool efficiently tend to be more reliable.

Whether FireWire, USB or eSATA, look for drives with the following characteristics:

- Disk Speed: 7200 rpm minimum for editing and long-term viewing of clips. Use of slower drives (i.e bus-powered) for offload in the field is fine but such drives are not recommended for editing because they typically have deficiencies in both speed and ventilation.
- Ventilation: This is the single most important characteristic. Look for powerful fans and ventilated enclosures. Often drives with these characteristics will come with longer warranties. Fully sealed or enclosed hard drives typically suffer from ventilation problems with the possible exception of drives constructed of materials (usually metals) designed to properly dissipate heat.
- eSATA: The most functional eSATA drives offer hot-swappable drive trays. A heavy-duty fan is recommended. Additionally, certain manufacturers offer hardware RAID controllers to automatically configure RAID 1 and RAID 0 configurations.

AUTHOR:

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APPENDIX

TABLES E and F: Sample Offload of Full 16 GB R-Series P2 Card

This table illustrates the methodology used for full card transfer times. The upper table shows the time to offload a full 16 GB P2 card whereas the lower table illustrates these numbers as a function of recorded time.

TABLE E: Offload Times for Full Card

MAC OSX 10.5.4

16 GB P2 Card 1080 30p AVC-Intra

840 MB/Min (Recording Bitrate)			
14.65 Total GB.			
FW800 (1394B) Copy to external HDD via P2 device / reader:			
	Duel Adapter	USB-PCD20	1394b-PCD20
CMS	14	15	16
HD Log	11	13	12
eSata Copy to external HDD via P2 device / reader:			
	USB-PCD20	1394b-PCD20	
CMS	*	11	11
HD Log	*	9	9

WINDOWS

16 GB P2 Card 1080 30p AVC-Intra

840 MB/Min.		
14.65 Total GB.		
USB 2.0 Copy to external HDD via P2 device / reader:		
	PC PCMCIA Slot	USB-PCD20
CMS	10	14
Explorer	9	12
eSata Copy to external HDD via P2 device / reader:		
	PC PCMCIA Slot	USB-PCD20
CMS	7	9
Explorer	5	8

* Duel Adapter to eSATA tested because Duel Adapter occupies sole PC-e Slot.

TABLE F: Offload Times compared to actual recorded time:

(Scores represent factor of recorded time. For example .8 = 20% faster than real-time for offload.)

16 GB P2 Card 1080 30p AVC-Intra

840 MB/Min (Recording Bitrate)			
14.65 Total GB.			
FW800 (1394B) Copy to external HDD via P2 device / reader:			
	Duel Adapter	USB-PCD20	1394b-PCD20
CMS	0.8	0.9	0.9
HD Log	0.6	0.7	0.7
eSata Copy to external HDD via P2 device / reader:			
	USB-PCD20	1394b-PCD20	
CMS	*	0.6	0.6
HD Log	*	0.5	0.5

16 GB P2 Card 1080 30p AVC-Intra

840 MB/Min.		
14.65 Total GB.		
USB 2.0 Copy to external HDD via P2 device / reader:		
	PC PCMCIA Slot	USB-PCD20
CMS	0.6	0.8
Explorer	0.5	0.7
eSata Copy to external HDD via P2 device / reader:		
	PC PCMCIA Slot	USB-PCD20
CMS	0.4	0.5
Explorer	0.3	0.5

* Duel Adapter to eSATA tested because Duel Adapter occupies sole PC-e Slot.

FORMAT OFFLOADS:

TABLE G: Offload Times Compared with Recorded Time by Format

(Scores are presented as a fraction of recorded time. For example, score of .5 means that the offload occurs in half of the time of the recording. For this test, two-minute clips were offloaded several times, averaged and then divided by two to get the offload time per minute.)

MAC OSX 10.5.4			
1080/60i -1080/30p AVC-Intra			
840 MB/Min (Rec. Bitrate)			
FW800 Copy to external HDD via P2 device / reader: (1394B)			
	Duel Adapter	USB PCD20	FW800 PCD20
CMS	0.52	0.58	0.58
HD Log	0.47	0.50	0.48
eSata Copy to external HDD via P2 device / reader:			
		USB	FW800
CMS	*	0.40	0.40
HD Log	*	0.33	0.33

WINDOWS		
1080/60i -1080/30p AVC-Intra		
840 MB/Min		
USB 2.0 Copy to external HDD via P2 device / reader:		
	PC Slot PCMCIA	USB PCD20
CMS	0.60	0.60
Explorer (Copy)	0.48	0.48
eSata Copy to external HDD via P2 device / reader:		
	PC Slot	USB
CMS	0.35	0.35
Explorer	0.30	0.40

1080/24p AVC-Intra			
670 MB/Min (Rec. Bitrate)			
FW800 Copy to external HDD via P2 device / reader: (1394B)			
	Duel Adapter	USB PCD20	FW800 PCD20
CMS	0.47	0.57	0.57
HD Log	0.37	0.38	0.38
eSata Copy to external HDD via P2 device / reader:			
		USB	FW800
CMS	*	0.33	0.33
HD Log	*	0.30	0.30

1080/24p AVC-Intra		
670.00 MB/Min		
USB 2.0 Copy to external HDD via P2 device / reader:		
	PC Slot PCMCIA	USB PCD20
CMS	0.45	0.57
Explorer	0.38	0.57
eSata Copy to external HDD via P2 device / reader:		
	PC Slot	USB
CMS	0.27	0.30
Explorer	0.20	0.30

* Duel Adapter to eSATA tested because Duel Adapter occupies sole PC-e Slot.

720 60p		AVC-Intra		
815 MB/Min (<i>Rec. Bitrate</i>)				
FW800 (1394B)		Copy to external HDD via P2 device / reader:		
		Duel Adapter	USB PCD20	FW800 PCD20
CMS		0.60	0.63	0.53
HD Log		0.40	0.47	0.47
eSata		Copy to external HDD via P2 device / reader:		
			USB	FW800
CMS		*	0.57	0.57
HD Log		*	0.30	0.30

720 60p		AVC-Intra		
815.00 MB/Min				
USB 2.0		Copy to external HDD via P2 device / reader:		
		PC Slot PCMCIA	USB PCD20	
CMS		0.50	0.50	
Explorer		0.47	0.53	
eSata		Copy to external HDD via P2 device / reader:		
			PC Slot	USB
CMS		0.47	0.53	
Explorer		0.30	0.43	

720 30p		AVC-Intra		
428 MB/Min (<i>Rec. Bitrate</i>)				
FW800 (1394B)		Copy to external HDD via P2 device / reader:		
		Duel Adapter	USB PCD20	FW800 PCD20
CMS		0.32	0.35	0.35
HD Log		0.25	0.37	0.33
eSata		Copy to external HDD via P2 device / reader:		
			USB	FW800
CMS		*	0.28	0.28
HD Log		*	0.17	0.17

720 30p		AVC-Intra		
428.00 MB/Min				
USB 2.0		Copy to external HDD via P2 device / reader:		
		PC Slot PCMCIA	USB PCD20	
CMS		0.32	0.42	
Explorer		0.25	0.33	
eSata		Copy to external HDD via P2 device / reader:		
			PC Slot	USB
CMS		0.22	0.33	
Explorer		0.17	0.22	

720 24p		AVC-Intra		
350 MB/Min (<i>Rec. Bitrate</i>)				
FW800 (1394B)		Copy to external HDD via P2 device / reader:		
		Duel Adapter	USB PCD20	FW800 PCD20
CMS		0.27	0.30	0.30
HD Log		0.20	0.27	0.27
eSata		Copy to external HDD via P2 device / reader:		
			USB	FW800
CMS		*	0.23	0.25
HD Log		*	0.13	0.15

720 24p		AVC-Intra		
350.00 MB/Min				
USB 2.0		Copy to external HDD via P2 device / reader:		
		PC Slot PCMCIA	USB PCD20	
CMS		0.27	0.28	
Explorer		0.20	0.20	
eSata		Copy to external HDD via P2 device / reader:		
			PC Slot	USB
CMS		0.20	0.27	
Explorer		0.13	0.20	

* Duel Adapter to eSATA tested because Duel Adapter occupies sole PC-e Slot.