



# Coming of age

After what has been a turbulent couple of years in the NLE market, **Barrie Williams** finally gets his hands on Matrox Axio HD – the system that offers Adobe Premiere for grown-ups.

Over two years ago, having heard that the Matrox Digsuite was being replaced with a new board set, we sold our Digsuite system and waited with baited breath for the new product to be officially announced. The new product was predicted to be “just a few months away”, but it was a full two years later that we took delivery of the new Matrox Axio HD system. What took so long?

Well, a lot of things have changed in two years. It's hard to comprehend that just two years ago the only question asked when selling a top-of-the-range edit system was “is it PAL or NTSC?”. But that was also the time when mainstream, affordable high definition video was just emerging in Europe, with all the complexities that go with it.

At the time, nobody really addressed the problems of permitting HD to

‘emerge’ rather than being ‘conceived’. So at this monumental time of change for the video industry, would legacy issues associated with mains frequencies and analogue restrictions be abolished? Would drop-frame become a thing of the past, now we have electronics that can easily do away with this ridiculous workaround? Would engineers, hardware designers and programmers at last enjoy 24, 25 and 30 integer frame-rates? No, of course not. We missed the perfect opportunity.

Gone are the days of having a PAL/NTSC tick-box to select your video format. Now we are presented a huge list of formats, compounded in complexity by a long list of frame-rates. And there was still the need to maintain backward compatibility with the two SD legacy formats.

So it becomes clear why Matrox,

which has a reputation for prime-time reliability, couldn't possibly release a product during this time of emerging and changing formats. Even the task of finalizing a specification list required a good deal of prediction and a feel for the way the industry was moving.

## First impressions

I have to start this review by saying I have never been a big fan of Adobe Premiere, which is the control interface of Axio. So I approached the test with gritted teeth, and a substantial amount of prejudice.

As the huge boxes of drives were shoehorned into two minuscule 1U high NexSan blades, and the 23in LCD screen was connected to the HP XW8200, I had an overwhelming feeling of anxiety. Over the past two years, we have seen many ‘wannabe’ HD

systems, and so we know all too well that there are dozens of things that can go wrong. But within 10 minutes of the boxes being opened, we were ingesting and playing back HDCAM, with frame-accurate deck control. Very impressive.

For our *Showreel* test, we pulled out some camera tapes from the last Kylie Minogue shoot, which was largely bluescreen material. We used the HDW-750 camera in progressive mode for this shoot, using prime lenses, and had 45kW of spacelights flying over the cyc, plus a few 5K and 10K Arris, so the pics were clean. I had already processed this footage on a high-end Silicon Graphics system (IFX Piranha), so I knew the source very well, which shots keyed easily and which didn't.

Mischievously, I went straight to the shots that had loads of blue spill and blue denim clothes. We had previously used Primatte to key it, which is a non-realtime keyer, so I had already made up my mind that even if the Axio could key it, it would be a compromise. I added the chromakey effect, expecting a few minutes of delicate tweaking, and was amazed (and frankly, at the same time, gutted) that the shot was keyed perfectly. And it really did play in realtime, keyed over another HD clip, at full rez, no proxies.

To perform so well, I felt I must have been pushing the system near its limit, so I was keen to discover where it would fall over and require rendering. I added a heavy colour correction to the background image and still it played. I added some animated opacity changes to the foreground, still realtime. This was getting personal. Now I put an animated colour correction on the background. Darn, still realtime. I checked the status on the HD monitor to make sure we were really outputting high definition.

Eventually I managed to get it to max out: by putting colour correction on the background and a chromakey on the foreground, and then adding a secondary colour correction to make our poor chroma-key victim look like a female version of the incredible hulk, with convincing green skin but without changing the colour of the clothing. Very attractive. Anyway, now there is a red line over one area of the timeline, so it

needs rendering. So I load up a few more effects, add timestretch to both clips, and see how much time the render takes.

Not much time is the simple answer. The render happens rather elegantly, and every frame is previewed on the screen at what appears to be about half realtime. There must be some serious optimizing being done to enable two streams of HD both to be processed so heavily and then written back to disk at that rate. Just one word of warning. Don't stop the rendering prematurely as it does not keep the 'render so far', but works on a clip-by-clip basis. So stopping a render on one long clip will require the render to restart, but if the timeline is in many segments, you will lose less.

One area we are acutely aware of with these high data rates is dropped frames. So my first few days editing on the system, I watched the output like a hawk, fearing to blink, in case of a dropped frame. It was a pointless exercise, because the infrastructure of the system is designed to relieve the user of that responsibility. Axio is a 'guaranteed-playback' device. No ifs nor buts. The way it works is transparent to the user, but the Adobe and Matrox engineers have been very busy to ensure playback is never an issue. It's clear that the software guys have been working closely with the hardware

engineers. Neither could have independently come up with such a solid solution.

With so many different format signals floating around a modern edit suite, we all need some assistance to be confident about a setup before the client arrives. Is the system receiving house sync? Is it set to HD or SD? Is a signal patched correctly to the breakout box? Fortunately, the Axio HD breakout box is peppered with lights, which give immediate and clear indication of these items, and even has LEDs to indicate if the analogue output is set to YUV or RGB. The presence of a valid AES input signal is also indicated.

More importantly, the breakout box houses some critical electronics which could be susceptible to electronic noise. This is done to make sure that the video and audio signals don't inherit any interference from the computer. This is such an important issue that even the cable between the PC and the breakout box is a high specification SCSI lead – and the software can even detect whether or not a genuine Matrox cable is connected. This is not a ploy to sell users an expensive cable (it is included with the system), but it does give an indication as to how much attention is being paid to high quality signal paths. (see sidebar 'litter test')

There are two breakout boxes available. Both have an equal lack of

**The Premiere Pro project manager – so different from earlier versions that a renaming ceremony wouldn't be out of place.**





**A tough keying test the Axio passed with flying colours, but no spilling colours.**

aesthetic appeal. The HD-SD breakout box has HD and SD serial digital input and output, YUV, and analogue audio output. The cheaper SD-only breakout box has a full complement of analogue inputs and outputs, in addition to SDI with embedded audio. Both boxes have 1394 I/O, and both are very robust, but they do look cheap. Fortunately, they work well enough for that to be overlooked.

There is an elegant upgrade from SD to HD with Axio. Simply buy the HD breakout box, and that's the upgrade done. But with so many analogue sockets on the SD breakout, and none on the HD breakout, I would guess that Matrox is planning to let users connect both bobs at the same time. I don't know this for certain, but I did sneak a look inside at the main I/O board, which has two rather large expansion sockets currently unused. They must be there for a reason.

Another first for Matrox are the

many temperature sensors on the boards and in the breakout box, which are permanently monitored. The system will issue a warning if the temperature anywhere in the system becomes elevated. There is even a small fan and heat sensor inside the breakout box.

Axio is an edit system, not a boardset. Therefore it is sold as a system, qualified and tested and ready to earn its keep in a professional environment. Units are assembled with their drive raid arrays, and performance tested before being validated and shipped to the customer. The diagnostic software can even detect if a sub-standard cable has been fitted to the breakout. No wonder my system worked straight out of the box.

### Workflow

I really like the I-frame MPEG2 codec because you can save a lot of disk space,

and the re-conforming workflow is really impressive. The concept is simple. Ingest your HD at one quarter resolution in offline format, which produces very small files, then copy the project off to a laptop. When the edit is finished, simply copy the finished edit back to Axio, which will re-conform from the HD source tapes at full resolution. This is a very nice way to optimize drive space. And as the proxy footage is upscaled in realtime, you can edit at full HD size, with a slightly soft picture.

With any edit system for high definition, the drive array is going to be a large proportion of the cost. Using four channels of 2Gb fibre on a 16-drive SATA array, the drives will keep up with the most demanding of projects, and as they are connected using optical cables, they can be sited up to six miles (10km) away from the PC. Even though the drives are quite deep; it is amazing that we have over 4Tb of storage in a 2U chassis space. And best of all, there is no need to provide ventilation above and below the drives, because they are designed to use a linear horizontal airflow.

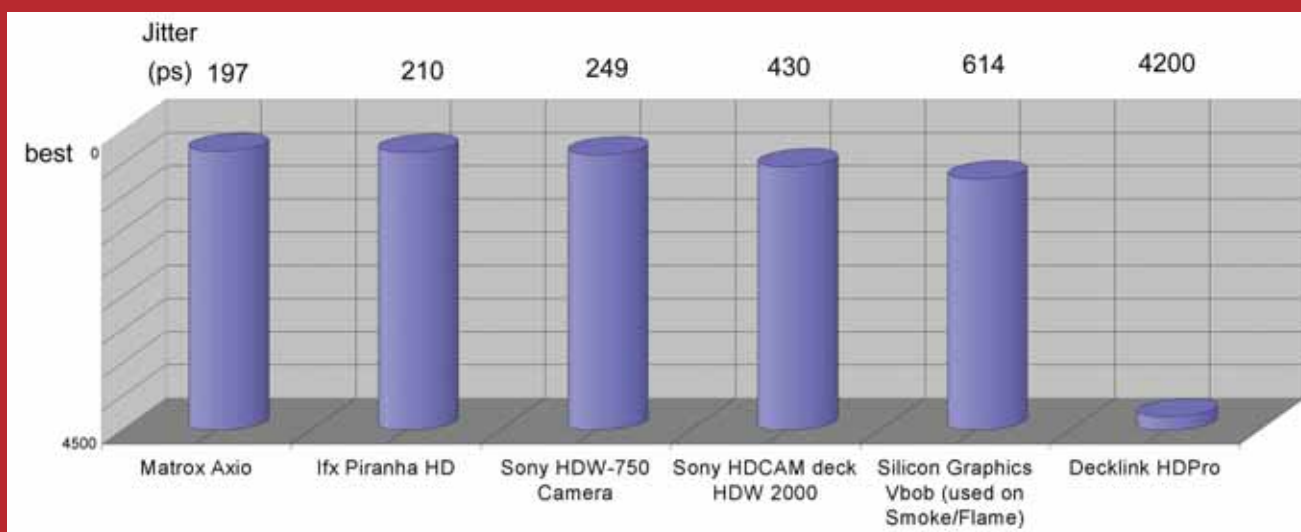
### How much of it is realtime?

This is the big question for everyone. Over the past year or so, some have stated (and many others have repeated) that we no longer need hardware to process video, because CPUs have become more powerful. That statement has been proved to be premature and optimistic. Yes, there are many amazing things that can be done in software, but when you add up the file i/o demands, the interface processing, the audio processing and the many

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## Jitter test



There are many contributing factors to high definition picture quality. It starts with the skill of the DP, then the lens, the chipblock, the recording medium, the signal path, the colourist, right the way down to the final method of delivery.

In a few short years, the technical side of video has moved from simple wiring to RF signal propagation. HD signals are now such high frequency, at 1.485Gbits/sec, that even running the signal through a patchbay can deteriorate the signal as much as running it through a 20m run of cable.

### What is jitter?

But one fundamental area that can cause serious problems is jitter. In simple terms, jitter is the deviation of the signal (in time) from its theoretically correct time. Very much like analogue signals need to be genlocked to be synchronous, jitter is the measure of the clock timing in digital video, and the higher the image quality, the more crucial the timing becomes. Without getting into the technicalities of transmission jitter and display jitter, in the worst case mis-timed digital video can cause picture disruption or, worse still, no picture at all.

### Real-world test

Using the Tektronix WFM-700 waveform and vectorscope, we performed a simple 'real-world' jitter test on several systems. Many manufacturers quote specifications obtained in laboratory test conditions, but they are not always representative of what happens in real life. So our tests were made in less than ideal conditions. We deliberately used unnecessarily long cables, took no care to keep video feeds away from mains supplies, looped the signal through a monitor or two and a couple of patchbays. And as we maintained the signal path and cables for all tests, each system would be subject to the same rigours.

This test is not to do with the 'look' of the HD image. Nor does it take into account the varying capabilities of each system. We are not comparing 'systems' here, just the foundation of the picture, the backbone of any system, the core signal stability. It has to be said that all the systems we tested managed to sustain

great looking pictures on the monitors. We used a grade1 Sony HD monitor and the brilliant colour-accurate VuTriX 40in LCD. This is purely a technical appraisal.

DecklinkHD did not do as well as the others in this particular test – but that's not to question the usefulness of the product. In fact I own three of their boards myself and am very happy with them. As an industry we owe BlackMagic a great debt for making HD affordable to the masses. Without their Decklink range of budget HD cards we would never have seen such a rapid worldwide move to HD. It is no criticism that a budget product performs less well than a considerably more expensive one.

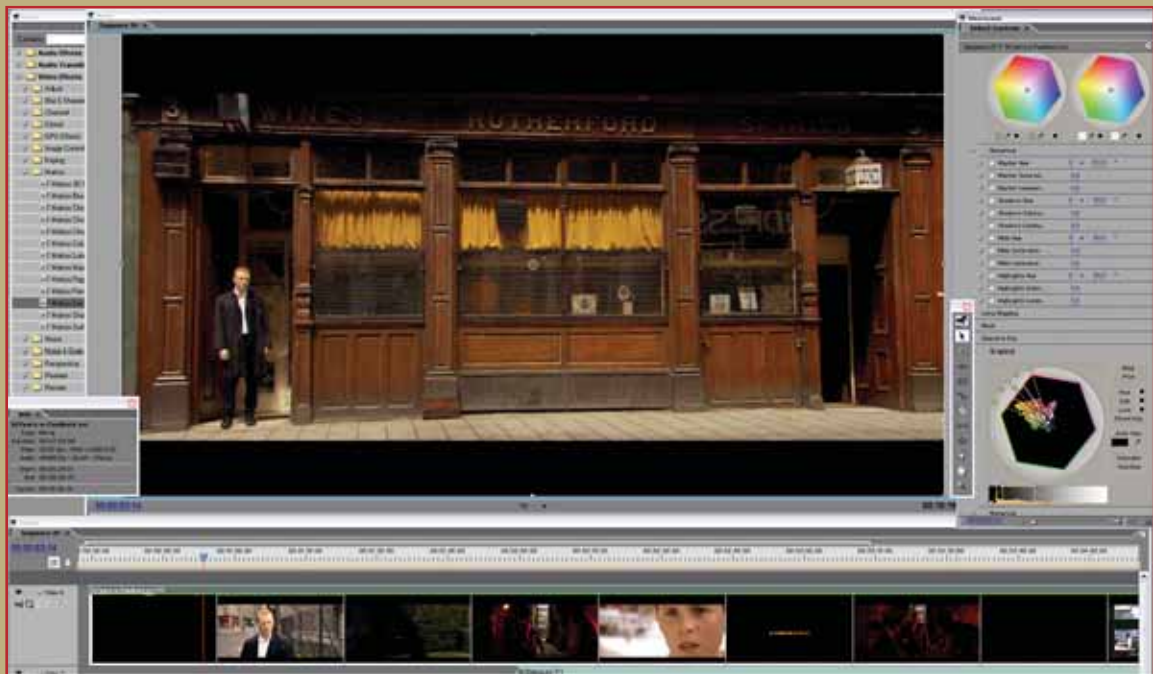
### Results

Looking at peak (maximum) jitter, the Sony HDW-2000 VTR reached 430(ps), which we used as a datum. The Matrox AxioHD, and the Piranha-HD both had signals which were very much more stable. In fact they managed to produce a signal that was twice as stable as the Sony deck, with Matrox Axio coming in at 197(ps) and Piranha-HD running a close second at 210(ps) using the DVS Centaurus. As you may expect, the Sony HDW-750P camera gives a very solid performance at 249(ps). My Silicon Graphics vBob was showing its age, producing a mediocre 614(ps). This is now very much a legacy device. The poorest performer in this test was DecklinkHD pro, which was fairly unstable when at rest, but any extra computer activity, like moving around the Final Cut Pro timeline, or scrubbing the video caused the jitter level to shoot right off the scale, often exceeding 4200(ps). This makes it an unstable signal compared with the other systems tested.

### Conclusion

Clock timing of video signals is crucial, but fortunately, monitors are very tolerant of bad signals, often displaying a picture which cannot be recorded. For monitoring purposes, all devices performed very well, but for high-end playout, for online or broadcast environments, the requirements are slightly more demanding than for monitoring.

Colour correcting within Premiere.



other processes that are occurring in a high-performance PC, we can quickly reach saturation point. The Matrox decision to co-process the video clearly has merit.

The result of splitting the effects processing over multiple processors is that this system is, as it claims, realtime. At least four streams of SD video with DVE, colour correction, blur, speed-change and even a handful of 32-bit graphics over the top, and still the system keeps playing. There is no hint of hesitation, or even a threat of a dropped frame. As CPUs increase in speed, the system produces more realtime streams before reaching saturation point. This is really a solid and professional product, and from the performance it is clear that this is going to become the new Digisuite, only this time in HD too.

The performance in HD is equally impressive, with two streams of uncompressed 10-bit HD guaranteed with effects. So at last we have an affordable system which can perform a really good chromakey on uncompressed 10-bit video in realtime, with spill suppression and edge softening in realtime, and still have some spare capacity for realtime titles.

With any system of this power, it is necessary to have good ventilation, and fans always mean fan noise. There is no getting away from it. The thing to do is site the noisy items away from the edit

suite. The test system uses the amazing Satablade from NexSan, which manage to pack 4Tb into a 2U chassis. There is a price to pay for the compactness, and fan noise is the price. I also tested the Xyratex X24 Fibre channel raid, which is bigger, but very much quieter. But the drives are not the only noise culprit. The HP XW8200, which is the core of the system, has been modified to increase airflow across the critical areas, which means it also creates slightly more noise than a standard PC. You won't be able to hear how good the audio is unless you site the system well away from the editor or wear DT100s.

### Support

I'm impressed with the support package offered by Matrox. Many professionals are critical of companies who want to sell into the post-production sector, but who also want to be home by 6pm. Our industry is well known to have flexible working hours, and we have all suffered the frustration of trying to call tech support at five in the afternoon (that's not the end of the day for most editors) only to be greeted by a talking machine. So the double benefit of the Axio support contract is most welcome. First, the tech support line is extended-hours (until midnight). And second, because the system is made up of hardware and software, the support line is there for all enquiries, both hardware

and software. This unified approach is excellent: we buy a 'system' and we need support for the 'system', not to be told that we need to speak to someone else because of some obscure job-demarcation internal policy stuff.

### Hardware

The Axio boardset is immensely powerful. It is not a simple video input and output board, like the Decklink or Bluefish. It has a daughterboard containing a hugely powerful graphics processing unit (GPU), which performs all the sub-pixel processing. As an indication of just how powerful the graphics processing card is, it requires its own separate power supply. This makes a big difference compared to systems that use the computer's own CPU to do everything. In practice it means that the video effects processing has two separate routes it can take, thereby increasing the bandwidth and letting it do more before it reaches saturation point. The user will not be aware which path the signal is taking, as it is cared for automatically to give the user the best possible performance. The result is that the user absolutely knows that video will playback in realtime. If a large number of effects are stacked up, taking the processing over the threshold of realtime, that section is immediately marked as needing rendering. This is no hit-and-miss guesswork. The system calculates accurately, and to date I have

not once seen even one unexpected dropped frame. One word of caution. Don't attempt to run the system on anything less than a 23in monitor, preferably use dual monitors.

The Axio system comes with just one heavy item of legacy: the preconception that Adobe Premiere is not a 'proper' editing tool. But the way it has changed over the past year has really taken a lot of professionals by surprise. This is largely due to Adobe having plucked one or two award-winning edit professionals from the basements of Soho and really listened to their real-world edit requirements.

Premiere Pro is now a highly capable edit system. In all our testing we have not experienced a single crash or even a moment of anxiety. With the inclusion of keyboard mapping templates, Final Cut Pro and Avid users are now able to immediately switch the system to behave as they are accustomed to working. This means a lot of new keyboard shortcuts have been added and remain unmapped by default. I personally do not like using a trim-window for editing, but rather use the trim and discard method of editing,

where we stop the timeline at the point we want to trim a clip, and press one key to automatically perform a razor. I was relieved to find this powerful shortcut exists, and I was able to map it to my own favourite keyboard setup. I was amazed that as soon as I had set up Premiere to emulate my current edit system's shortcuts, I felt completely at home.

### Integration

As if the edit speed and guaranteed playback was not enough, the integration with After Effects and the amazing noise reduction abilities in Audition are very strong benefits. It's a simple matter to remove unwanted noise from audio tracks. Adding VST plugins is live on the timeline, too. And with built-in Dolby 5.1 surround mixing, it is clear that Adobe is now aiming this product at a different market. Adobe was very quick to rename Cool Edit Pro to Audition. Now if only they would change that dated and stigmatized 'Premiere' name, so that people coming to an expensive edit suite can't say, "is *that* what you use to edit? I got that program free with my

digital camera"... This feature set is so far away from the old Premiere that it is worthy of a new name. Not to hoodwink anyone, but rather to boldly announce the leap from semi-pro to professional. They even added an interface dimmer for those of us working in darkened colour grading suites. A small touch, but so useful.

As standard, Axio completes the system with Adobe Video Collection and ProVTR for deck control, so out of the box it can capture, edit, composite, title, print to tape, encode and produce DVDs using Encore.

One slight disappointment is that I really wanted to check HDV support and After Effects frame buffer, but they are in final testing so it will not be available until IBC.

All in all Axio is a very capable SD and HD edit system. Axio would be able to edit and conform most commercial work as fast as any system. A thoroughly solid workhorse with the best Realtime HD chromakey I have seen. Audio software lets it down a little, but for a new product just hitting the market, there's time for improvement.



Barrie Williams started his career on the other side of the camera, as a professional musician. He now owns pixelfantastic post facility in London, where the combination of an impressive studio equipment list and a background in music create a unique style which is appreciated by many high profile music artists.

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