

## Analogue or Digital?

*Digital technology will dominate the evolution of the CCTV industry in the coming years, suggests Ian Fowler. That doesn't mean that analogue is 'dead', but it does mean that electrical contractors need to become familiar with the digital world if CCTV is to become a meaningful part of their business.*



### Overview

Digital Video Recorders (DVRs) are in the ascendancy. There are few large, complex CCTV installations today that would choose to incorporate an analogue-based VCR solution. Moreover, with digital prices continuing to fall, the rapid rise of storage capacity and the range of digital machines available now including single channel systems, the market for analogue would seem to be under ever increasing pressure.

However, there remain very pertinent reasons for choosing an analogue system. Price may be one factor, but more often analogue is selected for being the most appropriate solution to meet the end user's requirements. This article sets out to explore the advantages and disadvantages of both storage technologies, and provide guidance on the environments where one solution may be more appropriate than the other. We conclude by suggesting that the age of analogue is far from over but that electrical contractors need to equip themselves with digital skills if they are to have a significant role in the future CCTV industry.

### The enduring appeal of VCR

Digital Video Recorders represent the new standard in CCTV recording. Such is the image quality and flexibility of these units that, given the option and the budget, few users would opt for a traditional VCR solution.

However, the humble VCR, the workhorse of CCTV installations, deserves more attention than it sometimes receives. Its continuing popularity may reflect its domestic familiarity, ease of use and low training requirements. Yet, there is a world

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of difference between domestic and industrial VCRs, and although VCRs have been with us for over twenty-five years, the technology is surprisingly advanced and effective.

The two most common reasons for choosing digital over video recorders are the quality of the recording and the ease of searching for incidents. Analogue videotape is fragile and can wear very easily, and each time a copy is made the picture quality deteriorates. Analogue tape is a linear device, and while most CCTV VCRs have time and date, and alarm search modes, these are very slow and not as accurate as their digital counterparts.

A big advantage of analogue systems is the prevalence of the VHS recorder. Most Police stations and courtrooms have a VHS machine ready to play back tapes, whereas the proliferation of different digital units make it difficult for the authorities to support them all.

### **Understanding VCRs**

Unlike a domestic VCR that records continuously, an industrial VCR is set to record with small intervals between images. This enables, for instance, 24 hours of recording to be stored on a single 3-hour tape (at 5.56 frames per second compared with 25 frames per second for continuous recording).

The downside of timelapse recording though is that it produces a strobic effect when the tape is played back. For most installations, this generates a perfectly acceptable picture quality without loss of vital visual information, particularly for single camera installations. However, the larger, multi camera environment calls for the use of multiplexers and possibly multiple VCRs if the required frames per second rate is to be maintained. (A multiplexer is a device capable of switching through all the cameras at the same pace as the VCR captures image fields, creating an acceptable update/camera Rate.)

The functions available within CCTV VCRs indicate the depth of technology embedded within these familiar machines. Functions include auto record; holiday time codes; time, date and alarm event scanning & targeted search; external time input and time lapsed audio recording. Resolution varies from 250TVL (colour) to over 400TVL (Super Video Home System or S-VHS<sup>1</sup>).

The nature of the installed environment and other aspects of the installed system should influence the choice of VCR. Available features, depending on model, include an interface for remote management by computer or a suitable matrix controller and VEXT output for synchronisation with a multiplexer. This enables the VCR to alter the time modes on the multiplexer. Time & Date is an important evidential issue. Where more than one multiplexer is installed the multiplexer Time & Date rather than the VCRs is used, a clock synchronisation feature ensures that all the machines are locked to the same time as the control room machine.

Many end users will be content with a 24-hour recording capability. For extended recording, some machines are capable of 168 hour (7 days) and 960 hour (40 days) recordings respectively. Customers that require recording over weekends, bank holidays and similarly extended periods value these options.

### **Tape Management**

The danger of poor tape management is the single greatest weakness of the VCR storage solution. Failure to maintain a stock of high quality tapes, stored and handled correctly, and replaced daily is not a fault of the storage system itself, only of its operation. The discipline required to maintain a strict maintenance routine defeats many end users. It may seem absurd, but tape management and quality is more important than ensuring that the VCR itself is regularly serviced. For poor tape management damages the recording capability of the VCR and hastens the need for servicing. Overuse of a VCR tape itself results in poor quality recordings. For daily cycles, users should maintain a bank of 31 tapes, rotate each tape daily and replace all tapes once a year, or a bank of 7 tapes that are changed every 12 weeks. It is also of crucial importance that the tape management procedure includes that each tapes recording is tested and verified before loading the next tape and that all handling of the tapes is entered into the tape log book. Finally, awareness of data protection legislation is essential. In the UK, for example, all images must be erased after 31 days. Some DVRs feature an auto-erase function to take care of such legal requirements automatically.

### **Enter the Digital Age**

The traditional VCR multiplexer combination enables users to record images from multiple cameras onto a single tape. The downside is the noise, tape wear and tear, the tedium involved in finding specific images on the rewound tape (and the suspension of recording this entails), not to mention tape storage and management.

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<sup>1</sup> S-VHS (Super Video Home System) records at a higher resolution than VHS and is therefore chosen by end users that require high quality recordings.

A DVR however records images onto an internal hard disk, guaranteeing high quality image reproduction with little noise or picture degradation. The major benefit is the ease and speed with which one can search for a specific image (by camera, date, time, text, and alarm and with some products by setting a search for motion in a camera after recording) without having to stop recording.

DVRs fall into two main categories: PC based units, running standard operating systems such as Linux or Windows™, and “black box” units that use proprietary operating systems and have a conventional CCTV interface to the user.

With hard disk capacity continuing to raise inexorably, the relative high cost of a hard disk compared with a VCR tape is no longer a primary obstacle to end user adoption of DVRs. For users with very significant storage requirements such as banks or financial institutions, large groups or “arrays” of hard disks provide the ideal solution, capable of archiving months of easy-to-search footage or one month of higher rate recording.

It is beyond question that, overall, DVR solutions are the way forward for the industry and it is the ideal solution for many applications as diverse as retail, banking, commercial offices and industrial premises... It can offer the evidential image quality required by police forces worldwide (an image quality standard greater than S-VHS), and the ease with which archived images can be accessed has made DVR immediately popular with the security industry and end user.

DVR is the obvious choice for every prestigious new installation, but – particularly with the launch of new single channel DVRs – it also offers the perfect upgrade route wherever an analogue VCR, with or without multiplexer, is currently in use. However, DVR is not always the natural upgrade route from VHS. S-VHS remains an under utilised resource in the industry and offers an improved quality of image that is very satisfactory for many environments. For users confident of their tape management and security procedures, a switch to S-VHS from VHS may be preferable to the investment required for a completely new DVR installation.

### **Time Travel is here at last**

Many DVR multiplexers also have the ability to provide a ‘Pre-Event’ recording when used in an event driven mode. This means that previously impossible lead-in views can be gained because the unit retains a short period of images before finally saving the normal sequence to disk. At the moment the trigger happens, the DVR rewinds to the pre-event images and records them to disk as though the event started up to 5 seconds earlier. A Multiplexer / VCR combination handles all images immediately and by the time the event is registered the target has walked through the camera’s view.

## Installation Issues

Which DVR model is appropriate for a specific installation primarily depends on the number of channels required as determined by the number of cameras within the system. Multi-screen display is available in live and playback modes in line with the unit's channel capability. The unit records a selectable number of images per second, either globally or individually per camera depending on the model.

The advantages of DVRs compared with a traditional VCR solution lie in several areas: ease of use, search functionality, network compatibility, picture quality, the security of the image and the opportunity to break free of the limit of recording a maximum of 25 frames per second.

The security industry is one of the last industrial sectors to latch onto the processing power of PCs. This may be partly due to the high processing power required to handle large volumes of CCTV images, which has only recently been available on an affordable PC. One effect of this late arrival is that many installers and users already have PC experience and knowledge, and even where this is absent, the quality of software embedded in DVR units is sufficiently sophisticated for an operator with limited PC knowledge to grasp it with ease. Most DVRs offer simple operational controls and instantly recognisable Windows™ style drop-down menus, so that the operator's learning curve is reduced to an absolute minimum.

Offering considerable search functionality, the DVR comes into its own when a rapid recall of archive image is required, perhaps sparked by the unit's alarm or video motion detection function (where available). The correct frame can be located in seconds, compared with the hours required to search manually through a bank of VCR tapes. Fast Forward & Reverse play works on DVRs; multiplexers cannot do this.

## Networking

Perhaps the single greatest advantage of digital storage – but also an area that for many installers presents a significant learning curve – is network compatibility. This gives users the option of remote monitoring, control and access to archived images. Every communications network that supports the IP protocol is accommodated including Ethernet (LAN and WAN). Care needs to be taken however to maintain effective control of recorded images accessible across a network in order to comply with data protection legislation and to avoid suggestions that an image may have been tampered with. This can be achieved by adopting a layered approach, restricting access to authorised users only.

Many domestic users have a PC. A small 4 channel DVR unit in the loft in an appropriate enclosure, requires no tape changes and linked to the PC through a LAN connection can provide a weekend or week long coverage. In the event that the PC is stolen, the DVR in the loft is unlikely to be discovered retaining vital evidence.

For reasons such as this, it is often assumed that digitally stored images are more at risk from tampering than VHS tape; this is not always the case. For example, machines using Wavelets™ compression technology use a technology called fragile watermarking. This is an invisible code, present on each image captured, which is destroyed the moment an image is tampered with. This is a considerable advance on the physical security required to protect VHS tapes.

### **Training**

Anyone approaching Digital CCTV for the first time is presented with an array of new terminology to grasp and understand. Training is therefore essential and many companies, including Norbain, offer suitable courses to equip installers with the technical and product knowledge they need.

In essence however, the initial approach required is no different for a digital installation to an analogue one. Consider first the requirements of the installation. Is storage required? What is the purpose of storing images (security, staff management)? What volume of images needs to be recorded and archived from how many cameras? Can staff be relied upon to manage an analogue system? Have staff the PC skills to manage a digital solution? Do the images need to be archived off site or accessed from elsewhere?

### **To summarise**

In broad terms, analogue is ideal for small, single site, cost conscious installations where deterrence is the primary requirement and where staff can be relied upon to practice good tape management. Digital meanwhile is the preferred solution wherever the recording of high quality images is essential, where network communications are involved, where CCTV is integrated with other systems such as access control or ATMs, or where the size and complexity of the installation (number of cameras and sites for instance) calls for a high volume recording capacity.

However, as with all aspects of CCTV, the storage device is only one aspect of a much larger installation. The storage options recommended to the end user must consider the whole system specification. Further, the strengths of functions offered by a particular system are only as effective as the staff training and culture available to manage and maintain it.