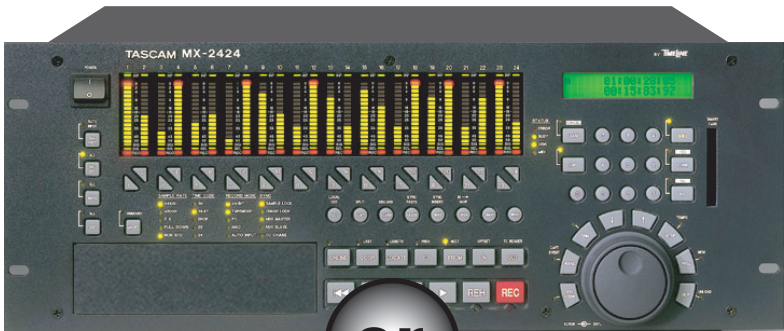


Which is Better ?

Hard Disk Multitrack



or



Digital Tape

Yes!

Introduction

Have you ever walked into a music store and asked to see some multi-track recording equipment? The salesperson asks "Analog or Digital?" You say "Digital". They ask "24-bit?" You reply "Of course". Then a new question comes: "Hard disk or tape?" Uh-oh, you didn't see this one coming. You didn't have that choice before...PANIC ATTACK!!

Don't panic. The good folks at TASCAM are here to help. We believe choice is a good thing, so we've worked hard to provide you with a variety of 24-bit hard disk and digital tape multi-track recorders...the MX-2424, PCI-822, US-428, DA-78HR and DA-98HR. Hard disk and digital tape machines both have unique advantages that will be explored in this booklet so you can decide which format or combination of formats will work best for your individual situation.



Since TASCAM is the only recording equipment company in the world that offers 24-bit digital recording capability in both digital tape and hard disk formats, we are free to give you unbiased advice in either direction. We can step back and show you the benefits of each format...even the benefits of owning both!

This booklet will examine six primary considerations. They are Compatibility, Portability, Editing, Synchronization, Interface and Backup. Let's start with...

Compatibility

If you are not going to exchange your multi-track recordings with other studios before mixdown this will not be a consideration. But consider this issue carefully; there are many situations where compatibility with the world outside of your studio is critical.

For example, your songwriting partner or band mate already owns a studio, and you want to be compatible with that studio. This is an easy one...just get the same kind of equipment! The real question is 'how are you going to physically transport your recordings?'. Tape has the obvious edge here; just pull the tapes out of your machines and take them over to your friend's place, even if one of you owns DA-78HR's and the other has DA-38's. The DA-78HR (and DA-98HR) is capable of recording onto and playing back the 16-bit tapes that were made in any other DTRS machine (DA-88, DA-38 or DA-98). It is also possible to synchronize a 24-bit DTRS machine to a 16-bit DTRS machine with no additional equipment if you want to combine machines for more tracks.

Having said all that, with the availability of removable media, removable hard disk drive enclosures and inexpensive CDR (CD-Recordable) technology, exchanging material between appropriately equipped hard disk recording systems is now easier than it's ever been. Just make sure that you and your friend are working in the same file format and software, or at least something that's compatible. To list all the possible combinations of software and computer systems would be beyond the scope of this booklet; however this information is easily found in the documentation of the software or hard disk system that you are using.

The TASCAM MX-2424 24-track hard disk recorder uses standard Sound Designer II files on Mac formatted disks and Broadcast Wave files on PC formatted disks. These files can simply be imported into a large number of popular digital audio applications for both Mac and PC. In order to make the MX-2424 as widely compatible as possible, TASCAM has made OpenTL (the MX-2424's Project format) freely available for compatibility with many familiar digital audio applications.

You may be a commercial studio and need to be compatible with a variety of formats. This is a special case where it may be economically necessary to decide who your clientele is and what gear you need to be compatible with them. For example, in the post-production industry the 8mm TASCAM DTRS tape format is the industry standard due to its high reliability and long recording time. However, a significant amount of post work is being done on hard disk systems to simplify the editing process. Find out what equipment the studios to whom you will be delivering material are using before making your decision.

Portability

You want to record your band's rehearsals and shows in a multi-track format but also in the more controlled environment of your project studio. This means you will have to tote your recording rig to different locations, so size, weight, rack-mount capability and ruggedness are issues to consider.



TASCAM has long been known for manufacturing "bullet proof" equipment, and our reputation for ruggedness is one of the main reasons, along with long recording times, that many mobile recording companies choose DTRS machines for their rigs. It is a little known fact that the tape transports in

DTRS machines are based on flight data recorders that are manufactured by TEAC, the parent company of TASCAM. Those flight data recorders have to withstand the most demanding commercial, military and aerospace conditions, so the back of a truck between gigs is like a stroll through the park in comparison.

With the MX-2424 hard disk recorder TASCAM offers our reputation for ruggedness to the users of hard disk systems for remote recording. An added benefit is that carrying around one MX-2424 for 24 tracks of recording is lighter and takes up less space than 24 tracks of DTRS machines. Just remember that the component most likely to be damaged in transit is the hard disk itself. When using an MX-2424 for remote recording it may be wise to pack an external hard drive in a secure road case for use on the SCSI bus of the MX-2424.

And no matter what you use, DTRS or MX-2424, always mount your gear in road-worthy cases. That's easy to do since all of our equipment is rack-mountable.

Carrying around a computer for location recording might seem a little daunting... not so with the TASCAM US-428 and a USB-equipped laptop! With that kind of system it is possible to record on location and have immediate access to the advanced editing and processing power offered by today's computer software packages.

Editing

Computer-based hard disk recording systems, with their sophisticated software interfaces, offer recording, editing, processing (such as EQ, compression and effects) and mixing all in one package and can even offer MIDI sequencing capabilities. For someone who is comfortable working in the "on-screen" environment this can be a great way to get a lot of power in a small, inexpensive system.

When using a computer-based hard disk recording system the question comes up of "How do I get sound into and out of the computer?" TASCAM offers two choices of interface so that the owner of almost any computer can take advantage of sophisticated software editing functions.

The PCI-822 offers 8 channels of digital I/O on a TDIF connector, MIDI I/O, SPDIF I/O and word clock output on a standard PCI card (Coming Summer 2000) . This makes it easy to interface your computer software with other devices such as DTRS machines, digital mixers like the TM-D1000 or TM-D4000 and various digital two-track recorders.

The US-428 offers 24-bit performance, a physical fader interface, microphone pre-amps, a guitar input, digital & analog I/O, MIDI I/O, transport controls, and it can be instantly connected to any USB-equipped computer.

US-428



There are musicians and engineers who will prefer to work in a more traditional way using a mixing console for mixing/processing connected to a hardware multi-track recorder. Many of these people will still need the kind of advanced editing power offered by a hard disk recorder. The MX-2424 provides that power and more with all of its highly advanced editing functions available from both the front panel of the MX-2424 and its optional remote, the RC-2424. For a visual interface, the MX-2424 is packaged with ViewNet MX GUI (Graphical User Interface) software that will run on a Macintosh or Windows-based computer equipped with a standard 100Mb Ethernet port.

There are two terms we will hear when discussing hard disk editing: Destructive and Non-Destructive. They're not as frightening as they sound once the difference is clear. Destructive Recording/Editing overwrites existing audio with newly recorded/edited audio, just like tape. Non-Destructive Recording/Editing, which came along with hard disk recorders, keeps every piece of audio recorded as a separate file. A set of instructions called an EDL (Edit Decision List) tells the recorder which audio file to play, when to play it and how much of it to play.

Destructive recording/editing uses up less space on the drive since there is only one audio file per track. Non-Destructive recording/editing provides the ability to "undo" edits & recording operations, keep many different versions of a recording and freely experiment without the fear of losing "that great take". The MX-2424 can operate in either Destructive or Non-Destructive mode. It's all about removing the barriers to creativity in recording; you decide how you want to work.

Even though DTRS machines are tape-based it is not possible to perform edits the old-fashioned way using a razor blade! To edit material recorded on a DTRS machine it is necessary to transfer the recording to a hard disk based system. This is easily done using a TDIF-equipped MX-2424 or a PCI-822 equipped computer. This is a scenario that commonly arises when having both tape-based and hard disk based recording systems provides a great deal of flexibility. In fact a studio with both systems could also use the hard disk system to expand the track count of their DTRS rig by synchronizing the two systems.

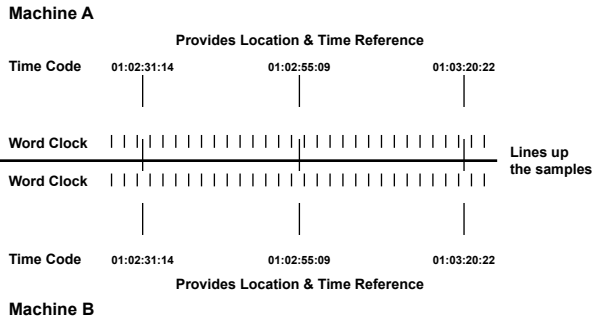
Synchronization

This is an important issue, so much so that it is actually the topic of its very own booklet from TASCAM titled *Timing Is Everything*. However for this booklet we're going to focus on the differences between syncing a hard disk recorder vs. a tape-based recorder and what those differences mean in the real world of recording.

A synchronizer, whether it is a stand-alone unit or built into a recorder, is very simply a device that causes the transports of two or more recorders to run in step with a common timing reference to a high degree of accuracy. This was tricky in the analog era because the wow & flutter of the master recorder had to be exactly tracked by any slave recorders synchronized to it even though the slave recorder had its own problems with flutter!

Things are much easier now that we have digital recorders with zero wow & flutter! By using SMPTE or MTC (MIDI Time Code) for time reference and word clock to line up individual samples between two digital recorders, accurate sync can be quickly achieved. The important things to consider are method of

synchronization, required degree of accuracy, lock-up time between recorders and physical connections.



The most “user-friendly” method of synchronization is that which is built into a modular digital tape recorder like a TASCAM DTRS machine that allows up to 16 DTRS machines to be synchronized without any additional equipment. In this way it is possible to start with an 8-track system and gradually add tracks as needed by adding more machines. This DTRS sync bus carries both time reference and word clock on a single cable so that when the transport controls are operated on the master machine, all the machines in the system lock up within two seconds. This extremely fast lock-up time is yet another reason the DTRS format has become the industry standard in post-production facilities worldwide.

A synchronized system of DTRS machines could then be thought of as one machine, which could be synchronized to something like a video deck or digital audio workstation. This DTRS system could also provide time code and word clock so that other equipment can be synchronized to it. It is important to remember that only the master machine in a DTRS system needs to send or receive sync and word clock information since the machines that are chasing the master operate on the DTRS sync bus.

The 24-bit DA-78HR and DA-98HR modular digital tape machines both feature complete built-in synchronizers capable of master or slave operation. The DA-78HR is designed for both the commercial studio and the musician’s project studio while the DA-98HR has functions specific to the post-production industry and modes for increased sample rates for mastering, archiving and DVD authoring.

When a digital tape machine needs to be synchronized to another piece of equipment it is possible to slightly vary its tape speed as needed, just like an analog tape machine, in order to achieve sync in the event that the incoming time code is not stable.

Synchronizing a hard disk recorder introduces some special requirements that need to be taken into consideration. All the timing information in a hard disk recorder is referenced to a master clock. To be able to vary the transport speed of a hard disk recorder for synchronized operation to another piece of equipment this master clock must be varied or at least have its output modified. This has always required specialized equipment... until now. The synchronizer built into the MX-2424 has the ability to track incoming time code, even from an analog machine, and modify its internal clock to achieve accurate sync.

Many digital recording systems, both tape-based and computer-based, operate in what is known as Lock & Release mode when synchronized to incoming time code. This means that those units snap to a time code location immediately when time code is received, and then run without further time reference to a stable digital clock. In most cases this is acceptable when the time code source is also a stable digital transport. But if the time code source drifts, synchronization will be lost over time. This is not a problem with the TASCAM MX-2424 and DTRS machines (except the DA-38 operating alone) since they have the ability to accurately track incoming time code and adjust their transports accordingly.

When a hard disk or digital tape recording system is used to generate time code for another piece of equipment to chase, that time code will be very stable. That's no problem if the chasing unit is also digital. Word clock is transmitted with the digital audio signal or across a separate connection and will line up the samples for a very steady lock. But suppose the chasing piece of equipment is analog? Our old friends "Wow and Flutter" return for a visit! In this case the synchronizers that are used to control analog machines incorporate a margin of error to compensate for the analog machine's wow & flutter. Typically this is adjustable and for not more than a few frames.

User Interface

So far we've touched a little bit on the issue of user interface...how someone physically interacts with their recorder. This issue deserves a closer look. Hard disk recording systems have always had an on-screen computer user interface or a hardware user interface very different from the tape machines that most people are used to. On a tape machine, whether it's a Portastudio, a two-inch 24-track analog machine or a DTRS machine we have the familiar controls of Play, Stop, Fast Forward, Rewind, track arming and some kind of locate functions. Those controls have always been present on a multi-track tape machine for good reason... the machine would not be very usable without them! Recognizing the widespread familiarity with and understanding of tape-based multi-tracks that has developed over the past 30 years, TASCAM set out to create hard disk recording solutions that incorporate the "tape machine" interface that we're already familiar with.

In addition to the powerful editing controls we all expect on a hard disk recorder, the MX-2424 has full transport controls, track arming buttons, and a 100-point auto-locator both on the front panel and on the optional RC-2424 remote control. These design features make it easy for someone already familiar with a multi-track tape recorder to use the MX-2424 in a way they are comfortable with immediately. In fact, when operating in TL-Tape Mode the MX-2424 will behave exactly like a tape recorder and erase old material on a track when new material is recorded... just like a tape recorder! You can use the MX-2424 like this without the advanced functions ever getting in your way while those functions are always no more than a couple of button pushes away.



Working with a hard disk recorder in a graphical environment is an easy and convenient way to access many powerful functions. A GUI can be used for editing, transport control and machine setup. The GUI that comes with the MX-2424 (ViewNet MX) can directly control all your machines from a single Ethernet-equipped computer. In addition to transport control, track arming, locate functions and editing the ViewNet MX application can also broadcast setup information to any or all machines on the network. Since ViewNet MX is programmed in Java, it will run on a Macintosh or Windows computer.

We like to call the US-428 “the Portastudio for computers” but it’s a great deal more than that! With the US-428 it is now possible to have a hardware interface for software-based hard disk recording systems running on USB-equipped computers with transport controls, track arming and locate functions just like a traditional tape machine. But the US-428 is more than just a recording system controller; it is also a 24-bit audio interface, MIDI interface and hardware fader package that allows all of your software faders to be controlled from a very small and portable unit.

Safety Copies



Recording technology has come a long way in the past decade. We now have available to us powerful and affordable capabilities that we could only dream of just ten years ago. While the reliability of that technology has increased so much that we take it for granted, and many products will continue to work without fail for many years, nothing is absolutely 100% reliable. 99% maybe, but

do we really want to trust that our priceless recordings will not fall into that 1%? No way! Tapes sometimes break, hard drives sometimes crash, things get dropped and broken, recordings get erased, soft drinks get spilled, sunglasses get crushed... you get the idea. If it's worth recording then it's worth making a back-up copy. This is nothing new. Safety copies were routinely made of two-inch 24-track masters even though the cost of one 16-minute reel of tape could be \$125 - \$250!

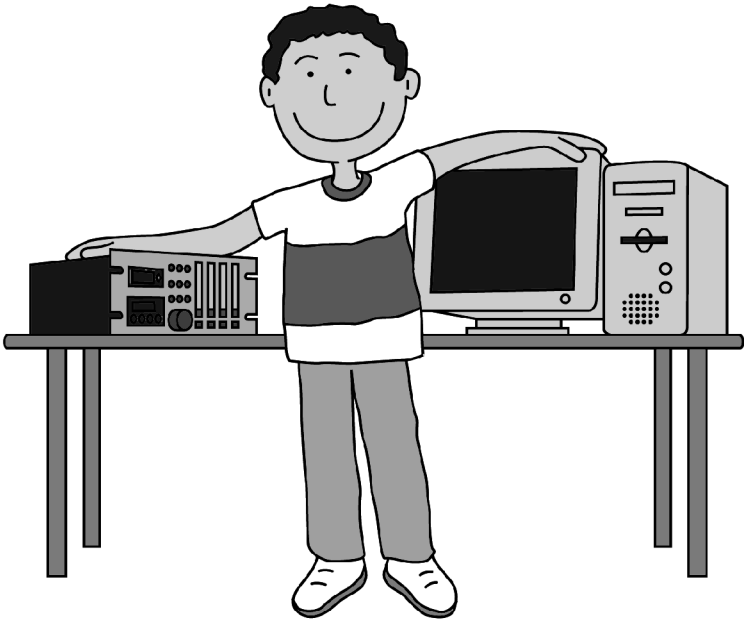
DTRS tape is not that costly. You could back up six reels of two-inch tape for around \$30-\$40. Making a backup copy of your DTRS tapes couldn't be easier. With a single TDIF cable and a single sync cable connected between two DTRS machines you can make perfect digital copies (also called clones since there is no analog circuitry involved). Many people we've talked to are using their DTRS machines to make backup copies of material from their digital audio workstations.

Audio files from a hard disk recording system can also be backed up as data just like any other computer files. You do have backup copies of your computer files don't you? When using a computer-based hard disk recorder it's easy to burn a CD or back up your material to a data tape drive, but what about a stand-alone hard disk recorder?

When designing the MX-2424 TASCAM engineers determined that an inexpensive, reliable, flexible and easy-to-use backup solution should be incorporated on the front panel. Since the MX-2424 utilizes SCSI drives there are various backup options available including tape drives, DVD-RAM and removable hard drive enclosures. The latter can be moved to a computer for backup, just like computer data, to many commonly available and affordable backup formats. A qualified backup device can be installed into the standard 5¼" slot on the front panel or connected to the SCSI bus on the rear panel. Flexibility is important since there is no way to predict every possible setup the MX-2424 could find itself in.

Summary

So what does all this really mean out in the real world? When it comes right down to it TASCAM has a 24-bit digital solution to fit virtually any situation. It could be said that almost anything you'd want to do could be done with either hard disk or digital tape. Certainly editing on a hard disk system is a powerful tool, but not everybody needs it. And it sure is convenient to pull a tape out of a DTRS machine then take it to another studio for more recording or mixdown. The choice has a great deal to do with what you're comfortable with in addition to the technical considerations of compatibility, editing, sync, etc. Hopefully this little book has helped to show how some common things are accomplished on both hard disk and tape so you can decide what capabilities are important to you and what you'll be comfortable using.





TASCAM®

A Whole World of Recording

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