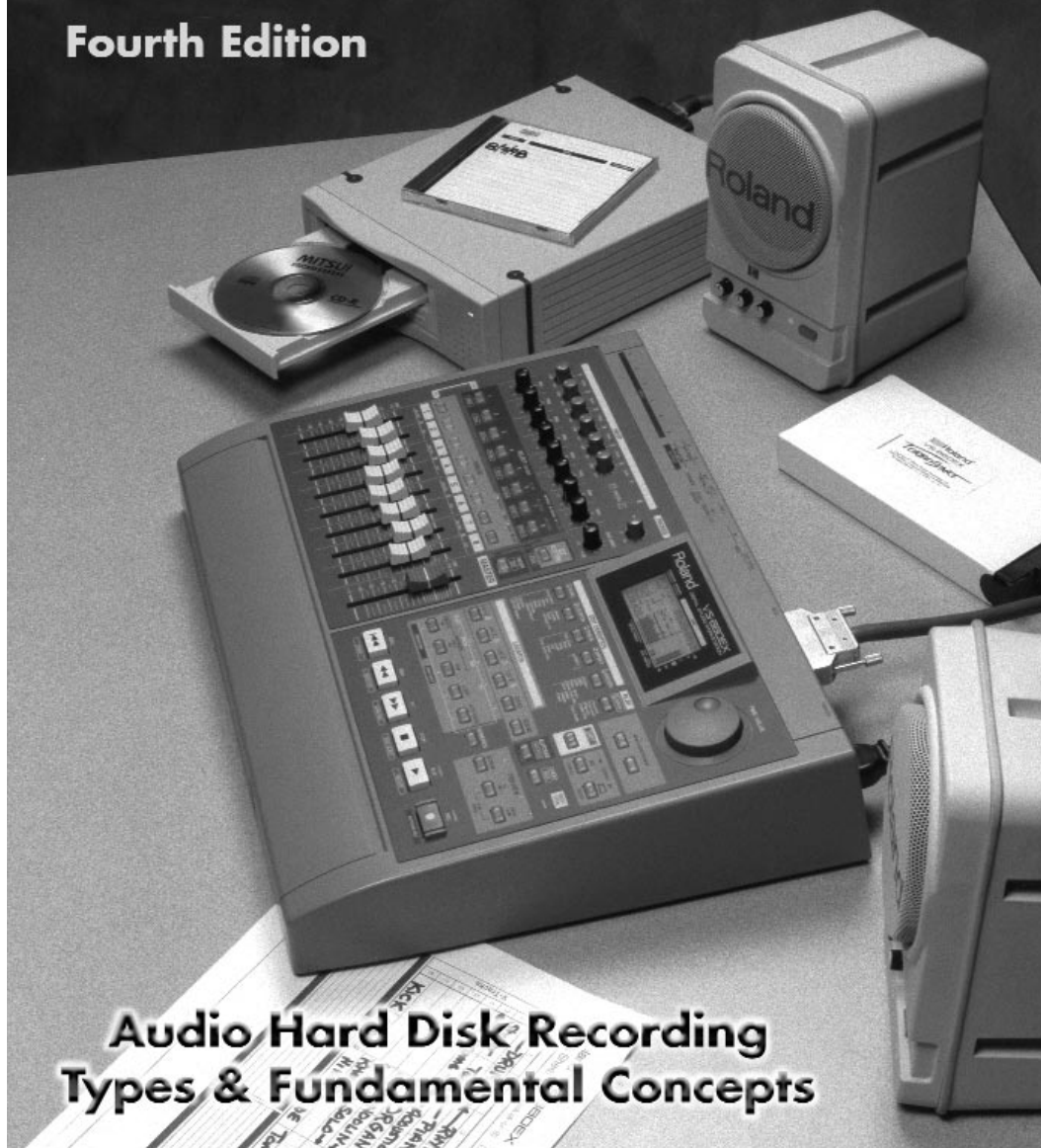
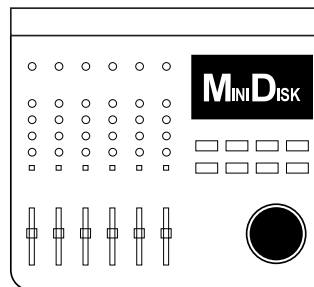
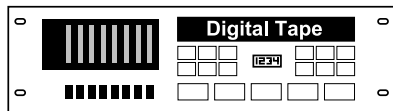
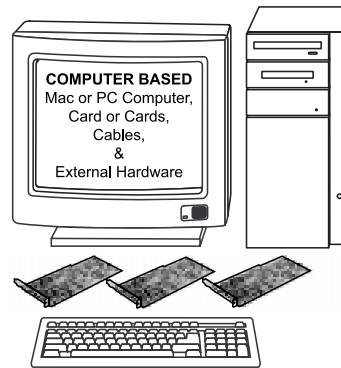
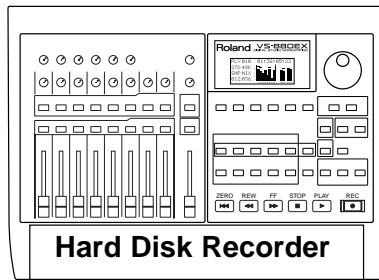


# An Introduction To Hard Disk Recording

Fourth Edition



**Audio Hard Disk Recording  
Types & Fundamental Concepts**



The cover illustration shows a Roland VS-880EX Digital Studio Workstation with the optional Roland VS-CDR CD Recorder, two Roland MA-12 powered monitors, and the VS-880EX TurboStart Video.

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## **An Introduction to Hard Disk Recording**

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Just as word processors have revolutionized the writing process, digital hard disk recorders (HDRs) are giving musicians unprecedented creative freedom in the production of their music.

### Imagine being able to...

- ...record as many tracks of a guitar solo as you want without having to erase one take.
- ...listen to your song in many different arrangements and choose the one that you or your producer likes best.
- ...boldly experiment, knowing that your original recordings are safe and mistakes can be 'undone'.
- ...record, mix and add effects all in one digital unit.

This creative flexibility is what  
Hard Disk Recording is all about.

This guide discusses the issues and power of Hard Disk Recording and will help you to:

- Understand the basics of digital recording,
- Learn about different kinds of digital recorders,
- Understand how hard disk recording is different from other types of digital recorders, and
- Understand the basics of how recording works on HDRs and where your music "goes."

You will see the incredible benefits of such features as: random access; virtual tracks; and pointer based, non destructive editing.

You will also learn about integrating HDRs with effect processors and MIDI devices, and how easy it is to understand and use HDR systems. This second edition has even added the latest concepts and terms to keep you up to date.

Most importantly, this guide will be your doorway to HDRs, showing you how much control they can give you, empowering you to expand your creativity and make your music sound its best.

## What IS Digital Recording?

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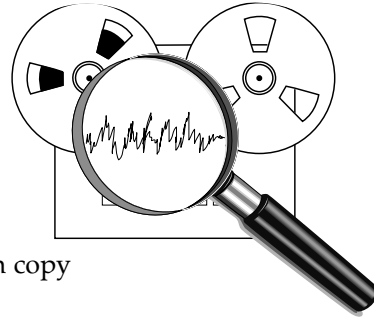
Every recording process converts audio to something.

### Analog tape

Recording on analog tape converts audio to constantly changing magnetic fluctuations.

Although this process has been in use for many years, it has some inherent problems:

- Hiss on original tape and more in each copy
- Wow and flutter of tape media
- Degradation of tape over time
- Maintenance: regular cleaning and adjustment
- Linear access: to get from Introduction to the Ending, you must go through all of your verses and choruses



### Digital Recording

Just like music on an audio CD, digital recording changes sound to numbers.

This process has some distinct advantages over analog recording:

- No hiss, no wow, no flutter: virtually no noise at all
- Copying with no degradation: you're only copying numbers
- Lots of processing options (reverb, delay, etc.) with no loss of sound quality
- Some have random access locating: to get from the Introduction to the Ending, just jump there instantly!



HDR's have extremely high quality audio

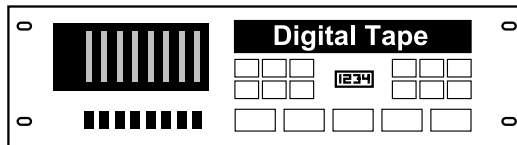
## Different Forms of Digital Recording

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There are several forms of digital recording:

- Digital Tape Recorders (such as Alesis ADAT® & Tascam DA-88®)
- MiniDisk Recorders
- Hard Disk Recorders

### Digital Tape Recorders



Record digitally onto tape.

Advantages:

- Cheap media

Disadvantages:

- Linear access: to get from Introduction to the Ending, you must go through all of your verses and choruses
- Destructive recording: lose the originals when you record over a track
- No UNDOs
- Impossible to copy from one section to another using one unit
- Limited editing without multiple units
- No virtual tracks
- Require you to buy external mixer and effects processors

Basically, they are very high quality "typewriters" (more on this later).

### MiniDisk Based Systems

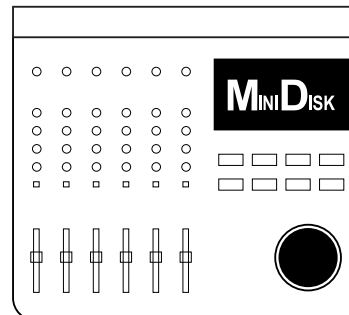
Record onto a data-type MiniDisk.

Advantages:

- Low cost

Disadvantages:

- Most are limited to 4 tracks
- Destructive recording without multiple levels of undo
- Use analog mixers so there is degradation when bouncing tracks
- No on board digital FX
- Track level copying or editing is either impossible or takes additional time or disk space. See page 10 - 12 for more details.
- Can't lock multiple units to increase the number of tracks



# Types of Hard Disk Recorders

## Hard Disk Recorders (HDRs)

Record digitally onto a Hard Disk. Recording to hard disk has many advantages over the other types of digital recorders. For the remainder of this booklet we will focus on HDRs. These recorders really open the doors to your creativity.

## Types of HDRs

There are two basic types of Hard Disk Recorders: Computer Based Recorders, and Dedicated (Stand-alone) Hard Disk Recorders.

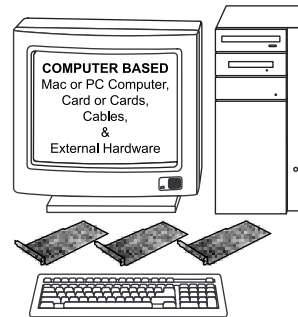
### Computer Based Recorders

Advantages:

- Graphics

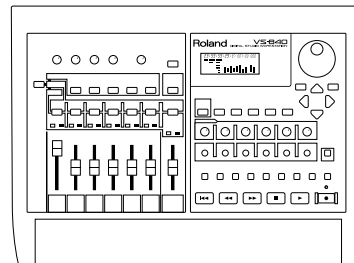
Disadvantages:

- Expensive
- Require advanced computer knowledge
- Usually require a powerful computer, cards, cables, and external hardware
- Often less stable than dedicated units
- Not portable



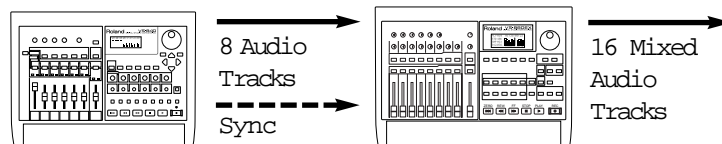
### Dedicated Hard Disk Recorders

Stand alone systems designed specifically for audio recording and editing. Dedicated HDRs range from units that are basically recorders alone, to workstations (all-in-one boxes with mixers with faders and knobs and digital effects).



Advantages:

- Great dollar value
- Familiar layout and controls
- Easy to learn and use
- Extremely stable
- Portable
- Exceptional sound quality
- Multiple units can be easily sync'd to increase the number of tracks



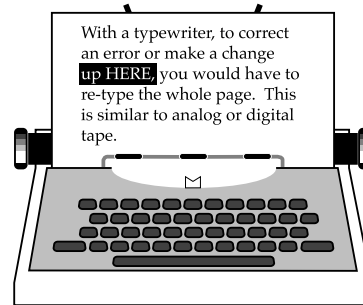
## What's the Big Deal About Hard Disk Recording?

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Let's answer this question with an analogy:

What's the big difference between a typewriter and a word processor?

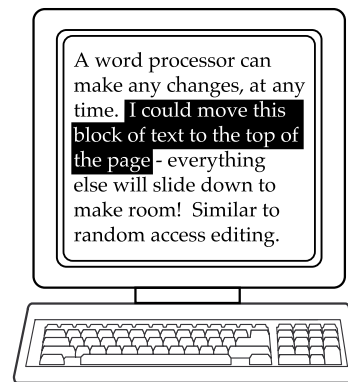
When you write something on a piece of paper with a typewriter, it's there to stay. If you want to change the order of the words, add a paragraph in the middle of the page, or correct a mistake, you are out of luck. You have to start all over again. This is similar to analog or digital tape.



Word processors give you the creative freedom to move paragraphs, copy sections, insert new material, easily fix mistakes, or save several versions of a document.

That's one of the biggest differences between hard disk recorders and linear recording, either digital or analog tape.

HDRs enhance your creativity. They allow you to re-organize your material, fix mistakes and try different ideas to see how they might sound.



Read on to find out about some of the great features HDRs give you, including:

- Random Access
- Virtual Tracks
- Non destructive, pointer based editing
- Digital mixing
- Digital effects
- SMPTE, MIDI, and extensive syncing options

HDRs allow you to try many ideas with your music.

## How Do I Record Music With an HDR?

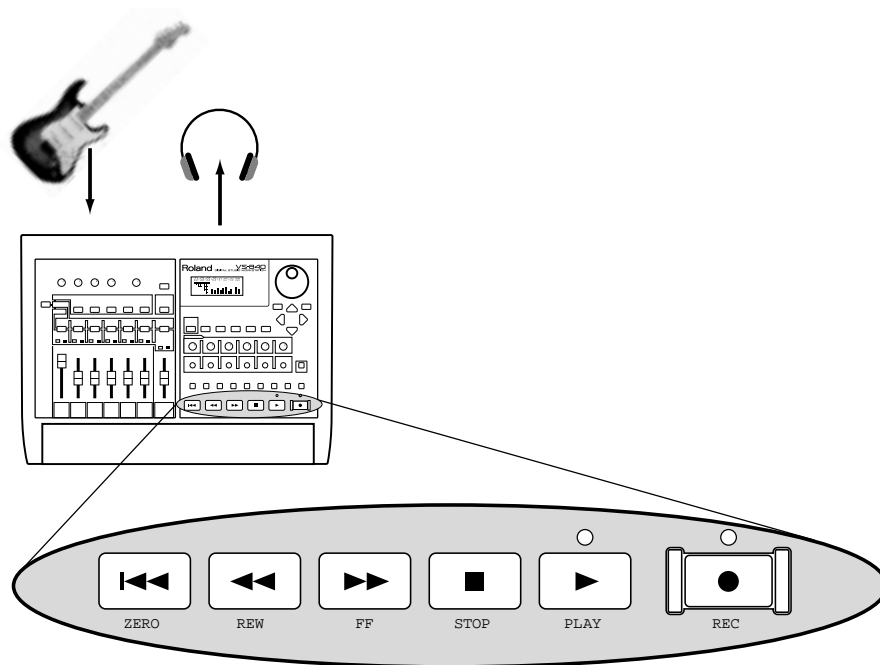
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Dedicated HDRs with digital mixers are easier to use than any type of tape recorder and mixer combination.

Just plug in and start recording, just as you would on an old fashioned tape recorder.

You record right onto tracks just like a tape recorder. When you are finished recording, you can listen to what you recorded and record more material on other tracks.

This process is quite simple because the HDR takes care of all of the work without you having to worry about it!

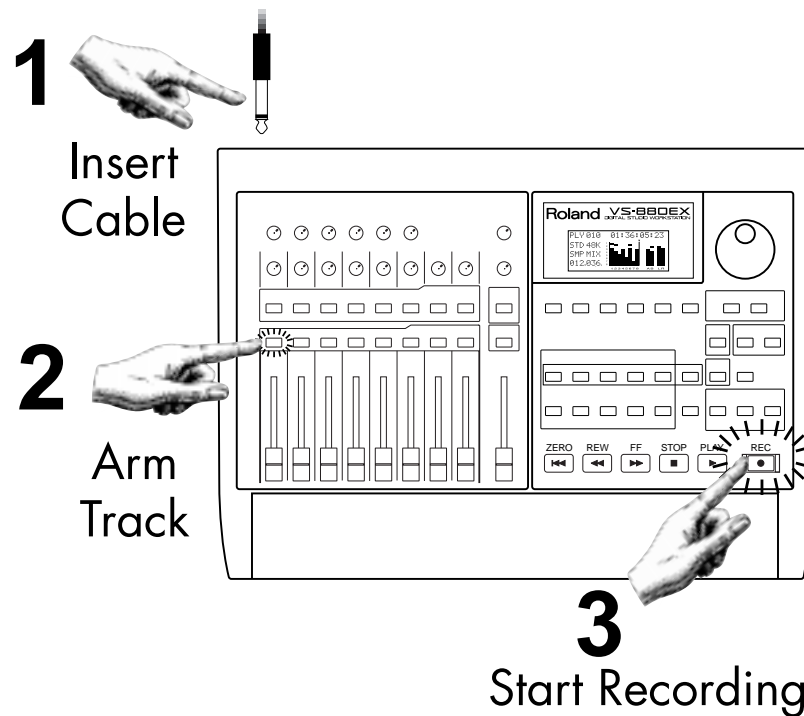


Recording music with HDRs is very easy

## How Do I Record Music With an HDR?

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Recording is as easy as 1, 2, 3!



Recording to an HDR is similar to any tape recorder!

It is also easy to integrate HDRs with:

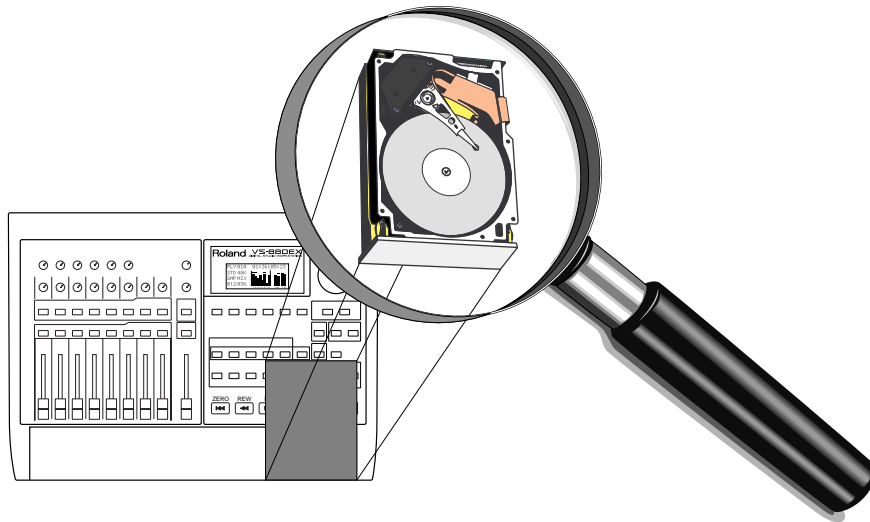
- Drum Machines (using MIDI)
- Keyboard sequencers
- Computer sequencers
- Video
- other forms of recorders, such as Digital Tape recorders

## Where Does the Audio Go in Hard Disk Recording?

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Just as a tape recorder stores your music on tape, a hard disk recorder stores your recordings on a hard drive. The hard drive can be inside your HDR, or your HDR may be connected to an external Hard Drive with a SCSI connector.

The great part: the HDR takes care of the details for you. You really don't have to think about it any more than you would with an old style tape recorder.



HDRs record audio onto a hard disk.

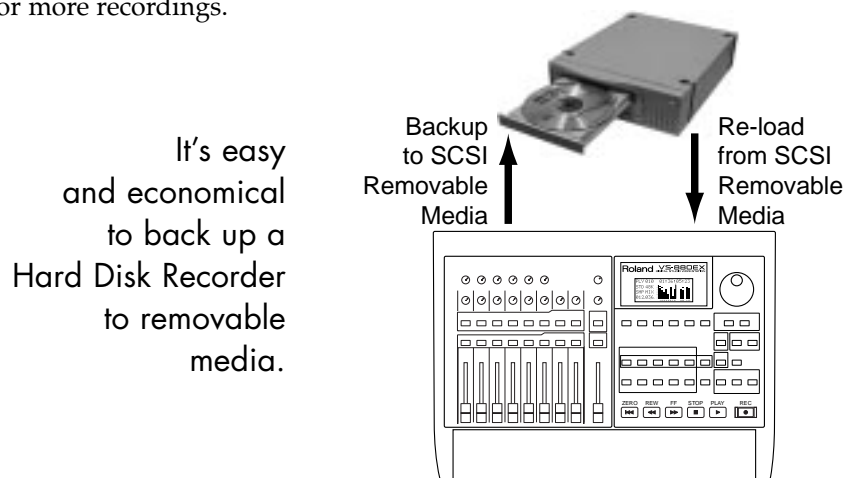
## What Do I Do When the Disk Gets Full?

A large hard disk can hold many songs. Just as a tape gets full, a hard disk also gets full. What do I do then?

Some hard disk recorders have removable media built-in. When you want to start a new song, you just pop out the removable cartridge and put in a new one. The cartridges are very inexpensive and as easy to find and buy as tape.

On other systems, to store your songs and free up space for new recordings, all you need to do is “backup” your recordings onto some form of removable media. Removable media types include Zip drives, Audio DAT, Magneto Optical drives, and even CD-R (Recordable CD).

You can backup songs onto media for future use, or to free up disk space for more recordings.



HDR's can backup a LOT more than audio!

This type of digital backup has some distinct advantages. Unlike analog tape, which only stores your recorded takes, some HDRs can also store all of your mixer settings, effects settings, virtual tracks, edits, different versions of your song, and even all of your Undos! This gets you going very quickly and accurately when you want to work on the song again.

Backing up an HDR to removable media stores lots more information than an analog or digital tape.

## What Is Pointer Based Editing?

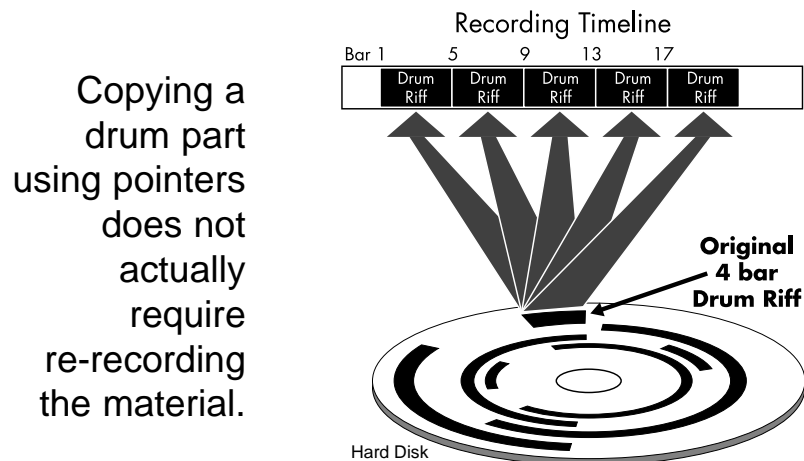
Pointer based editing is the key difference between any tape based system (either analog or digital) and Hard Disk Recorders.

Once you have recorded something onto your hard disk, you never “touch” that material again. It stays there, ready for a command from the HDR to play part or all of it.

For example, if you record a vocal on tape, and then decide to erase part, you are erasing your original recorded material. It is gone forever!

If you record a vocal on a pointer based hard disk recorder and erase part of it, you aren’t erasing the original material, you are just telling the HDR to play only part of the original recording. You never actually erase the original material! You can use an UNDO to get back to the original recording if you decide that you like the original better.

Likewise, if you want to copy a drum part you recorded, you don’t need to record that part again as you would have to on a tape based system. All you are doing is instructing the HDR to play the same material over and over at different points in your song, using “pointers” to the original material. This is commonly referred to as “pointer based editing.”



**WARNING** - make sure your HDR is pointer based or these advantages do not apply!

## Pointer Based Editing

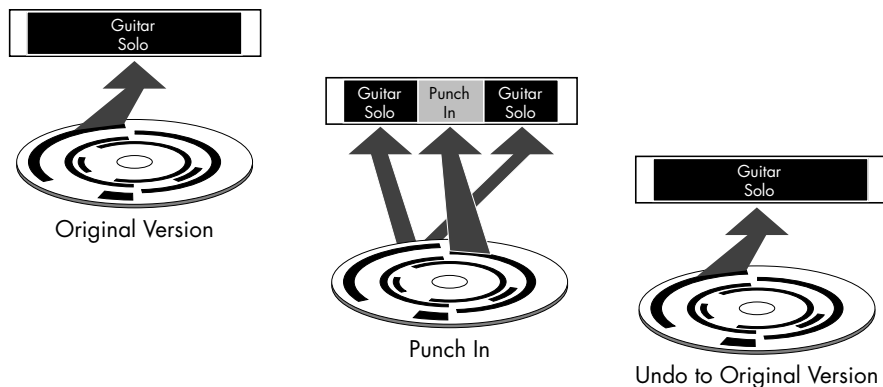
What are the advantages of “pointer based editing?”

First of all, in most HDRs, you can Undo any erase, cut, or copy anytime. Remember, the original is still there! You never lose your ability to go back and change something if you decide you need to.

Secondly, copying is instantaneous because you aren't actually copying the original material, you are just adding a “pointer” to tell the HDR to play it again. You can use copy to make different arrangements of your song, and it doesn't use any room on your hard disk!

Let's say you record a guitar part on a track. Then you punch in a new section and you realize you made the punch too early. With an HDR, you can always go back to the original recording. Try that with tape!

You can erase, cut, or move anything anywhere without destroying your valuable recordings. If you don't like it, just 'Undo' it.



This all means that you can try any old idea that you like, and compare it with the original to decide which you like best. This is a huge advantage for your creativity.

This is what Hard Disk Recording is all about!

Pointer based editing allows you to quickly try your ideas without the fear of making a mistake.

## Pointer Based Editing

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### Song Arrange

Some Hard Disk Recorders can even edit for you. This function is called Song Arrange. It steps you through the process of re-arranging your song, automatically making a copy with the new sections for you.

You could specify a shorter Intro, two Choruses after the first verse, a repeat of the Intro before the Bridge, then a doubled ending. You can even add other parts to this new version and compare it to the original. Song Arrange does the edits automatically, instantly, without taking up any disk space!

Pointer Based Editing  
lets you experiment quickly and easily  
without worry!

### Summary of Pointer Based Editing

Pointer Based Editing has many advantages. It allows you to Undo an edit such as an Erase or punch-in. Looping a drum part or copying a vocal is virtually instant on most pointer based HDRs. Pointer based editing even allows you to experiment with different versions of a song, all virtually instant and without taking up any additional disk space.

To help clarify the difference between HDRs, MiniDisk recorders, and digital tape recorders; let's examine what you would need to do to loop a drum part on each of these types of recorders.

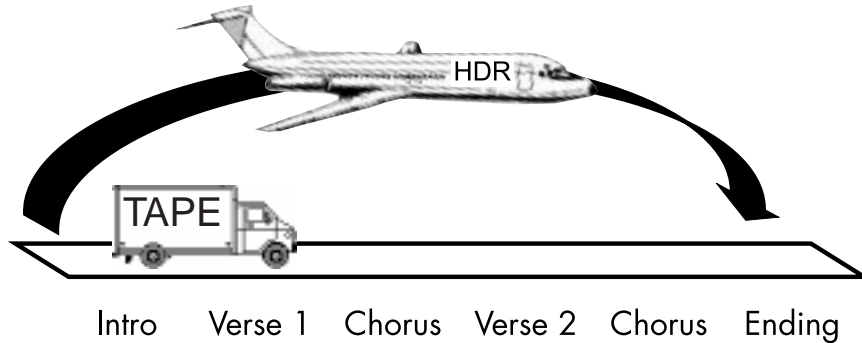
Looping a Drum Part on Digital Tape: You would need two tape recorders, one for the source and one for the copies. You would also have to synchronize them and figure out exactly where to punch in each copy. This process is destructive re-writing of the original, and would be very time consuming.

Looping a Drum Part on a MiniDisk: Most MiniDisk 4 tracks don't allow track level editing, so the process would be the same as described in the digital tape example. Otherwise, it would require destructive re-writing of each copy to disk, taking time and disk space.

## What Is Random Access?

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Unlike a tape based system, HDRs don't make you fast forward through all the verses and choruses to get from the beginning to the end. Just jump there instantly.



# Random Access is FAST!

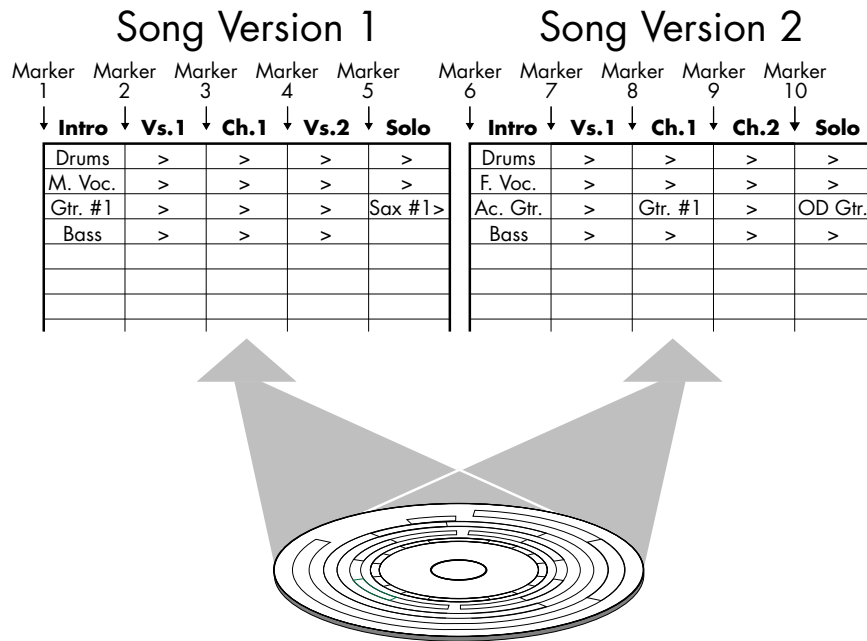
You can immediately jump to a specific bar and beat, or time location in your song. In fact, some HDRs allow you to have hundreds of markers so you can jump to any location, instantly.

This is another way that HDRs help your creative process - speed. You don't have to wait to rewind to try a new solo when your creative juices are really flowing. You can jump instantly to the second chorus to see how it compares to the first. You can instantly jump from one version of your song to another, to see how it sounds with 2 choruses after the second verse instead of the one you originally recorded. The possibilities are endless.

Using a Random access system  
means not having to wait for rewinding –  
you can keep your creative processes flowing.

## Random Access

Using Pointer Based Editing in a Random Access System allows you to quickly and easily try different versions of your song.



### Try different arrangements of your song:

- #1. Copy your whole song
- #2. Change the order of verses, number of choruses, choice of solo and vocal, etc.
- #3. Use markers to quickly jump from section to section to compare the two versions of your song.

If your HDR has a digital mixer with FX and automation, you can even compare mixes of your song in this same way.

Random Access and Pointer Based Editing  
can help you make better music.

## What Are Virtual Tracks?

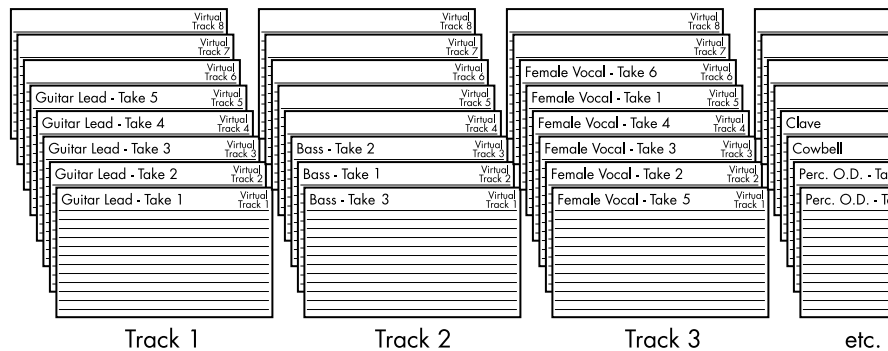
In the “old days” most albums were recorded in studios with expensive tape recorders with lots of tracks. Often the artist needed many tracks in order to have several different versions of the lead vocal, or the guitar solo. Or, maybe they wanted to have several background vocals on different tracks, so they could mix them later. They needed so many tracks because they didn’t want to throw away any of their recorded takes!

The Virtual Tracks that some HDRs have give you this same ability to keep all of your takes for later comparison, editing, or re-mixing.

Here’s how Virtual Tracks work:

Picture several piles of filing cards. Each pile has one card on top, with several others underneath. By shuffling the cards, you can bring any individual card to the top at any time. Virtual Tracks work in the same manner. Each track has one main or top virtual track. That is the track you hear.

You can bring any track to the top anytime you want. In fact, you can even make a new virtual track that contains pieces of the other virtual tracks or even mixes of the other tracks. These Virtual Tracks or layers are just different storage locations for your recordings.



You can keep many takes of a guitar solo on the same track using virtual tracks.

## Virtual Tracks

---

How can you use Virtual Tracks to help you make music?

### Recording a guitar solo:

On different Virtual Tracks of one track, you can record several solos. You don't have to erase previous takes or lose other tracks. You keep your creativity flowing, then later decide which solo (or parts of solos) you want to use.

### Recording background vocals:

Record several tracks of background vocals. Mix or bounce them to one track for playback. You can now re-use these tracks for other instruments and still re-mix the original vocal parts later if you want. They're still safely stored on virtual tracks.

### Recording a dry guitar and a processed guitar at the same time:

Record a guitar with all of your effect pedals. Also record a dry guitar without effects on a different track. Keep the dry guitar on a different virtual track in case you later decide to mix it with the guitar.

Virtual Tracks can make your music-making process

V Track 1: Lead 1

V Track 2: Lead 2

V Track 3: Lead 3

V Track 4: Lead 4

## Digital Effects

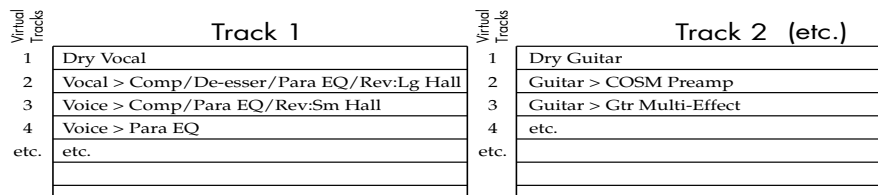
Some HDRs have built-in digital effects. These effects allow you to process your sound without leaving the digital domain. Some even have effects such as Roland's COSM guitar preamp and microphone modeling. Just plug in a guitar or mic and choose from a selection of amp and microphone sounds at any point during recording, editing, or mixing.

Remember, you lose quality every time you move in and out of the digital domain. Also, if your HDR doesn't have internal effects, you will need to buy additional effects processors.

Advantages of internal digital effects:

- Maintain the highest sound quality by keeping everything in the digital domain
- Customize different effects types and levels for every track
- Experiment with different effects without changing or losing your original recordings
- Keep the dry, unaffected track for use at any time
- Automation
- No cables to worry about

You can have a truly portable studio, with on-board processing to make a vocal or guitar part sound great, without having to lug around extra gear.



This diagram shows how Virtual Tracks and internal digital effects work together to get the most out of your music!

Keeping your whole song digital  
can make it sound much better.

## Digital Mixing

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There are many advantages to HDRs with built-in digital mixers.

- You keep everything in the digital domain. You don't lose fidelity when bouncing or mixing tracks
- Digital mixers with automation, snap shots, and scenes give you more control over your mix
- Dedicated digital faders and knobs make mixing faster and easier
- Built-in digital mixers adds portability to your HDR system

If your HDR does not contain a mixer, you'll need to purchase a console specifically designed for recording.

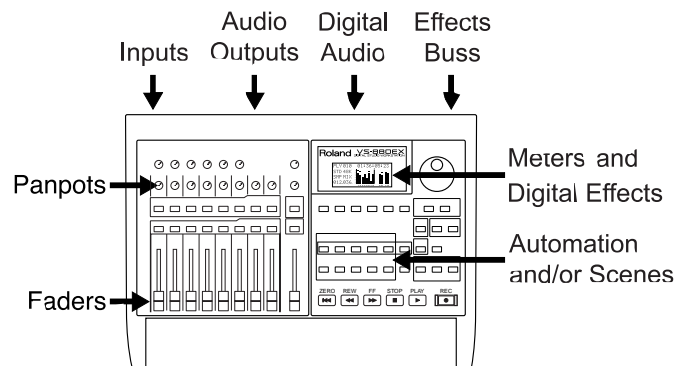
An integrated HDR and digital mixer often allows you to:

- Compare different mixer settings instantly (level, pan, etc.)
- Restore all effect and mixer settings when you re-load a song!
- Craft intricate mixes
- Recall the levels and effects for bounced tracks to re-mix them
- Even automate your mix

Internal digital mixing allows you to make an audio CD directly from some Hard Disk Recorders! This gives you complete control over your entire musical project.

### EZ Routing

Some HDRs with integrated digital mixers include onboard assistance with the process of Recording, Bouncing & Mixing. The HDR makes mixer and routing settings automatically after you answer simple on-screen questions.



Save time by storing your custom mixer and effect settings with each song.

## What About MIDI?

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Many people use MIDI to record keyboards or drum machines. Most HDRs make it easy to work with MIDI.

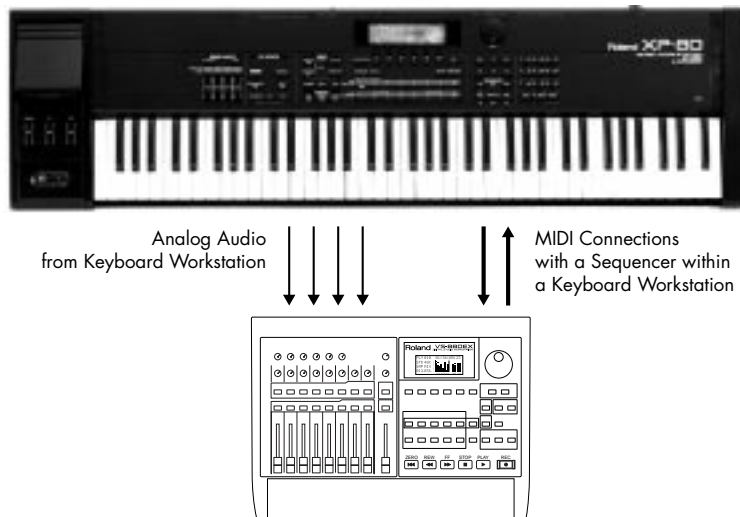
HDRs with digital mixers typically have additional inputs for keyboards, sound modules, or an outboard mixer. These inputs can be mixed with your recorded tracks for the final digital mix.

Some even allow you to create a tempo map of bars and beats to match your song. This makes your editing more musical and creates MIDI Clock to keep your drum machine or keyboard sequencer in sync with your HDR.

MIDI Machine Control and MIDI Time Code are also ways that most HDRs synchronize with your sequencer.

If your HDR has a digital mixer that can be controlled via MIDI, then your computer sequencer can be used to automate and control your mix. Some HDRs even have the ability to automate the mix without the need to purchase an external MIDI sequencer.

These capabilities allow you to easily integrate an HDR into your MIDI environment.

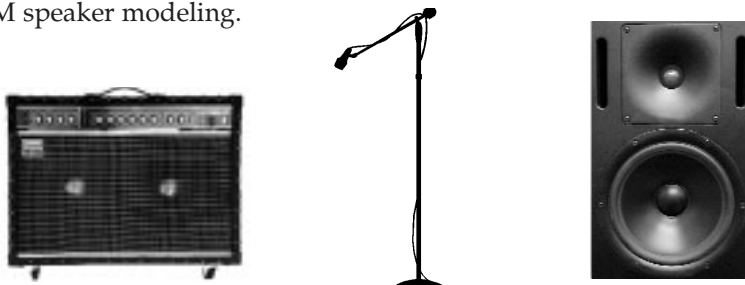


## Modeling

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Having all of your audio and FX in the digital domain has huge advantages, as we have seen. One of the great new technologies available using digital FX is modeling. Modeling technology takes a known source and "models" the sound characteristics of one or more usually very expensive sound processors or devices.

The three most powerful modeling technologies available today are COSM\* guitar amplifier modeling, COSM microphone modeling, and COSM speaker modeling.



Guitar modeling simulates the sound of very expensive guitar pre-amps, amplifiers and speaker systems using as an input a standard electric guitar.

Microphone modeling simulates the response of some very expensive large and small diaphragm condenser mics using as an input very inexpensive dynamic microphones.

Speaker modeling creates the listening experience you would have using a variety of expensive studio monitors or even TV speaker or a boom box from the same, inexpensive digital powered reference monitors\*\*. Using just this one set of speakers you can hear how your mix would sound in a variety of listening environments. This is a great way to improve your mixing skills and make your music sound its best in a variety of settings.

\* COSM stands for Composite Object Sound Modeling, a proprietary technology from Roland Corporation. COSM is used to model a wide variety of expensive microphones, guitar amplifiers, and monitor speakers.

\*\*COSM speaker modeling uses the COSM modeling software in the VS-880EX or VS-1680 with the the Roland DS-90 Digital Powered Reference Monitors to model a wide variety of speaker systems.

## How Does Modeling Work??

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Let's take a closer look at speaker modeling to understand how this revolutionary technology works. First of all, you need a "source" speaker system designed to work with the modeling. All of the sound reproduction characteristics of that speaker system is studied by the engineers and mapped out. Next, the same characteristics of the speakers being modeled are studied and also charted out. Then advanced DSP technology is used to adjust the output characteristics of the source speaker system to exactly match the output qualities and characteristics of the speakers being modeled.



The bottom line is that you can listen to your mixes as they would sound on a wide variety of very expensive and also some inexpensive, lower fidelity but very common speaker systems. Using Speaker Modeling, you can check your mixes and make sure they will sound great in many different listening environments just as they do in very expensive studios all over the world!

Modeling technology lets you save lots of money  
and still make world class music.

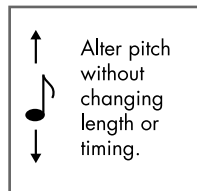
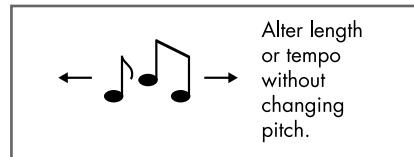
## Other Advantages of Hard Disk Recorders

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### Time Compression

Some HDRs include the option of Time Compression. Since the information on an HDR is stored as numbers (binary info just like a computer), it's possible to process these numbers several ways.

One way is to change the length of something without changing the pitch.

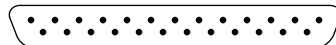


OR, fix the pitch without changing the length.

So now you can fix that flat vocal note, or slow down a rushed drum fill in an otherwise perfect take!

### SCSI (Small Computer System Interface)

A SCSI connection allows your HDR to connect to extra storage (hard drives) for more recording space. It also makes it easy to backup and store your songs for later use to SCSI removable media like Zip and magneto optical drives.



A SCSI buss may allow you to interface directly with a computer for audio file integration with a sequencer. In some cases SCSI will allow you to record a CD directly from your dedicated Hard Disk Recorder, or even to backup song information including all Virtual Tracks, all mixer settings including EQ, effects, scenes and automation, and all editing and UNDO levels.

## Comparison Chart

	Roland VS Family of Hard Disk Recorders		Digital Tape	MiniDisk	Analog Tape
	VS-840EX	VS-880EX			
64 Virtual Tracks	64	128	No	No	No
Non Destructive Pointer Based Editing	YES	YES	No	Limited	No
Onboard Digital Mixing	YES	YES	No	No	No
Onboard Digital Stereo Effects	YES	YES	No	No	No
Dynamic Mixer Automation	NO	YES	No	No	No
Snapshot Mixer Automation	NO	YES	No	No	No
Non Destructive Punch In and Out	YES	YES	No	Limited	No
Waveform Editing	YES	YES	No	No	No
Non-destructive Track & Phrase Level Editing	YES	YES	No	No	No
Easy Multiple Versions of the Same Material	YES	YES	No	Limited	No
Time Compression	NO	YES	No	No	No
Note Level Pitch Correction	NO	YES	No	No	No
Onboard Digital EQ	YES	YES	No	No	No
Undo's	999	999	No	Very Limited	No
SCSI Buss for external drives and backup	Optional	YES	No	No	No
Digital inputs and outputs	OUT	YES	No	No	No
Instant, random access locating	YES	YES	No	Yes	No
Backing up stores mixer settings, effects, Virtual Tracks, and Undo's	YES	YES	No	No	No
Sync multiple units for 16/24/ or 32 tracks	As Master	YES	Yes	No	No
Direct CD Mastering & Backup	NO	YES	No	No	No
Microphone Modeling / Speaker Modeling	YES/NO	YES/YES	No	No	No
PC & Macintosh file transfers (3rd party software)	NO	YES	No	No	No
EZ Routing	YES	YES	No	No	No
Song Arrange	YES	NO	No	No	No

# Feature Comparison

## Summary

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Hard Disk Recording offers extensive advantages over other recorders. How many people who have gotten familiar with the flexibility of a word processor would ever go back to using a typewriter? HDRs give you this same kind of power with your music.

HDRs have the ability to:

- use Virtual Tracks to record and edit many different solos on one track
- keep background vocal takes in case you want to re-mix them later
- have access to the quality and control of built in digital effects
- record and edit without fear of losing your valuable material due to many levels of Undo
- be able to try many different arrangements of your song
- use mixer automation
- record an entire song, mix, & effects in digital domain
- master a CD directly from your HDR
- jump from Intro to the last chorus instantly without having to wait for fast forward (or rewind)
- synchronize easily with MIDI, video, and other recorders
- connect multiple units together in sync for more tracks

All of these advantages truly will help you make better sounding music, whether its a demo of your songs, a sound track for a film, or a finished CD made digitally right from your HDR.

Enhancing your creativity is what Hard Disk Recorders are all about.

### The Roland VS-880EX

The Roland VS-880EX includes all of the great HDR features and advantages we have been discussing.

- 128 Virtual Tracks
- 999 levels of Undo
- Fully automated 16 channel digital mixer
- Two built-in stereo digital effects processors with: COSM mic, amp, and speaker modeling; 3-D effects; reverbs; delays; graphic and parametric EQ's; compressors; limiters; guitar effects; etc.
- 1,000 markers
- 32 bands of digital EQ
- Waveform editing
- Integration with computer based systems
- Portability
- SCSI port for expansion
- Extensive syncing methods
- Digital In & Out
- 'TurboStart' video included

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### The Roland VS-840EX

The Roland VS-840EX is less expensive than the VS-880EX, but still packs powerful features, plus a few of its own.

- 64 Virtual Tracks
- 999 Levels of Undo
- Built-in Zip drive for fast and easy song storage
- 12 Channel Digital Mixer with Scene Memories
- Built-in Stereo Effect Processor with COSM guitar amp modeling, reverbs, delays, RSS 3-D effects, parametric EQs, compressors, limiters, guitar effects, bass simulator, and more
- Tuner
- 1000 Markers
- EZ Routing and Quick Record
- Song Arrange
- Waveform Editing
- 24 bands of Digital EQ
- Digital Output (Optical and Coaxial)
- Bar and Beat Tempo Maps and Display
- Dedicated guitar input
- Portability

### The Roland VS-1680

For even more power, the Roland VS-1680 includes:

- 16 Channels of Track Playback
- Internal 16 Track to 2 Track bouncing
- 8 Tracks of simultaneous recording
- 256 Virtual Tracks
- 26 Channels of Fully Automated digital mixing
- 4 onboard digital stereo FX processors (with optional FX boards)
- Crossfading and advanced editing capability
- SCSI support for computer integration and direct CD burning
- COSM microphone, guitar amplifier, and speaker modeling
- and much more.

## Glossary

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Analog Audio Storage: Constantly changing voltages stored on magnetic tape.

Arming tracks: Selecting a track to record on. Also called "Record Ready".

Audio DAT: Audio recorder that stores 2 tracks of material on magnetic tape in digital format. Often used for pre mastering storage and usually has stereo digital inputs.

Automated Mix: Storage of fader movement, panpots, and all mixing controls to allow very precise control over the final mix.

Back up: To archive or save a second version of the material you have recorded and edited to some form of removable media. This frees up space for new songs. The fastest back up is via the SCSI port to removable media. Other forms include digital back up to Audio DAT.

Bouncing Tracks: Combining several tracks to a mono or stereo track. Used to free up tracks for more recording. Usually the original tracks are then recorded over, erasing the original recordings. With Virtual Tracks, the original tracks can be saved for re-mixing later, if needed.

Computer based recorder: Digital Audio Recording that uses a computer for control. This method usually requires software, audio cards, external sync boxes, and audio interfaces.

Digital Audio Storage: Audio is converted to binary numbers and stored on hard drives, or tape.

EZ Routing: A fast & easy way to set up Recording, Bouncing & Mixing. Makes mixer and routing settings after you answer on-screen questions.

HDR: Hard Disk Recorder. A Digital Recorder that stores audio on a hard disk.

Hard Disk: Mechanism used to store digital information for computers and HDRs.

Hiss: The background noise common to all analog recorders. This is more noticeable in smaller tape formats such as cassettes and is additively increased during any copying process such as track bouncing.

MIDI: Musical Instrument Digital Interface. A language allowing note information and control information to be communicated from keyboards to sound modules and to be recorded on MIDI sequencers.

MIDI Clock: Timing information derived from Tempo Maps used to synchronize MIDI sequencers and other devices.

MMC: MIDI Machine Control. Transport commands such as Play, Stop, and Locate that are used to control one audio or MIDI device from another.

MTC: MIDI Time Code. A representation of real time in Hours: Minutes: Seconds: Frames: Subframes communicated via MIDI and used for synchronizing audio or MIDI recording devices.

MiniDisk Recorders: Record audio onto data type MiniDisks. Usually combined with analog mixers, they can only play back up to 4 tracks.

## Glossary

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- Non destructive editing: Editing that doesn't change, erase or delete the original material, just changes a playlist of play and stop pointers.
- Random Access: The ability to instantly jump to any event in time.
- Pitch Correction: A digital algorithm that changes the pitch of a phrase of audio without changing its length.
- Pointer Based Editing: Feature of HDRs that make them non destructive and capable of many levels of undo. Editing doesn't re-record or erase the original material, which remains unchanged for future use.
- Removable Media Drives: Zip, Magneto Optical, CD-R (Recordable CD), or other drive that stores data on removable disks or cartridges. They allow you to back up your songs, or load previously recorded material. They are almost always SCSI devices.
- Restore: Loading material that has been archived on removable media or other digital back-up to your hard drive for more editing or recording.
- SCSI: Small Computer Systems Interface. A high speed standard used to transfer digital information from a computer or HDR to another storage device such as an external Hard Drive or removable media.
- SMPTE: A representation of real time in Hours: Minutes: Seconds: Frames: Subframes format that can be recorded to an audio track or to video, used for synchronizing audio, video or MIDI recording devices.
- Snap Shot: Storage of all mixer settings at one instant in time.
- Song Arrange: Automatic way to make a copy of a song with a new arrangement. User specifies sections and their order, then the HDR automatically makes a new copy without using any additional disk space.
- Magneto Optical (MO) drive: SCSI based removable media that stores digital information using lasers and a polymer substrate. Very reliable storage, but not as fast to read or write as magnetic hard drives.
- SubMix: Often MIDI generated audio is mixed to stereo and routed as a separate, or "sub", mix to the digital mixer of an HDR. The total mix is then output digitally to DAT for mastering. This allows the HDR recorded material to remain in the digital domain.
- Tempo Maps: Referencing recordings by Bars and Beats for easy editing. Tempo maps can be created before or after a recording has been made.
- Time Compression: A digital algorithm that changes the length of a phrase of material without changing its pitch. Used for matching or changing tempos.
- Undo: The ability to instantly restore a system to a previous state after an edit or recording. Multiple levels of undo allow a user to try several edits without the risk of losing their original material.
- Virtual Tracks: Storage areas for more recordings "underneath" the main track. Virtual tracks allow recording many different solos or versions on the same track, without throwing away material. Later the material can be edited together to produce a "best of", or different version. Stays with the song when it is saved or backed up.



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