

Welcome to Pro Tools 101!

This course covers all of the foundational skills necessary to record, edit, and mix on a basic level using a Digidesign Pro Tools system. The main focus is on learning to use fundamental tools and techniques through demonstrations, real-world examples, and frequent hands-on assignments.

The required use of the Pro Tools 101 official courseware (available in the book store) is a comprehensive workbook that's accompanied by step-by-step exercises using Pro Tools demonstration sessions. This course offers several advantages, including:

- additional focused, hands-on practice activities
- weekly quizzes to help you gauge your progress
- interaction with your instructor and classmates.

Goals

Upon completion of this course, you will have learned to:

- start up and configure a Pro Tools session
- use the main Pro Tools windows and customize displays
- record audio into a Pro Tools session
- import audio files and regions
- use basic Pro Tools MIDI features
- work with selections and navigate a Pro Tools session
- create audio regions and edit tracks
- create stereo mixes within Pro Tools
- process audio using RTAS plug-ins
- bounce to tracks and disk
- work with music and postproduction projects

Pro Tools 101

Lesson 1 Due Jan 8th

- **Introduction**
- **Capabilities of Pro Tools Systems**
- **The Evolution of Digidesign**
- **Elements of Sound**
- **Digital Audio Theory**
- **Quiz**
- **Configuring a Pro Tools System**
- **Assignment: Your DAW**
- **Recap**

Introduction

Welcome to Pro Tools 101. This week's lesson will provide an overview of Pro Tools, review its historical development, and familiarize you with the technical fundamentals of sound and digital audio.

Objectives

Upon completion of this lesson, you will be able to:

- identify the fundamental capabilities of Pro Tools
- describe the development of both Pro Tools and Digidesign
- recognize the significance of Pro Tools within the general history of digital audio
- understand the basic characteristics of sound
- describe the differences between analog and digital audio
- identify the significance of digital audio specifications for sample rate and bit resolution
- compare the capabilities of various Pro Tools configurations
- choose the appropriate Pro Tools system, whether native or TDM, based upon your need.



Read Chapter 1

Capabilities of Pro Tools Systems

Pro Tools is as prominent today as a tape recorder was twenty-five years ago. Vast multitrack recording capability, non-destructive editing, MIDI sequence playback, automated mixing, signal processing, integrated software, synthesizers and samplers, full video support, and numerous other capabilities make it possible to use Pro Tools for anything that involves audio recording.

- Multi-Track Audio Recording
- Audio Editing
- MIDI Sequencing
- Full Mixing and Mastering capabilities
- Audio post production for video
- Provides a true industry standard

The Evolution of Digidesign

Pro Tools was introduced as an upstart system “for the rest of us,” providing a low-cost alternative to professional audio products of the 1990s. Today, it is the industry standard for digital audio production. The workbook provides a detailed history of Digidesign on pages 6–17.

Elements of Sound

Making recordings with Pro Tools is more an art than science... yet there is a technical underpinning that draws heavily from such fields as acoustics and electrical engineering. Often you’ll do fine by simply listening and expressing your musical ideas, but at times choices must be made that require a more technical thought process. While you don’t need to be an expert, a basic familiarity with acoustics and digital audio goes a long way. We’ll do a brief review of digital audio theory that was taught in Intro to Music Technology last Fall. Make sure you’ve completed the assigned reading below before continuing.



READ!

Chapter 1, pp. 20-21.

What Is Sound?

Sound is a complex phenomenon that includes three distinct elements: a **source**, **medium**, and **receptor**. Let’s look at some examples:

The Source

The sound source can be a musical instrument, voice, or any physical object that is elastic enough to vibrate when it is excited (as in plucked, bowed, hammered, etc.). Many objects can be forced to vibrate, but certain ones will sustain a distinct pattern of vibration and the result will be a musical tone.

The Medium

A vibrating object won't have much impact unless it's surrounded by a medium capable of transmitting its energy. Fortunately, just about any environment—air, water, even solid substances—will do this. The patterns of sound energy radiating through a medium are called waves, familiar to anyone who's dropped a pebble in a pond.

The Receptor

The receptor is any device designed to respond to a vibration, either machine or living being. The microphone is an obvious example, but we can also consider our ears, central nervous system, and brain to be a complex sound receptor. The critical difference between microphones and human hearing is that people also have a psychological response to sound waves, so discussing what we hear is not quite the same as observing the patterns measured by a microphone, though of course they are related.

Parameters of Sound

A good way to understand the details of a sound is to study a graphical representation. This can easily be accomplished by connecting the output of a microphone to an oscilloscope, which plots the signal's changing voltage as a function of time.

Digital Audio Theory

In the last section, we examined the fundamental nature of sound and how it makes its way from a source to receptor. Now, let's look at some important issues involving how sound is represented in the digital world, where massive streams of numerical codes carry all the subtle details of the original acoustic phenomena. To best understand how this works, we'll first discuss the principles of analog audio and how well it fares in conveying sound. Then, we'll establish the basic parameters of digital encoding so you can understand how these issues come into play when doing recording projects.

Complete the assigned reading below before continuing. After finishing this topic, you'll be able to check your progress by taking a quiz on basic acoustics and digital audio.



Analog Recording

In order to use Pro Tools—or any other audio production system—we must first represent sound in a form that can be stored and manipulated. You can't simply capture sound waves in a jar and release them at a later time! Years ago, the most effective way to do this was to create an analogous pattern of vibration in a different medium. For example, early phonographs stored sound as grooves in wax cylinders, and later disks.

But these early recorders could not modify the characteristics of sounds or manipulate their recorded patterns. Two developments revolutionized sound recording: the use of electrical signals to represent sound, and the development of magnetic media for storing them. Sound as electricity could be easily amplified and processed, and magnetic recordings could be erased, re-recorded, and split into multi-track configurations. Music would never be the same.

In this example, there are several transducers that convert one form of energy to another, maintaining an analogous pattern:

- microphones convert acoustical to electrical energy
- record heads convert electrical to magnetic energy
- playback heads convert magnetic to electrical energy
- loudspeakers convert electrical to acoustical energy

Each time the original sound is represented with a different state, there is some signal degradation. As a result, there are significant pros and cons with the process:

- Analog representations have infinite resolution, so it's possible to convey the most subtle details of a sound.
- But noise, distortion, and other artifacts are an inevitable result of the impossible quest to achieve true infinite resolution. No analog representation can be identical to the original.
- Ironically, these artifacts are often appealing, and can enhance sound. For this reason, they are still desirable to many recording engineers and audiophiles.

Digital Audio

While an analog audio device utilizes a signal whose pattern is much like the original sound

(but in a different state), digital audio technology takes a fundamentally different approach: audio signals are represented by a numerical code that describes the sonic characteristics. This code is communicated as a stream of binary numbers, simply 1s and 0s. Sounds complicated compared to the beautiful simplicity of analog, right? And indeed it is, but there are great benefits from digitizing sound:

- The signal is very robust. It's hard to mistake a 1 from a 0 when storing or transmitting information, so the integrity of the signal is maintained. Noise and distortion, artifacts that always confound analog systems, generally have no effect upon a digital audio signal.
- The code can be manipulated by high-speed data processing networks and stored on mammoth magnetic and optical disks. Existing computer technology is well-suited for digital audio operations, although keyboard and mouse control isn't always the best user interface.
- Digital signal processing can do things previously unimaginable. Try creating a convolution reverb system (in which the characteristics of a room are sampled and applied to dry sounds) with analog technology!
- Digital is cheap! You almost always get more bang for the buck.

Digital Audio Conversion—Sampling

The main challenge of digital audio is the conversion process in which we go from analog to digital, and later back again. Let's see how this works.

The most common method for digitizing an analog audio signal is to sample the signal at regular time intervals and represent the amplitude of each sample with a binary number. As long as these "snapshots" are taken frequently enough so that the waveform doesn't change much between samples, we can accurately represent the signal.

Digital Audio Conversion—Signal Reconstruction

It's not obvious that sampling is a lossless process, but in fact you don't lose any information as long as the sample rate is at least twice as high as the highest audio frequency contained in the signal. But how do you restore the signal in between samples? In the digital-to-analog conversion process, filtering fills in the spaces and you'll be back where you started (assuming ideal performance from every element in the process, which is not necessarily easy to accomplish).

Digital Audio Conversion—Sample Rate

Because humans can't hear above the 20,000 cycles per second (Hz) range, it is generally

considered that a sample rate above 40,000 samples per second is sufficient for high-quality encoding. Actually, there are at least two good reasons to use higher rates:

- Transient, percussive attacks contain much higher frequencies than 20,000 Hz. Even though we couldn't hear those tones sustained, with brief durations they will contribute to an instrument's sound and placement in a mix.
- Some signal processing algorithms sound better using higher sample rates.

Take Quiz Lesson 1

Configuring a Pro Tools System

The MIDI Lab is equipped with Pro Tools LE 8. All of you taking this course will more than likely eventually purchase your own system. Sooner or later, you'll all need to configure a new system. Familiarize yourself with the Pro Tools hardware options outlined in the reading below, and then we'll go into more detail on the important question of choosing a native vs. TDM system.



READ!

Chapter 1, pp. 25–46.

The fundamental question all Pro Tools users must address is whether to invest in a native system—one that utilizes the host computer's processing power for all digital audio operations—or a TDM system, which has dedicated hardware for mixing and signal processing. Why choose one or the other? Here are the main issues:

Audio Quality

What factors determine audio quality in digital audio systems? The main ones are:

- design and implementation of A/D and D/A converters
- signal processing algorithms
- proper operating technique, especially input levels and gain staging

The A/D and D/A converters within peripheral hardware vary in sonic quality, and the differences are most certainly audible though not nearly as extreme as other elements of the audio signal chain. The converters available for TDM systems are very nice, but you'll pay a premium for this technology. For those doing professional recording, this premium can probably be justified.

There are mathematical differences between the ways that native vs. TDM systems handle digital audio, and these differences may affect operations such as mixing and signal processing (equalization, compression, etc.). There is no definitive evidence I am aware of that the results are audible or preferable, one way or another.

Processing Power

For years, many folks have claimed that the days of dedicated signal processing power were numbered. They've suggested that advances in microprocessor speed and power as well as multicore and multiprocessor configurations would soon give native systems sufficient firepower to accomplish any imaginable signal processing needs. Yet TDM systems are alive and well. Why?

- The increased demands of more tracks, complex sessions, and higher sampling rates require more signal processing.
- Newer plug-ins, such as convolution reverbs, use much more processing power.

Pro Tools Software Features

Prior to versions 7.x, Pro Tools LE software lacked some of the capabilities of the "full" version, including many of the coolest features. LE users will be happy to know that there are now far fewer differences, especially when using the optional Music Production Toolkit discussed in the workbook.

Compatibility

Pro Tools sessions created with TDM systems generally open just fine on LE systems, and vice-versa. However, LE systems may not support the sample rates and track counts for all TDM sessions.

Available Plug-ins

TDM plug-ins run on TDM systems only. RTAS plug-ins run on either native or TDM systems. So there are many more options with a TDM system, including some of the more sophisticated signal processors. The downside, though, is that TDM plug-ins typically cost more.

Latency

Latency is the delay introduced by digital processes such as conversion, disk access, and signal processing. It's a significant issue while recording if you hear notes after they're played rather than instantaneously. The dedicated processing hardware in TDM systems makes this a non-issue, but latency can be noticeable in native sessions. Fortunately, there are workarounds that make it possible to minimize such problems.

Support for External Hardware

Both native as well as TDM systems can be supplemented by control surfaces, though there

are more options for TDM. TDM systems can also be expanded to include integrated software-controlled preamps, sync devices, and expansion chassis.

Portability

It's possible to configure a portable TDM rig, but most setups are a bit bulky for travel. Native systems easily pack up for road use.

Cost

TDM = \$\$\$\$. LE, not so much.

Many of the above factors suggest that a TDM system is the way to go... if money is no object. However, the price of a powerful professional system is high, so everyone must weigh the benefits of TDM against the costs.

Once you've made the choice between native and TDM technology, numerous options are available, depending upon your specific needs. The workbook includes a complete review of HD, LE, and M-Audio products.

Assignment: Your DAW

Assignment Let's explore the DAW systems we each use. By hearing about the decisions others have made and the issues they've encountered, you'll be better prepared for dealing with your own situations.

- What type of recording hardware and/or software had you used before Pro Tools?
- Describe your rig. Include specifications of your Pro Tools software version, installed plug-ins, host computer, storage devices, control surface (if any), and peripheral hardware. Post a picture, too!
- Why did you choose this particular system?
- How has the setup worked so far? Have there been any issues or problems to contend with? Any pleasant surprises?
- If you had to do it all over again, would you make different choices?

Optional: Describe your dream Pro Tools configuration.

Recap

Congratulations—you've completed the first lesson, *Introduction and Background*.

This week, we took a broad view of the many capabilities of Pro Tools, took a little history lesson, reviewed the basic characteristics of sound and digital audio, and explored the differences between various Pro Tools system configurations.

You should now be able to:

- identify the fundamental capabilities of Pro Tools
- describe the development of both Pro Tools and Digidesign, as well as the overall history of digital audio
- understand basic characteristics of sound such as frequency, waveform, and amplitude
- describe the differences between analog and digital audio
- identify the significance of sample rate and bit resolution
- compare the different capabilities of native and TDM systems
- configure an appropriate Pro Tools system

Take one more look through the topics we covered this week. If necessary, take some time to go back and review.

Next week, we'll do a general overview of basic Pro Tools operations and functions, and then you'll see these at work in our first Pro Tools session.