Abbey Road Vinyl

User Guide

Contents

Welcome

Thank you for choosing Waves! In order to get the most out of your Waves processor, please take the time to read through this manual. We also suggest that you become familiar with www.waves.com/support. There you will find an extensive answer base, the latest tech specs, detailed installation guides, new software updates, and current information about licensing and registration. By signing up with Waves Support, you'll receive personalized information about your registered products, reminders when updates are available, and information on your authorization status.

Introduction

For more than 50 years, music meant vinyl records. Vinyl was the format for everyone, from teenagers with portable record players to critical audiophile listeners. Vinyl records were relatively affordable and easy to store. They could be played on any turntable, and they sounded great. Vinyl's purely analogue production and playback processes, and its standardized frequency and dynamic specifications, yielded a listening experience that's different—and some argue, more life-like—than digital processes. Reproduction of sound in this analogue format was in many ways subjective, so there were heated disagreements over tone arms, styluses, platters, motors, and other minutiae of turntables. At the same time, records were subject to scratches, dust, warping, and more, so practices about caring for, cleaning, and storing these disks developed into fetishes. Despite this, people loved their vinyl records because they provided unbeatable sound.

It's this sound that Waves delivers in the Abbey Road Vinyl plugin. It doesn't just add pops, clicks, and band limiting. Instead it dissects the technical elements that gave vinyl its sound and it lets you deliver anything from a very subtle recreation of vinyl for discerning listeners, to aggressive vinyl artifacts for club settings. While bringing you the attributes that make vinyl what it is, Abbey Road Vinyl is not bound to the physical limitations of records, such as loudness. You create and control the personality of vinyl rather than being a slave to it.

At the end of this manual is a description of the technology of the production and playback of the vinyl records. This should help you understand the physical world that the Vinyl plugin is recreating. There's also a brief history of vinyl records to help put things in perspective.

Chapter 1: Components

Abbey Road Vinyl has four components:

1. Abbey Road Vinyl Mono – Mono to Mono
2. Abbey Road Vinyl Stereo – Stereo to Stereo
3. Abbey Road Vinyl Mono Lite – Mono to Mono
4. Abbey Road Vinyl Stereo Lite – Stereo to Stereo

The mono and stereo **Lite** components can introduce Noise and Crackles to the selected playback Generation/Turntable/Cartridge setup, and provide control over their level and the crackle density. Lite components also include the Slow Down effect controls. They do not include the modelled sonic attributes of the Generation/Turntable/Cartridge functions, as found in the full components, nor do they enable control over Tone Arm position or Wow, Flutter, or Phase Distortion.

The Lite components require less CPU resources than the full version.

Chapter 2: Quick Start Guide

Abbey Road Vinyl emulates the entire vinyl process, from the mastering desk at Abbey Road studios, to the processing rack and vinyl lathe (resulting in the sound of the Lacquer disk generation), to the press factory (which creates the sound of the final printed generation). There are layback options with two turntable setups: the high-end turntable that is part of the Abbey Road lathe or a commonly-used DJ turntable. Three popular cartridges are available.

To get started:

1. **Listen to your material with the different setups.** Turn the TG Desk on/off. Toggle between the different Generation, Turntable and Cartridge options, and decide which best compliments your material and does what you want to accomplish.
2. **Adjust the Noise, Crackle and Click levels and Click Density.** You may want to go for an exaggerated noisy effect or not use this effect.
3. **Adjust the Wow and Flutter Rate and Depth controls**. You can exaggerate these modulation effects or remove them altogether. Note that the values in this section change from setup to setup to match the sound and behavior of these setups.
4. **Adjust the Phase Distortion controls.** Abbey Road Vinyl creates and controls phase distortion by duplicating the input signal and sending one source through a modulator. The other source is unaffected. When the two signals are recombined, phase distortion occurs. You can increase or decrease the level, shape, and focus of phase distortion effect by changing the bandwidth of the modulated signal. The HP/LP filters change the spectrum of the modulated signal.

   Increasing the value of the HP filter, for example, results in a “thinner” signal going to the modulator. The recombined signal will have less phase distortion at low frequencies. Decreasing HP distortion, conversely, results in more low-frequency phase distortion.

Note that the values in this control section vary from setup to setup to match the sound and behavior of these setups.

5. **Experiment and adjust the Tone Arm position.** As the tone arm moves closer to the center of the disk, the frequency response changes (less High Frequency boost) and harmonic distortion increases. You can automate this control to change the sound of your material as the virtual cartridge moves from the outside to the inside of the record.
6. **Determine the desired Drive levels**. Driving the plugin will result in a more saturated/distorted signal. Adjusting the Drive level does not impact loudness.
7. **Experiment with the Slow Down Mechanism:**
    - Select the Time Format you wish to use – Time or Bars, synced to your session tempo.
    - Double click the Length field to enter the length in time or Bars/Beats of the stopping effect you wish to apply. You can also drag your mouse or use the keyboard arrows to change the length. If your session includes tempo changes and you have selected Bars as your time format, the length will adjust accordingly at the tempo change events.
    - Press Stop – This will slow down the playback to a full stop. This effect will take as long as the value you have set in the Length control.
    - Playback is stopped until Play is pressed.
    - You may turn on Auto resume control for creative effects. When Auto is activated, playback will resume immediately at the end of the slow down effect.
    - Experiment with automating these controls.

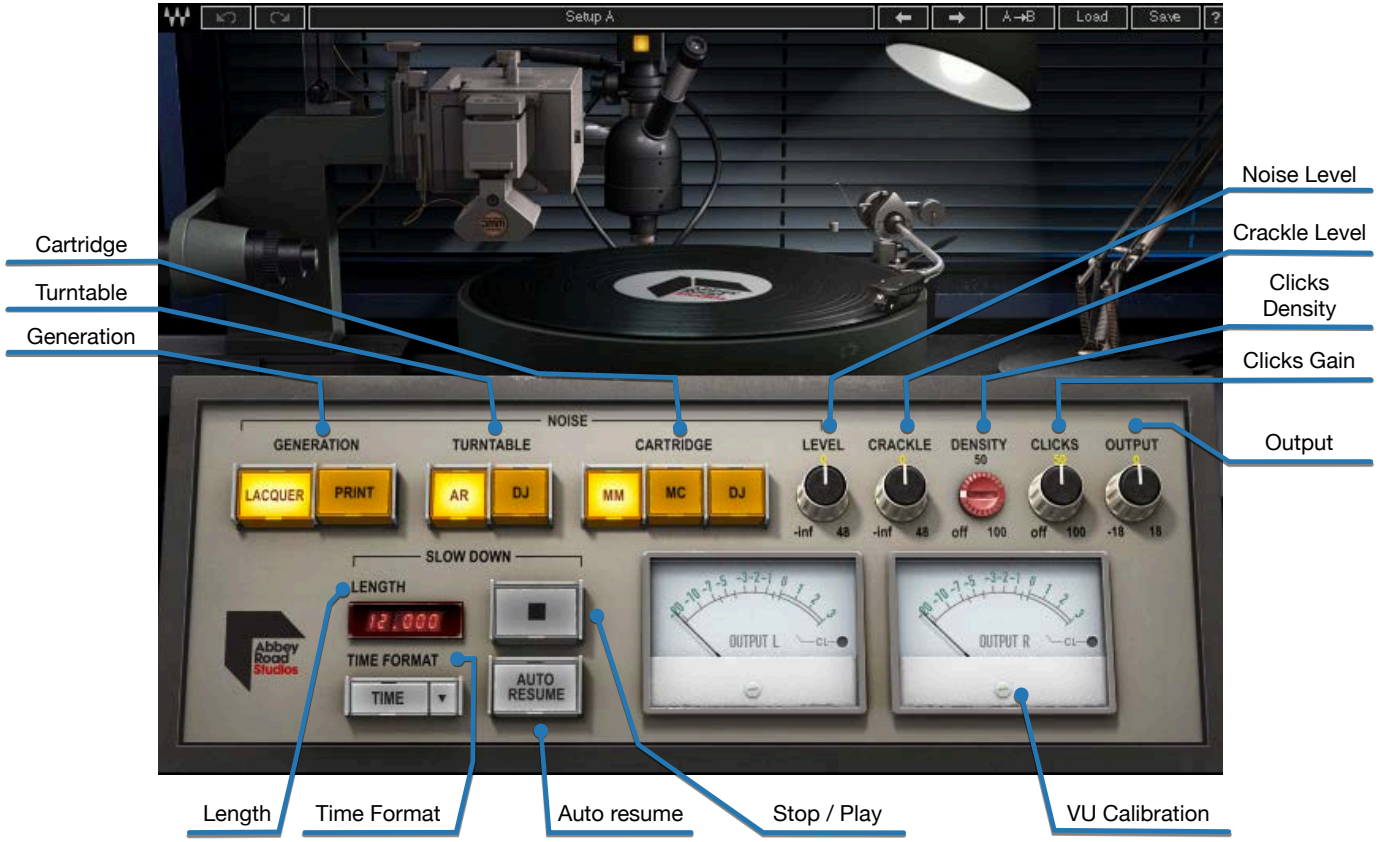
Note: You can stop the record from spinning by clicking the left-hand side of the record.

Chapter 3: Interface and Controls

Interface Panels

Full Vinyl Component

Lite Vinyl Component



Controls

Input Level
Determines the level at which signal enters the plugin.
Range: -18 to +18 dB
Default: 0 dB
Reset: 0 dB

Input Drive

This control increases the level going into the plugin, while inversely decreasing the output in order to maintain equal loudness. Higher Drive levels result in increased harmonic distortion. Note: At higher Drive levels the amplitude of the signal may be clipped (depending on your source material), which may result in lower perceived loudness.
Range: 0 to 100
Default: 0
Reset: 0

Generation

Select which generation of Vinyl production you wish to use:

1. **Lacquer** (Default/Reset): Acetate disc cut on the Abbey Road vinyl lathe.
2. **Print**: Vinyl disc pressed at a vinyl print factory.

Turntable

Select which turntable you wish to use for playback:

1. **Abbey Road** (Default/Reset): Playback on the built-in turntable of the Abbey Road vinyl lathe.
2. **DJ**: Playback on a popular DJ direct-drive turntable.

Cartridge

Select which cartridge you wish to use for playback:

1. **MM** – **Moving Magnet**: (Default/Reset): A classic, much sought-after cartridge from the 1980s, used regularly on Abbey Road's turntable for playback.
2. **MC** – **Moving Coil**: A modern, high-end audiophile moving-coil cartridge.
3. **DJ** – **Disk Jockey**: A modern, popular, midrange moving-magnet cartridge used by many DJs.

TG Desk

Applies the modelled frequency response and harmonic distortion and noise profile of the Abbey Road TG12410 mastering console.
Range: Off, On
Default: On
Reset: On

Noise Level

Adjusts the level of noise added to the signal. It changes as you select different Generations/Turntables/Cartridges.
Range: -INF to +48 dB
Default: 0 dB
Reset: 0 dB

Crackle Level

Crackles are a constant granular noise created by roughness of the record groove.
This control adjusts the level of crackle added to the signal. It changes as you select different Generations/Turntables/Cartridges.
Range: -INF to +48 dB
Default: 0 dB
Reset: 0 dB

Clicks Level

A click is a short, loud burst created by the stylus striking a physical interference on the record.
This control adjusts the level of clicks added to signal. It changes as you select different Generations/Turntables/Cartridges.
Range: Off to 100
Default: Off
Reset: 50

Clicks Density

Adjusts the density (approximate frequency) of clicks added to the signal.
Range: Off to 100
At the lowest setting, clicks are generated randomly at a rate of approximately once in 5 to 10 seconds.
At the highest setting, up to 2 clicks are generated per second.
Range: Off to 100
Default: 20
Reset: 20

Tone Arm Position

In addition to the knob on the GUI, the Tone Arm itself is a graphic control that moves as you grab it from its base and slide it across the record. As you move the tone arm inward, HF frequency response and harmonic distortion change in character.
Range: 0 to 100; 0=beginning of record, 100=end groove
Default: 0
Reset: 0

Length

Displays the duration of the Slow Down effect. This display/control changes as you enter text or drag the value up/down using your mouse or keyboard arrows.
Range: 00.001 to 30.000 sec / 1 Beat to the tempo-dependent number of Bars that fit in 30 seconds
Default: 12 Sec
Reset: 12 Sec

Time Format

Toggles the Length display between Time and Bars.

Stop/Start

Indicates if plugin is currently stopped (play icon) or playing/stopping (stop icon). Pressing this button engages the slow-down effect manually for the duration of the Length setting. Once The slow-down effect has ended, the control will remain “stopped,” waiting to resume playback. Press **Play** or use the **Auto Resume** feature to restart play.

Auto Resume

When engaged, Playback will resume immediately when the slow-down effect is completed. When disengaged, no sound will pass once the slow-down effect has ended–until the Play button is pressed once again.
Range: Off, On
Default: Off
Reset: Off

Phase Distortion On/Off

Turns the phase distortion effect on/off.
Range: Off, On
Default: On
Reset: On

Phase Distortion Level

The amount of phase distortion being added to the frequency range as determined by the Phase Distortion LP and HP modulator controls.
Range: -48 to 48 dB
Default: 0 dB
Reset: 0 dB

Phase Distortion HP/LP Modulators

These controls shape the character of the phase distortion by determining which frequencies of the signal will be removed from the overall bandwidth of the phase modulation.
This setting changes according to Generation/Turntable/Cartridge selection.
Range: 0.1 (16 Hz) to 100 (20 kHz).
Default: Setup dependent
Reset: Setup dependent

Wow Rate

Determines the rate of Frequency Modulation (FM) applied. This setting changes according to Generation/Turntable/Cartridge selection.
Range: Off (-) to 100
Default: 50
Reset: 50

Wow Depth

Determines the amount of Frequency Modulation (FM) applied. This setting changes according to Generation/Turntable/Cartridge selection.
Range: -50 (off) to +50
Default: 0
Reset: 0

Flutter Rate

Determines the rate of Amplitude Modulation (AM) applied. This setting changes according to Generation/Turntable/Cartridge selection.
Range: Off (-) to 100
Default: 50
Reset: 50

Flutter Depth

Determines the amount of Amplitude Modulation (AM) applied. This setting changes according to Generation/Turntable/Cartridge selection.
Range: -50 (off) to +50
Default: 0
Reset: 0

Meter selector

Toggles the meter displays between input and output.
Range: In/Out
Default: Out
Reset: Out

Output Level

Controls the total signal output level.
Range: -18 dB to +18 dB
Default: 0 dB
Reset: 0 dB

Monitor selector

Changes the monitoring of the plugin.
Range: Stereo/Mono/Left/Right
Default: Stereo
Reset: Stereo

VU Calibration

Controls the VU meter headroom calibration. It's represented by the small screw-head below the VU meter display and does not have a visible label. For most users, the default headroom setting of 18 dB should be the best choice. (On the Stereo component, use the screw located on the left to calibrate both meters.)
Range: 8 dB to 24 dB
Default: 18 dB
Reset: 18 dB

Chapter 4: Vinyl Record Production and Playback

Creating the Record

Making a vinyl record is a labor-intensive process that hasn't changed in a long time. Most of the record pressing machines in use today are many years older than the consumers who listen to the records made on them. The record production involves these steps. Where applicable, the corresponding Abbey Road Vinyl control is described in italics.

1. **Transcribe the music to lacquer.**
    a. **TG 12410 Transfer Desk**

        The final mixed audio passes through the TG 12410 Transfer Desk. This gives the mastering engineer the tools needed (EQs, filters, limiters) to master the musical content for optimal placement on the lacquer.

        These desk characteristics can be turned on or off.

    b. **Neumann SAL-74 cutting rack**

        Once the signal is prepped on the transfer desk it goes to the Neumann cutting rack. This is the last gate before the signal goes onto a vinyl, so it was designed to be as flat as possible, with minimum harmonic distortion. It includes a de-esser to protect the cutting head from overheating when trying to cut very loud high frequency sounds. The rack also applies the RIAA encoding to the signal and get the signal ready level wise to be cut to a Lacquer.

        This device does not measurably alter the signal, so there is no corresponding control.

    c. **Neumann VMS-80 cutting lathe**

        This is where the lacquer is actually cut. Soft lacquer disk turns on a platter while a very precise, heated, cutting head shapes grooves into the material. The lathe utilizes a "groove width logistics board" that delays the incoming audio by 1.5 seconds in order to analyze the signal. If needed, it the lathe will cut a wider grove in order to fit more

information into the grove. If the groove width logistics board encounters high-energy, low-frequencies sound, the groove will temporarily be cut wider. The cutting head moves horizontally, in a straight line. However, almost all playback turntables use a stationary, pivoting tone arm, which induces phase distortion during playback.

The RIAA curve is added during the cutting process–it has crucial impact on the signal being cut to the disk. The Abbey Road VMS-80 RIAA curve was precisely modeled, as was a slight modulation due to the spinning engine of the VMS-80.

2. **The pressing plant:**

The press process has the biggest impact on sound, and plays a big role in what we call the “vinyl sound.” It increases the noise level and adds crackling to the sound.

a. **Master acetate**

At the end of the cutting process, the 14” acetate is the considered the master. An acetate is a piece of aluminum coated with a layer of vinyl, into which grooves are cut, like a record.

b. **The “Father”**

The master is sent to the pressing plant, where it is plated by silver and then electroplated with nickel. This creates the “Father.”

c. **The “Mother”**

The father is then oxidized and plated once again. The result is a metal plate that when separated from the father can be played back on a turntable to check for errors. This is called a “Mother.” The mother is used to create the “Stampers.”

d. Stamper

Stampers are the negative molds that press the grooves into the vinyl records. A stamper is good for about 1000 copies.

To understand how the program material is altered by this process, switch between "Lacquer" and "Print" in the Generation section.

3. Confirm quality:

After a stamper is created, about ten records are produced for evaluation and approval by the Abbey Road mastering engineer and the artist. The mastering engineer will assess whether the noise level and profile are what one would expect from a test press (about 3–6 dB louder than the master when pressing is done properly). Once the test pressing is approved, the stampers are used for mass pressing.

To experience how playback sounds at Abbey Road mastering suites, Select AR in the Turntable section. You can also play back through a standard DJ turntable, which although not as pristine as the Abbey Road turntable, provides a classic "vinyl sound."

Playing Back the Record

Playing back a record on a turntable is simple in concept and demanding in application. A turntable is made up of many elements, each of which carries with it its own characteristics—for better and for worse.

Turntable

The turntable is the circular, spinning platform upon which the record rests. A quality turntable must deliver a correct, consistent rotation speed, without short-term irregularities such as wow (a once-per-revolution speed distortion) and flutter (short-term speed changes). To prevent motor noise from passing acoustically to the audio chain, most turntables from the 1970s and later were belt driven. Certain audiophile turntables used an isolated direct-drive turntable that was an integral element of the driving motor. These turntables are typically expensive to produce.

Tone Arm

The tone arm is a lightweight counterbalanced cylinder or lever that connects the chassis of the turntable with the pickup cartridge. It must weigh very little, so as not to distort and damage the grooves. Yet it must have sufficient mass to track well and to prevent passing motor rumble to the cartridge. Philosophical disagreements over tone arm specifics have led to lost friendships among vinyl record enthusiasts.

When a lacquer is made at the mastering studio, the grooves are cut with a lathe. The cutting head is always perpendicular to the axis of rotation of the disc. However, when playing back the record, the stylus—at the end of the tone arm—is moving more obliquely near the inner part of the record than at the outer part. This can result in **phase distortion**, a difference in the frequency response of the cutting head and the playback device. The shape and design of the tone arm influence the phase distortion. Certain turntables offer linear tracking, in which the stylus moves laterally with respect to turntable rotation. This reduces phase distortion, but such turntables are expensive and relatively rare.

Cartridge and Stylus

The pickup cartridge converts the vibrations of the stylus into an electrical signal, which is then amplified and sent to loudspeakers. The stylus, usually made of diamond, is at the end of a metal cantilever, which mechanically amplifies the stylus' motions. This metal bar connects to either a magnet within a coil or a coil within a magnetic field. It's this motion that generates a small electrical signal for amplification. There are two types of pickup cartridges: moving magnet and moving coil.

Moving magnet cartridges are often found in inexpensive record players, while moving coil cartridges usually used in more critical applications. However, a good moving magnet cartridge can often outperform a comparable moving coil. Moving coil cartridges typically have lower inductance and impedance than moving magnet types, which means less capacitance in the cables within the turntable electronics. Moving coil cartridges often have less mass, which can reduce groove wear.

Abbey Road Vinyl offers three modelled cartridges:

- **Moving Magnet** (MM)-This is modelled from the cartridge stylus that's used at Abbey Road Studios. It is one of the best moving magnet cartridges ever produced, and is defined by very good transient response and very flat frequency response.
- **Moving Coil** (MC)- a model of a very high-end moving magnet cartridge that is characterized by good super-frequencies response, lower noise level, and great sub frequencies response.
- **DJ** (DJ)- A "cheap" DJ cartridge, widely used in DJ setups. This provides a "dirty, gritty" sound.

Together, these provide a wide variety of vinyl playback options.

The shape of the stylus tip (conical, or elliptical, or other shapes) can often have as much of an influence on the listener's subjective experience than does the construction of the cartridge. Price and performance are completely linked when it comes to styli and cartridges, and a poorly-designed stylus can quickly damage a record. Tone arm shape, the material used in the cantilever and its design, and many other factors greatly influence sound reproduction.

There's a great deal of room for a consumer to shape his or her listening experience when it comes to vinyl. It's a matter of personal taste, music preferences, and, of course, budget.

Chapter 5: Vinyl, A Brief History

A vinyl record is an analogue sound storage medium, usually made from polyvinyl chloride. Sound is recorded in a spiral groove that starts near the outer edge of the disc and ends near its center. Just as magnetic recording uses the changing organization of oxide to store an audio signal and optical recording uses changing shapes and densities of transparent materials, vinyl records use the changing shape and depth of these grooves to reproduce sound.

Recording an analogue signal onto some sort of malleable disc or cylinder dates back to the 1880s, if not earlier. Thomas Edison's mythic recording of "Mary Had a Little Lamb" onto a turning cylinder covered with tinfoil is generally touted as the first sound recording. Early recordings were made acoustically: the artist's sounds moved a diaphragm that then caused a needle to move and cut into a wax mastering material (later in history wax was replaced with lacquer). Using a diaphragm to capture and amplify sounds for "recording" is the same process that the human middle ear uses to amplify the air compressions and rarefactions that make up sound. Wax soon replaced tin foil as the mastering media. Electric recording came into being in the 1920s, when the vacuum tube, the preamp, and a means of moving the cutting needle electrically became commercially available. These developments also brought about electrical sound amplification.

By the 1910s, spinning discs had replaced cylinders as the preferred sound storage media. Discs didn't necessarily sound better than cylinders—they often sounded worse, since a rotating disc has a higher linear speed at the outer grooves than at the inner ones, which can cause distortion and other problems. But discs were cheaper to produce on a large scale, since they can be stamped rather than individually engraved. The disc format survives to this day. As the record-making industry developed, a number of different media were used for records, including rubber and celluloid, but shellac soon became the most common material. Shellac records are durable, but they suffer from very high surface noise. Other materials were offered as alternatives, including vinyl, but no other record material was able to displace shellac commercially. This changed during World War II, when shellac was scarce. It was vinyl's big break.

In the early days of the record industry, playback speeds varied from one manufacturer to another, but in the mid-1920s, 78 rpm became the standard. The 45 rpm format was released in 1949. It could hold up to eight minutes of program per side, so it was well suited for popular music. But the post-war market was demanding higher-quality sound and longer playing times to hold a meaningful amount of content. Music companies needed to deliver greater frequency response and larger dynamic range from smaller grooves. The introduction of the tape recorder to consumer markets further pressured music companies to develop a good-sounding, commercially-viable, vinyl record format. The long-play vinyl microgroove 33 1/3 rpm record was released in 1957. This format had existed for several years before, and was initially marketed to radio stations that played long, typically classical, works. It took several years for the industry to agree on a standard play speed, but by the late-1950s they settled on 33 1/3 rpm, where it remains today.

Improvements in Vinyl Sound

Until the late 1950s, records were mono. Sound quality was improving, but there was no sense of “sound space.” In a mono record, irregularities in sides of the grooves cause the needle to move back and forth, which generates a small voltage in the pickup cartridge. This mono signal is then sent to a preamp and finally to the amplifier and speaker. But we really hear the world in a much more complex way: sounds come from all directions. In the ‘50s, record companies were selling the idea of “hi-fi,” a new way of experiencing music. One obvious element was stereo: different sounds coming from two channels, creating a more-or-less realistic sound space. To do this, a new way of tracking the grooves of a record was developed. In stereo records, the needle moves laterally, as it does in mono playback. But the needle also moves vertically. Together, this provides sufficient information to construct a stereo image. This poses a number of technical problems.

To address the issue of putting an increasing amount of information into narrowing grooves, the Recording Industry of America (RIAA) established a specification for the recording and playback of phonograph records. By adapting this equalization curve, record manufacturers are able to decrease the average width of each groove, thus yielding greater recording times, to improve overall sound quality, and to reduce groove damage.

High fidelity sound reproduction quality surged in the1970s, as turntables incorporated belt or dampened direct drives, precision tone arms, some made of exotic materials such as titanium, beryllium, or carbon fiber, and magnetic cartridges with frequency responses beyond the range of human hearing.

High quality production and equipment provided deep-pocketed audiophiles with amazing sounds. At the same time, a modest, perfectly decent “stereo system” that sounded good was not terribly expensive.

The Decline of Vinyl

The 1970s were the glory days of vinyl. Since sales of records and playback equipment were robust, healthy budgets were available for music production. It’s no surprise that some of the masterpieces of music recording are from this era. But over the next decade, the dominance of vinyl as a distribution media faced two great hurdles. The first was the audiocassette recorder/player. The dominate player in the field was the Sony Walkman. This small, portable device provided a playing time that far exceeded LPs. It was durable and could play back as well as record audio. This ability to record music posed a threat to the music business, to the point that legal action was taken against tape manufacturers. The fact that the media was durable and transportable and sounded good cut deeply in to vinyl sales. By the mid-1980s audiocassette sales had surpassed vinyl.

In the early 1990s the compact disc was released on a large scale. This was an even bigger challenge to vinyl records. For years, people recognized the unique sound quality of vinyl, but there was always complaint about surface noise and clicks. Plus, vinyl records are fragile and utterly impossible to enjoy on the go. Early CDs were sold as being quiet, but not for their sound quality, which couldn’t match LPs. But quickly, A/D/A converters improved, reducing the “zipper noise” that characterized early players. Recording and production technology improved, and developments in noise reduction enabled the resurrection of archived albums ranging from Caruso to Led Zeppelin. Audiophile listeners hung on to their LPs for a long time (perhaps forever), but the market had made its choice. By the early 1990s, many were declaring the death of vinyl. This was essentially true, given the many market forces standing in its way.

Vinyl Revival

Even when CDs were taking over the market, vinyl continued to attract some audiophiles and collectors. But what undeniably saved the format were the DJ and hip-hop markets. You can't scratch with a CD.

Since the mid-2000s there's been a steady decline in CD sales, coupled with a huge increase in sales of vinyl records. By the mid-2010s, it was clear that the boom in the number of people who like to listen on vinyl is not just a fad. Vinyl was back, and for the same reasons that existed 50 years before. The fun of opening the sleeve, lowering the needle, and experiencing the music in a special way. But mostly, it's because a well-made record gives us an unbeatable sound.