

MADRIGAL

THE TRANSPORT CHALLENGE



The characteristics of an outstanding CD transport are simple to define: while suppressing the noise inherent in digital processing, it must recover the correct data from the disc and deliver it to the digital processor without any timing errors. As simple as this sounds, achieving it in reality has been extremely difficult—as evidenced by the significant sonic differences between various CD transports.

Recovering the correct data, by itself, is not difficult. The error detection and error correction schemes used by all modern CD players are quite powerful. Since the technology used for compact discs borrows heavily from computer technology (where even a single error can cause a system "crash"), you might imagine that uncorrectable errors would be quite rare. If so, you would be right. Even badly scratched discs can often be played without difficulty.

Significant sonic differences between quality CD transports are frequently the result of differences in their *timing accuracy* : unlike a computer, digital audio depends on the signal being reconstructed by the digital to analog converters *at precisely the right time* . Timing errors in digital audio have come to be known as "**jitter**," which can be thought of as the digital version of "wow & flutter." These inconsistencies in the transmission rate of digital information distort the sound, causing it to sound harsh and unnatural.

Since compact discs operate with a 44.1 kHz sampling rate, there should be exactly 44,100 samples passed on to the digital processor each second. Moreover, each sample should consistently follow the previous one at precise intervals; that is, each sample of musical information should last for exactly 1/44,100th of a second before being replaced by the next one. One of the big challenges in digital audio is "clocking" these samples out with a high level of precision—without it, the system falls short of its potential.

Traditional transport designs seek to retrieve the digital audio information from the disc itself at exactly the correct rate. An oscillator mounted on the laser pickup mechanism provides a "reference" frequency that is used to control the rate at which digital information is being extracted from the disc. You might think of it as being like the transport's "metronome," determining the "tempo" at which the musical information is recovered. Any discrepancy between the "tempo" of this oscillator and the transport causes the latter's motor to adjust its speed accordingly. Thus, in conventional CD transport design, the regularity with which information is obtained from the disc depends on the quality of the oscillator as well as on many associated components (such as the motor, its bearing, control servos, power supplies, etc.).

Unfortunately, this important oscillator exists in an extremely noisy electrical environment, close to the motor that spins the disc and to related circuits that interfere with the oscillator's consistency. The resultant electrical noises introduce timing errors in the critical reference frequency produced by the oscillator. In addition, mechanical problems such as friction, vibration, and inertia prevent the laser/disc mechanism from attaining even the imperfect level of accuracy called for by the oscillator. All of the resultant timing errors, regardless of their source, carry over into the delivery of the digital signal and have come to be known collectively as "jitter."

Subsequent handling of the digital audio signal in traditional transport designs cannot improve upon this "jittery" signal, lacking a better reference. To the contrary, the various stages of signal processing between the laser pickup and the final output can only contribute additional jitter of their own.

Until now.

A NEW GENERATION

The Mark Levinson N° 37 Compact Disc Transport leaps beyond conventional digital audio playback technology by employing a proprietary, closed-loop jitter-reduction system in conjunction with an industrial-quality CD-ROM drive. Simply put, the N° 37 separates the recovery of the actual digital data from the task of maintaining a consistent, jitter-free output. This separation of labor allows each task to be performed with greater accuracy than is otherwise possible: both accurate data recovery and jitter-free performance are optimized.



The N° 37 derives its reference frequency from a part custom-made for the task: a temperature-compensated crystal oscillator that acts as a "clock" with better than five part-per-million accuracy. This oscillator is isolated from the noisy environment of the laser mechanism and placed on a quiet, independent digital output board. Benefiting from its own dedicated power supply and electrically isolated signal feeds, this "clock" provides a far more stable reference frequency than in any previous design. In addition, its very proximity to the digital output minimizes the opportunity for corruption of the reference frequency (by minimizing the distance between the oscillator itself and the digital output circuitry).

Prior to the digital output, each bit of the digital audio signal is momentarily stored in a small memory buffer, and then released according to the accuracy of the reference "clock." This process virtually eliminates transport-related jitter from the digital audio signal, whether it be of mechanical or electrical origin. Since another bit must be ready to be loaded into the buffer when the current bit exits (on its way to the processor), this same crystal oscillator controls the all-digital servo used to control the rate at which the disc spins.

In effect, the design of the N° 37 turns the accepted *status quo* on its head. By placing the all-important reference clock in the *final* stage of the transport's output section, and slaving the mechanical subassemblies to the requirements of the output rather than the other way around, the signal presented to the outputs of the N° 37 is uncontaminated by electrically- or mechanically-induced jitter. The sonic advantages of this design are immediately apparent in the clarity, warmth and stunning dynamic contrasts exhibited by the N° 37.

DIGITAL SERVO CONTROL

The laser mechanism used in the N° 37 uses all digital servo control of its operations. Critical functions such as focus and tracking are handled completely in the digital domain with mathematical precision. A digital servo performs more consistently and predictably than an analog servo, and remains stable over time. Under normal conditions, the servo in the N° 37 should never need adjustment or servicing.

OUTPUT VERSATILITY

All high quality digital output configurations are supported in the N° 37. Each of these digital interfaces has been carefully optimized to deliver the finest performance its standard allows. As a direct result, the N° 37 performs optimally with any digital processor without having to resort to techniques which would limit its compatibility to other Mark Levinson products.

For example, some digital processors yield their best performance using their ST-optical inputs, since an ST digital input is far simpler to optimize than the electrical inputs (even though the latter have greater *potential* performance). The N° 37 uses a high-bandwidth Hewlett Packard® ST interface that outperforms more common, less costly parts.

The N° 37 also supports both AES/EBU and S/PDIF electrical interfaces. A new complementary driver for the balanced AES/EBU electrical output delivers outstanding performance to the high quality XLR connector. Single-ended S/PDIF electrical outputs are provided *via* both BNC and RCA connectors for complete compatibility with a wide variety of products. Special care has been taken with all the electrical outputs to maintain excellent symmetry between the rising and falling edges of the digital waveform (which looks like a series of square waves) to maximize high performance compatibility with the widest possible range of digital processors.



INDUSTRIAL DESIGN



The N° 37 shares the handsome industrial design of other Mark Levinson components such as the [N° 36 digital audio processor](#). The combination of the hand-brushed, black-anodized aluminum faceplate and bead-blasted custom-machined buttons make operating the N° 37 a tactile as well as a sonic pleasure.

A large, easily read display provides information as to the operational status of the N° 37 from across the room, enhancing the value and usability of the supplied remote control.

In keeping with its sophisticated design, the N° 37 also incorporates a Madrigal-designed loading mechanism. Contrasting strongly with the bulky, plastic drawers commonly used, the slim 1/8-inch drawer is machined from a solid piece of aluminum and rides on highly polished steel and Teflon™ bearings. Its variable-speed design opens and closes quickly, without jarring the disc contained within. Optical sensors ensure that the drawer cannot close on an improperly-placed disc—something off-the-shelf drawer mechanisms cannot offer.

Unwanted mechanical energy is removed from the system using newly developed, exotic shock and vibration mounting materials that outperform the more commonly-used Sorbothane™ or Neoprene™. This high degree of mechanical isolation combined with the digital servo described above yield a fast tracking, error-free transport system.



CONVENIENCE FEATURES

Too often, high performance CD transports have eschewed convenience in the hopes of achieving greater performance. While there were good arguments for such a "minimalist" design in the days of analog turntables, modern digital formats (implemented with good engineering practices) no longer force the audiophile to give up operational convenience for the sake of musical performance. After all, convenience features in a digital product are largely a matter of writing appropriate software, and have no affect on the quality of the digital data itself.

As an example, the N° 37 supports custom programs, including "delete programming" wherein selected tracks are omitted from the playlist. This allows the user to skip the one or two songs on an otherwise good disc that have been overplayed on the radio (for example). The N° 37 will remember such programs for thousands of discs, should you want to save that many programs.

The remote control included with the N° 37 provides for all normal operations. It even allows you to create a custom program from the comfort of your favorite chair. But it does more. When used in the context of a "Linked" Mark Levinson system (see below), the N° 37 remote control even allows you to control the volume setting on your preamplifier, the digital input on your processor, and several other day to day functions *without* having to juggle multiple remote controls.

COMMUNICATIONS LINKS

As with all Mark Levinson 30-series components, the N° 37 incorporates a sophisticated inter-component communications bus. Unique among high performance audio systems, Mark Levinson 30-series components offer a degree of system integration that makes even complex systems easy to use.

For example, pressing Play on the N° 37 CD transport will bring it out of Standby and "wake up" the Linked digital audio processor, preamplifier and power amplifier(s). Next, both the digital processor and the preamplifier will automatically select the appropriate inputs so that a CD can be enjoyed. Even a sophisticated system with many components can thus offer one-button simplicity of operation.

In short, the Mark Levinson N° 37 establishes a new standard for performance and value among high end CD transports and should be auditioned by anyone who desires the finest in digital audio.

SUMMARY

The technology embodied in the [N° 36](#) and the N° 37 sets them apart from other high end products. Used separately, each establishes a new standard of performance and value. Together, the N° 36 and N° 37 form the heart of a digital playback system that offers uncompromising performance, outstanding flexibility, unsurpassed convenience and ease of operation.

No mere piece of Web literature can convey the pleasure derived from simply using these fine instruments. Please visit your nearest Mark Levinson dealer at your earliest convenience to evaluate the N° 36 and N° 37 for yourself, preferably as part of a complete, linked Mark Levinson system.

[N° 37 Specifications](#)
