CONCEPT

The Ultimate in Sound Reproduction

Concept

Concept 2QD—the result of a concerted effort to design a turntable that offers both ultimate precision and ultimate convenience. Every detail, from the action of the controls to the damping material of the feet, has been carefully thought out and crafted by a distinguished international team of designers and production engineers. The final result is a remarkable record playing instrument—a turntable to satisfy even the most discerning audiophile.

Experience the calm authority of the Concept 2QD. Look at it, operate it, hear your favorite records played on it. You'll find the Concept 2QD offers more than the best competing models.

Two Critical Factors

As we completed the development of our laboratory standard electronics and constant energy speaker systems, we began critical listening to a wide variety of the most dynamic recorded material available—including the highly modulated direct-to-disc and digitally recorded pressings. We became acutely aware of two problems that plagued many turntables: inadequate speed stability and excessive tonearm inertia.

We set out to design a turntable that would maintain highly accurate, highly stable speed—even when subjected to the increased drag caused by a stylus tracking highly modulated grooves of the loudest passages. And we set out to develop a tonearm that would minimize mistracking due to uncontrolled resonance and excess inertia—mistracking that limits dynamic range, drains amplifier power, and that leads to audible distortion on the loudest passages.

We wanted a record playing system to reproduce the most lively recordings without any audible loss in the full dynamic range and sonic integrity of the music. With the development of the 2QD, we feel we have succeeded.

Quartz Control Improves Direct-Drive Speed Stability

Constant platter speed must be maintained continuously or there will be noticeable distortion (wow and flutter) in the sound of music. While many turntable drive systems are designed to maintain consistent rotational speed under low-stress or non-stress conditions, the increased friction that comes from a stylus tracking a highly modulated groove will cause minute fluctuations in the speed of these drive systems. Recognizing this fact, Concept engineers set out to develop a drive system that would maintain constant speed under varying load conditions.

The direct drive system has proven capable of maintaining the most consistent speed control yet achieved in standard turntable design. By mounting a massive platter on top of a low-speed, high torque motor, a direct- coupled flywheel is produced. This technique overcomes many factors that tend to degrade the speed stability of other designs.

To absolutely eliminate speed fluctuation problems, however, a motor control system was needed. This system would keep the motor precisely regulated so that minute speed fluctuations were detected as they happened and corrected immediately.

The quartz crystal is one of nature's most accurate time references. Crystal references are used for the precise control of instruments ranging from standard-maintaining chronometers to radio transmitters. When stimulated by an electrical current, the crystal will vibrate at an extremely stable frequency. By using crystal control in the drive circuit of the Concept 2QD, it is possible to achieve a laboratory standard of speed control.

The 2QD's DC drive motor is equipped with a built-in frequency generator. While the motor/platter system is rotating at a constant speed, the output of this generator is a constant frequency. Any deviation in the speed of the motor/platter system is detectable as a change in this frequency.

A phase-locked-loop (PLL) system compares the output of the motor's frequency generator with the precisely controlled frequency of the quartz crystal oscillator. The most minute speed changes initiate a correcting voltage from the PLL which adjusts the motor's driving circuitry and instantaneously corrects the speed variation. This sophisticated control circuit, consisting of 4 integrated circuits plus associated discrete parts, assures that increased drag—as when the stylus tracks highly dynamic material or when a tracking record cleaner is being used—will not cause platter speed variations.

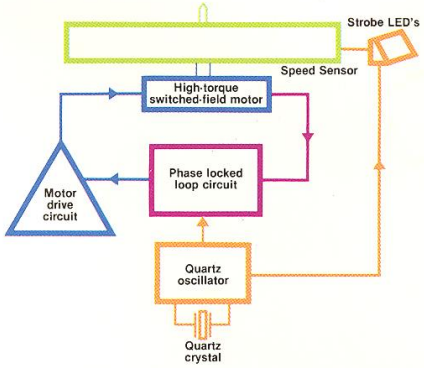
The DC servo platter drive motor used in this quartz-locked system has been engineered with a high stall torque of 650cm/g. High torque gives the motor a margin of power for maintaining correct speed even under extreme load conditions. And due to this high torque, the platter drive system reaches full speed quickly—in a maximum of 1.8 seconds.

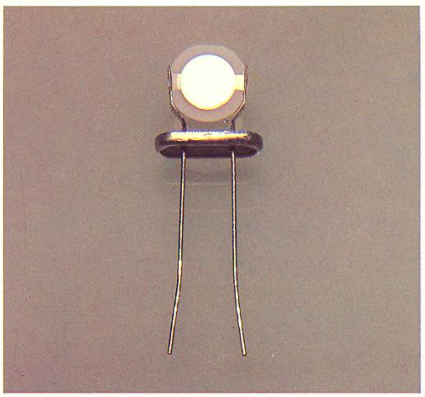
The 90-pole armature frees this motor from another speed variation problem: cogging. Cogging is a minute starting/stopping that can be heard as wow and flutter in turntables with fewer poles. The motor has been further refined with the elimination of friction-inducing brushes.

The platter sitting on this high torque motor is 3½ lbs. (1.7 Kg) of die cast aluminum, precision machined to achieve the most delicate balance possible.This massive platter serves as a flywheel for the drive system, further reducing the problems of a speed variation.

The machined strobe markings on the platter are illuminated by a 3-LED strobe. This strobe is driven by circuitry referenced to the highly accurate crystal oscillator so that it is immune to fluctua-

Quartz-locked PLL servo system.



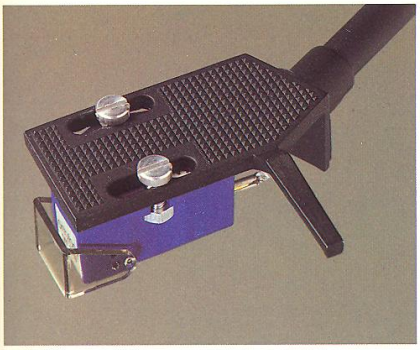


The quartz crystal—one of nature's most accurate time references.

For the 2QD, a solid brass, precision machined counterweight with a thin profile design was developed. This counterweight could be placed much closer to the pivot point than standard counterweight designs. The result is reduced inertia for the tonearm system, even with the increased mass it takes to balance the cartridge with the weight placed closer to the pivot.

The thin profile counterweight reduces moment of inertia and arm resonance.

To place even more of the necessary mass as close as possible to the pivot point, the tonearm shaft itself, rather than the headshell, was made detachable. This moves the mass of the clamp and connectors from the end of the tonearm, where they would have high inertia, to near the pivot point, where they display reduced inertia.



Cutaway headshell design helps minimize tonearm mass and inertia.

To help further reduce resonance and to tune the arm so that resonance falls into the optimum range between warp energy and acoustic energy, the counterweight shaft has been decoupled from the rest of the tonearm shaft by means of a compliant rubber mounting junction. This junction works as a tuned shock absorber, tending to absorb resonances in the critical warp/wow spectrum, where the most dramatic mistracking problems described above occur.

For accurate tracking across the surface of the record, the length of the tonearm (222.2 mm) and the 24.5° offset angle of the headshell have been carefully calculated to maintain the extremely low tracking error of less than 0.19°/cm. And horizontal tracking friction has been reduced to a bare minimum by the use of two precision ground bearing assemblies, with 21 ball bearings each. These allow unrestricted movement along the horizontal axis, while maintaining excellent vertical rigidity and freedom from vibration.

The automatic return mechanism uses zero-friction magnetic detectors to avoid increased horizontal drag as the stylus tracks to the final band of a record. And to assure utmost reliability, a second motor has been incorporated to drive the automatic tonearm functions. This decreases the load on the platter drive motor and eliminates much of the complex linkage mechanism incorporated into one-motor automatic turntables.

Base Design Keeps Out Unwanted Vibration

The base of the Concept 2QD does more than hold the platter and tonearm systems. It prevents distortion that can be produced by external vibrations. These vibrations may come as feedback from the speakers—feedback that causes the tonearm/cartridge assembly to start vibrating, resulting in muddied sound. Or they may come from external sources (footsteps, passing traffic) that may cause the stylus to hop around and mistrack.

The 2QD base is designed to minimize the effect of these factors. With ½-inch of non-resonant particle board supporting the motor assembly and the tonearm, the effects of vibration between tonearm and platter are damped out. Further isolation is achieved with the use of shock absorber feet. These compliant, medium-density rubber supports tune out low frequency vibrations—the vibrations that contribute most to mistracking and acoustic feedback—extremely effectively.

Controls That Offer Utmost Ease, Utmost Precision

The 2QD's controls have been designed to make its high-technology record playing performance available to all music lovers. That's important. Many esoteric turntables have control panels that resemble a computer console. But everyone—not just the technically oriented audiophile—should be able to enjoy their favorite records played with the utmost precision.

That's why the 2QD has been engineered to offer fully automatic operation, for those who prefer putting on a record and letting the machine take over. The 2QD will repeat a record, for those who enjoy listening to favorite albums again and again. And for the critical listener who prefers listening to selected tracks, the 2QD offers manual operation with fluid damped cueing.

For the musician who enjoys playing along with records there's pitch control. A unique two-color LED glows green to indicate that platter speed is locked to the quartz crystal reference, red to indicate that speed can be adjusted by means of the pitch controls.

The counterweight gauge is finely calibrated so critical vertical tracking force can be adjusted with high precision. Anti-skating compensation offers similar precision, applying just the right force to the stylus tip to minimize record wear and maintain proper tracking.

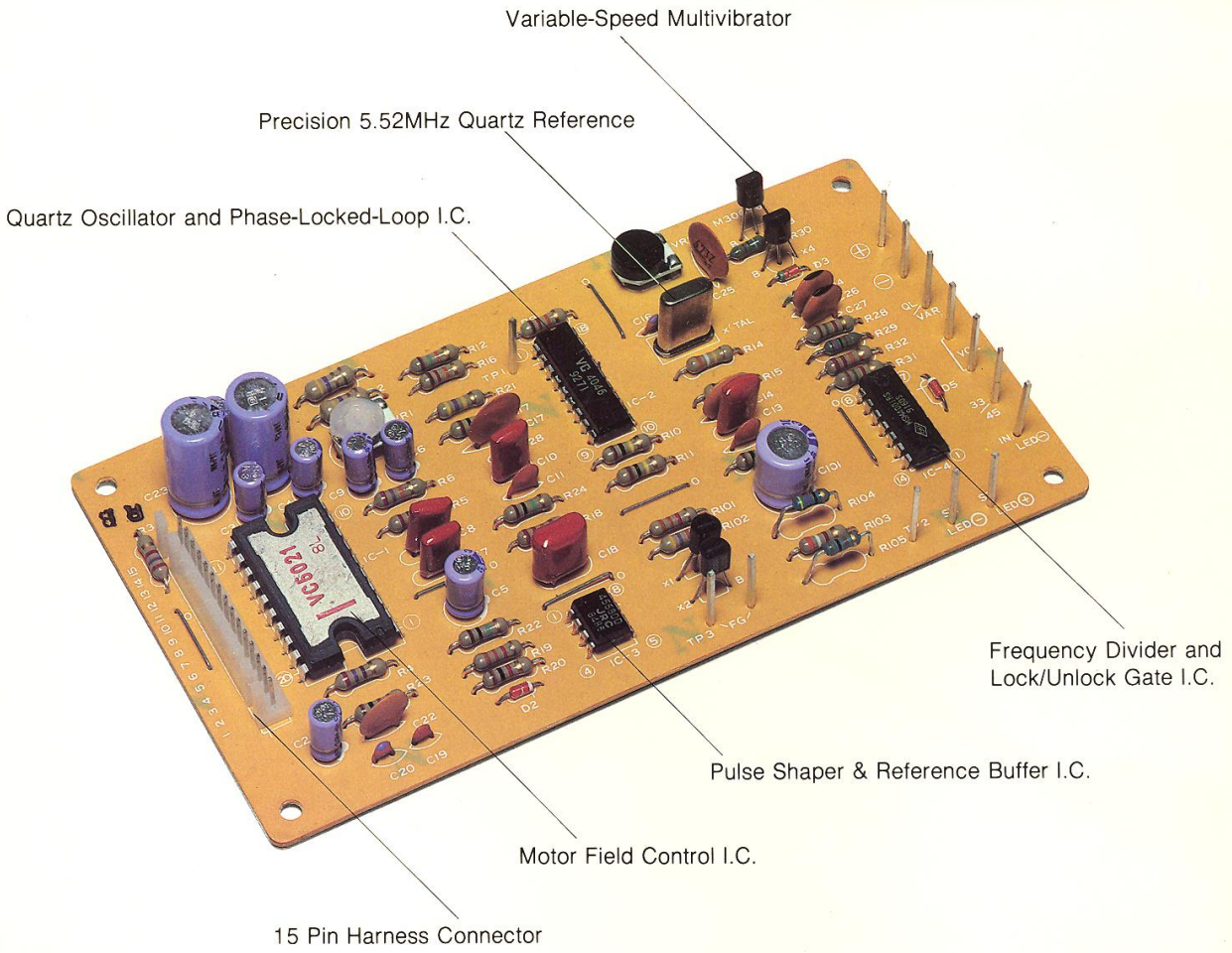
With its precision design, its striking appearance, and its ease of operation, the 2QD is indeed an audiophile quality turntable that anyone can appreciate.

Specifications

Platter drive system
Wow and flutter: 0.025%
Rumble: -75dB (DIN B)
Speed accuracy: ± 0.1%
Speed adjust range: ± 8.5%
Speeds: 33 RPM, 45RPM
Platter motor: 90-pole, brushless DC servo motor
Stall Torque: 650cm/g
Start up time: 1.8 sec.
Motor control system: Quartz crystal reference phase-locked-loop servo system.
Platter: 12-inch die-cast aluminum alloy
Platter weight: 3½ lbs (1.7 kg)

Tonearm
Length: 8¾-inch (222.2 mm)
Overhang: 11/16-inch (17.6 mm)
Offset angle: 24.5°
Tracking error: 0.19°/cm
Counterweight: Thin-profile, reduced inertia design. Solid brass with precision calibrated tracking force scale.
Horizontal pivot: Two precision ballbearing assemblies with ground races and 21 bearing balls per assembly.
Automatic trip mechanism: Zero-friction magnetic detectors.
Automatic drive: Separate induction motor for automatic tonearm functions
Useable cartridge weights: 4.5 to 10g

General
Power requirements: 117 VAC, 60 Hz, 10 watts
Dimensions:
17-⅝-inch (45 cm)W
14-inch (35.7 cm) D
5¾-inch (14.6 cm) H
Weight: 18 lbs (8.2 kg)



tions in the line frequency of household AC. When the pitch control is engaged, it is possible to use this strobe system to adjust platter speed with remarkable accuracy.

The result of these refined techniques is a platter drive system that can truly be said to be free of speed fluctuations under even the most demanding record playing conditions.

The LED strobe is precisely controlled by the crystal oscillator circuit.

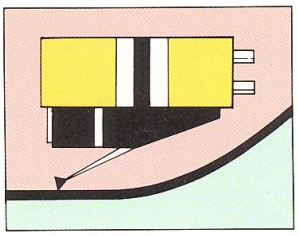
The 2QD Tonearm: Minimal Inertia, Minimal Resonance

In developing a tonearm to match the quality of the 2QD's drive system, it was necessary to consider several factors. First, today's quality light-tracking cartridges have extremely compliant cantilever systems which lead to increased resonance of the tonearm/cartridge assembly. Second, modern recordings have more material in the low audio frequency ranges—loud bass material that tends to activate arm resonance and cause mistracking. Third, while the ideal record surface should be perfectly flat, records continue to be plagued with warp problems. Record warpage, like dynamic low frequency material, tends to excite arm resonance.

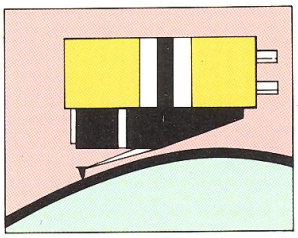
Any tonearm has resonance—even the most highly engineered. But with proper engineering, the effects of resonance can be significantly reduced. Arm inertia can be reduced to compensate for the increased compliance of modern cartridges. And arm resonance can be tuned to between 10 and 15 Hz—above the frequency of most warp energy but below the lowest frequencies of the audio spectrum.

Inertia—the tendency of a mass at rest to remain at rest and of a mass in motion to remain in motion—contributes significantly to resonance related mistracking. The illustration shows a tonearm with excess inertia tracking a warped record. As the compliant stylus tracks into the warp, it flexes upward. Inertia keeps the tonearm itself from moving immediately with the stylus. As a result of this cantilever flexing, the dynamic range of the cartridge is reduced and an infrasonic signal is sent to the amplifier—a signal that can't be heard, but which drains system power and causes distortion.

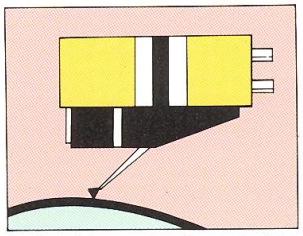
As the stylus reaches the peak of the warp, inertia causes the tonearm to continue its upward motion, while the stylus cantilever flexes downward. On some warps, tonearm inertia may force the stylus to alternately dig into and hop out of the record groove. Arm inertia and arm resonance may also cause the up and down movement, along with the unnecesary stylus flexing, to continue well past the warp.



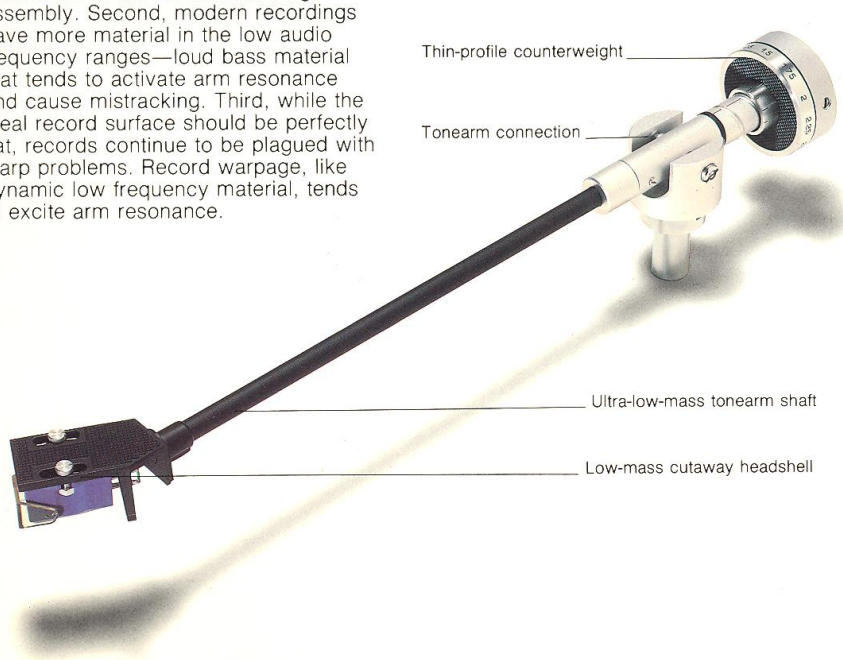
A tonearm/stylus assembly with excess inertia tracking into a warp.



As the compliant stylus tracks into the warp it flexes upward.



As the stylus reaches the peak of the warp it flexes downward.



The 2QD tonearm begins reducing inertia by reducing the excess mass that causes inertia. The ultra-low mass tonearm shaft is made of aircraft quality aluminum. The thin walls and small diameter have been carefully selected for maximum rigidity *and* minimum mass. The headshell is a mass-minimizing cutaway design.

A second step in reducing inertia in the 2QD's tonearm was to move necessary mass as close as possible to the pivot point. The reason: a well-known law of physics states that a mass placed close to the pivot point of a pendulum (a tonearm is essentially a pendulum placed on its side) will have less inertia than the same mass—or even less mass—placed further from the pivot point.

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CBS Inc.
1601 W. Glenlake Ave.
Itasca, Illinois 60743