

 **KENWOOD**

**KD-650**  
**KD-600**

QUARTZ PLL DIRECT DRIVE TURNTABLES



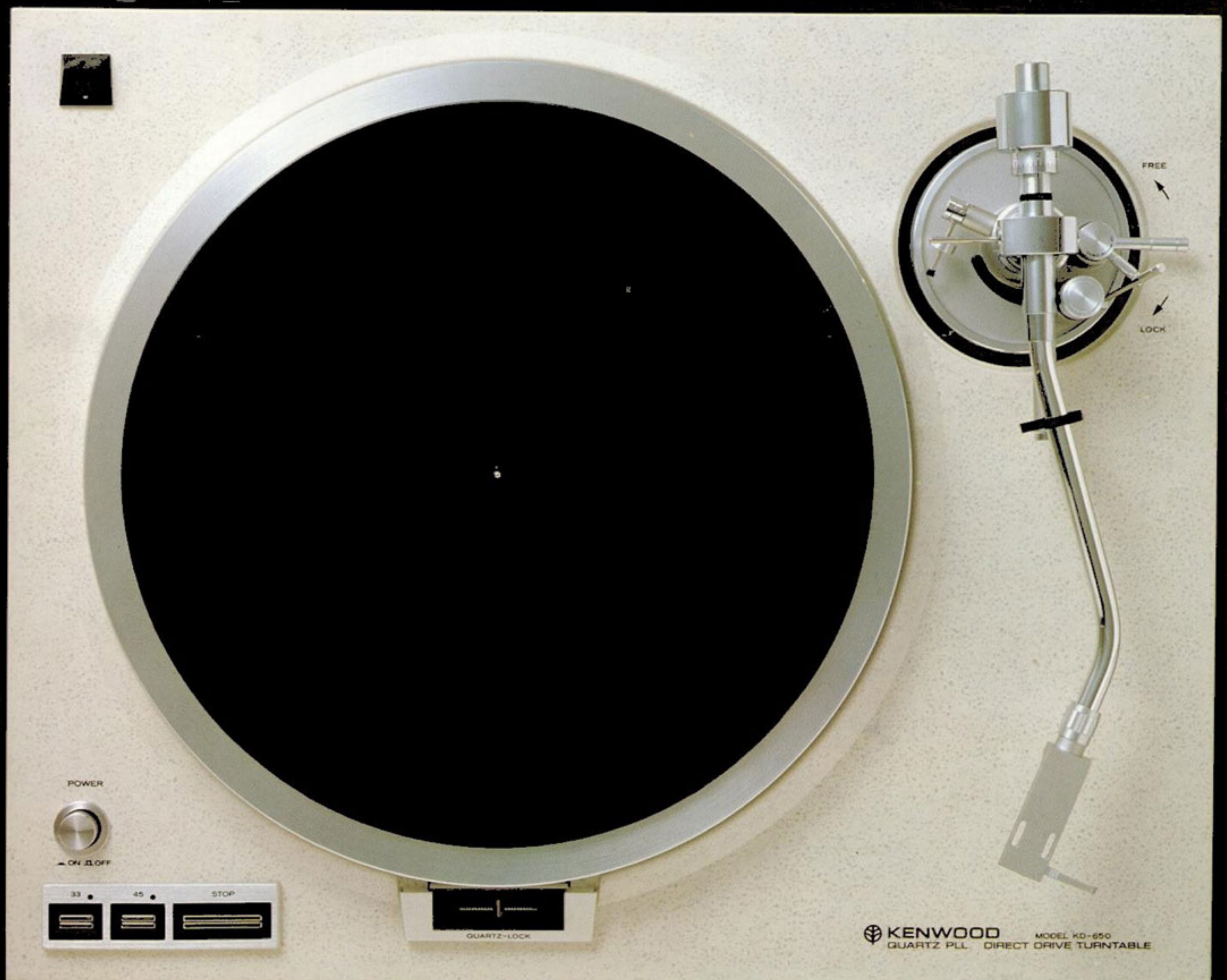


# Quartz phase-locked speed control combined with a high-inertia platter produces outstandingly authentic music reproduction from records.

- \* High-inertia platter:  $550\text{kg}\cdot\text{cm}^2$
- \* Quartz PLL servo speed control
- \* ARCB limestone-resin-concrete base

Complex signal-imprinting processes that provide records with wider dynamic range, combined with more subtle reproduction from a new generation of cartridges, are allowing today's record fan to be more critical of reproduced sound quality than ever before. Setting the pace for the serious audiophile is the new Kenwood KD-650/600, a turntable capable of

reproducing the most complex musical passages with accuracy and authenticity. With its new technology based upon transient-load theory and its strong emphasis on resonance suppression, the KD-650/600 turntable demonstrates once again Kenwood engineers' deep commitment to the improvement of quality in sound reproduction.





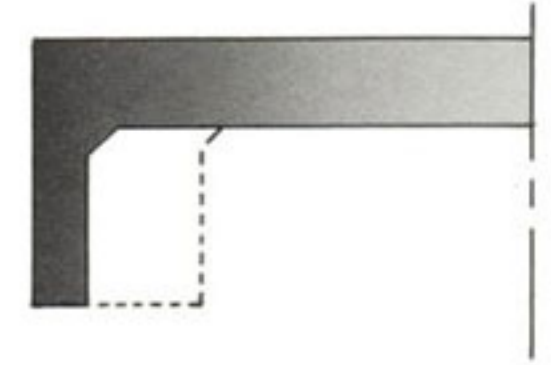
## A High-Inertia Platter

The greater a platter's moment of inertia, the better it will resist all external disturbances, which include fluctuations in transient load dictated by the actual signal, stylus-drag load, pivot bearing friction, as well as all vibrations from the motor, transformer, floor, or sound pressure waves generated from the speakers. With its heavy weight of 2.6 kg (5.7 lbs) and extremely high moment of inertia of 550 kg·cm<sup>2</sup>, the platter of the KD-650/600 is fully capable of resisting or absorbing any external influence, and thus minimizes the margin of error over which the quartz servo speed control system has to operate. As a result, the high-inertia Kenwood platter is the over-riding factor in

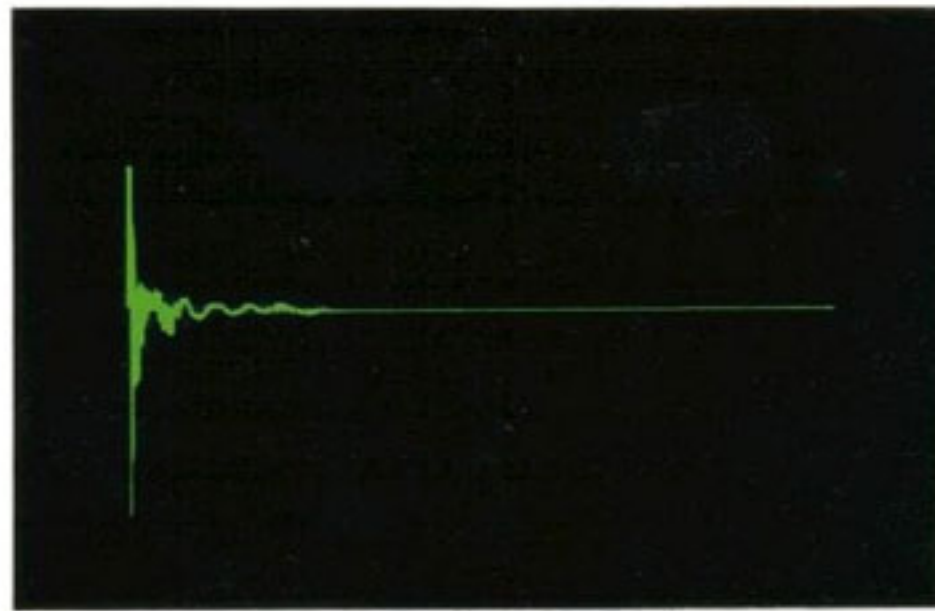
KD-650/600 loaded with a 550kg·cm<sup>2</sup> platter



With conventional 200kg·cm<sup>2</sup> platter

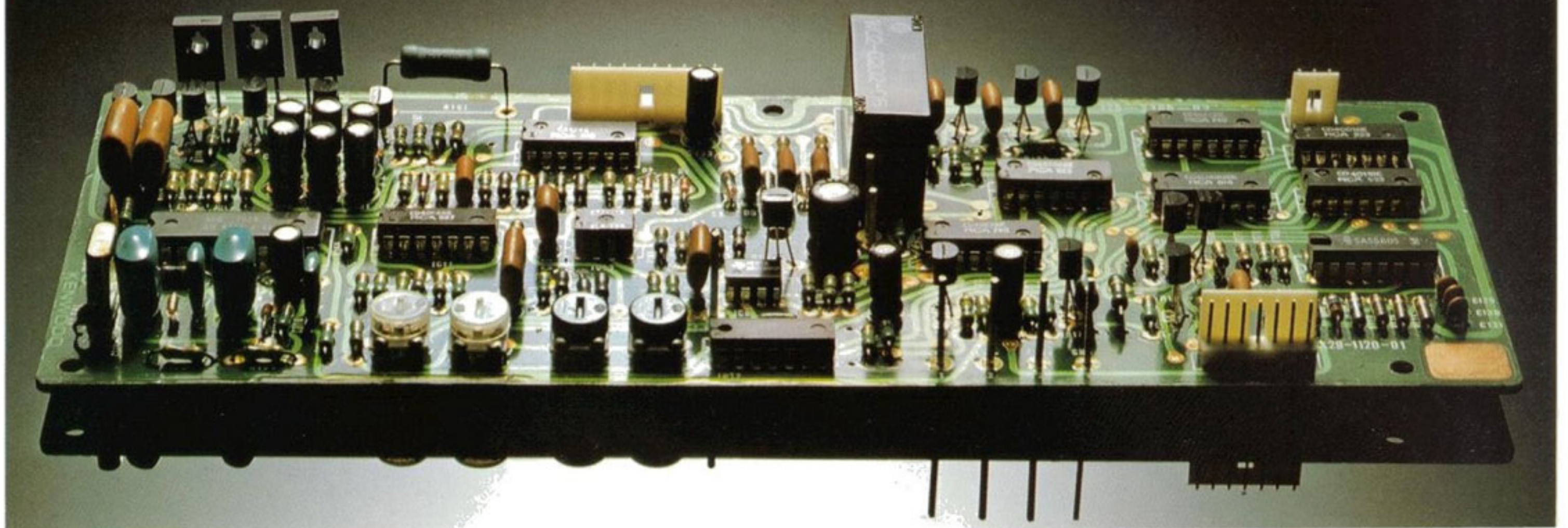
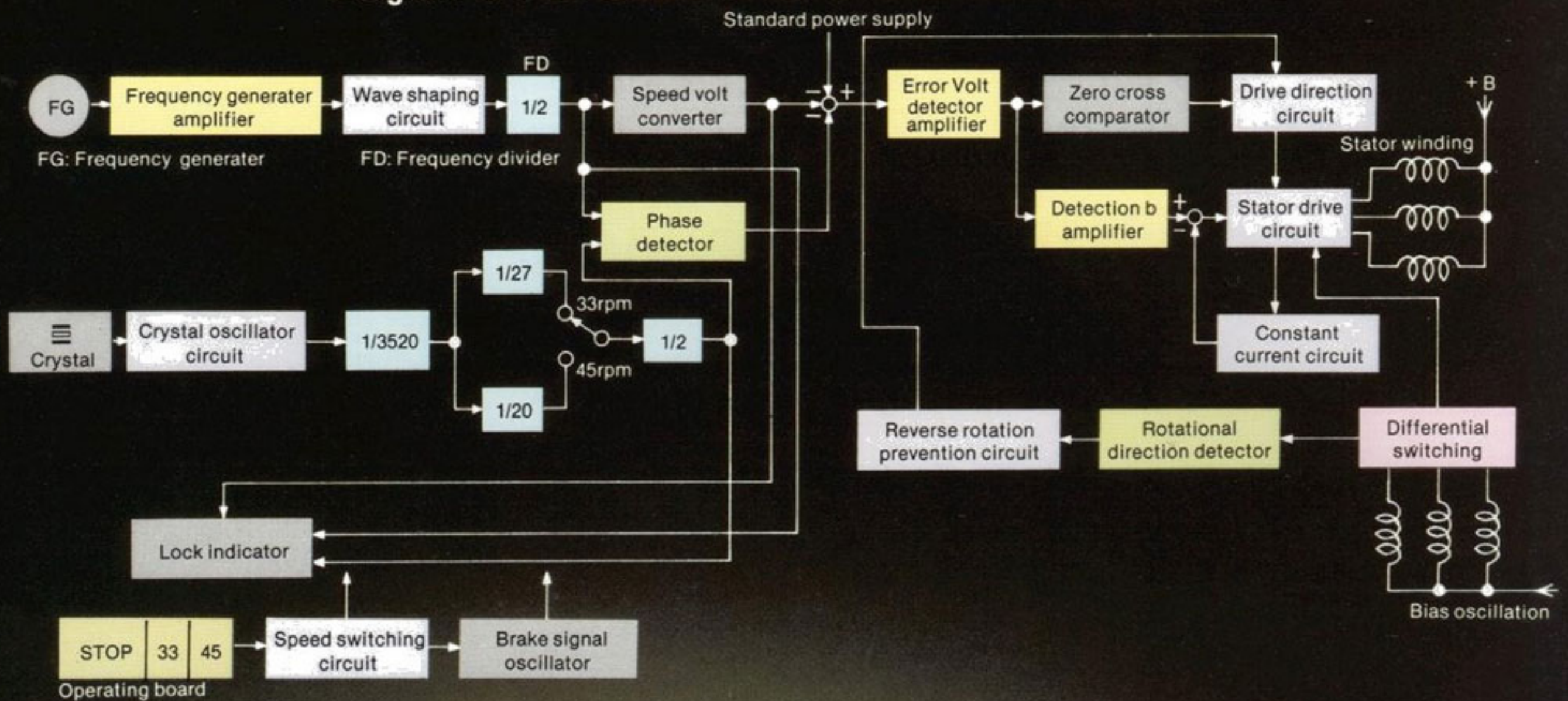


The KD-650/600's extra-heavy platter provides a high 550 kg·cm<sup>2</sup> moment of inertia capable of absorbing all external influences, complemented by quartz phase-locked speed control accuracy.



Scope traces show how Kenwood's heavier 550kg·cm<sup>2</sup> inertia platter quickly stabilizes after shock is given-to center shaft.

## Diagram of PLL control circuit in the KD-650 /KD-600



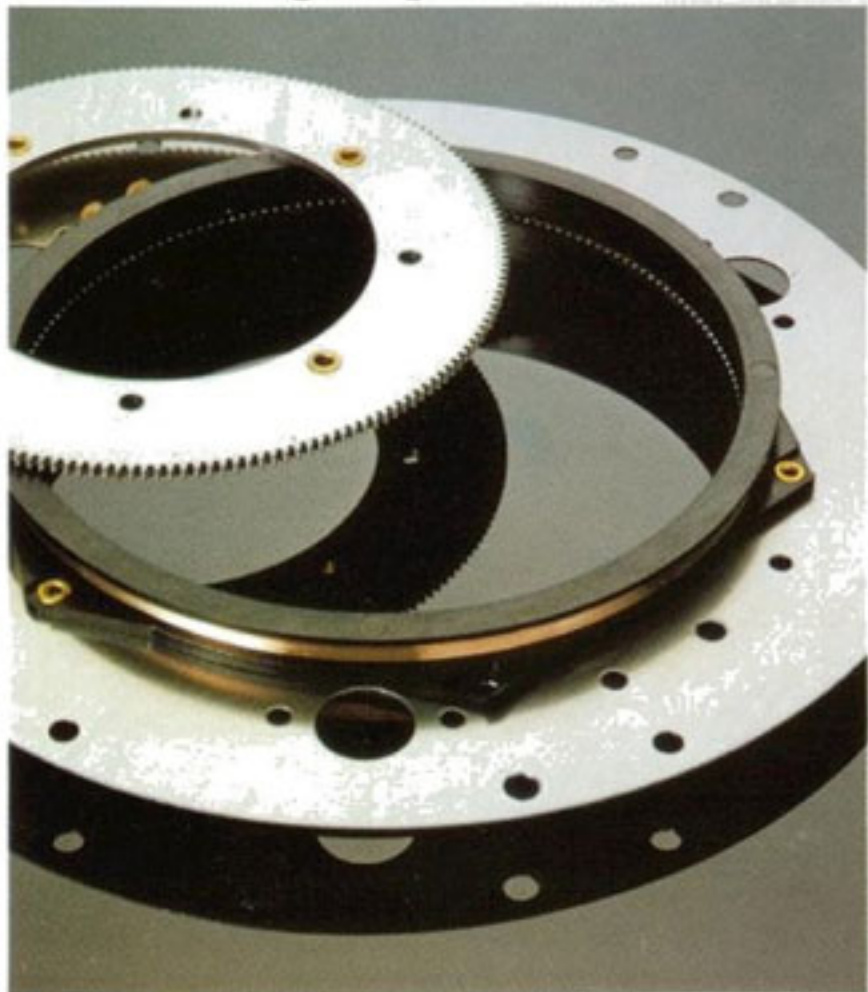
A mechanical 180-tooth speed detector and a linear speed control signal provided by the Kenwood Speed-Volt servo motor ensure that the quartz PLL circuit maintains maximum platter rotation accuracy



\* obtaining the KD-650/600's remarkable transient accuracy. This can be seen in the performance data: 0.00015% transient load fluctuation at mid-frequency, with a typical 20 g-cm stylus load at 33-1/3 rpm.

### How the Quartz PLL IC Controls Motor Speed, Platter Rotation

Although quartz crystal oscillation used as a standard reference signal is an extremely accurate way of measurement, other factors can diminish this accuracy. For example, ordinary quartz systems using printed magnetic coating or machine-pressed slit-disk systems as the speed detector are inherently inefficient, and their accuracy can also deteriorate with time. The Kenwood system is a purely mechanical integration-type detection system linked with a new Speed-Volt motor. Unlike conventional signal-pulse detection



methods, servo feedback is provided by a 180-tooth precision-cut wheel. These teeth generate pulses whose frequency varies linearly with rotational speed. Moreover, the reversible Speed-Volt servo motor directly converts the fluctuations of platter speed into a linear control signal (ordinary FG servo systems cannot produce a linear signal). Because it is linear, the quartz oscillator is able to operate more efficiently in a true negative feedback system. A large-scale IC, which includes highly stable MOS FETs provides a circuit entirely unaffected by temperature or moisture. An advantage of the linear speed con-

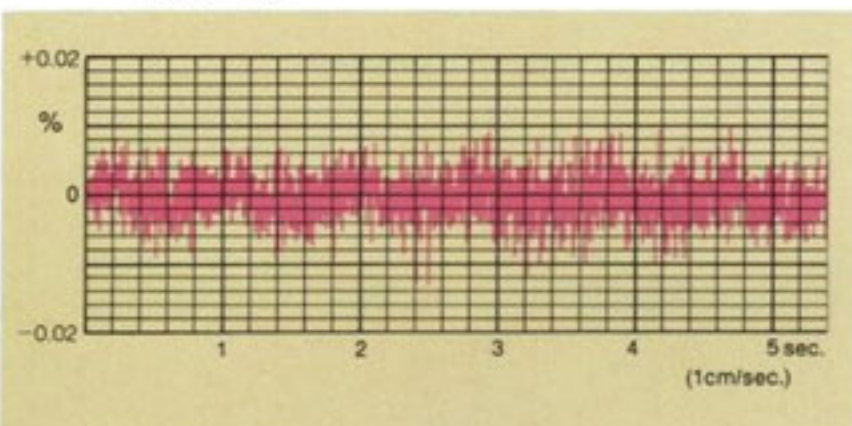
trol factor is that it eliminates the low-pass filter usually used to block unwanted oscillation that occurs at the resonant frequency ( $f_0$ ) of the turntable system. In this way, every element designed into the KD 650/600 contributes to extreme stability and accuracy, creating ideal conditions for playback of records.



Quartz lock indicator lights up when PLL circuit is "locked" and turntable is operating at correct speed

### 0.025% (WRMS) Wow-And-Flutter

In a turntable, various elements can produce wow-and-flutter, a combination of slow and fast variations in pitch which can be highly audible if uncorrected. Wow-and-flutter in the KD-650/600 has been reduced to 0.025% (WRMS). This has been achieved by the incorporation of the high-inertia platter and the quartz phase-locked servo circuit, and by the development of a new 20-pole 30-slot brushless DC motor. Designed with extremely high torque to drive the extra-heavy platter, this new motor offers an important advantage over other motors. Its 30-slot design eliminates the common fault of erratic delivery of energy during the motor's current-switching process, a phenomenon known as "cogging".



Kenwood's 20-pole 30-slot brushless DC servo motor combines with the high-inertia platter and quartz PLL circuit to produce extremely low wow-and-flutter.

### Smooth Operation

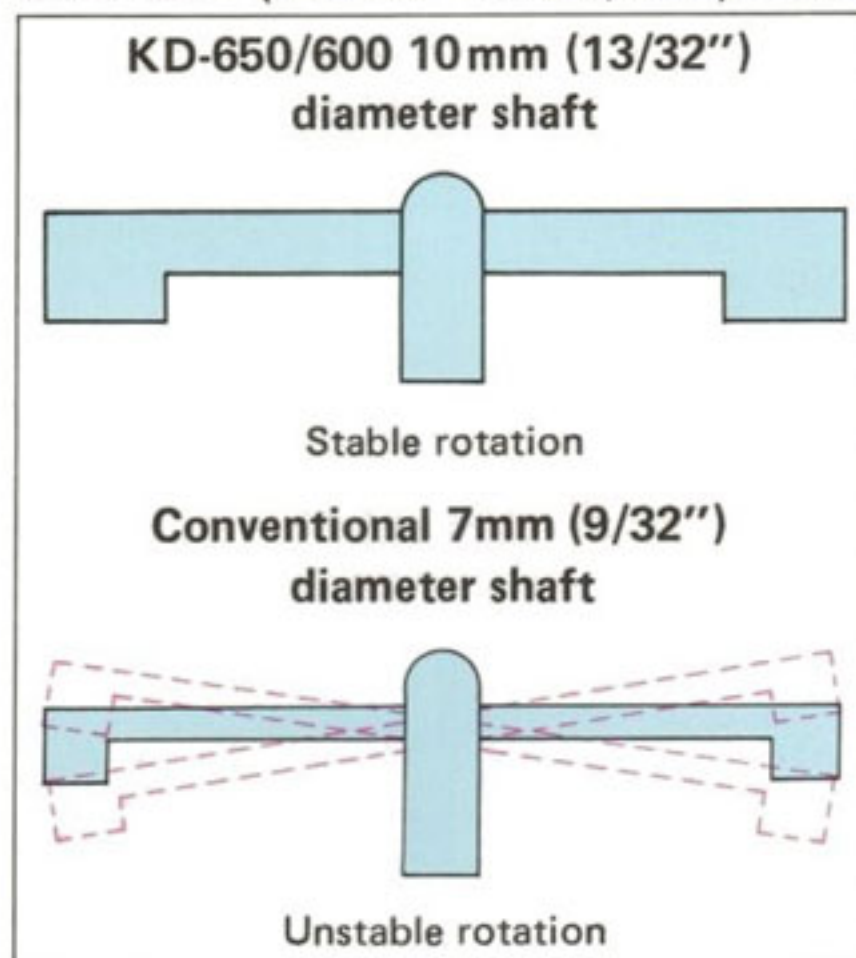
In addition to the high starting torque (1.5 kg-cm) motor, the PLL reversible servo circuit maintains accurate platter speed deviation control in both directions, which results in exceptionally smooth start-up and stop, as well



as smooth direct changes between speeds. A digital touch-sensing start/stop switch eliminates potentially harmful vibration. The braking system is all-electronic: it utilizes the polarity of a motor coil to slow down the platter smoothly without placing any load on the servo motor.

### Direct-Drive System Uses Large Diameter Center Shaft

With many inferior direct drive designs a weak point lies in the use of an inadequate center shaft which in fact is the focal point for long-term drive stability. The KD-650/600 uses an unusually large diameter (10 mm or 13/32") shaft



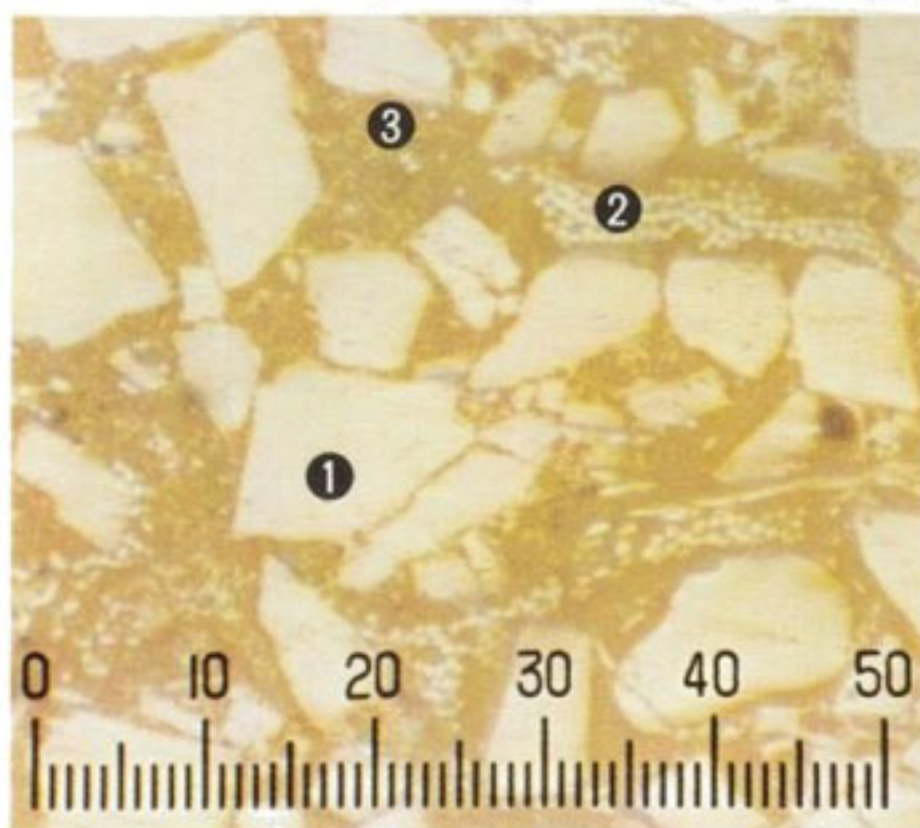
A precision finished high quality stainless steel core rotates totally enclosed in a brass friction-free sleeve for rock-steady vibrationless rotation.



as an integral part of the direct drive system, ensuring maximum mechanical impedance, or firmness, between the turntable and the cabinet. A very low rumble figure of better than  $-75$  dB (DIN wtd) is one result.

### An Anti-Resonance Turntable Base

“Howling”, or acoustic feedback, is often caused in a turntable which uses inferior materials in its construction. It is created when vibrations from the floor or other structures, or when sound pressure waves generated by the speakers and reflecting off room surfaces, reach the cartridge. Acoustic feedback within the system itself can also be a problem. Because resonances can occur at any frequency with various materials, a quality turntable must use only the best cabinet materials which will damp and absorb resonance over the whole frequency range. Thus the KD-650/600 uses a double construction which bonds the main top layer of ARCB resin-concrete with a bottom layer of hard homogenized compression board. Together, they form a compact, rigid structure capable of damping resonances to a high degree over the whole frequency range.



- ① Limestone particles
- ② Glass powder
- ③ Polyester resin and limestone powder

*Compression molded using natural limestone particles, Kenwood-developed ARCB is one of the most effective materials for damping low frequency resonance. A bottom layer of hard homogenized compression board effectively damps high range resonance.*

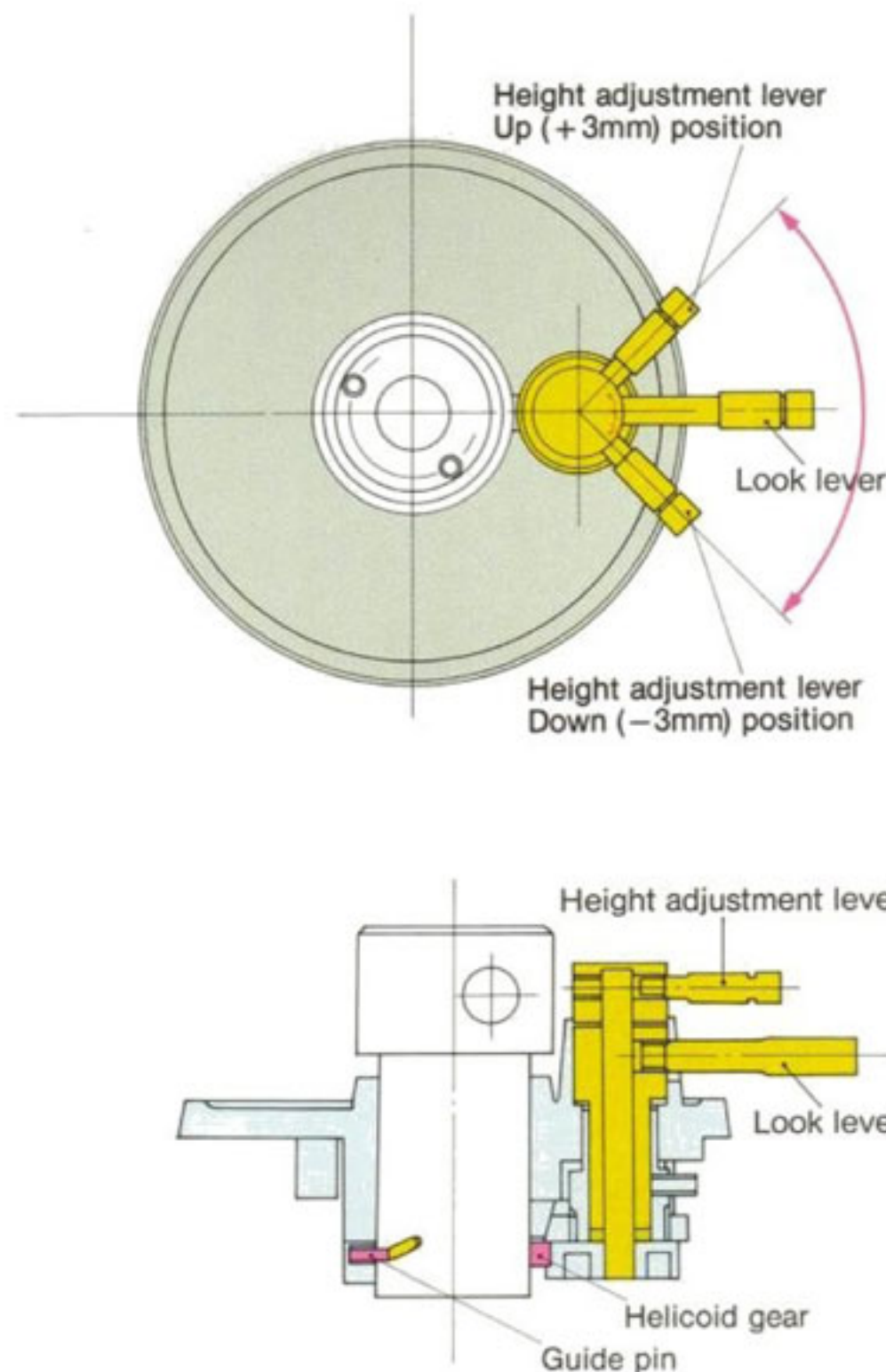


*The KD-650 non-resonant tonearm assembly is a remarkable achievement in tonearm design, providing precision in every detail and performance that matches the high level of the turntable assembly. It is, in fact, an integral part of the KD-650 system.*

### Kenwood's Integrated High Performance Tonearm For The KD-650

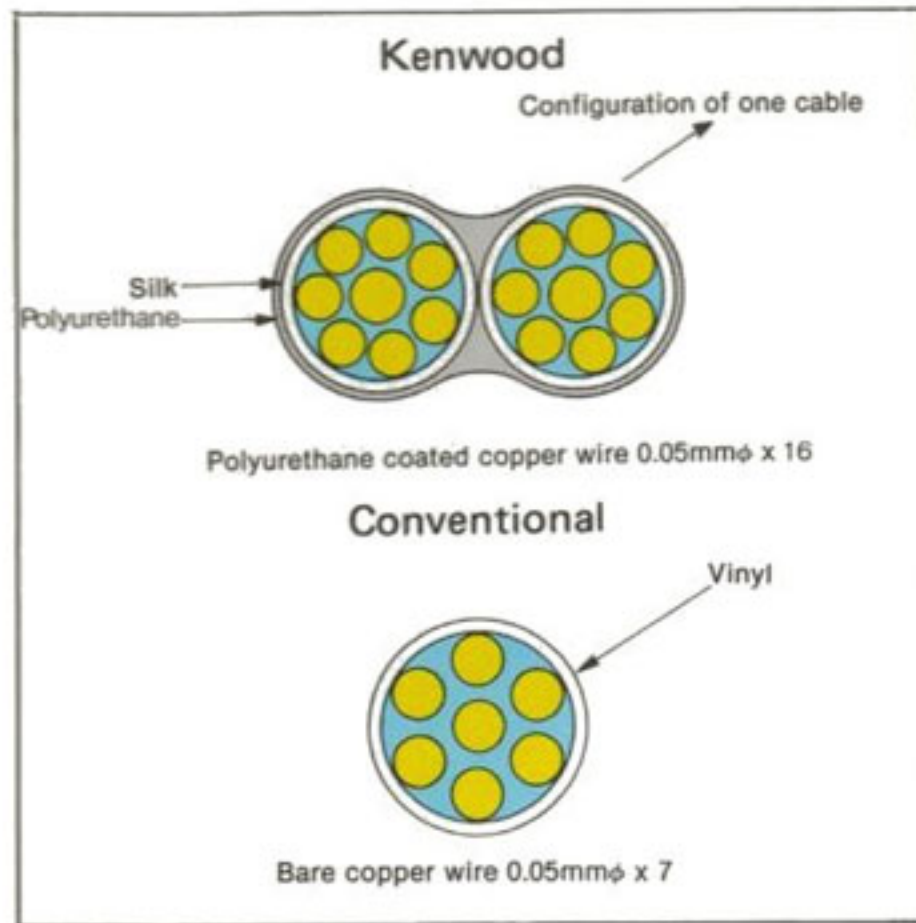
This is a carefully designed tonearm that fully matches the high level of performance obtained with the turntable assembly. Its proven S-shaped static balanced design with a hand-made brass pivot bracket provides low tracking error to reduce harmonic distortion, and resonance suppression adequate for most cartridges. It is light and flexible, but possesses sufficient strength and mass to prevent mistracking or “shimmy”, at the same time being highly responsive to groove modulations. But this is more than just an efficient tonearm, for it is designed as a totally integrated part of the KD-650 system. Every detail of its performance has been taken into account. For example, its wide-diameter thick diecast aluminum base is attached directly to the ARCB cabinet base using machine screws to obtain a very high mechanical impedance. A layer of anti-resonant hard rubber is sandwiched in between. A new wedge-shaped chuck system is used to attach the tonearm firmly to the base. This is both highly rigid and easy to operate, and results in a contact rigidity some 45 times greater than that obtain-

ed with ordinary screws. Since many users of this high quality turntable will undoubtedly wish to select their own cartridges, tonearm height is adjustable by a smooth operating helicoid mechanism (like that used for cameras) to  $\pm 3$  mm ( $\pm 1/8$ ”). In addition,



*High-precision helicoid arm adjustment permits use of different types of cartridge.*





*Silk-wound parallel Penta-Litz wire offers the advantage of low resistance to maintain tonal quality.*

a common resonance problem caused by the resonant frequency ( $f_0$ ) of the counterweight is solved by an elastic decoupling method. Arm elevation is by a non-reaction oil-damped sealed cueing device designed to prevent "bounce". Static type anti-skating control is also provided. Inside the tonearm, new silk-wound low resistance parallel Penta-Litz wire (patent pending) reduces signal loss, crosstalk and capacitance. All contact points are gold-plated. The bracket which supports the pivot is made of brass and uses no parallel faces, thereby preventing resonance. Finally, the headshell of lightweight diecast aluminum uses a unitized construction and industrially-derived Collet chuck system to increase its rigidity and lower its resonance into the "safe" range.

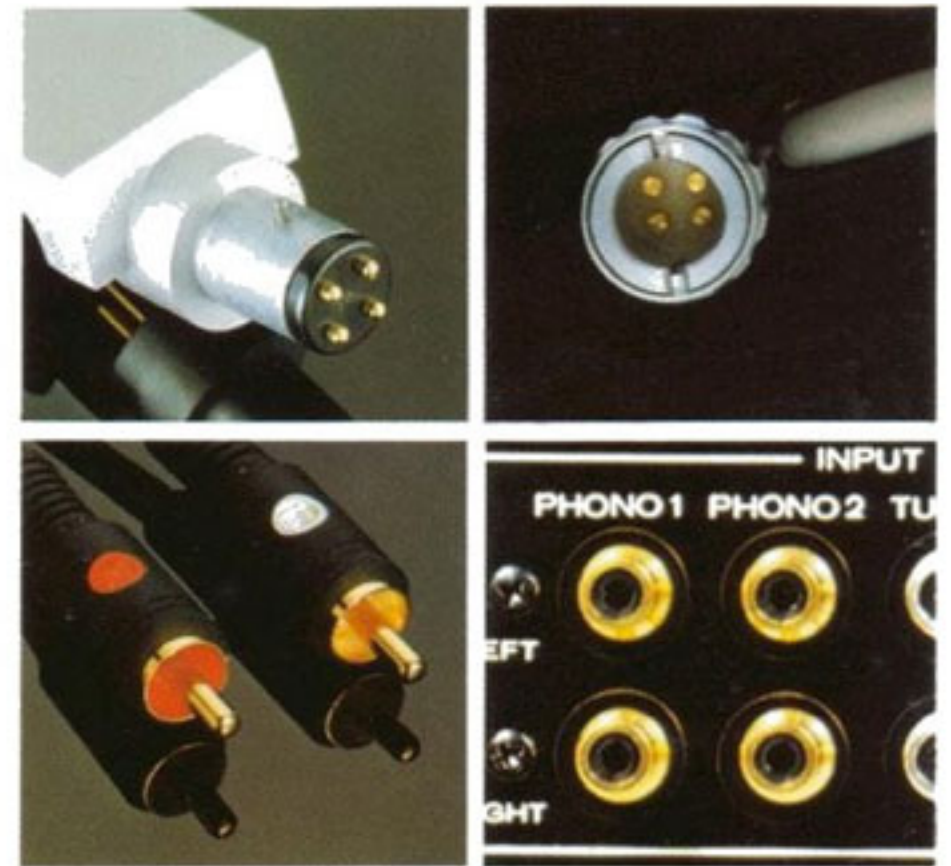
### The KD-600 Used With Top-Quality Tonearms

With a quality turntable capable of such performance as the KD-600, many audio enthusiasts will wish to choose a particular tonearm in order to create a sound system suited to individual preference. The KD-600 is therefore supplied with two different tonearm bases. One is designed to mount the Ortofon AS-212MKII tonearm; the other to mount either the Infinity Black Widow or SME-3009I, 3009II, 3009III series laboratory reference tonearms. With this additional flexibility, the KD-600 easily takes its place in

the best of today's high fidelity systems.

### Other Quality Features

- LED Indicators Embedded In Touch-Sensing Switches
- Electronic-Controlled Braking System
- Special Anti-Vibration Rubber Platter Sheet  
Helmholtz-principle air cavities inside the sheet absorb resonances created at the record/rubber sheet interface.
- Illuminated Quartz-Lock Indicator  
Large and positioned for easy visibility.
- Illuminated Power Indicator
- Audio Insulators  
Designed for both vertical and horizontal vibration absorption.
- Heavy Duty Ribbed Non-Resonating Acrylic Dust Cover
- Low-Capacitance Phono Cables  
Ready For CD-4 discs.



*All contact points are gold-plated for minimum contact loss.*

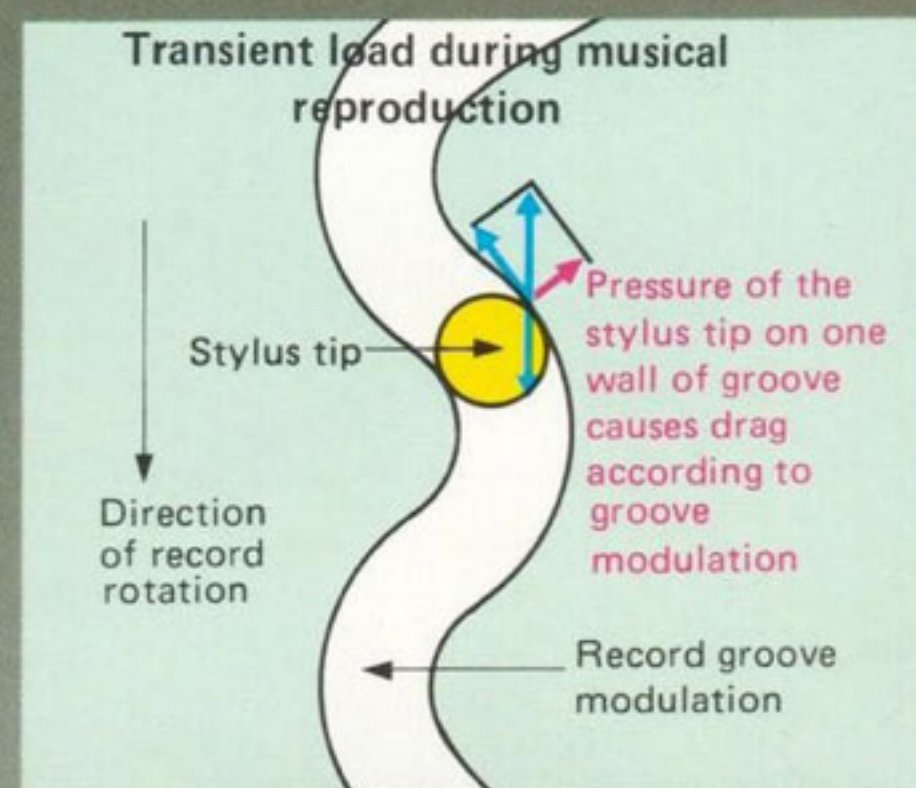


**KD-600**



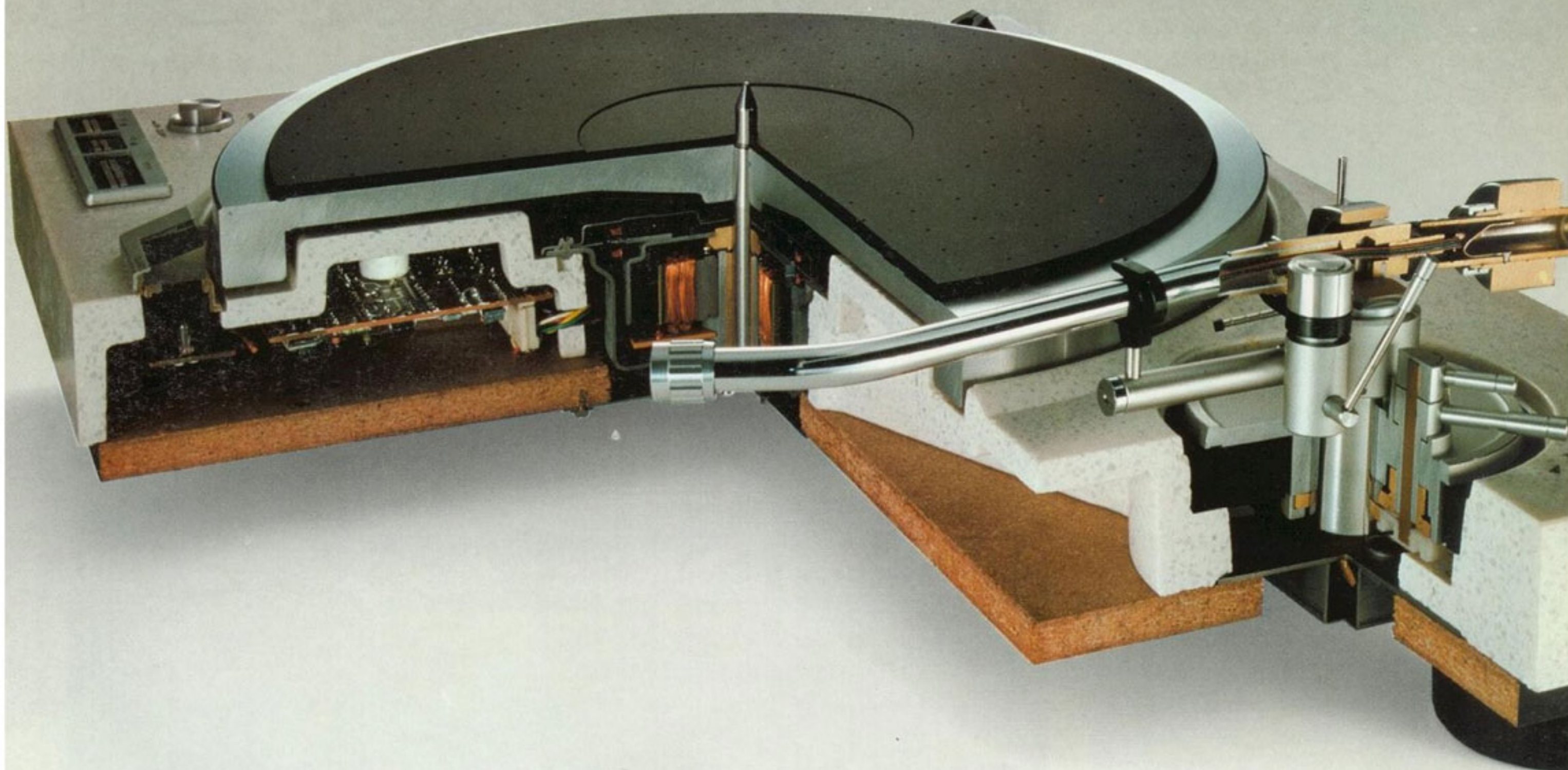
### A Turntable's Dynamic Performance Is Affected By Transient Load Fluctuations

It may be surprising that Kenwood stresses the importance of a high-inertia platter over quartz-lock speed control, especially when most manufacturers feature quartz speed control prominently in their brochures. But the fact is, quartz speed control cannot cover up basic deficiencies in transient performance, when the stylus is actually tracking the grooves. Quartz oscillation uses its stable signal as a reference to compare the platter's rotation speed, correcting its phase fluctuations as appropriate through a servo circuit. Its effectiveness depends to a great extent on how speed is detected, and on how stable the whole system is. More importantly however, quartz servo control merely controls motor speed; it cannot by itself correct transient load fluctuations. These minute fluctuations occur when a heavily modulated groove (for example a heavy transient signal in the range of 100 Hz to 1 kHz) causes a kind



*Under dynamic conditions, serious degradation of sound quality can result from transient load fluctuations created when the stylus tracks an inscribed signal with very wide dynamic range.*

of "braking" effect which varies in effect according to the amplitude of the signal and its duration. Tests at Kenwood have shown beyond doubt that transient load fluctuations form a major barrier to authentic music reproduction. The solution to this problem was to incorporate a heavy platter that embodies very high inertia. This primary source of transient rotational stability is therefore fully complemented by the greater speed control accuracy afforded by the quartz phase-lock servo system.





# KD-650/KD-600

## SPECIFICATIONS

### KD-650

#### MOTOR & TURNTABLE

Drive System	Quartz PLL direct drive system
Motor	20 Pole, 30 Slot brushless DC servo motor (Starting torque 1.4 kg-cm)
Turntable Platter	33 cm (13 inch) diameter, aluminum alloy die cast Weight — 2.6 kg (5.7 lbs) Moment of inertia — 550 kg-cm <sup>2</sup>
Speeds	2 Speeds, 33-1/3 and 45 rpm.
Wow & Flutter	Less than 0.025% (WRMS)
Rumble	DIN weighted better than -75 dB DIN unweighted better than -55 dB
Load Fluctuation	0% (within 120 g of tracking force)
Transient Load Fluctuation	Less than 0.0003% (at 33-1/3 rpm., 400 Hz, to 20 g-cm load) Less than 0.00015% (at 33-1/3 rpm., 1,000 Hz, 20 g-cm load)
Starting Time	Within 1.8 sec.
Platter Speed Deviation	Less than 0.002%
Time Drift	Less than 0.0002%/h
Temperature Drift	Less than 0.00002%/c

#### TO NEARM

Type	Static-balanced type, S-shaped pipe arm, EIA plug-in connector,
Effective Tonearm Length	245 mm (9-5/8 inch)
Overhang	15 mm (9/16 inch)
Tracking Error	+1.8 to -1.0 degree
Stylus Pressure	
Variable Range	0 to 3 grams (0.1 g steps)
Usable Cartridge Weight	2.0 to 12.0 grams
Adjustable Height Range	Within ±3 mm (±1/8 inch)
Arm Base	Wedge-shaped chuck type

#### ADDITIONAL FEATURES

Illuminated quartz lock and power indicator, Electronic-controlled brake, digital sensor start and stop switches, helicoid type arm-height adjuster, wedge shaped chuck type arm base, static type anti-skating device, oil damped cueing device, LED speed indicators, adjustable height insulators, acrylic dust cover (weight 1.2 kg), stylus pressure direct readout counter, headshell stand.

#### MISCELLANEOUS

Power Requirement	AC 120V, 60 Hz
Power Consumption	35.0 watts
Dimensions	W 490 mm (19-5/16") H 165 mm (6-1/2") D 460 mm (18-1/8")
Weight	16.0 kg (35.2 lbs)

#### SUPPLIED ACCESSORIES

Low resistance phono cables with gold plated terminals, EP adaptor with overhang gauge, Screwdriver, silicon cloth, Ground wire.

### KD-600

#### MOTOR & TURNTABLE

Drive System	Quartz PLL direct drive system
Motor	20 Pole, 30 Slot brushless DC servo motor (starting torque 1.5 kg-cm)
Turntable Platter	33 cm (13 inch) Diameter, Aluminum alloy die-cast Weight — 2.6 kg (5.7 lbs) Moment of inertia — 550 kg-cm <sup>2</sup>
Speeds	2 Speeds, 33-1/3 and 45 rpm.
Wow & Flutter	Less than 0.025% (WRMS)
Rumble	DIN weighted better than -75 dB DIN unweighted better than -55 dB
Load Fluctuation	0% (within 120 g of tracking force)
Transient Load Fluctuation	Less than 0.0003% (at 33-1/3 rpm., 400 Hz, to 20 g-cm load) Less than 0.00015% (at 33-1/3 rpm., 1,000 Hz, 20 g-cm load)
Starting Time	Within 1.8 sec.
Platter Speed Deviation	Less than 0.002%
Time Drift	Less than 0.0002%/h
Temperature Drift	Less than 0.00002%/c

#### ADDITIONAL FEATURES

Illuminated quartz lock and power indicator, electronic-controlled brake, digital sensor start and stop switches, LED speed indicators, adjustable height insulators, acrylic dust cover (weight 1.2 kg), headshell stand.

#### MISCELLANEOUS

Power Requirement	AC 120V, 60 Hz
Power Consumption	35.0 watts
Dimensions	W 490 mm (19-5/16") H 165 mm (6-1/2") D 460 mm (18-1/8")
Weight	15.4 kg (33.9 lbs)

#### SUPPLIED ACCESSORIES

Low resistance phono cables with gold plated terminals, EP adaptor with overhang gauge, Screwdriver, silicon cloth, Ground wire, Hexagonal wrench, Two tonearm bases for SME-3009I/3009II/3009III and Infinity Black Widow or Ortofon AS-212MKII.

### KD-650/600

#### CABINET

Material	Construction of cabinet is Anti-Resonance Compression Base (ARCB) with hard homogenized board. This massive ARCB is compression molded from lime-stone particles, glass powders and lime stone bonded unsaturated polyester resin.
Cabinet Assembly Weight	7.9 kg (17.4 lbs)
ARCB Weight	6.5 kg (14.3 lbs)

Kenwood follows a policy of continuous advancements in development. For this reason specifications may be changed without notice.



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