

# ESTABLISHED 1945 Straight Tonearm

## A Straight Approach to Unparalleled Sound

*An exciting addition to Yamaha's long list of audio innovations, the Yamaha straight tonearm offers a number of improvements in phono reproduction quality. Unlike other tonearms of similar design, however, the Yamaha tonearm does not have to be used with a specific type of cartridge to get optimum performance. Since your choice of a cartridge is generally a matter of personal taste (and budget), Yamaha engineers were careful to make sure that this revolutionary tonearm will give you the stunning performance it was designed for with virtually any available cartridge. The key word is "versatility." Of course, the straight tonearm also features Yamaha's first-class craftsmanship using the highest quality materials so you enjoy long-lasting, top-precision performance.*

The Yamaha straight tonearm is available on:



P-750

Quartz-Lock Fully Automatic Direct Drive Turntable



P-550

FG-Servo Fully Automatic Direct Drive Turntable



P-450

FG-Servo Fully Automatic Belt Drive Turntable



P-350

Semi-Automatic Belt Drive Turntable

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Archiv Michael Otto

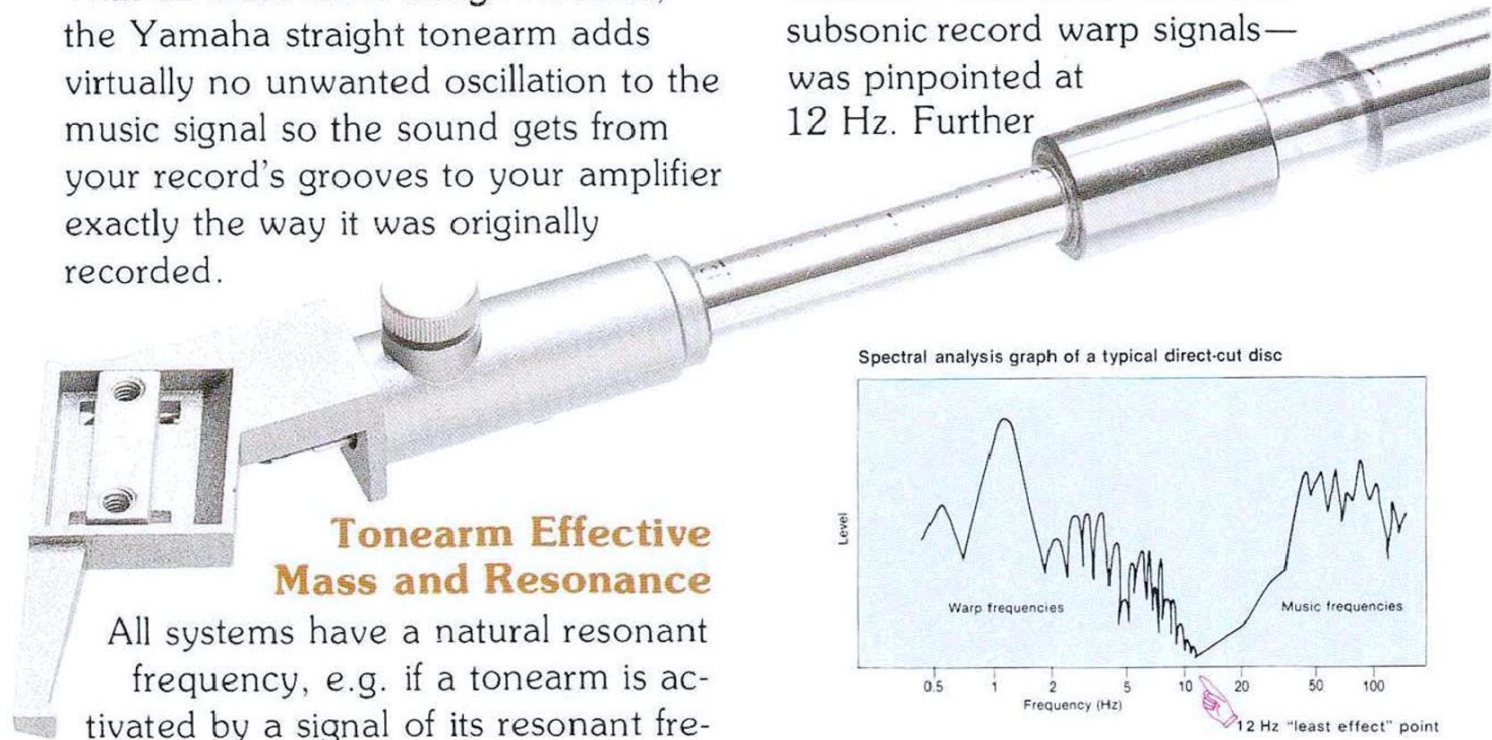


## High Stability

If any part of a turntable's tonearm is able to oscillate or resonate, this oscillation is mechanically transferred to the cartridge's stylus and is "added" to the reproduced sound, the result being a degraded music signal. The first step in eliminating this type of oscillation is to make the tonearm assembly as rigid as possible. In the Yamaha tonearm this is accomplished by using inherently rigid materials and extremely fine construction tolerances. The possibility of oscillation is further reduced through detailed consideration of the tonearm's actual shape, length, support, and the ratios of the masses of the various parts.

Yamaha engineers chose the straight configuration for the new tonearm because, compared to conventional tonearm designs, it is highly resistant to oscillation of the "twisting" type—as well as having a lower mass. In addition, the tonearm tube is solidly attached to a large, massive rectangular counterweight which effectively subdues this and several other types

of oscillation. The width or "span" of the pivot itself has also been increased, heightening tonearm stability. Another troublesome form of oscillation is the "bending" type. This means that the tonearm actually bends back and forth at the point where it is attached to the pivot. The Yamaha straight tonearm features an extra tonearm wall or "double tube" extending 30 mm (1-1/4") from the pivot, thereby increasing rigidity in this area so bending oscillation cannot occur. Bending-mode oscillation is also prevented by the arm's relatively short effective length of 222 mm (8-3/4")—a carefully chosen length that further results in the ideal combination of tracking accuracy, weight and rigidity. With all these extra design features, the Yamaha straight tonearm adds virtually no unwanted oscillation to the music signal so the sound gets from your record's grooves to your amplifier exactly the way it was originally recorded.

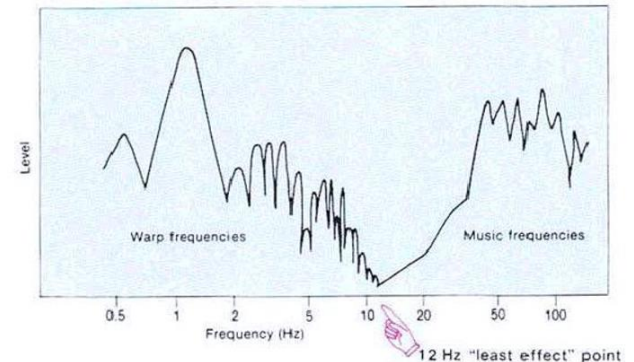


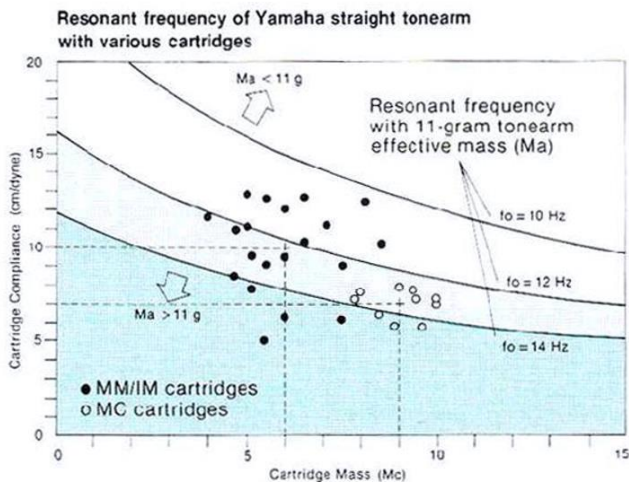
## Tonearm Effective Mass and Resonance

All systems have a natural resonant frequency, e.g. if a tonearm is activated by a signal of its resonant fre-

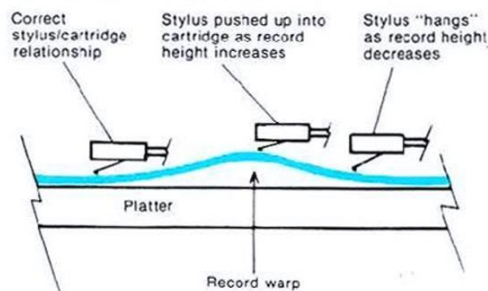
quency, it will resonate in harmony with the activating signal. And although great lengths have been taken to minimize this by making the tonearm as structurally rigid as possible, resonance is impossible to eliminate altogether. Faced with this problem, Yamaha engineers resolved to design the tonearm so that its resonance is at a frequency that would have the least possible effect on reproduced sound quality. Since resonant frequency varies inversely with mass, this would be effectively accomplished by adjusting the tonearm's mass. Through extensive experimentation, the desired "least-effect" frequency—the frequency where resonance would not "add to" or cause intermodulation distortion with either music or subsonic record warp signals—was pinpointed at 12 Hz. Further

Spectral analysis graph of a typical direct-cut disc

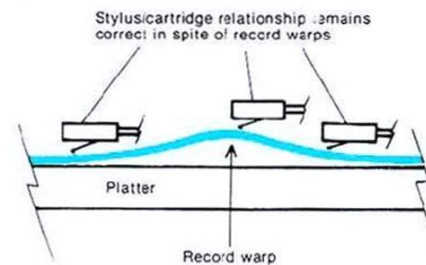




### Conventional Tonearm



### Yamaha Optimum Mass Tonearm

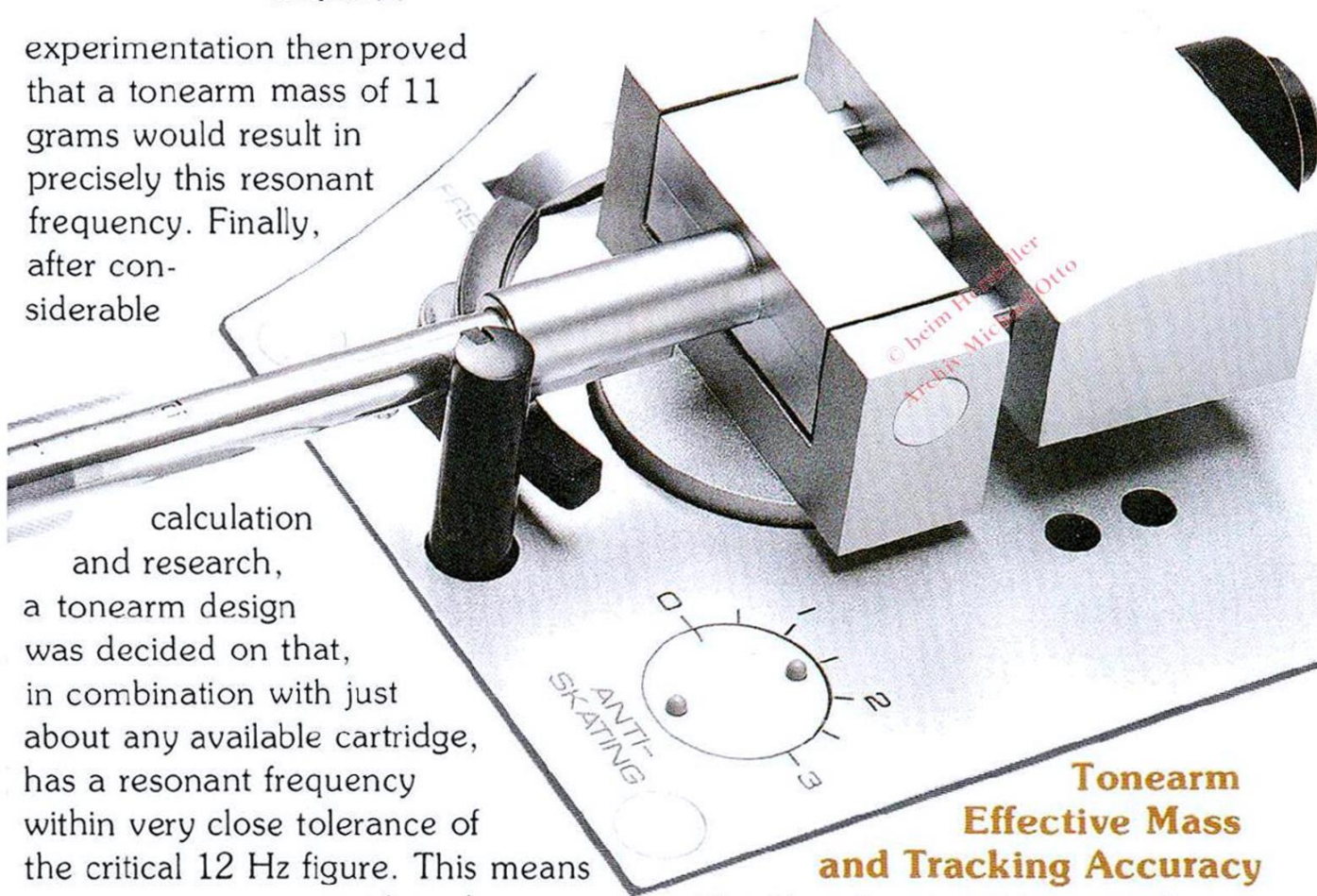


tion if the record being played is even slightly warped (all records are slightly warped) because the arm's mass pre-

vents it from following the curvature of the record's surface, i.e. when the warp goes up, the stylus gets squashed up into the cartridge; and when the warp goes down, the stylus is almost left hanging from the cartridge, with distortion resulting in both cases. The Yamaha straight tonearm, however, has comparatively low mass so it stays at the same distance from the record surface despite warps—the stylus remains at the correct attitude in relation to the cartridge and there is minimal tracking distortion.

experimentation then proved that a tonearm mass of 11 grams would result in precisely this resonant frequency. Finally, after considerable

calculation and research, a tonearm design was decided on that, in combination with just about any available cartridge, has a resonant frequency within very close tolerance of the critical 12 Hz figure. This means you can use any cartridge of your choice with the assurance that the clarity of your music will not be obscured by resonance-induced intermodulation distortion.

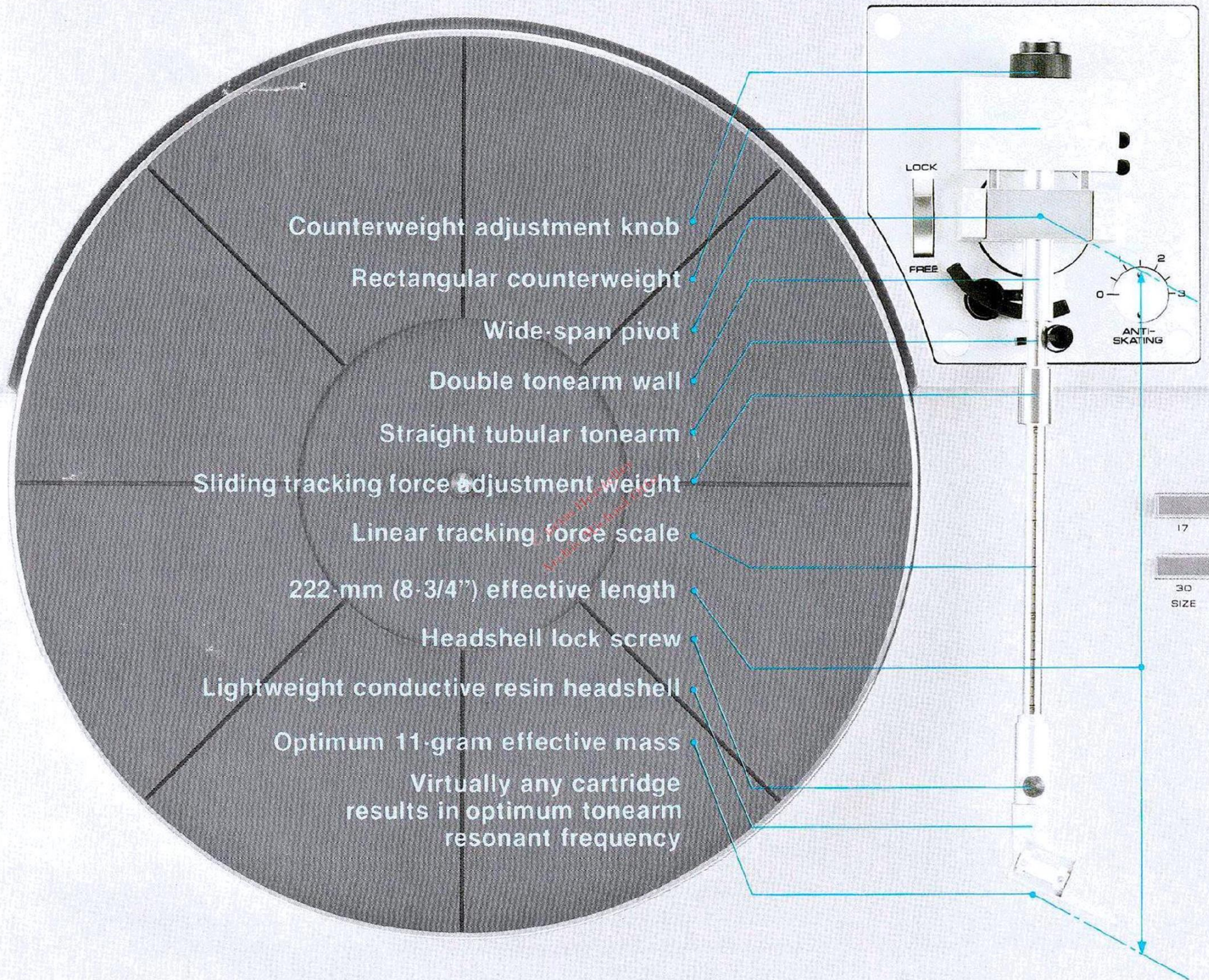


### Tonearm Effective Mass and Tracking Accuracy

The Yamaha straight tonearm's optimum 11-gram mass also offers considerable benefits in the area of tracking ability. Conventional, more massive tonearms can lead to distort-

### Sliding Tracking Force Adjustment Weight

The tracking force of the Yamaha straight tonearm is adjusted by a sliding weight on the tonearm tube. In addition to being much easier to set than conventional rotating types, this adjustment is also more accurate, so you get optimum performance from your cartridge.



Counterweight adjustment knob

Rectangular counterweight

Wide-span pivot

Double tonearm wall

Straight tubular tonearm

Sliding tracking force adjustment weight

Linear tracking force scale

222-mm (8-3/4") effective length

Headshell lock screw

Lightweight conductive resin headshell

Optimum 11-gram effective mass

Virtually any cartridge results in optimum tonearm resonant frequency

LOCK

FREE

ANTI-SKATING  
0 1 2 3

17

30  
SIZE

SPEED 33 45

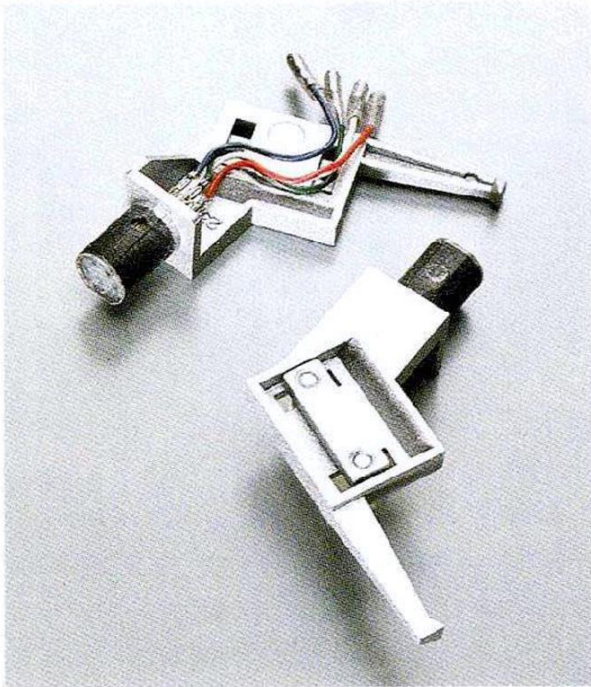
**YAMAHA** P-760  
QUARTZ D.D. FULL AUTOMATIC

LOCK

REPEAT

CUEING

CUT PLAY



### Lightweight Conductive Resin Headshell

To keep mass to a minimum, the Yamaha straight tonearm uses a lightweight resin headshell impregnated with 20% carbon fiber. The carbon fiber improves rigidity so resonance is minimized, and makes the headshell electrically conductive so it acts as an effective hum shield. Rigidity is further increased by using two bolts and a solid aluminum cross-bar to attach the cartridge rather than individual bolts and nuts. Also, the headshell connector pins are self-

cleaning types that actually plug into connector sockets in the tonearm. This ensures excellent contact so noise is effectively eliminated.

### Extra Headshell

With Yamaha turntables featuring the straight tonearm, two lightweight conductive resin headshells are provided. This means you can install a different type of cartridge in each one, so they can be quickly and easily changed to bring out the finer qualities of different types of music.

## TONARM SPECIFICATIONS

Type	Straight, Tubular	Tracking Force	Static balanced, sliding weight
Effective Length	222 mm (8-3/4")		0—3g. 0.1 g steps
Overhang	16 mm (5/8")	Headshell	Resin, 20% Carbon Fiber
Offset Angle	23°		ADC Type
Arm Lifter	Oil damping system	PU Cable Capacitance/	
Suitable Cartridge Weight	2.5—10 g	Resistance	100 pF/1Ω

*Specifications subject to change without notice.*

For details please contact:

SINCE 1887



# YAMAHA

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