

**Technics**  
**R&B** series

**RS-10A02**

**"Isolated Loop" 2-Track  
Stereo Tape Recorder**



## A Refined Approach to Meet Professional Requirements

The RS-10A02 is a 2-track stereo open-reel deck designed for professional and semi-professional applications in broadcasting, recording, and film making. The major feature of this deck is its "isolated loop" transport which maintains stable tape tension, thereby greatly limiting modulation noise and wow and flutter. The large 34mm diameter capstan is driven by a quartz locked direct drive motor which assures outstanding speed accuracy (no more than 0.05% speed fluctuation and 0.1% deviation). IC logic control, air-damped tension

rollers, and direct drive reel motors provide operational convenience and reliability. Highly linear amp circuits and stabilized bias circuitry provide excellent overall performance. For complete and accurate calibration, the deck is equipped with adjustable record bias, adjustable EQ and level calibrations for both record and playback, and test oscillator. For professional requirements, an NAB/IEC selector, balanced connectors, and 19-inch rack mount brackets are also provided.

# The Superiority of the Isolated Loop Transport

## Tape Transport Performance Requirements

For any professional application, a tape transport must provide:

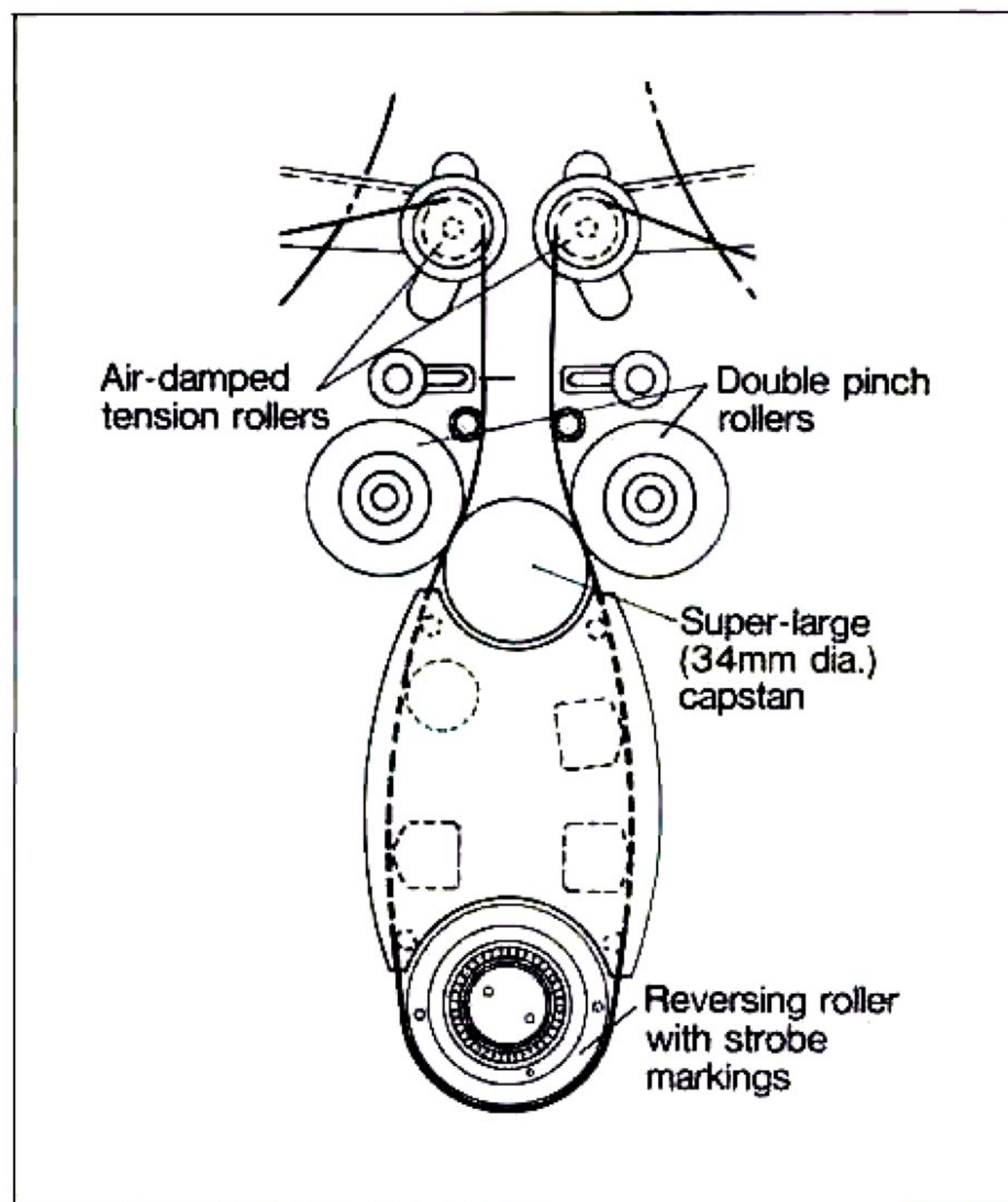
- 1) Correct and stable tape speed which is free from speed variation or deviation, regardless of tape position.
- 2) Very low wow and flutter.
- 3) Very low, stable tape tension to maintain optimum tape-to-head contact and minimize modulation noise, level fluctuations, head wear, and dropouts.
- 4) Quick start-up to rated speed without hunting and overshoot.

The Technics R&B Series Isolated Loop system more than meets all of these requirements. As explained below, this transport is inherently superior to conventional designs. In fact, performance is so stable and precise that it reveals inaccuracies in the very test tapes used to measure such basic parameters as wow and flutter and speed deviation.

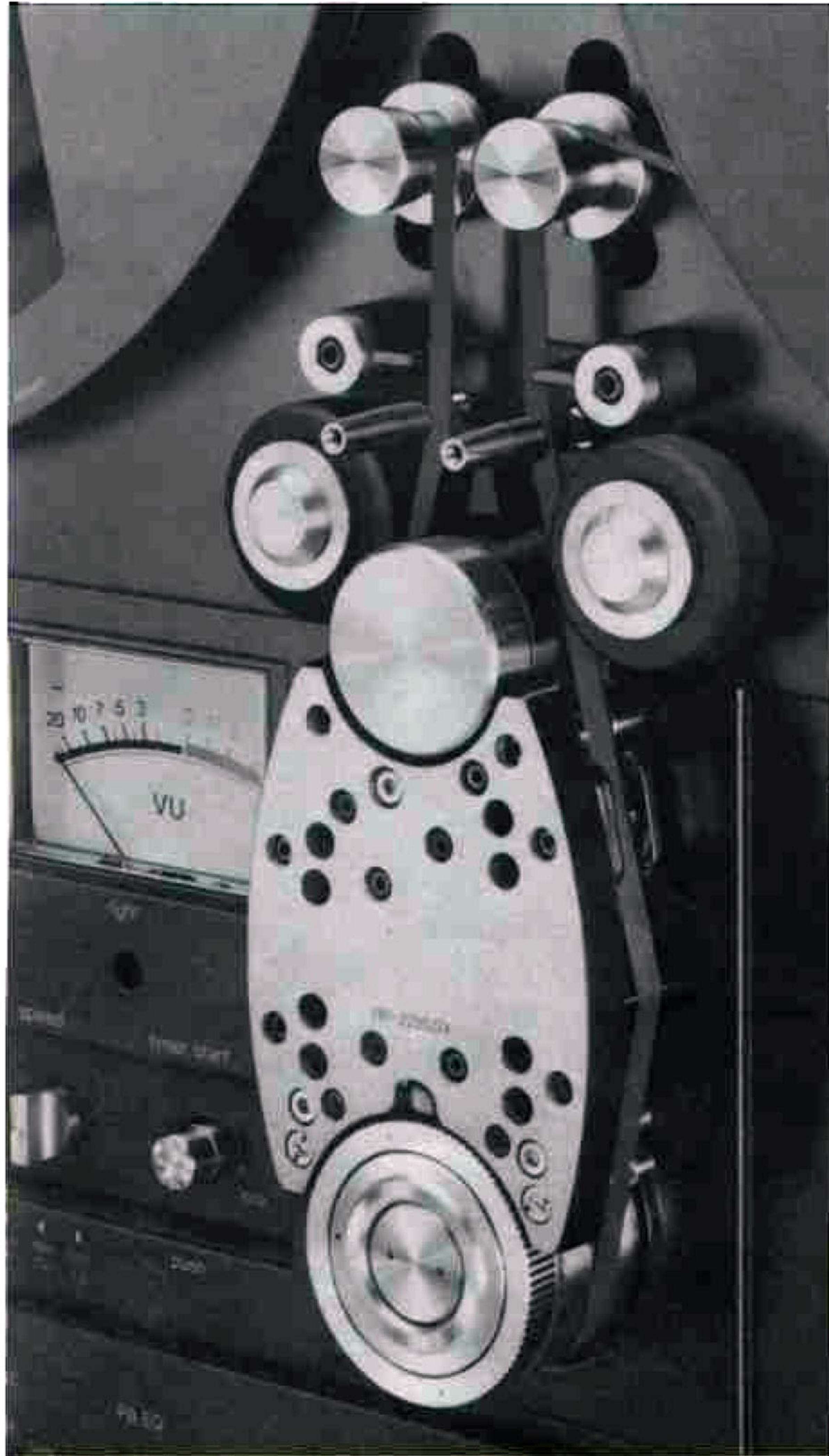
## Technics Single Capstan vs. Conventional Double Capstan

Although both the single capstan isolated loop and double capstan closed loop transports are designed to reduce the influence of tape tension fluctuations caused by reel torque, the Technics single capstan system has significant advantages. The double capstan approach depends on variations in the speed of the two capstans and in the pressure of the two pinch rollers to maintain the desired tape tension. This makes speed and tension adjustment complex and difficult, and increases the tape tension. The relatively long distance between the two capstans over which the tape must stretch contributes to higher modulation noise and scrape flutter.

In contrast, the Technics single capstan system maintains exactly the same speed and pinch roller pressure on both sides of the capstan. The wide contact area between the pinch rollers and the single extra-large capstan allows for lower tape tension. Tape tension is low (about 80 grams) and very steady, partially because the tape path between the capstan and the reversing roller is relatively short. So modulation noise, wow and flutter, and level fluctuations are dramatically reduced. Add to this the quartz locked slow-speed direct capstan drive system (which is aided by tension controlled direct drive reel motors and air-damped tension rollers), and it becomes obvious that the Technics isolated loop system achieves enviable overall performance.

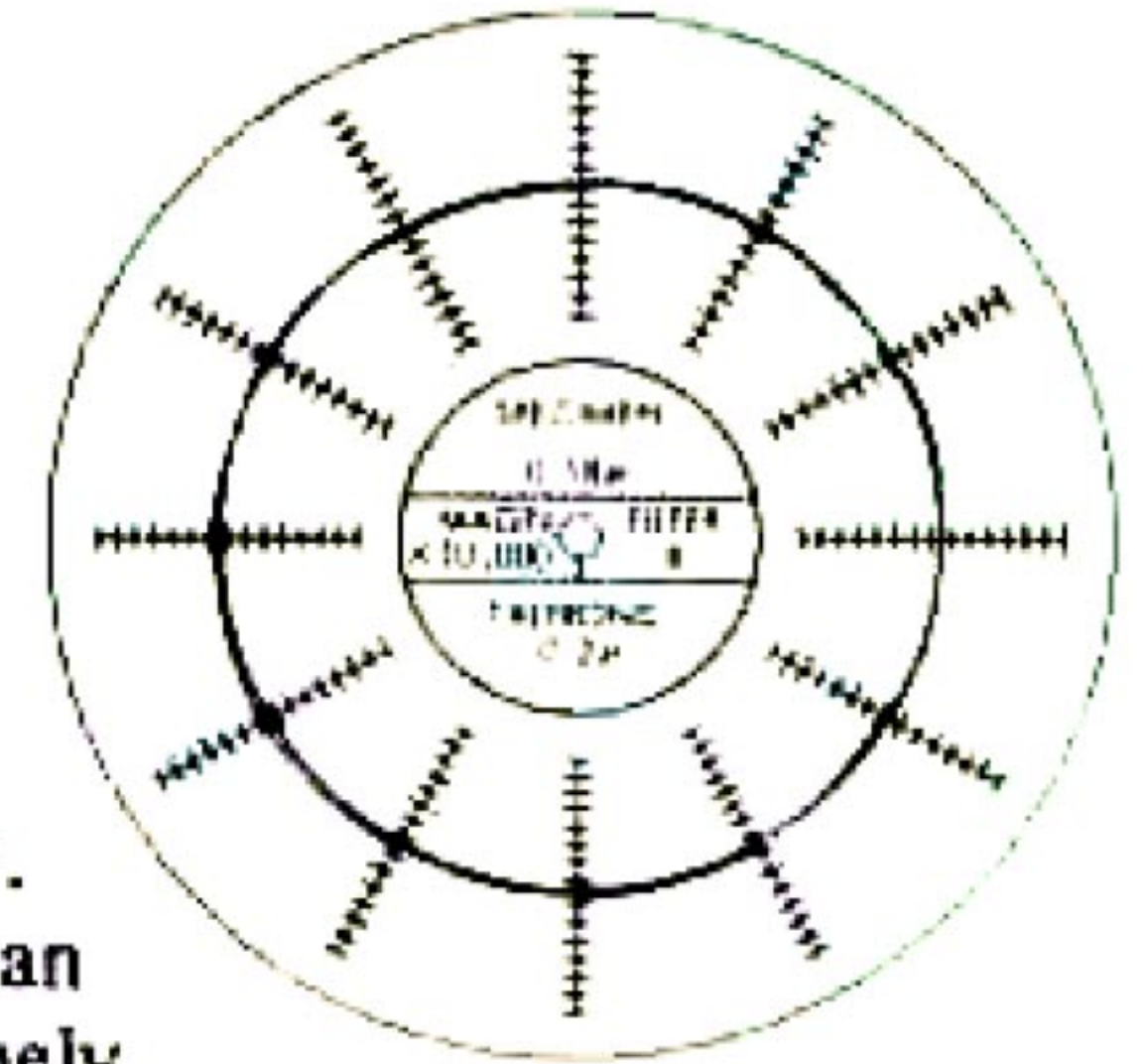


# Isolated Loop Construction



## Large Single Capstan

The capstan is 34 mm in diameter (several 5 times larger than conventional capstans) and is driven by a low speed direct drive motor (213.3 rpm at the 15 ips tape speed). Therefore, there are no intermittent belts or pulleys to wear, slip, or otherwise interfere with speed accuracy. Since the capstan is very large, it can be manufactured within an extremely precise roundness tolerance, which further reduces wow and flutter. And since the influences of reel torque and tension fluctuations have been eliminated, tape speed reaches a previously unheard of level of accuracy: fluctuation is 0.05% or less; deviation  $\pm 0.10\%$  or less.



## Double Pinch Rollers

Both pinch rollers are the same size and apply constant pressure over a relatively wide area of the capstan. They are controlled by a single solenoid so that there is a small time lag between each roller's initial contact with the tape. This provides correct tape tension within the closed loop (which, of course, contains the heads) without the need for the staggered contact patterns seen in other single capstan designs.

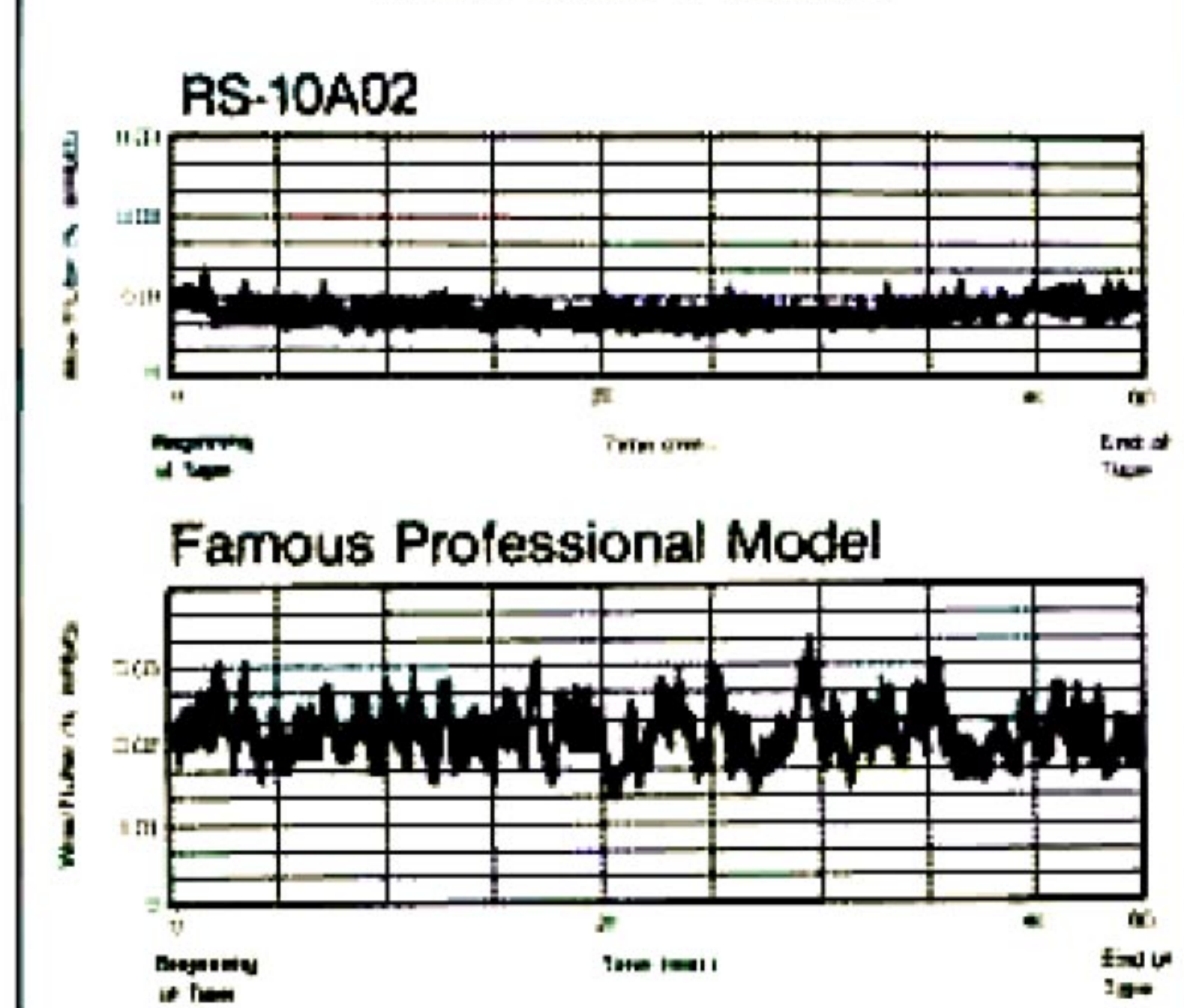
## Reversing Roller

The reversing roller changes the tape direction at the mid-point of the closed loop. In addition to greatly reducing the inertial mass which facilitates rapid rise time, this roller has an added benefit of reducing modulation noise by shortening the tape path.

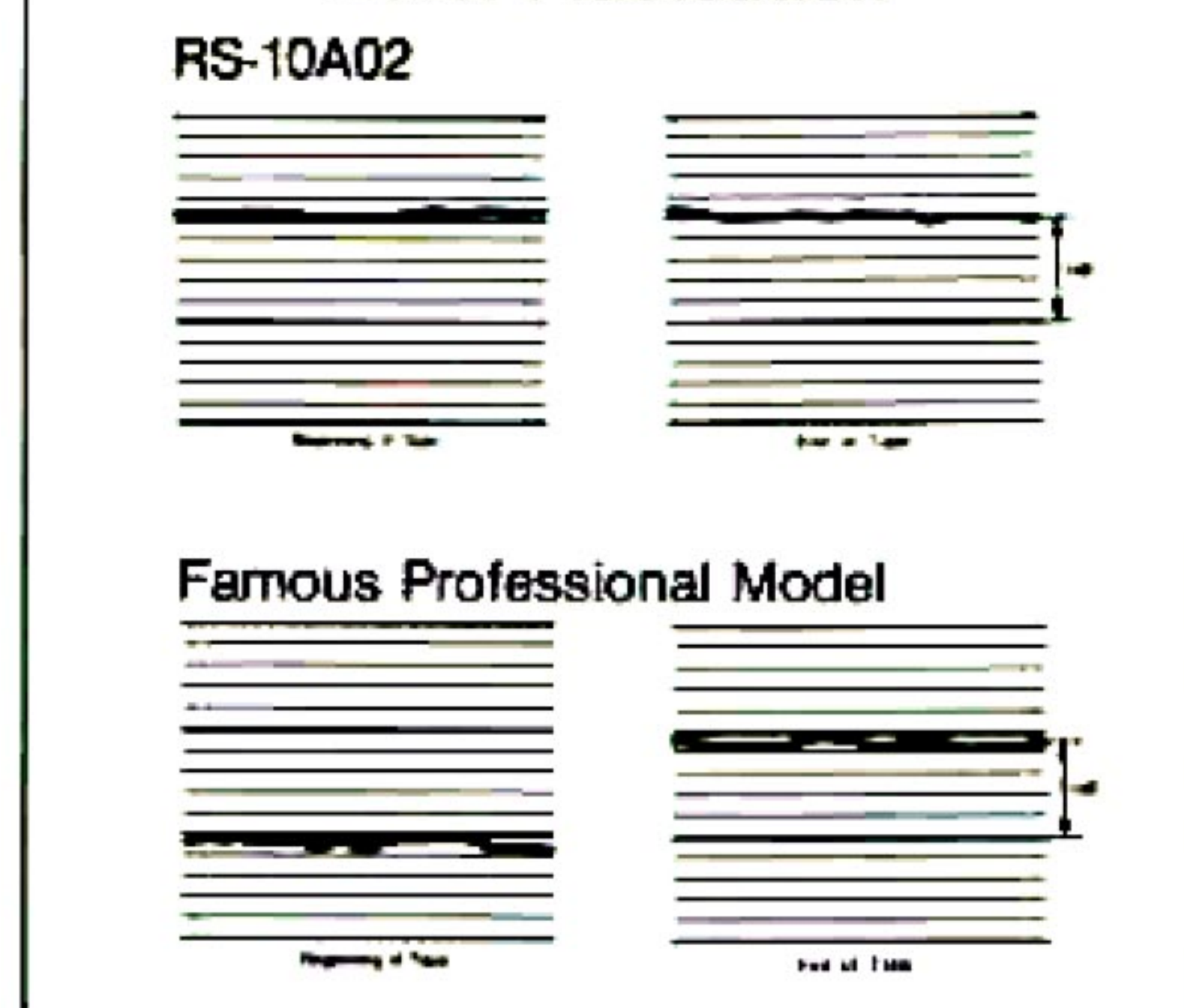
## Air-Damped Tension Rollers

Employing a pneumatic bellows that provides the correct damping coefficients for each direction, these tension rollers help assure quick attainment of rated speed and correct tension without the hunting behavior that may be present in other designs.

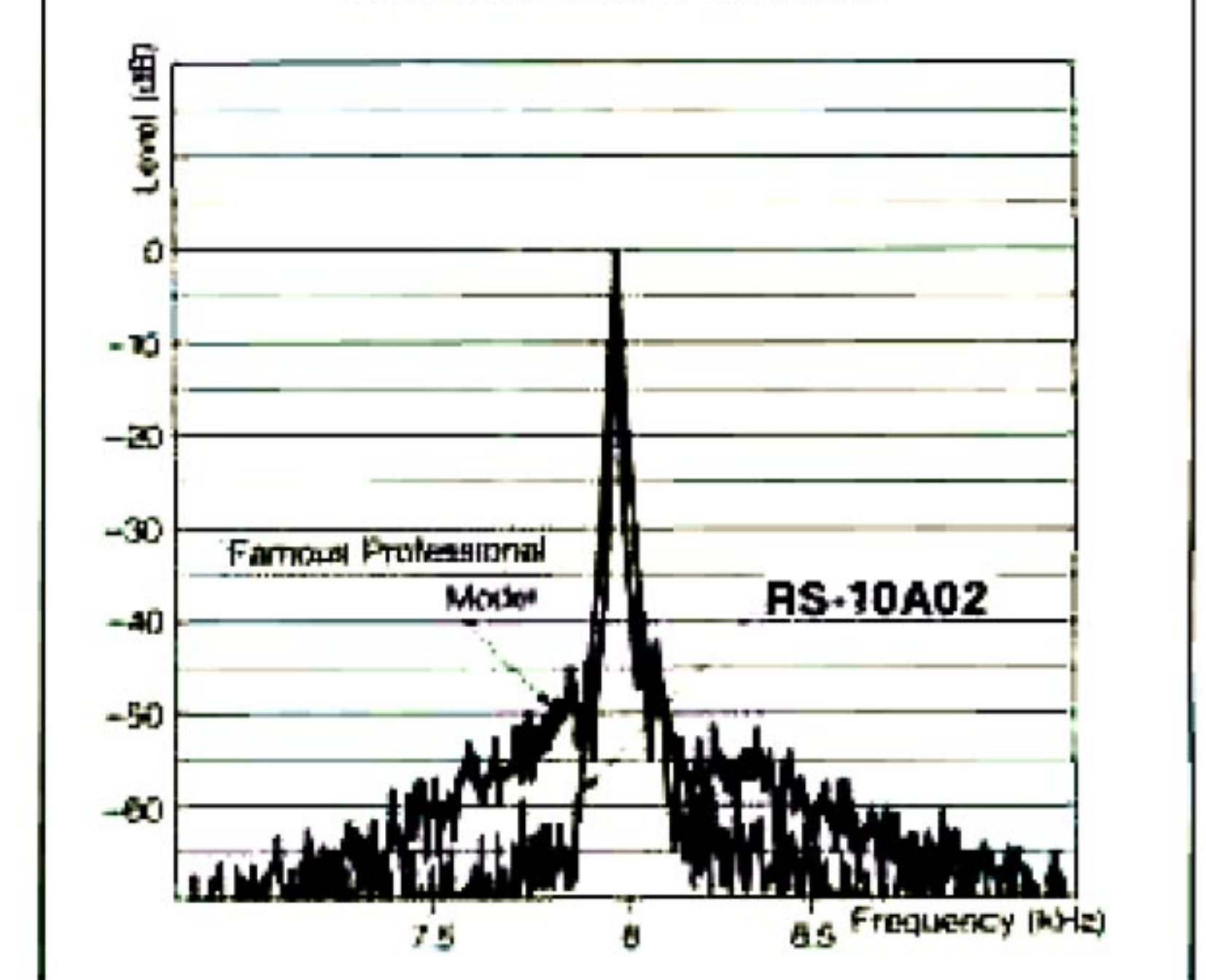
### Wow and Flutter



### Level Fluctuation



### Modulation Noise



# Capstan Motor: Quartz PLL Direct Drive

## The Original Direct Drive System

As the originator and foremost proponent of direct drive in both turntables and tape decks, Technics' motors boast performance characteristics which are unrivalled. Capstan, flywheel, and motor rotor form one integrated unit with no belts or speed reduction devices to introduce flutter and instabilities. Furthermore, the low speed DC design is more efficient, quieter, and cooler than its AC counterpart. This means extremely high reliability and long-term dependability. And the motor is coupled with a frequency generator (built to very precise specifications and designed to avoid amplitude modulation problems) which controls the speed of the motor. These 3 design characteristics combine to achieve superb performance.

## Quartz PLL Control

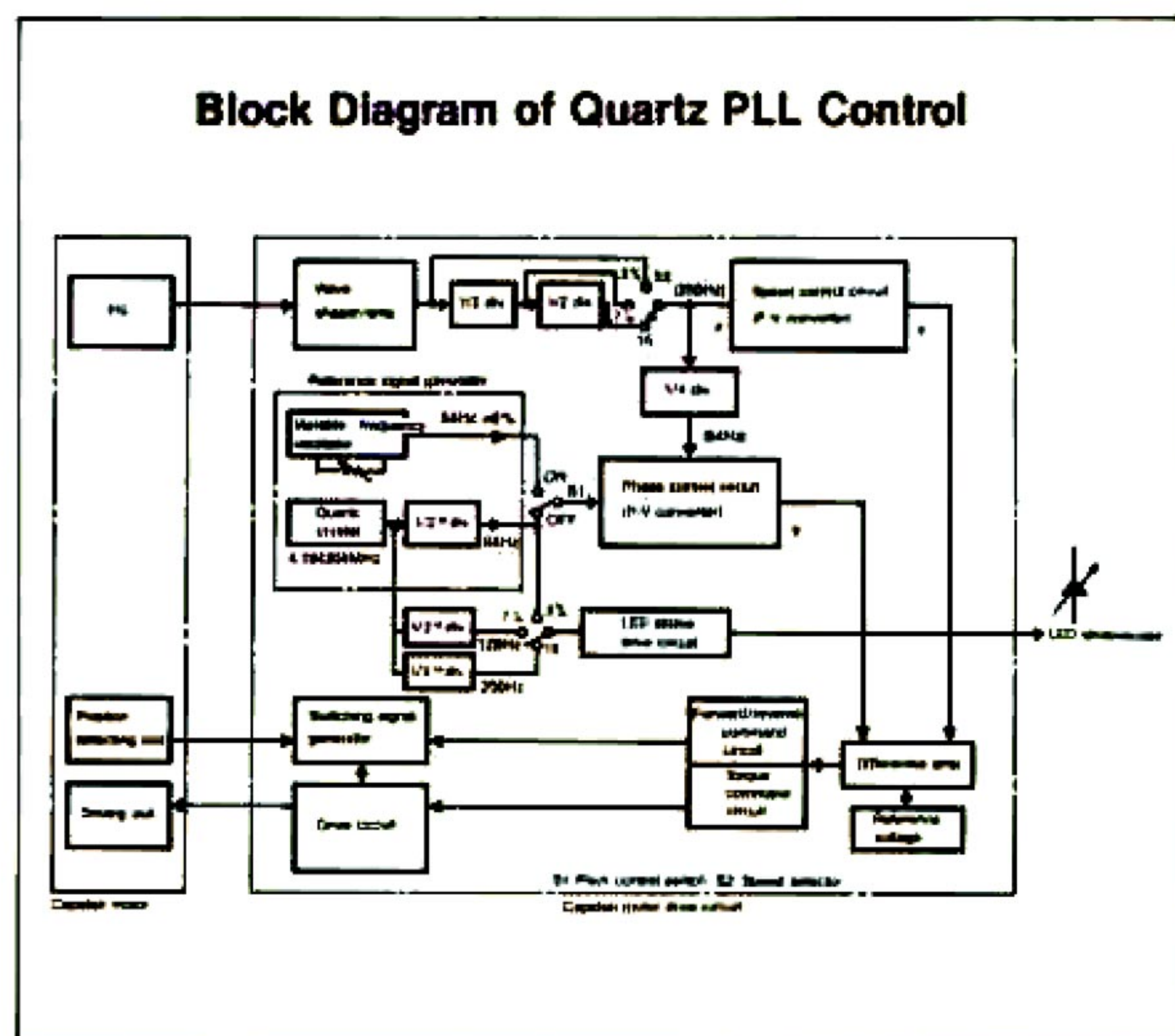
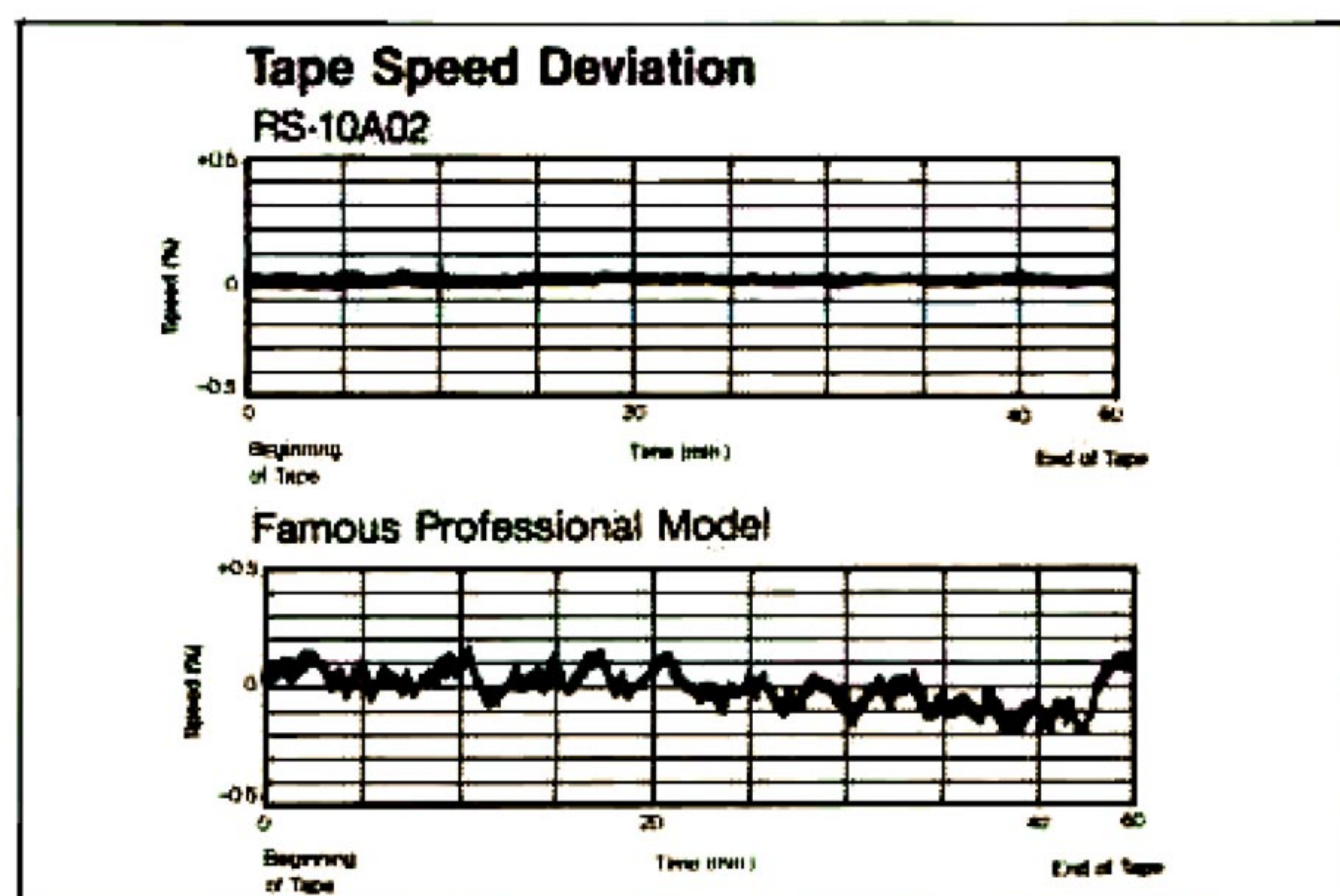
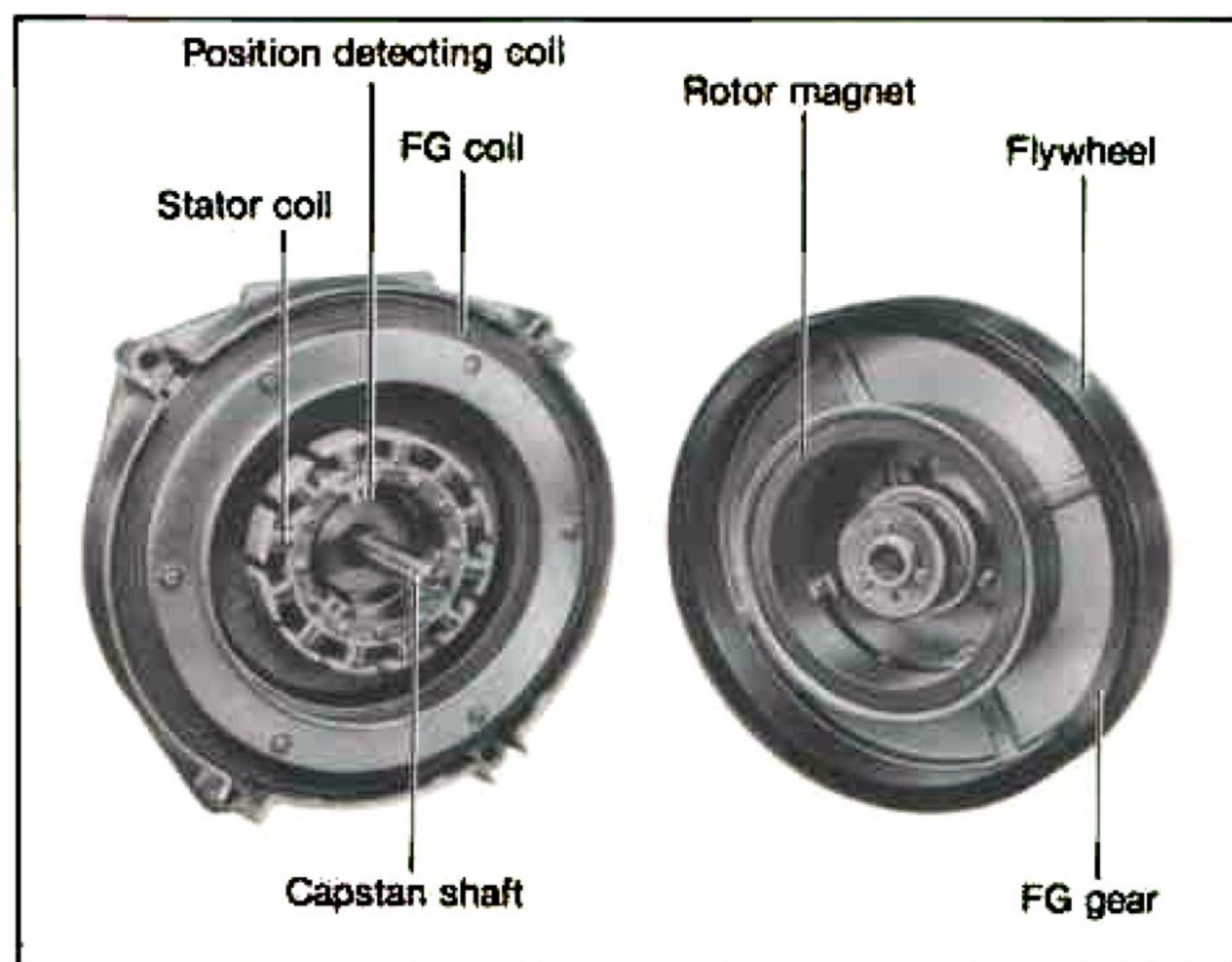
The FG signal from the motor is frequency divided and compared with the reference derived from the practically unwavering quartz oscillator frequency. Since this is a phase locked loop servo circuit, detection and correction of the slightest speed fluctuation occurs instantaneously. There are no problems with overcorrection or lag, which can sometimes occur with a conventional speed control design. The overall result is outstanding motor speed accuracy which results in tape speed stability unmatched by other open reel decks. Wow and flutter is no more than 0.018% (WRMS);  $\pm 0.035\%$  (DIN) at 15 ips.

## Quartz Controlled Stroboscope

The reversing roller at the bottom of the isolated loop is marked with a strobe pattern which is illuminated by a quartz oscillator controlled LED. This is useful for verification of any variations caused by dirt build-up on the rollers and guides. Technics isolated loop system is the first and only transport which is accurate enough to permit verification of the correct speed with a stroboscope; only a system of such enormous accuracy could benefit from the precision afforded by a quartz strobe.

## Pitch Control ( $\pm 6\%$ )

You can override the quartz PLL circuitry with the pitch control knob. It permits up to  $\pm 6\%$  tape speed variation during both recording and playback.



# Reel Motors: Direct Drive with Tension Control

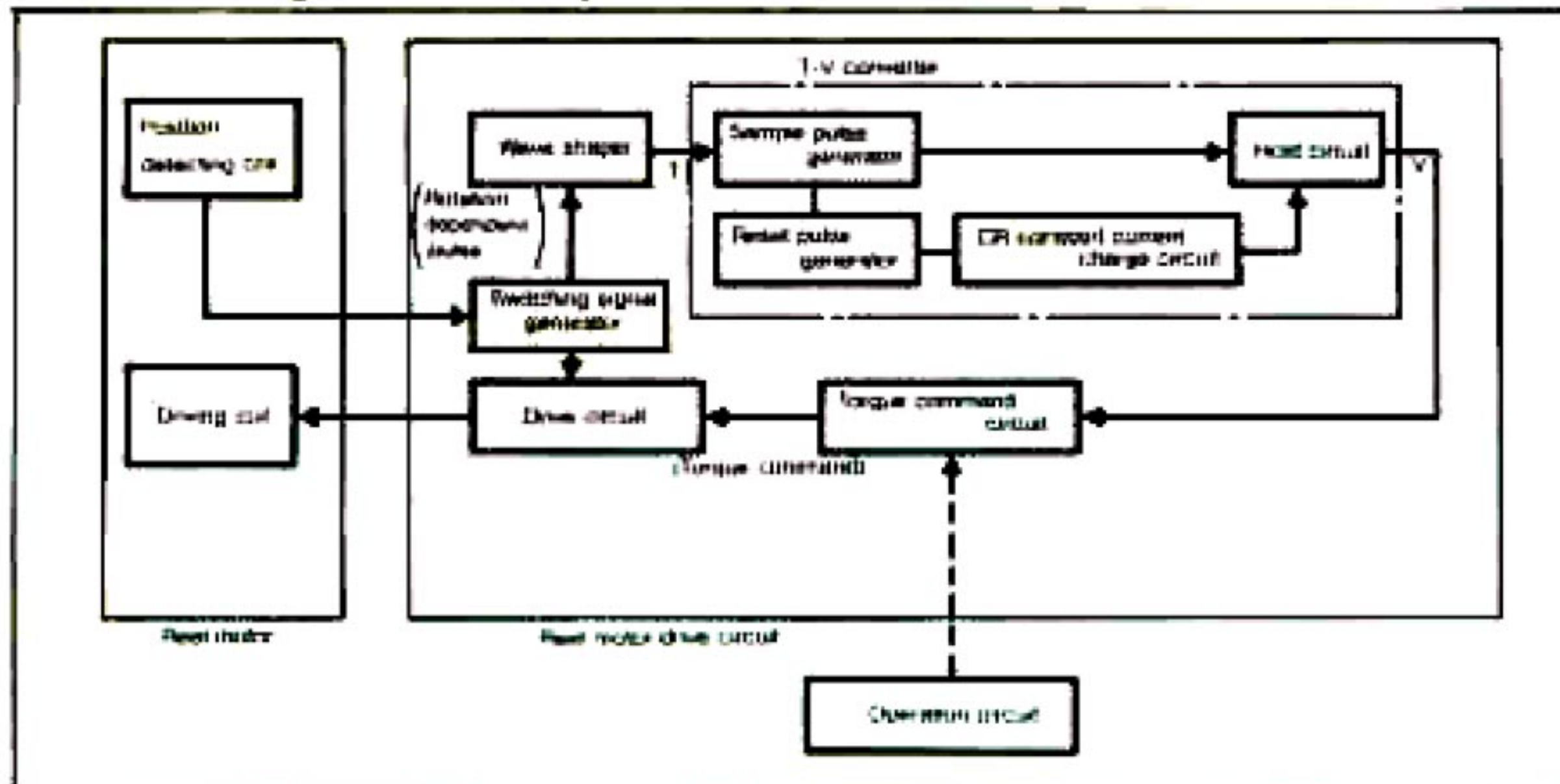
## DC Motor Design

While most decks use AC motors for reel drive, the RS-10A02 employs direct drive DC motors specially developed for their particular applications; these motors provide all the benefits associated with the direct drive principle. Furthermore, the DC design allows precise control of motor torque, preventing torque ripple from being translated into load fluctuations on the capstan – this eliminates a major cause of flutter.

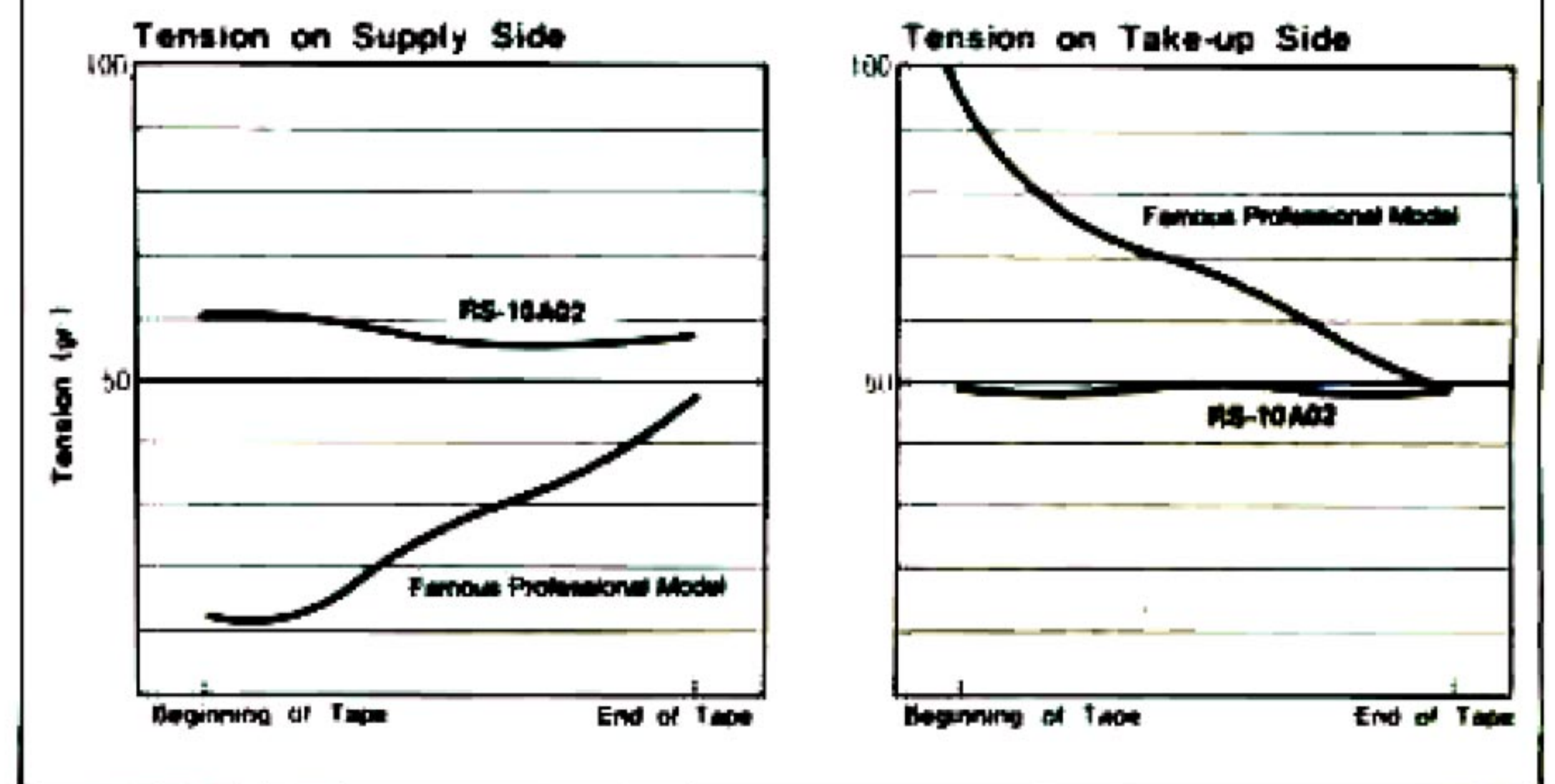
## Electronic Tape Tension Control

Tape tension is evenly maintained from the beginning to the end of the reels, even when reels of differing sizes are used. This is made possible by an electronic tape tension control system, which regulates torque based on the rotation cycle of the reels (i.e. how much tape is on either reel). Not only does this system optimize tape transport within the isolated loop, it also assures very smooth tape winding. And the load on all moving parts is reduced, to provide excellent long term performance and reliability.

## Block Diagram of Tape Tension Control



## Tape Tension Characteristics

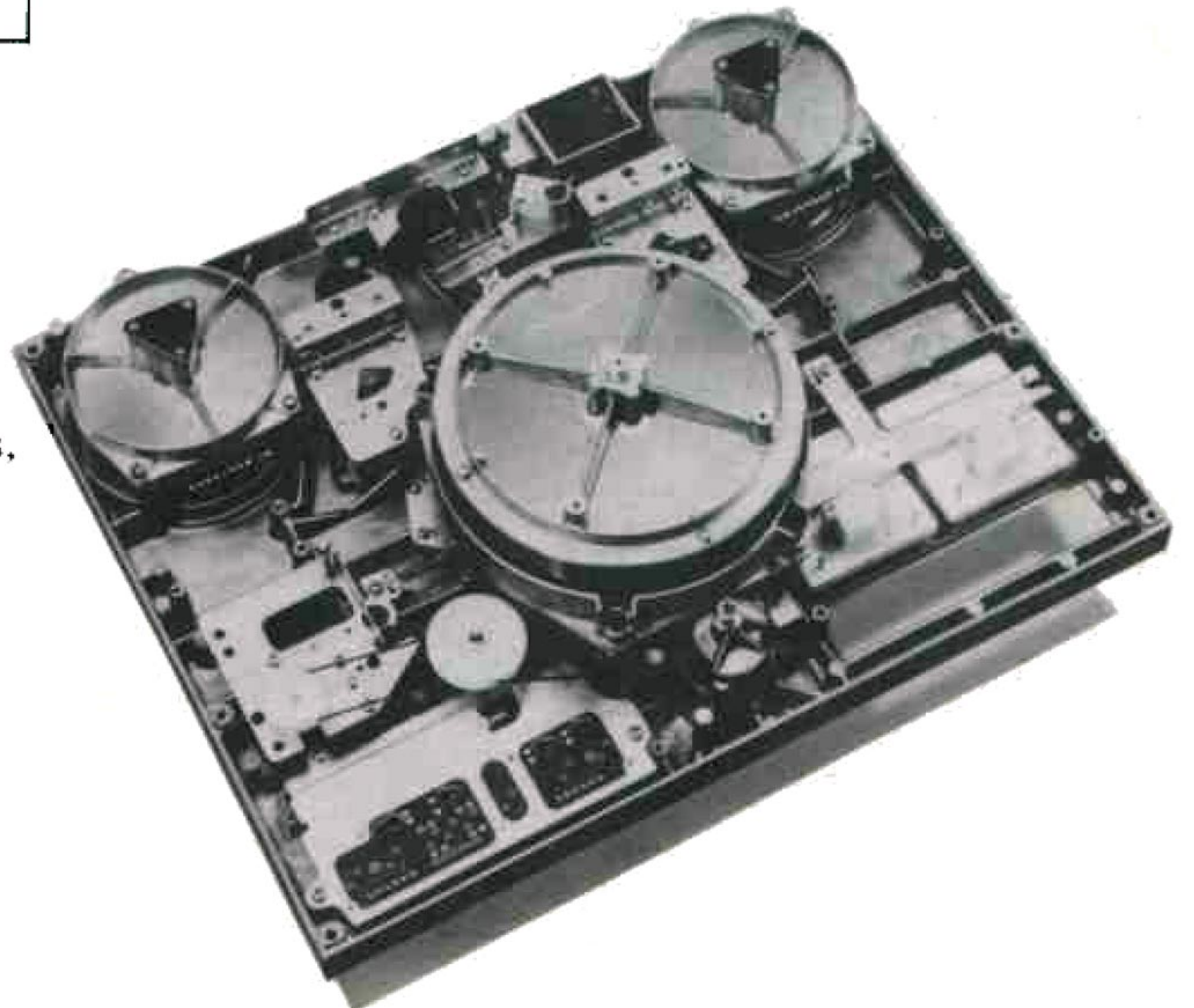


## Improved Reel Locks

Our new, improved hub adaptors securely fasten 10½" reels directly to the hubs, ensuring both easy removal of the tape reels, and a better fit.

## Aluminum Diecast Chassis

For precise and stable mounting of the motors and other parts, this unit is built with a rigid diecast aluminum chassis.



# Tape Transport Control

## IC Logic Control

To allow transport mode switching in any sequence, this deck is equipped with sophisticated logic circuitry which controls both timing and braking. So, even with thin tapes, there's no need to worry about stretching the tape when going from fast-forward to stop. All transport switches are electronic, and can be activated with a slight pressure of only 100g.



## Electro-Brake

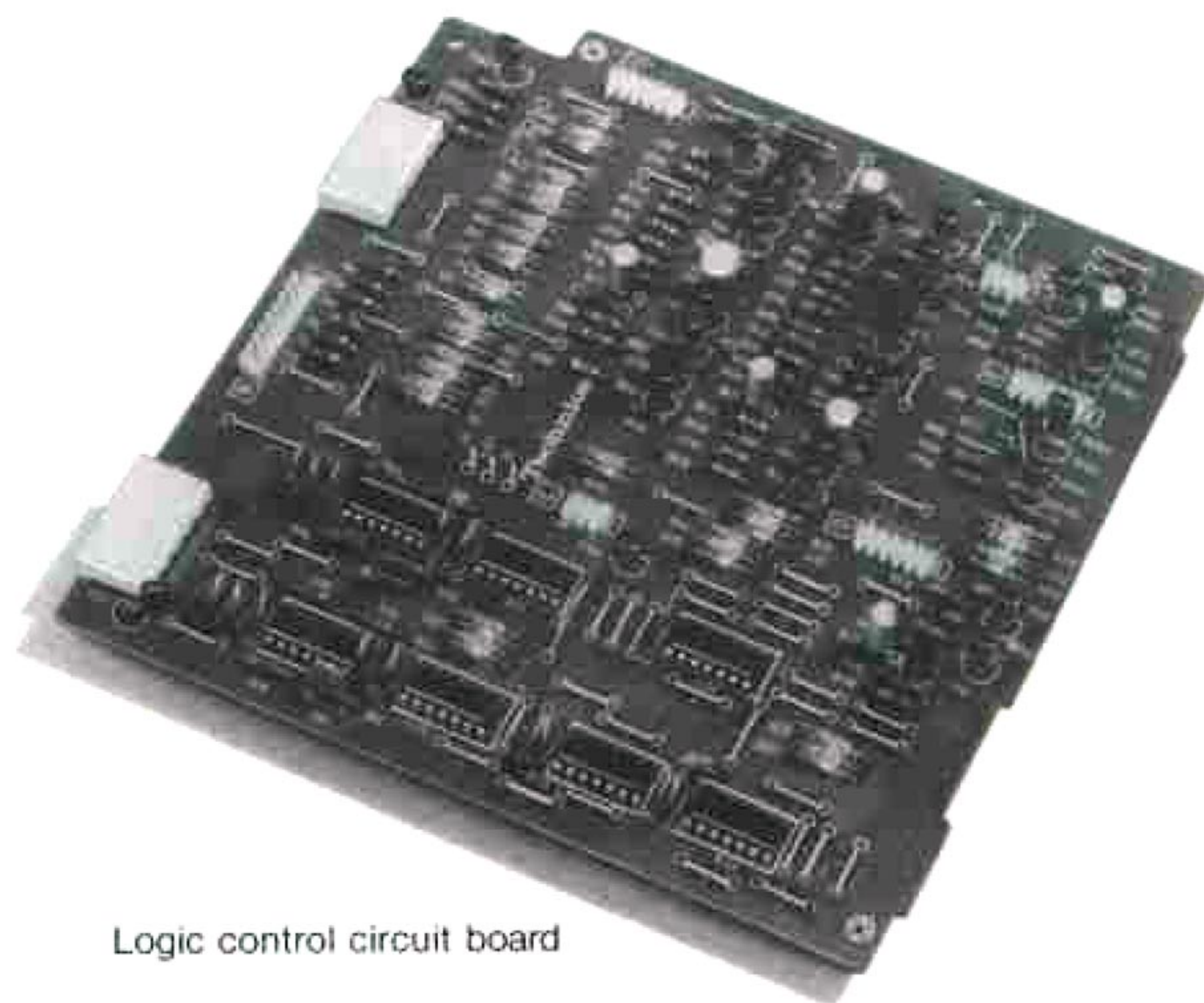
During transport mode switching, an electronic braking system automatically applies reverse torque to the reels to slow down the tape before mechanical braking is applied. Therefore, operation is smooth, quiet, and dependable, while both the tape and the transport mechanism are protected from undue stress and strain.

## Quick Play

When switching from a fast-wind mode into play, only 0.7 second elapses between the instant when the reels stop and playback begins. Such quick operation is possible because the logic control is combined with electronic detection of the reel motion.

## Remote Control Available

The optional RP-9690 unit allows remote control of all transport functions with IC logic and feather touch convenience. The cord is 16 feet in length.



Logic control circuit board

## Timer Start

Engaging the timer start button permits automatic recording or playback using an external timer.

## Safety Auto-Stop

A real advantage which helps avoid accidents during busy schedules, the auto-stop feature automatically brakes the reels if the tape runs out, or if the tape is halted for more than 3 seconds.



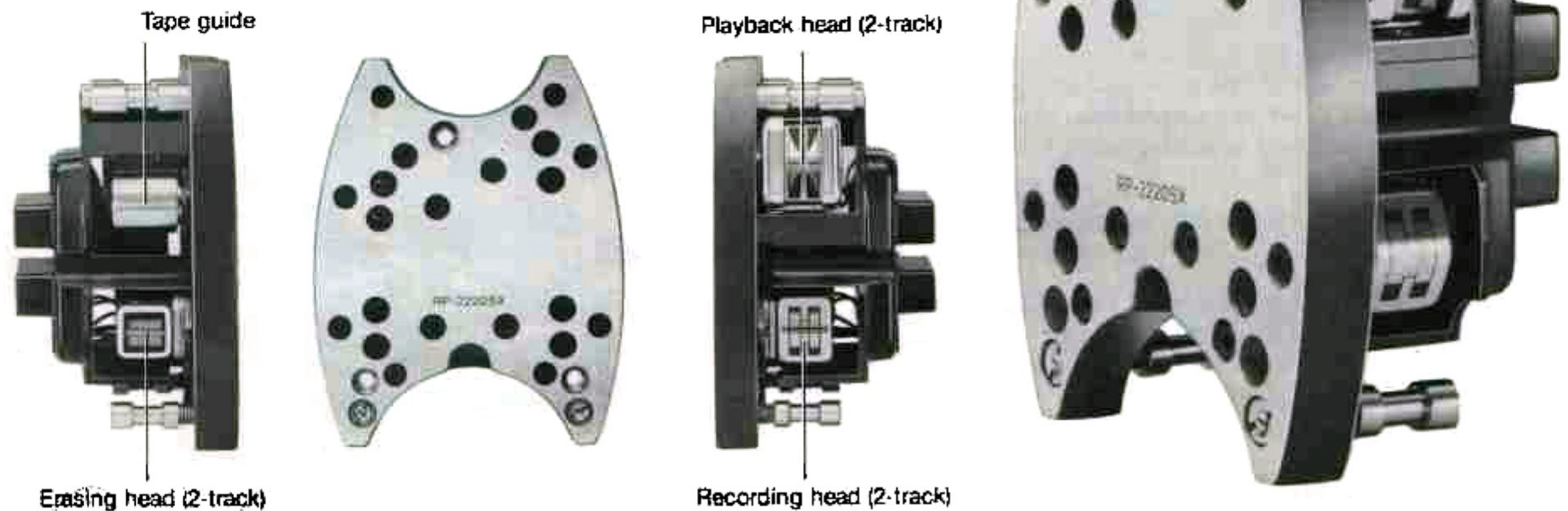
RP-9690  
Optional remote control unit

# Head Block

## 2-Track 2-Channel Record/Playback

The head block is designed for remarkably easy access, which facilitates convenient maintenance and adjustment. Tape threading is quick and easy, because the tape only has to be pulled around the complete head assembly.

When new heads are needed, replacement is simple with the plug-in design (Note: Readjustment will be required for optimum performance after replacement).



## Extremely Durable SX Heads

Produced with a Technics-developed squeeze casting process which combines special additives with the basic sendust alloy, the playback and recording heads exhibit great durability to ensure long life. With a hardness of 590 on the Vickers scale, the sendust tape contact area resists tape abrasion much like ferrite heads, yet maintains the low distortion associated with the relatively soft permalloy configuration. To reduce the contour effect, the playback head surface is finished in an X-shape. The erase head is double-gap ferrite which exhibits high efficiency.

## Recording Mode Selector

An LED becomes illuminated when the left and right channel recording mode selectors are activated. This helps avoid accidental recording over desired material.

### Specifications of RS-10A02 Heads

Head	Playback	Recording	Erasing
Track	2-Track	2-Track	2-Track
Channel	2-Channel	2-Channel	2-Channel
Material	SX (Sendust Extra)	SX (Sendust Extra)	Ferrite
Gap Width	2 $\mu$ m	10 $\mu$ m	100 $\mu$ m $\times$ 2
Gap Depth	200 $\mu$ m	200 $\mu$ m	200 $\mu$ m
Sensitivity	-63.5dB/400Hz		
Recording Current		180 $\mu$ A	
Bias Current		2.700 $\mu$ A	
Erasing Ratio			70dB/60mA $\times$ 1kHz

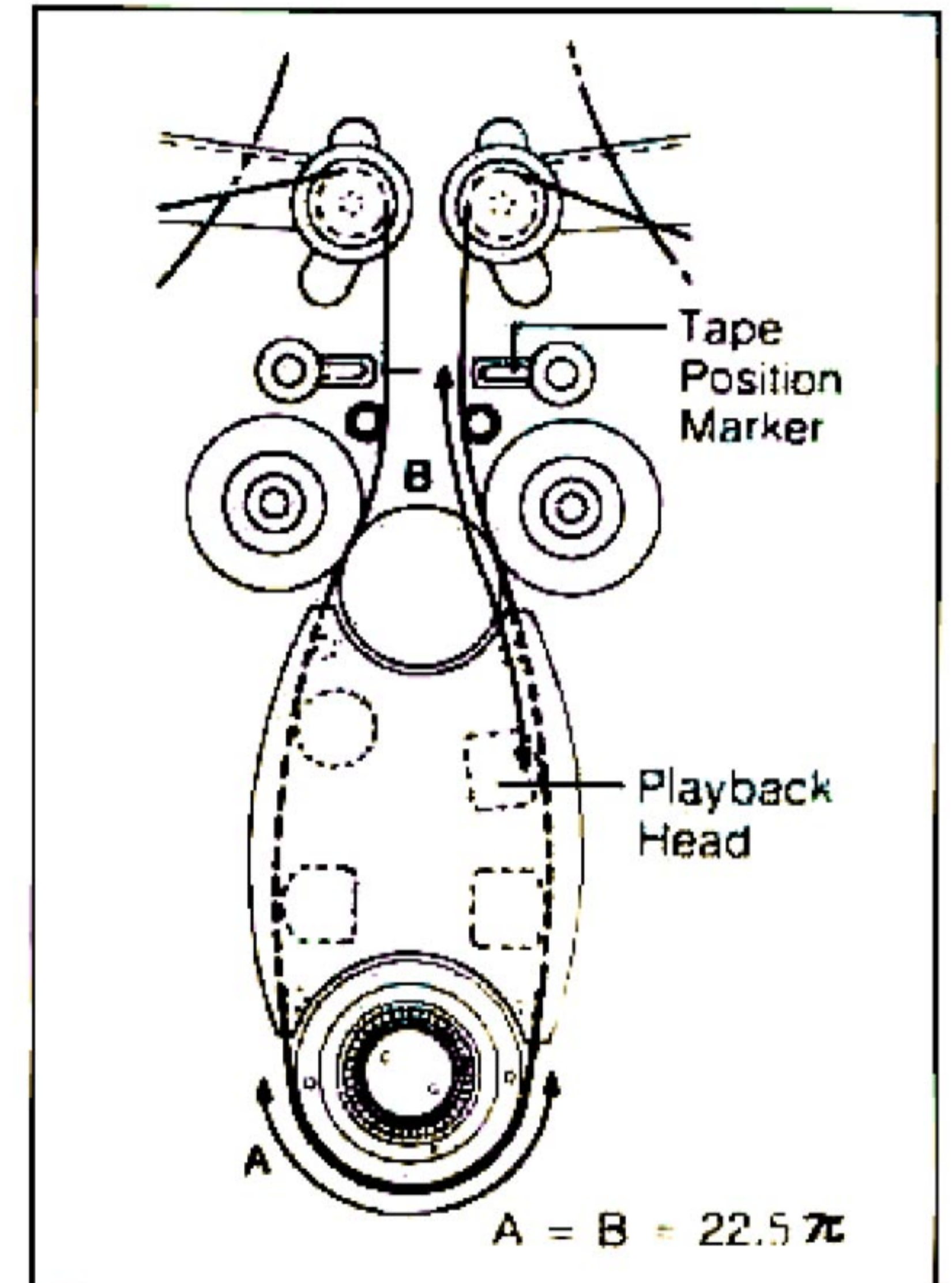




# Editing Facilities

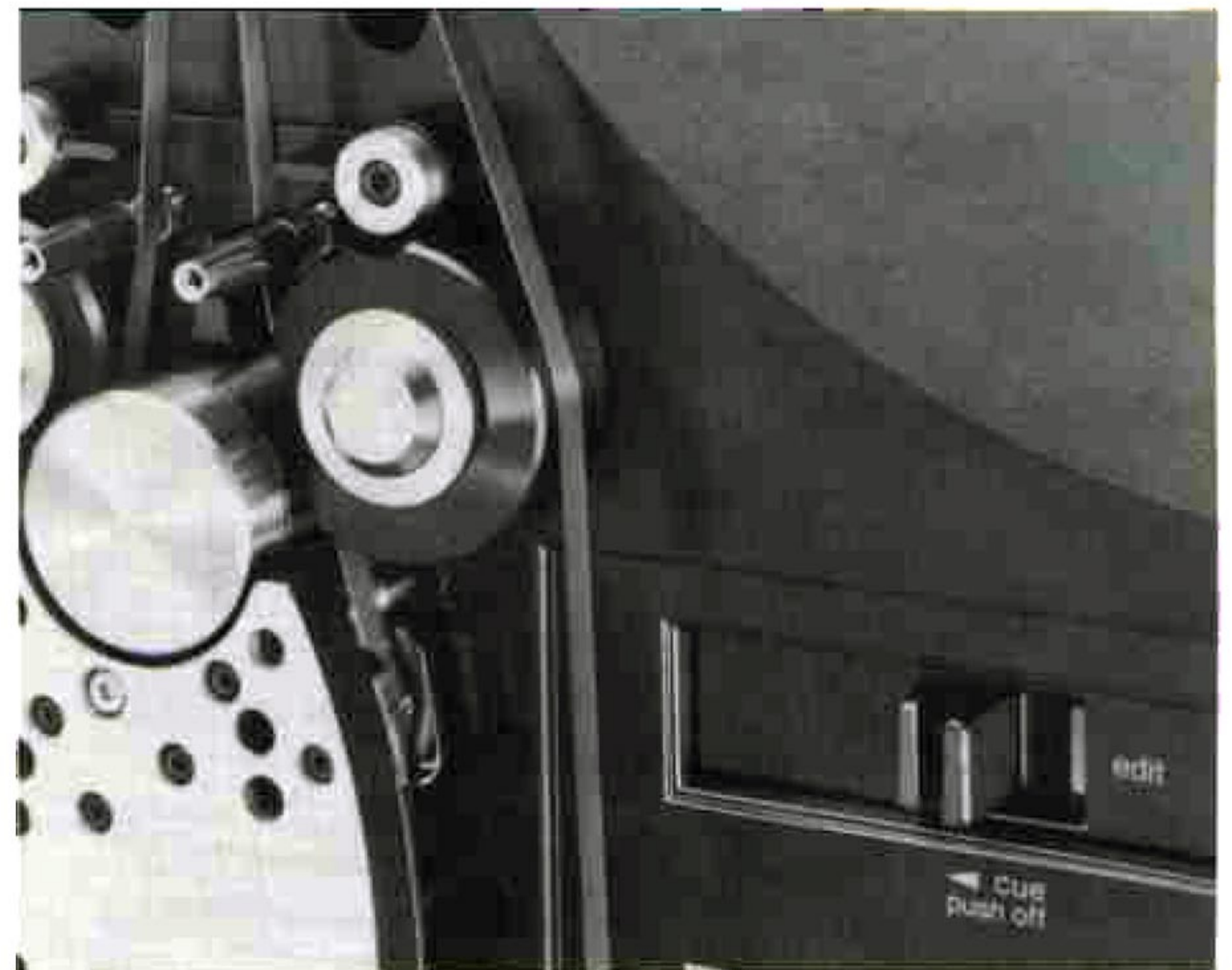
## Edit Dial in Reversing Roller

For accurate editing with no danger of harming the heads, this unit is equipped with a unique edit dial. It can be used this way: when you have centered the precise piece of tape to be cut on the playback head, you line up the dot on the inner edit dial with one of the two dots on the reversing roller. Then simply advance the tape by hand until the reversing roller has moved exactly half of one turn. At this point, the spot on the tape previously selected for editing will be located right next to the tape position marker. Then simply press the tape against the marker with your fingertip. This will mark the spot to be edited.



## Cue/Edit Switch

Sliding this lever to the left allows audio playback during hand-controlled reel movement (and FF and REW). In the locked position, the tape can be dump edited by pressing the play button. During editing, accidental contact with the transport mode buttons (other than stop) will have no effect, thereby preventing accidents. When editing thin tape or in high humidity, it may become necessary to use the accessory pinch roller cover to avoid wrapping the tape around the right pinch roller when unreeling or editing.



## Real-Time Counter (15ips)

At the 15 ips tape speed, this precise counter indicates elapsed minutes and seconds with real-time accuracy of  $\pm 1\%$ . At other speeds, it can be used as a reference, instead of a conventional counter.



# Calibration and Adjustment for Optimum Tape Performance



## 3-Position Bias and EQ Selectors

For compatibility with all major tape formulations, this unit is equipped with independent 3-position bias and equalization selectors.

## Bias Fine-Adjustment Control

Bias is continuously adjustable from  $-50\%$  to  $+20\%$  (standard reference value  $\pm 0\%$  – is indicated by position “2” on the selector). This permits fine adjustments for obtaining optimum performance with virtually any tape.

## EQ Fine-Adjustment Control (Record/Playback)

Used in conjunction with the bias fine-adjustment controls, the recording EQ adjustment control provides further precision for matching particular tape characteristics. The playback EQ adjustment control is useful for compensating for head wear, when new heads are installed, or optimizing performance.

## Record and Playback Level Calibrations

When combined with the test-tone oscillator, these controls allow compensation for differences in tape sensitivity and output level characteristics. This is particularly important for matching with external noise reduction equipment.

## NAB/IEC Playback EQ Selector

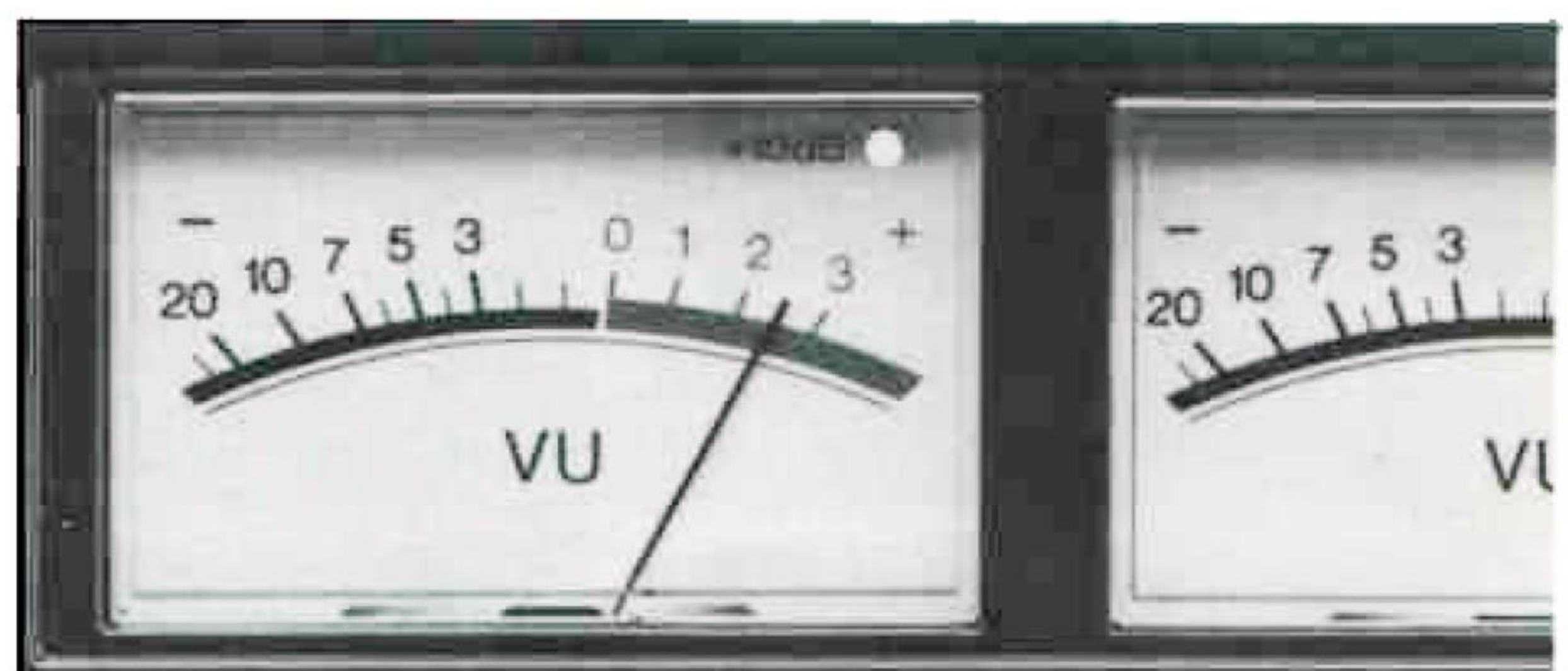
This switch allows you to correct playback equalization for either NAB or IEC 15 ips tapes. At 7-1/2 and 3-3/4 ips, this is not necessary, since the playback EQ is identical for both NAB and IEC.

## Built-in Test-Tone Oscillator

This built-in oscillator generates 1 kHz and 10 kHz test tones, which are useful for making precise bias, EQ, and level adjustments. The same test-tones are available at the line output terminals for checking the performance of other equipment.

## VU Meters with Sensitivity Selector and Peak Indicators (+10dB)

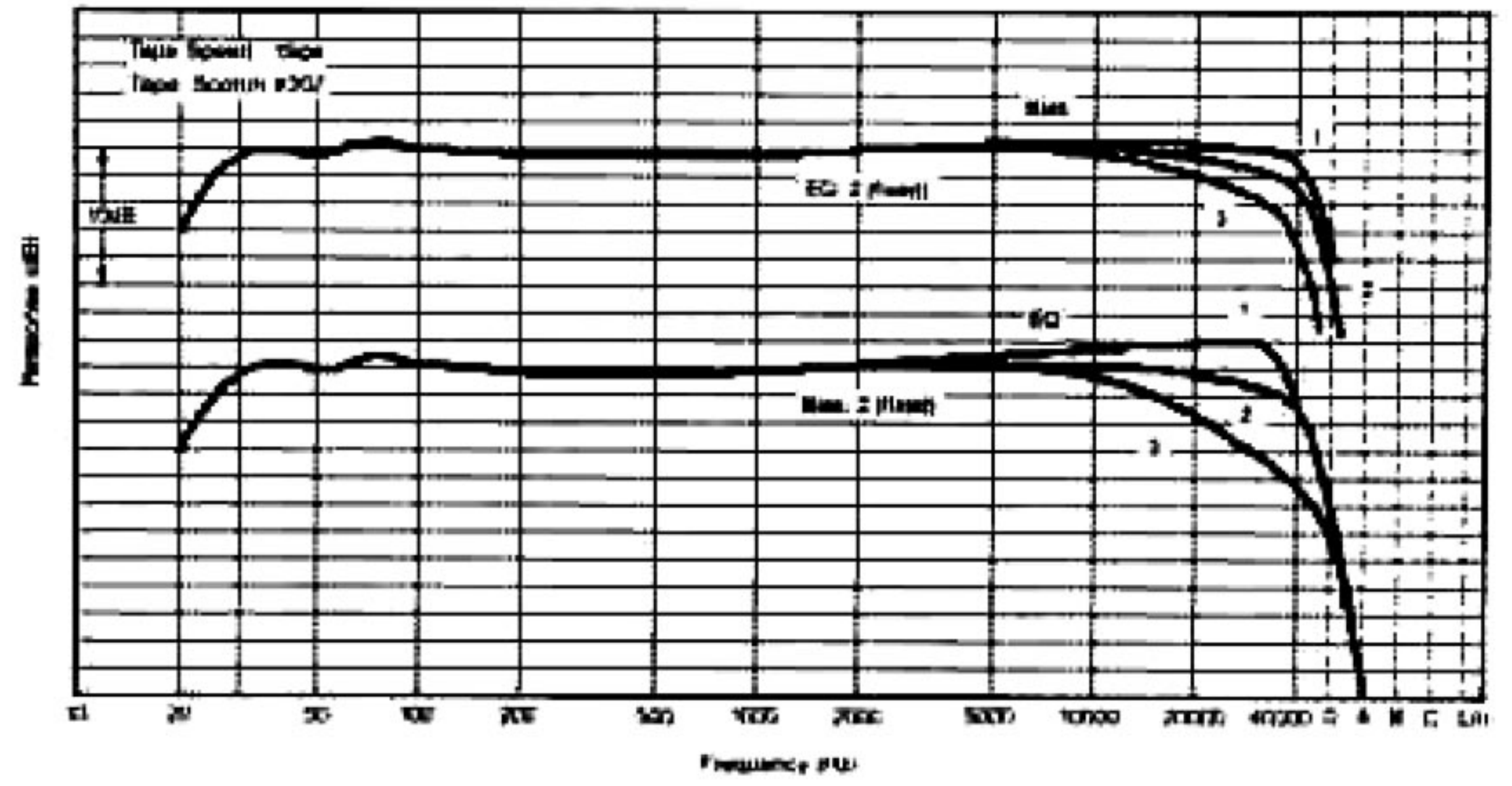
For more precise indication when using the test-tone oscillator, a switch increases meter sensitivity by 10 dB. A fail-safe switching system prevents +10 dB operation when the test oscillator is not being used.



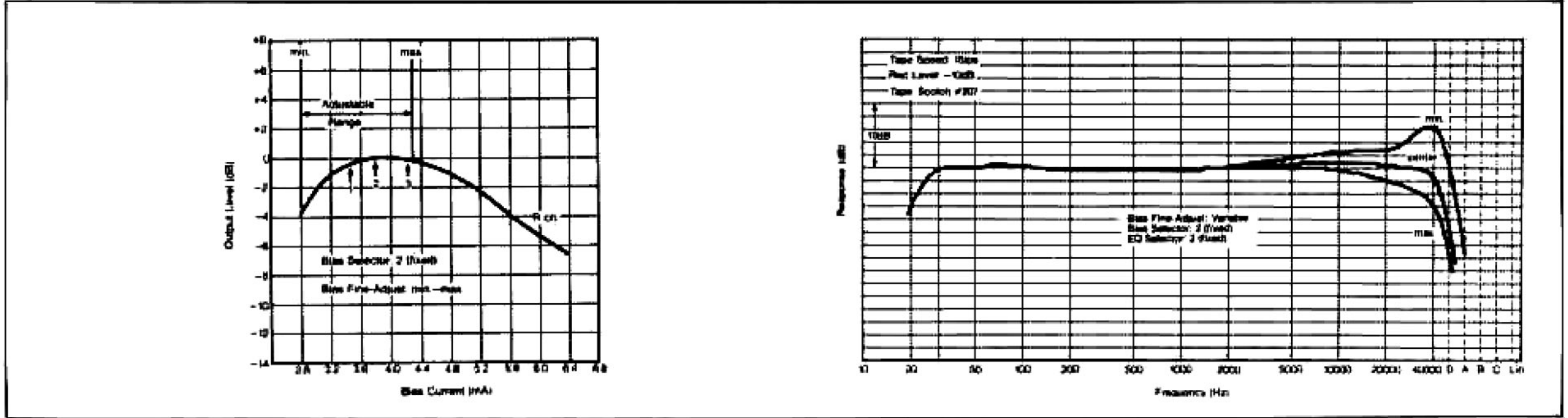
## Standard Settings of Bias and EQ Selectors

Bias EQ	1	2	3
1	AGFA PER525	TDK T SERIES	
2	FUJI FM SERIES	AMPEX GRAND MASTER AMPEX 20/20+(372, 373) BASF STUDIO SERIES BASF PROFESSIONAL SERIES (SPR50LH, LPR35LH, DPR26LH) REVOX #601 SCOTCH #206, #207 SONY DUAD (Fe-Cr) SERIES	AGFA PE25 FUJI FB SERIES MAXELL UD SERIES MAXELL LN SERIES SCOTCH #250
3	AGFA PE36 AMPEX 406, 407, 456 FUJI FG SERIES MEMOREX Quantum SERIES SCOTCH #211, #212, #213 SONY ULH SERIES	AGFA PEM268 AGFA PEM368 BASF LH SUPER SERIES MAXELL UD-XL SERIES SCOTCH CLASSIC SCOTCH #1500, #2000 SONY SLH SERIES	TDK AUDUA SERIES

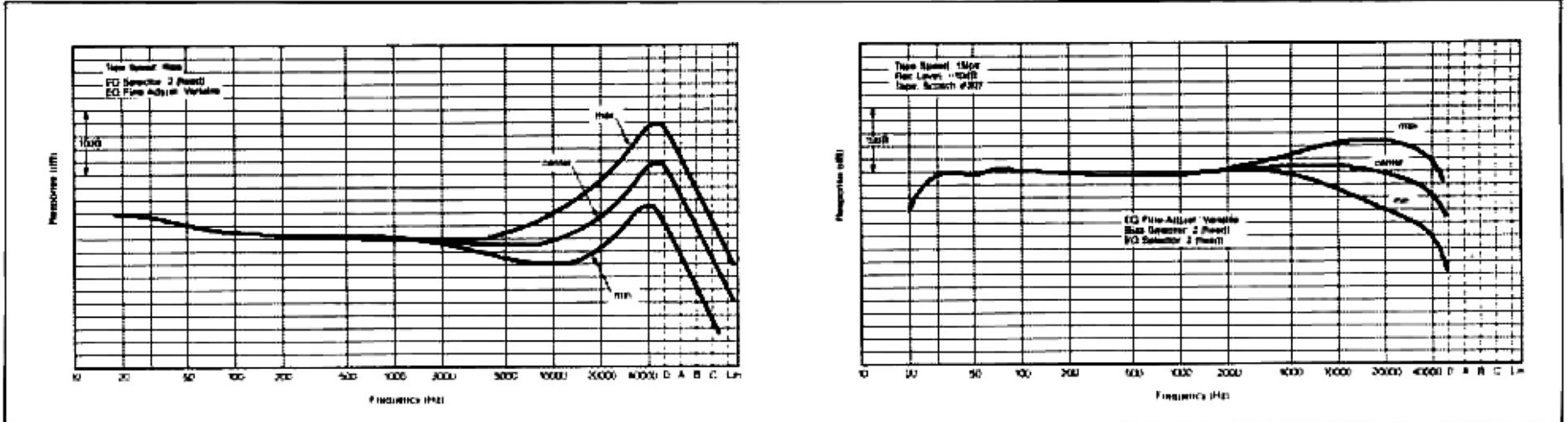
## Overall Frequency Response



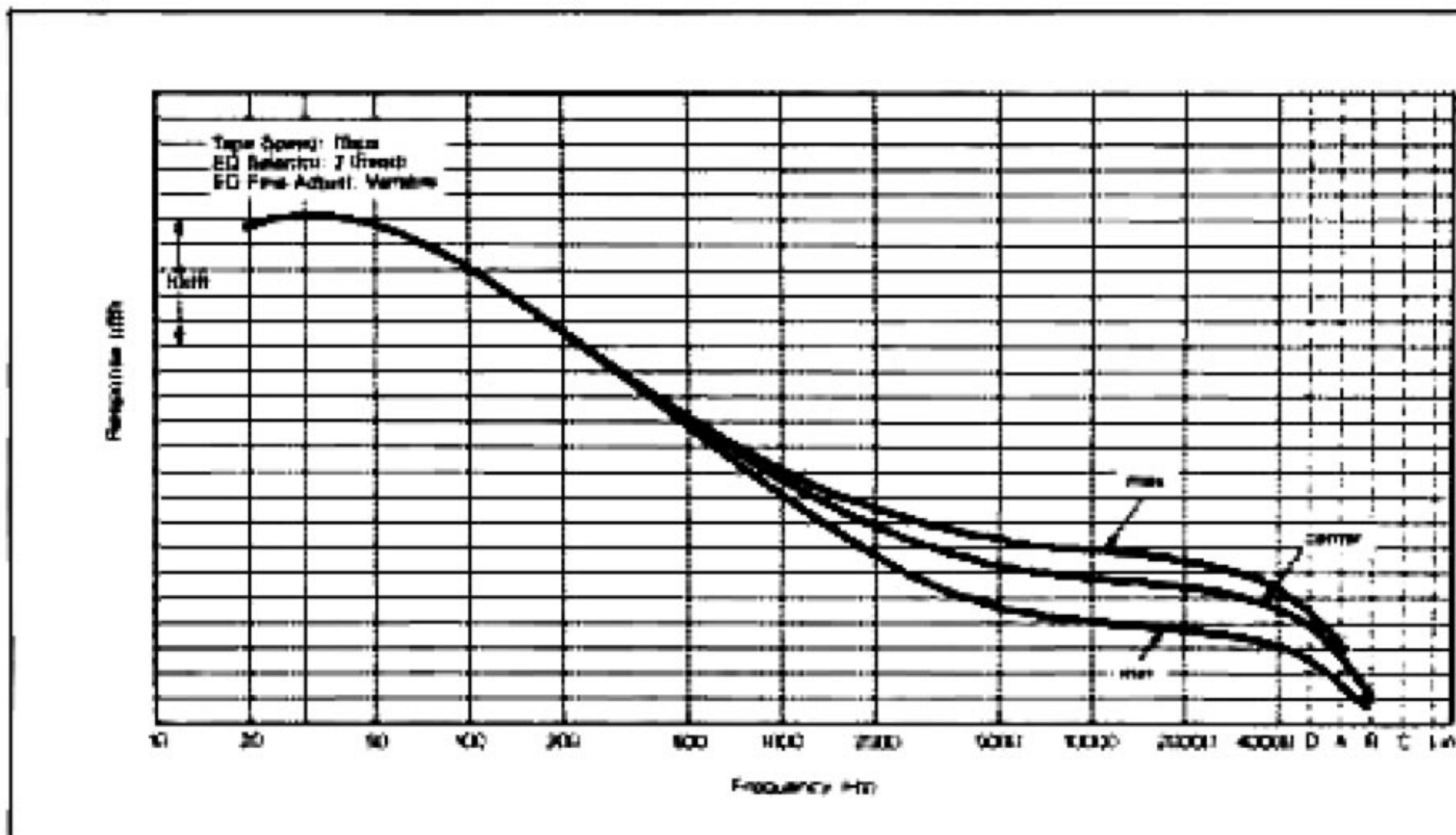
## Bias Fine-Adjustment Range and Overall Frequency Response



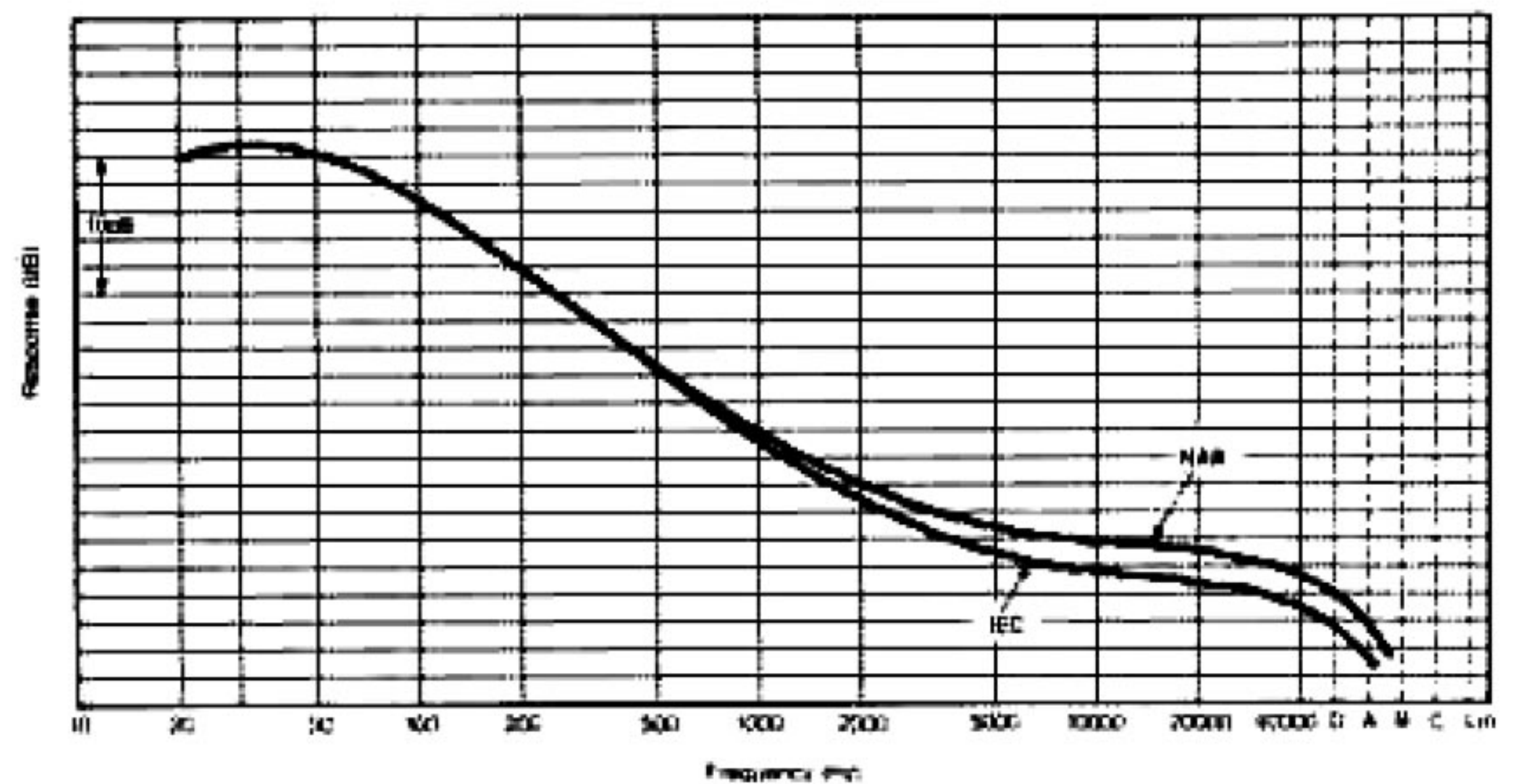
## Recording EQ Fine-Adjustment Characteristics and Overall Frequency Response



## Playback EQ Fine-Adjustment Characteristics



## NAB/IEC Playback EQ Curves



# Audio Amplifiers

## Microphone Amplifier

The microphone amp circuitry exhibits wide dynamic range, high S/N ratio, and wide frequency range. It employs 3-stage direct-coupled circuitry with low noise silicon transistors in the first stage. A 20 dB attenuator switch extends dynamic range to 75 dB to minimize the danger of clipping at high input levels or when employing high efficiency microphones.

## Recording Amplifier

This amp's single ended push-pull (SEPP) output stage takes maximum advantage of the power supply voltage to ensure wide dynamic range. Linearity extends up to +28.5 dB (1 kHz) over 0 VU reference, so that there is no chance of the recording amp overloading before the tape reaches saturation. Consequently, the S/N ratio is excellent.

## Mixing Amplifier

Transistors combined with FET circuitry reduce mixing losses and eliminate mutual interference, so a change in mic input level does not affect line input level.

## High Output Headphone Amp

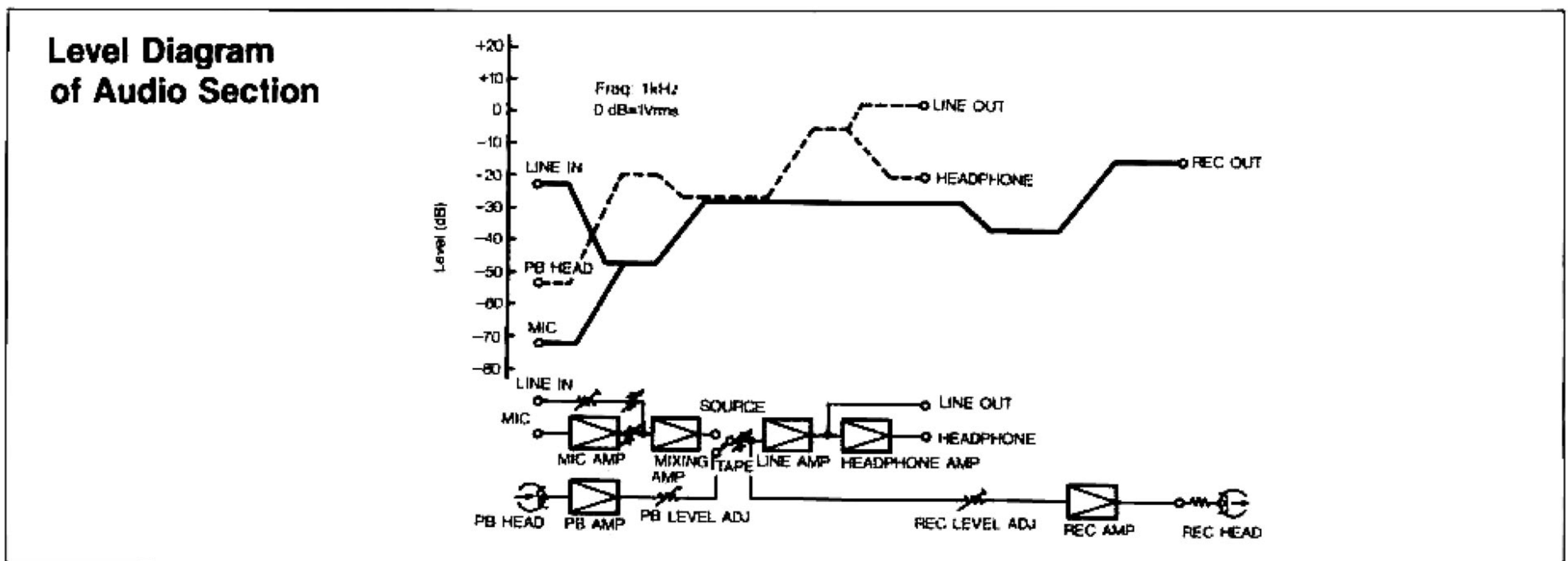
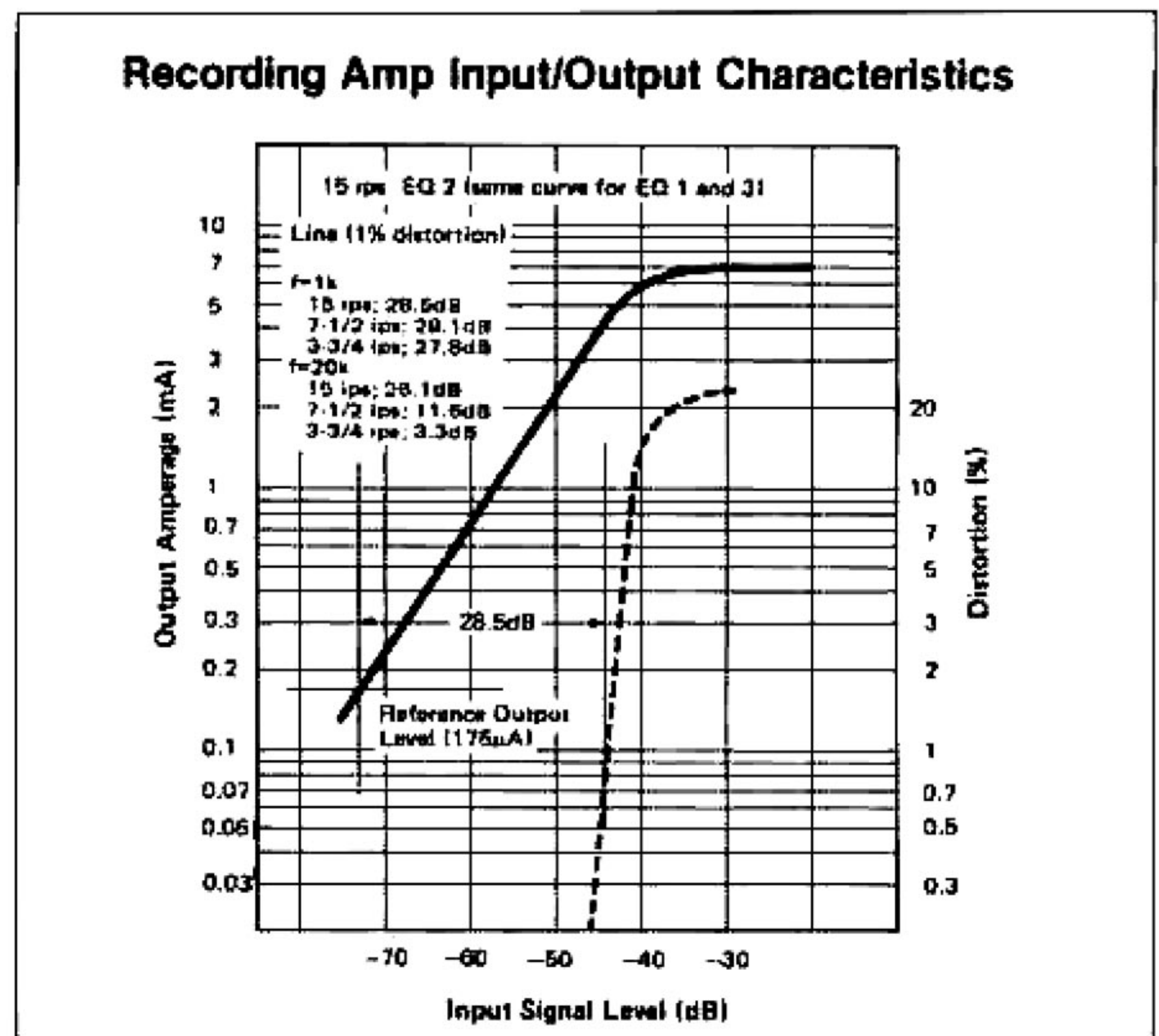
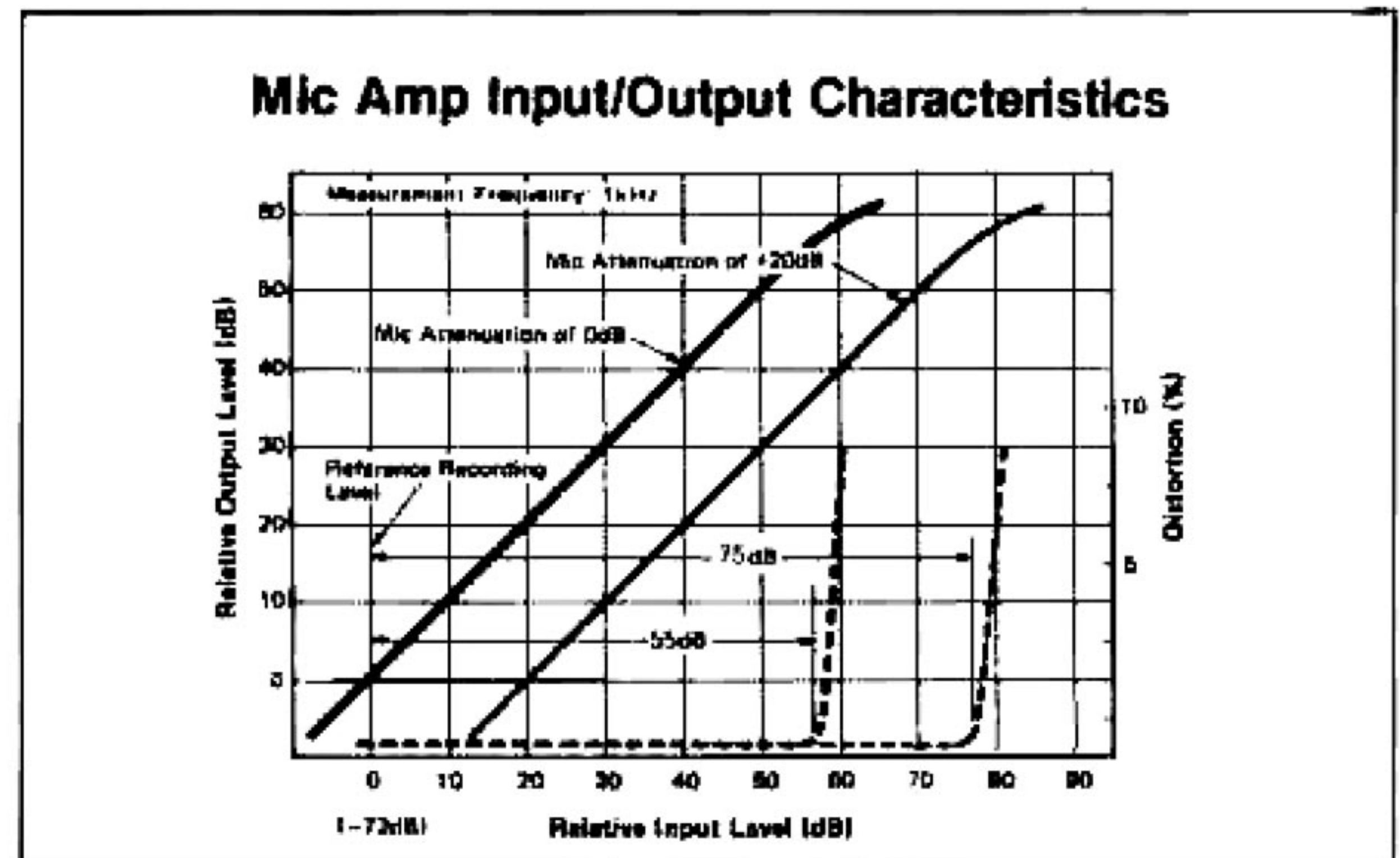
The headphone amp's output is exceptionally high (80 mV), which will drive virtually any headphones on the market today.

## Output Reference Level

On the output level control, position "8" indicates a 0 dB output level, which can be used for calibration purposes.

## Level Controls with Markers

The input, output, and mic level controls have concentric, user-selectable preset markers. At the level indicated by the marker, these level controls click into a detent-stop. All 3 of these level controls use ganged friction-coupled knobs.

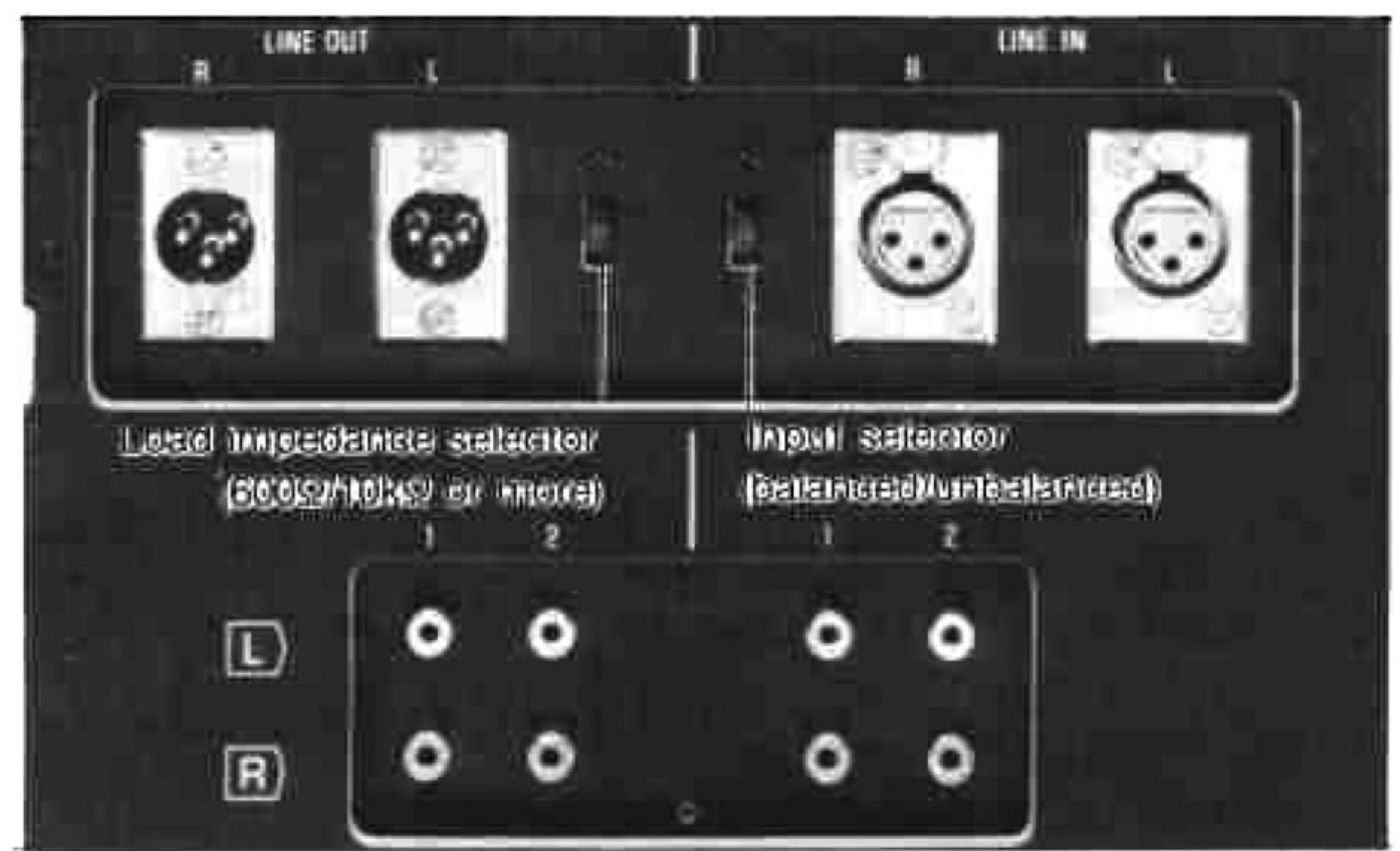


# Balanced Connectors

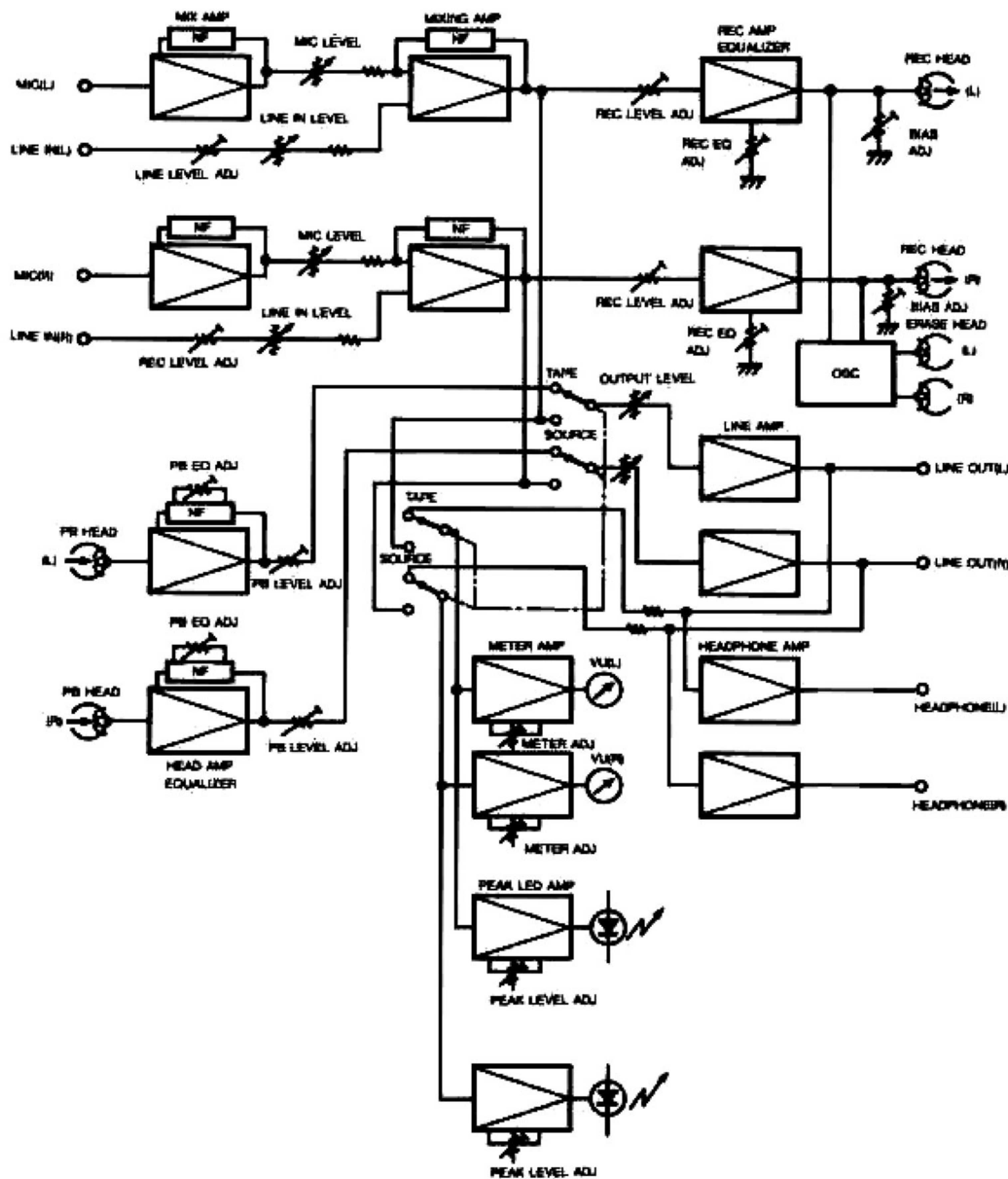
The 3 input jacks include a slider switch to select either balanced or unbalanced line inputs. With the 3 output jacks, two unbalanced output and 1 balanced outputs are all available at the same time.

# Load Impedance Selector

This switch selects either 600 ohms or more than 10 kohms impedance depending on the requirements of the equipment connected to the balanced output terminals.



# Block Diagram of Audio Section



# Technical Specifications

## TRANSPORT

Tape Width:	1/4" (6.3 mm), 0.069" (1.75mm) track width (2-track)		
Channel and Track:	2-channel, 2-track record and playback		
Tape Speeds:	3 speeds; 15, 7-1/2 and 3-3/4 ips (38.1, 19.05 and 9.53cm/s) Max. deviation $\pm 0.1\%$ and fluctuation 0.05% at 15 ips (38cm/s) Pitch control; $\pm 6\%$ (record and playback)		
Reel Size:	5 to 10-1/2" (13 to 26.7cm) EIA or NAB, plastic or metal		
Wow and Flutter (overall):	(JIS weighted RMS)	(DIN weighted peak)	(NAB unweighted RMS)
15 ips (38cm/s);	0.018%	$\pm 0.035\%$	0.045%
7-1/2 ips (19cm/s);	0.03%	$\pm 0.06\%$	0.07%
3-3/4 ips (9.5cm/s);	0.06%	$\pm 0.12\%$	0.15%
Time Counter:	Read-out in minutes and seconds (4 digits), real-time indication for 15 ips (38cm/s) Accuracy $\pm 1\%$ at 15 ips (38cm/s) less than 150sec. for 2500 feet (762m) tape		
Fast Winding Time:	Quartz-phase-locked control DC brushless servo direct-drive motor		
Capstan Drive:	2 DC brushless direct-drive motors with tape tension control		
Reel Drive:	Edit marker, tape dump or cue/review using edit dial and/or cue switch		
Edit Capability:	Constant at all speeds and reel sizes, Supply and take-up tension controlled		
Tape Tension:	Tension roller switches for end of tape running, or Tension control circuit stops the operation within 3 sec. for accidental stop of take-up reel motor		
Auto-Stop Detection:	Functions; Rec/Play/Pause/FF/Rew/Stop, Remote control unit RP-9690 optionally available		
Remote Control:			

## ELECTRONICS

Heads:	3-head system 2 SX (Sendust Extra) heads for record and playback 1 ferrite head for erasure
Inputs:	
LINE Balanced:	77.5mV (-20dBm)/10k $\Omega$ , max. input level = +5dBm at 50Hz 1% THD
Unbalanced:	60mV (-24dBm)/47k $\Omega$ (phono type jack), max. input level = infinity (Line input connected to LINE IN level control before passing through amplifier)
MIC Unbalanced:	0.25mV (-72dBm)/4.7k $\Omega$ (phono type jack), max. input level = -15dBm at 1kHz 1% THD Mic. attenuation 0/20dB, switchable
Outputs:	
LINE Balanced:	1.228V (+4dBm)/600 $\Omega$ output level control at volume "8", 2.19V (+8dBm) maximum, load impedance 600 $\Omega$ /10k $\Omega$ or more, switchable
Unbalanced:	0.775V (0dBm)/1k $\Omega$ output level control at volume "8", 1.228V (+4dBm) maximum, load impedance 22k $\Omega$ over (phono type jack)

## HEADPHONE:

### Frequency Response:

15 ips (38cm/s);	
7-1/2 ips (19cm/s);	
3-3/4 ips (9.5cm/s);	
Signal-to-Noise Ratio:	
15 ips (38cm/s);	
7-1/2 ips (19cm/s);	
3-3/4 ips (9.5cm/s);	

65mV output level control at volume "8", load impedance 8 $\Omega$  (stereo phone type jack)  
(overall)  
rec. level

-10dB	30—30,000Hz $\pm 3$ dB (40—22,000Hz $\pm 2$ dB)
0VU	30—20,000Hz $\pm 3$ dB (40—20,000Hz $\pm 2$ dB)
-20dB	20—25,000Hz $\pm 3$ dB
-10dB	20—20,000Hz $\pm 3$ dB (30—20,000Hz $\pm 2$ dB)
-20dB	20—15,000Hz $\pm 3$ dB

(overall) A-weighted at 1kHz  
(650nWb/m) (370nWb/m)  
67dB 62dB  
67dB 62dB  
65dB 60dB  
650nWb/m = 11dB above a 0VU of 185nWb/m, 1kHz THD is less than 3%  
370nWb/m = 6dB above a 0VU of 185nWb/m  
measured with bulk erased 3M type 207 tape

### Distortion:

(overall) Total Harmonic Distortion (THD) at 400Hz, all speeds  
less than 0.8% at 185nWb/m (0VU)  
less than 2% at 370nWb/m (+6dB)

### Channel Separation:

better than 50dB at 1kHz  
better than 65dB, recorded 1kHz +10dB

### Erase Depth:

185nWb/m

### Operating Level (0VU):

120kHz

### Recording Bias:

#### Bias Level:

3-position Bias selector (Fine-adjustment at "center")  
"1" 90%  
"2" 100%  
"3" 110%

Fine-adjustment range (referenced to standard value at position 2)  
-50% to +20%

### Equalization:

NAB standard for all speeds and switchable IEC(CCIR) standard for 15 ips (38cm/s) playback  
3-position EQ selector and fine-adjustment controls for record and playback  
Fine-adjustment range;  $\pm 3$ dB at 10kHz (record and playback)  
Position "2" of EQ, Bias selectors and "center click" of fine Bias, EQ adjustment controls set for 3M type 207 tape  
1kHz/10kHz

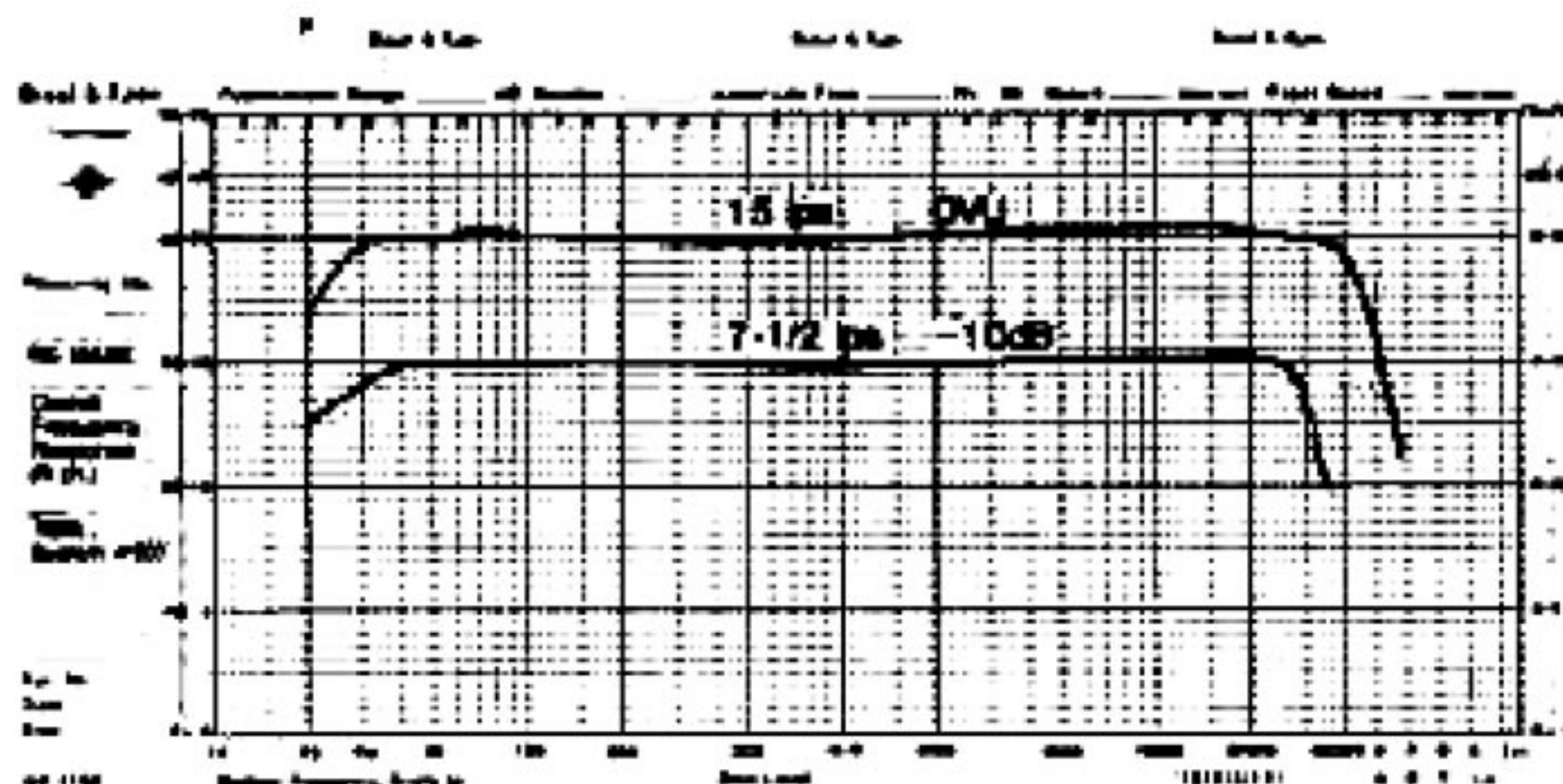
### Test Oscillator:

## PHYSICAL

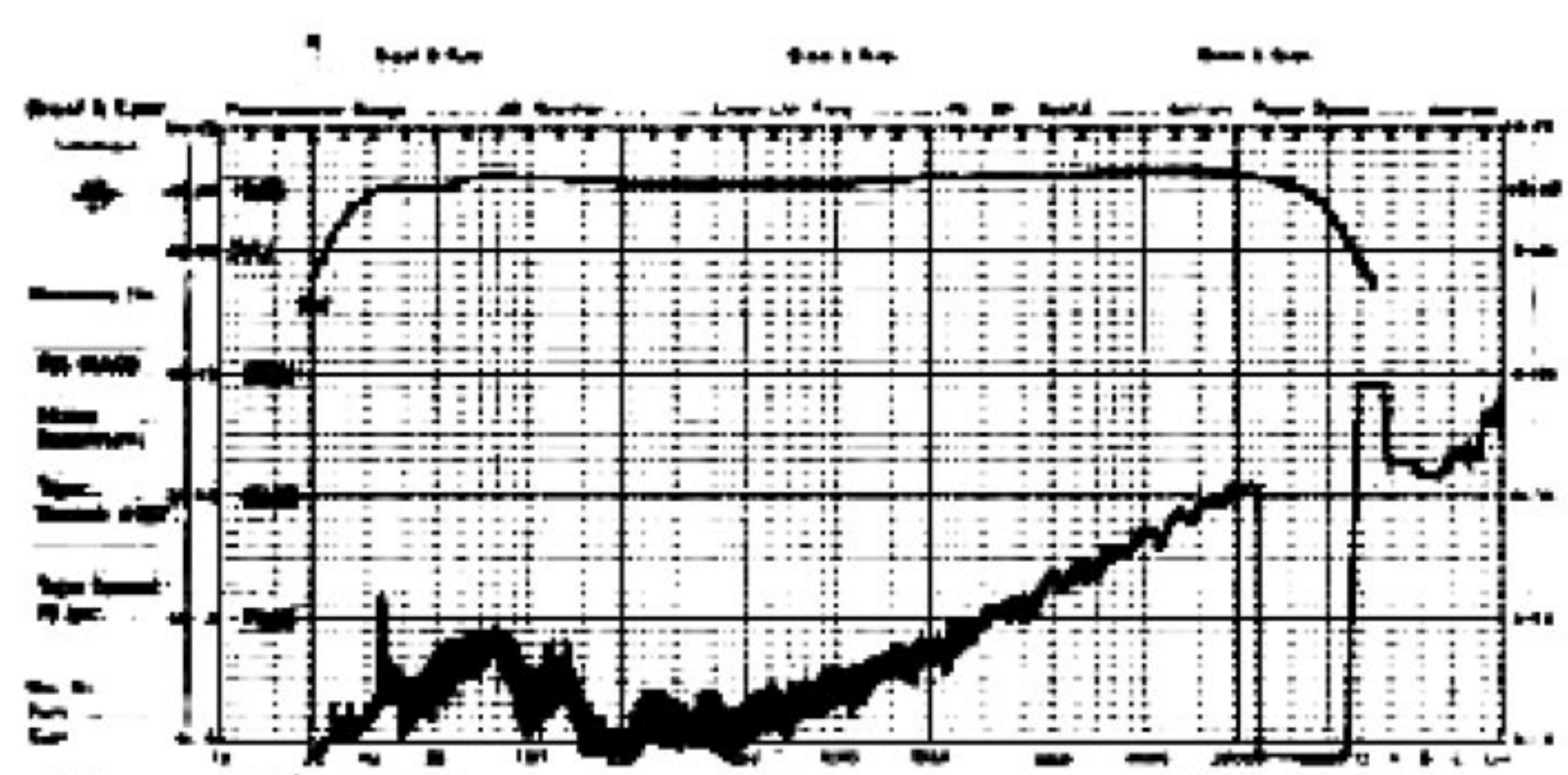
Power Requirements:	AC 120V, 50/60Hz, Consumption; 120W
Weight:	61 lbs. 11 oz. (28kg)
Dimensions (HxWxD):	19-3/4" x 18" x 10-1/8" (502mm x 456mm x 257mm)
Rack Mounting:	Shelf brackets included for a standard 19 inch rack

Specifications based on use of 3M type 207 tape

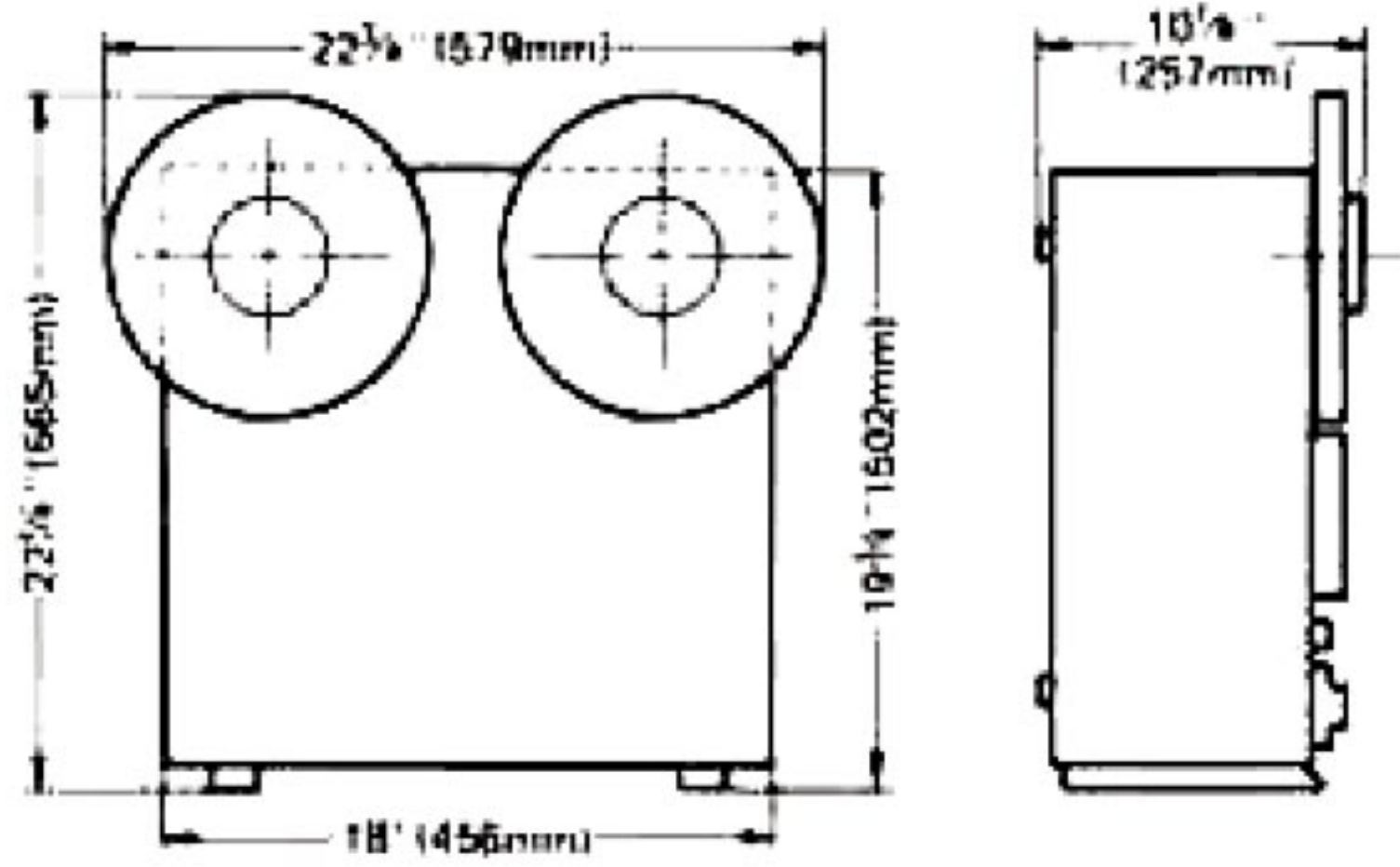
### Overall Frequency Response



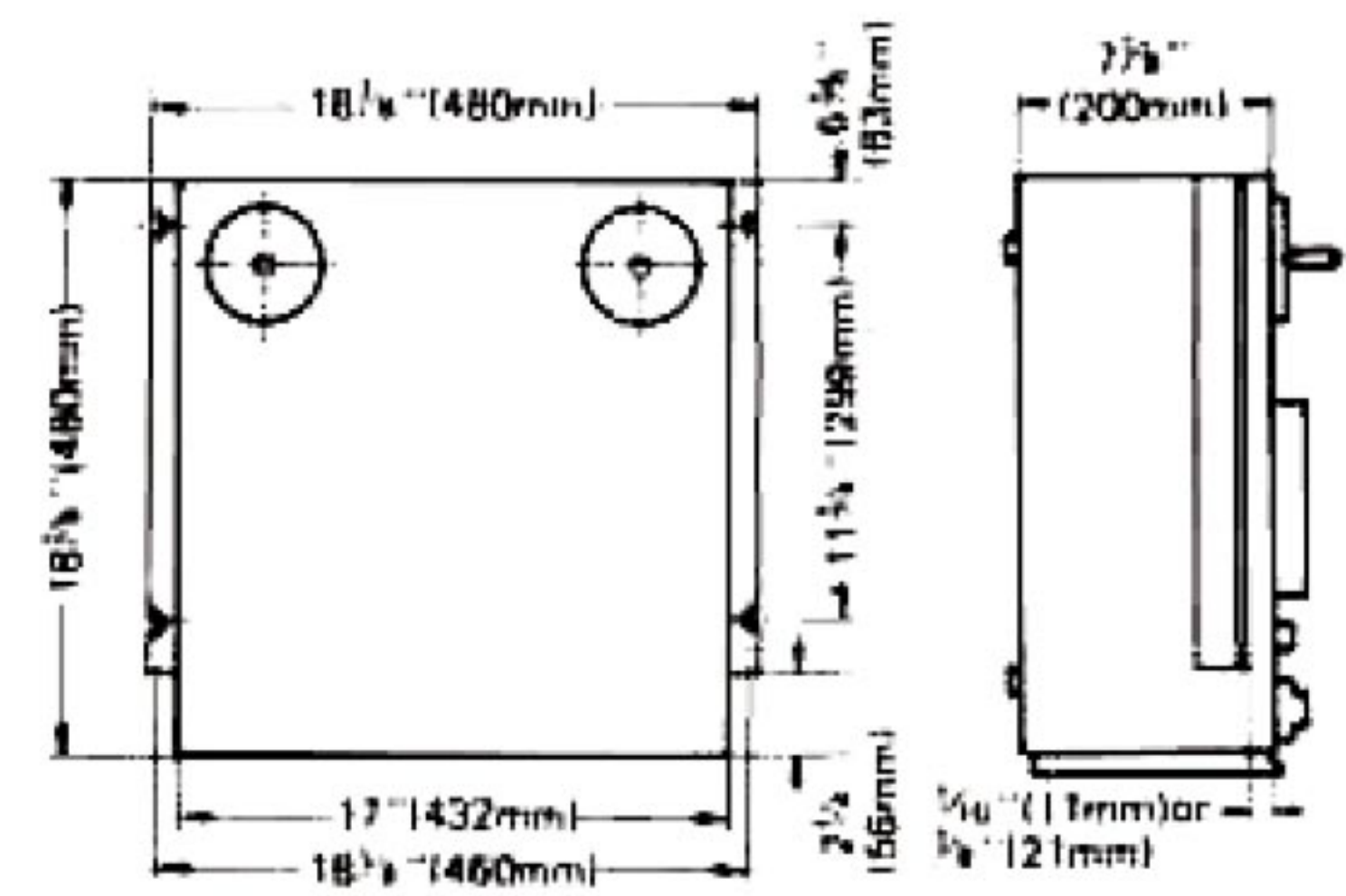
### Signal-to-Noise Characteristics



**Dimensions with Black Side Panels**



**Dimensions with Shelf Brackets**



## Precision Audio Test Tape

During the final stages of the development of the isolated loop transport, it became clear that the world's most precise test tapes were not manufactured with the same degree of speed accuracy as this new transport system was capable of. Practically speaking, this meant that such standard tapes were not useful for maintaining quality control during mass production

of Technics isolated loop tape recorders. Therefore it became necessary to develop and produce new test tapes using a new and much more precise method of measuring speed anomalies than the conventionally recorded 3kHz test signal. In fact, measurements using 3kHz test tapes showed different frequency changes between start and finish of the tape depending on which tape was used. To eliminate this problem, Technics engineers came up with a symmetrical head flux calibration method which could produce a test tape accurate enough for testing the isolated loop. This was followed by special new test tapes for frequency response, azimuth, tape speed and wow & flutter at the three standard tape speeds.

