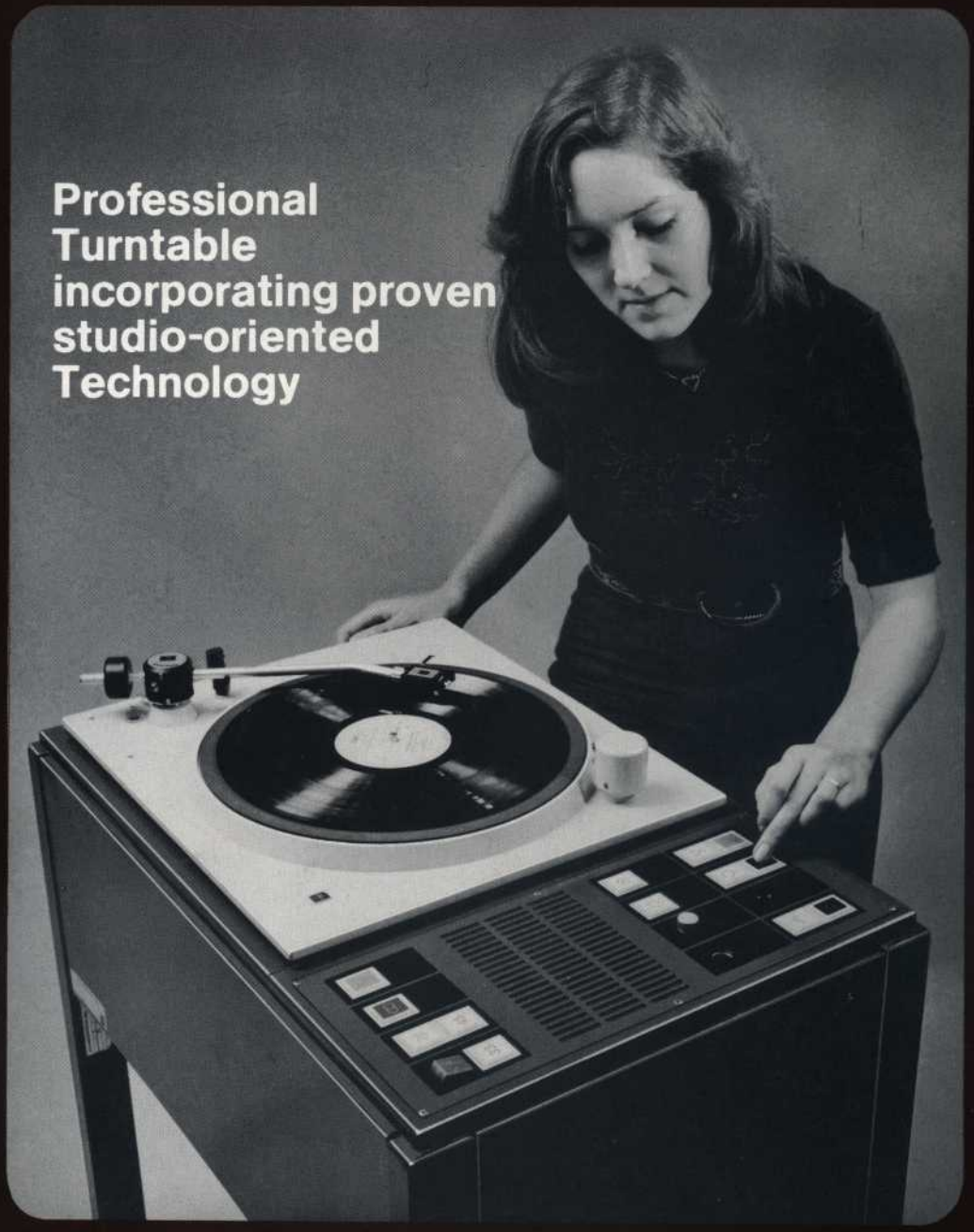
ELEKTRONIK-
MESS- UND
TONSTUDIOTECHNIK

EMT 950



EMT presents the new EMT 950 studio turntable, a significant, new development based on experience gained with the R 80, EMT 927, and EMT 930 turntable systems, which have been proven in twenty years of studio use throughout the world. All technical functions have been combined into a modern, integrated system affording unprecedented possibilities for use. The characteristic features of the unit include:

Electronically controlled Direct Drive

User-oriented, single-handed Pushbutton Operation

Improved Immunity to Shocks and structural Vibrations

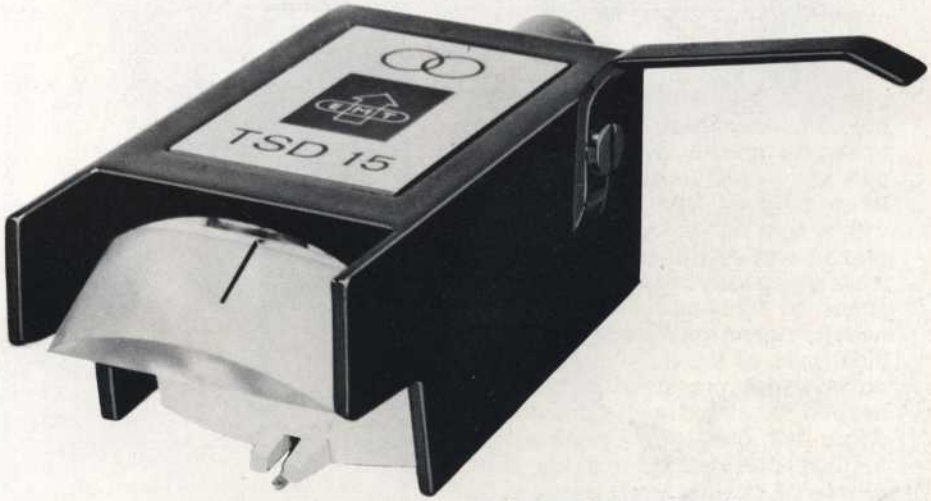
Highest Quality Reproduction – isolated from external Disturbances

Pick-up Cartridge

In addition to long service life, a broadcast studio turntable must be particularly immune to mechanical disturbances. Record imperfections and environmental vibrations should not impair reproduction quality. In contrast to the prevailing trend among domestic turntables towards the lowest possible stylus pressure, broadcast stations throughout the world employ special pick-up cartridges with relatively high stylus pressures of 20-30 mN (equivalent to 2-3 grams). Because of the additional requirements for the maintenance of high quality performance data even after the stylus has been replaced such cartridges possess permanently installed cantilever systems and are individually adjusted and measured during manufacture or refurbishing. The individually recorded data with frequency response curves accompany each delivered cartridge. The compliance and the effective stylus-tip mass are carefully matched to the recommended stylus force. A visible feature of this cartridge is its integrated lens with hairline, which is optically aligned with the stylus to enable accurate lowering of the tip into the desired record groove. A projected light beam and a mirrored surface integrated into the pick-up head facilitate this process, which is of great assistance in fast-paced studio operations.

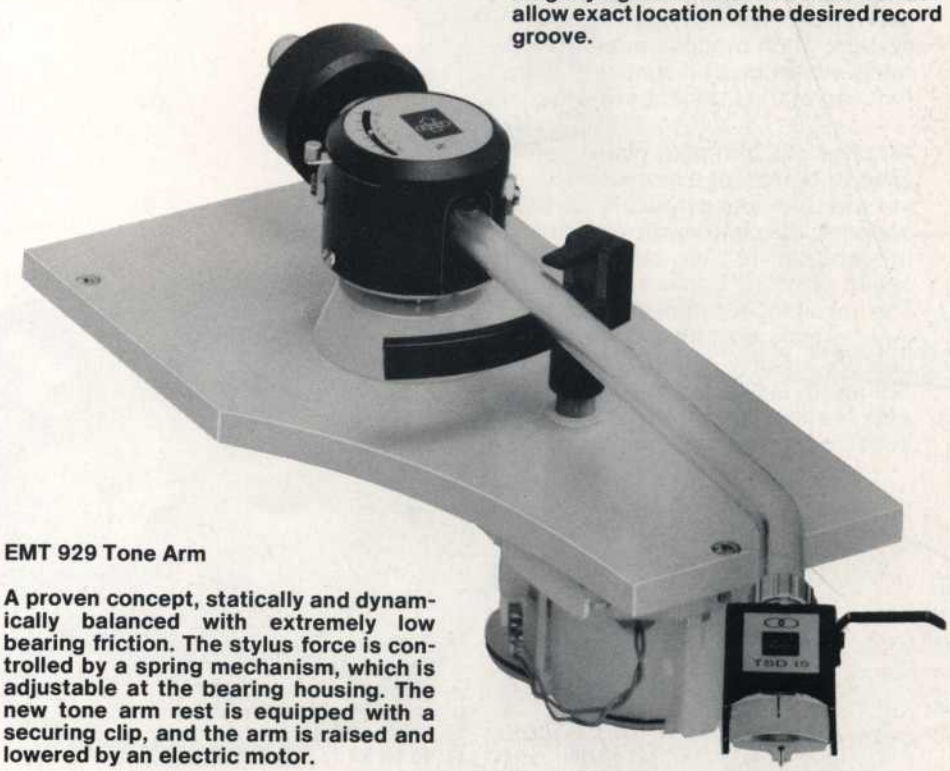
Tone Arm

The classic EMT 930 turntable has been equipped with the EMT 929 tone arm for about the last six years. This arm is statically and dynamically balanced in all three dimensions to minimize its sensitivity to external disturbances such as mechanical shocks and vibrations. Through use of precision ball bearings for all degrees of freedom, extremely low coefficients of friction are achieved; and this factor, together with the low forces obtained through the employment of extremely supple pick-up cables (terminated in an audio plug-in connector), results in extremely low frictional forces – the maximum force, including torsion forces, at the stylus tip is 0.5 mN or 50 mg. The stylus force is determined by spring tension and can be adjusted by means of a lever to any value between 0 and 50 mN (0 to 5 grams). An antiskating device affords the final compliment to the arm, which has been conceived to fulfill the most exacting state-of-the-art requirements and obviates the need for further developments in the foreseeable future. Of particular importance is the careful tuning of the resonant frequency of the tone arm integrated with the EMT TSD 15 pick-up cartridge in reference to the vibrational properties of the entire turntable system.



T-Series Pick-up Cartridges

Dynamic, moving coil cartridge with low effective mass at the stylus tip. Compliance characteristics optimally matched to the mass of the EMT 929 Tone Arm Magnifying lens and mirrored surface allow exact location of the desired record groove.



EMT 929 Tone Arm

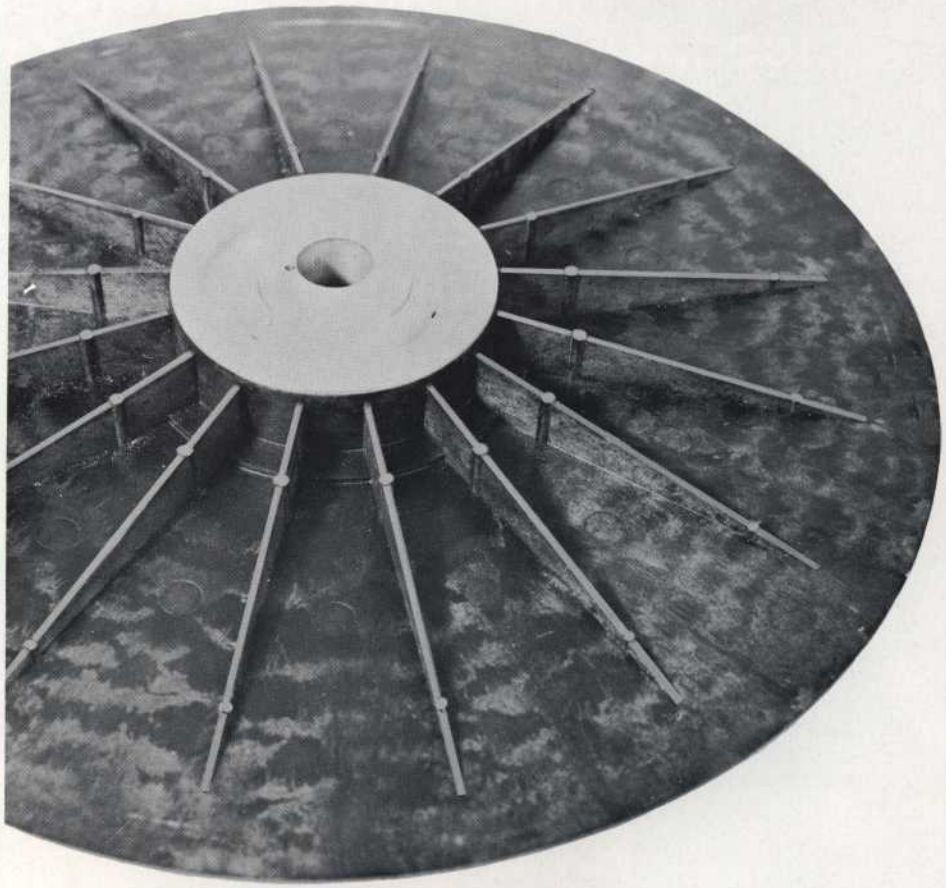
A proven concept, statically and dynamically balanced with extremely low bearing friction. The stylus force is controlled by a spring mechanism, which is adjustable at the bearing housing. The new tone arm rest is equipped with a securing clip, and the arm is raised and lowered by an electric motor.

Extreme light Turntable Platter

Turntable Platter

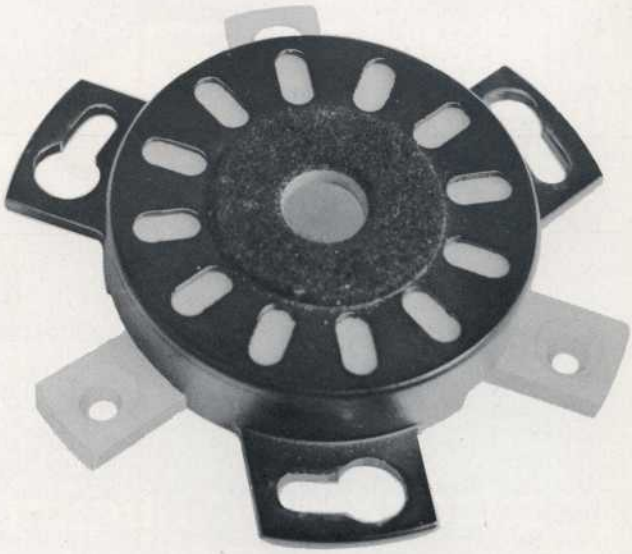
The conventional approach to the design of a high-quality turntable prescribes a platter with the highest practicable rotating mass. Naturally, a platter possessing a high moment of inertia is relatively immune to rotational irregularities and affords quiet operation when elastically coupled to the drive system. Internal or externally introduced disturbances are therefore chiefly manifested in low-frequency speed variations, termed "wow". The disadvantage of the high-mass approach is the relatively long time required to accelerate the platter to its operating speed. To overcome this difficulty, studio turntables of the last three decades have been equipped with a light auxiliary platter, which is braked and released electromagnetically and quickly brought up to playing speed by frictional contact with the heavy, rotating main platter below. The high mass of the main platter exerts an immense pressure on the lower support bearing, which consists of a single ball. The stability requirements for the platter shaft make a large-diameter guide bearing necessary, and this in turn requires careful attention to machining tolerances, bearing play, lubrication, and protection from foreign particles. In addition, the gyroscopic action of the platter results in shaft motions perpendicular to forces exerted orthogonally upon the rotating system. Such motions arise from external vibrations and shocks and are a function of the moment of inertia.

An ultralight turntable platter can be seen to represent a revolutionary and yet sensible and physically desirable concept. The platter with record can be brought up to the correct playing speed within a fraction of a second. The resultant rotational counter moment, which must be absorbed by the chassis suspension, is minimal. Furthermore, a lightweight platter presents fewer problems in the design of a suitable bearing assembly.



Turntable platter

molded of expoxy-fiberglass for superior strength; nearly as thin as a phonograph record, yet with exceptional rigidity by virtue of its ribbed construction.



Adaptor

Built-in for playing 45 rpm large-hole records; spring-loaded engaging mechanism, with automatic speed change from 45 to 33 1/3 rpm.

Electronically controlled Direct Drive

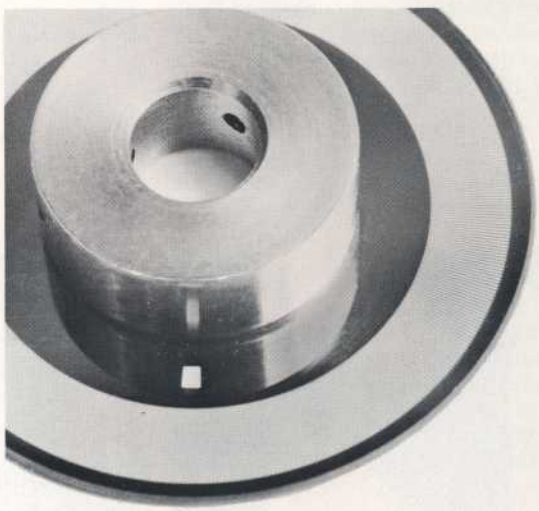
Drive System

A sufficiently elastic force-coupling from the motor to the inner circumference of the heavy main platter is achieved in most studio turntables by using a rubber idler wheel. Particularly stringent requirements must be fulfilled for the wheel bearing and for true-of-round. The elastic deformations of the wheel introduce mechanical wear.

An ultralight platter, on the other hand, lends itself to rigid coupling with an electronically regulated motor that incorporates a low-inertia rotor. The motor drive circuitry can be designed to simulate a high rotating mass, thus virtually eliminating wow and flutter. With respect to rotational frequencies, a direct-drive system affords the advantage of employing no moving parts which turn more rapidly than the platter itself. Thus, no inherent higher frequencies are produced. Crucial to the quality of direct drive is the electronic control system, as exemplified in the design of the EMT 950 studio turntable. The platter is driven by a dc motor, which is fed from a power amplifier and commutated using Hall generating elements. The drive signal for the power amplifier is derived from the commutation impulses and from a voltage produced as a function of the tachometer frequency. A transparent disc with a precision, opaque grid is attached to the motor shaft for producing the tachometer frequency by optoelectronic means. Selection of the three motor speeds is accomplished by suitable switching of the control circuitry.

Motor Assembly

dc motor of slender, extremely low-inertia construction, with electronic control and Hall-generator commutation.



Tachometer disk

with high-precision graduations for instantaneous optoelectronic control of rotational speed.

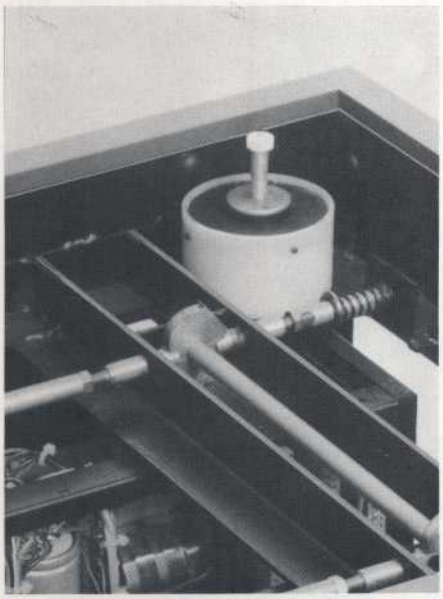
Shock Absorption

Installation

Studio turntables are customarily installed in free-standing mounting bases. A turntable so installed need not be elastically suspended as long as the base is constructed of vibrationless steel, to achieve sufficient dead weight and the floor affords a solid mounting foundation. Such conditions represent the ideal environment for a turntable, since a perfectly rigid mounting structure is immune to mechanical disturbances produced by manipulating the controls. On the other hand, non-rigid floors and light wooden bases make considerable mechanical, vibrational, and even airborne disturbances likely, especially during stereophonic reproduction. A special suspension frame, which has been dubbed "the four-posted bed for studio turntables", absorbs vibrations conveyed from the environment.

Shock-absorbing elements are integral to the modern design of the EMT 950 studio turntable. The construction consists of a heavy, gray cast-iron chassis and four elastic suspension elements, which lie in the same plane as the center of gravity and exhibit a higher degree of horizontal than vertical compliance.

This construction fully inhibits the occurrence of mode changes, that is, the transformation of lineal excitations into rotational vibrations.



Suspension element

with differing degrees of horizontal and vertical compliance for shock and vibration-free suspension of the main chassis.

Vibrational Mechanics

A phonograph turntable intended to meet the most stringent technical and operational requirements cannot be designed simply by combining "building blocks" of individually optimized components. A complete turntable system contains numerous mass-spring pairs, which are comparable to resonant circuits and their natural frequencies. Several of the most important examples are listed in the table below. It should be noted that many of these resonant structures behave not in one but in two or three planes and represent as many separate mass-spring pairs. In addition, the angular momentum of the motor and of the platter during starting and braking as well as the gyroscopic action of the rotating system represent aspects requiring analytical consideration.

To develop a turntable intended for high-quality performance, the designer is confronted with the requirement of distributing the resonances and manifold partial resonances as evenly as possible throughout the entire reproduced spectrum to achieve the broadest possible bandpass filter action. It is particularly important to avoid a summation of two resonances at any one frequency, since the turntable would then be predominantly sensitive to disturbances at this point,

Mechanical Turntable Resonances in the Form of Mass-Spring Pairs.

Dynamic Mass of	Elasticity of	Resonant Frequency
tone arm 1)	horizontal excursion thrust of the pick-up system	4 – 14 Hz
tone arm 1)	vertical excursion thrust of the pick-up system	1 – 1,4 times that of horizontal excursion
pick-up head 2) especially with a stiff cantilever	tone arm tube	50 – 150 Hz
tone arm 2)	tone arm bearing	50 –150 Hz
cantilever system 2)	cantilever tube	10 – 60 kHz
pick-up system 2)	groove walls of the record	12 – 35 kHz
chassis 2)	suspension elements, e.g., rubber absorbers horizontal	4 – 10 Hz
	vertical	4 – 15 Hz
base 2)	contact points e.g. rubber feet on floor	1 – 2 Hz or higher than chassis resonance

1) measured at the stylus-contact point.
2) measured at the center of gravity.

manifest for example as microphony at high frequencies or rumble in the bass region. The resonant structures of the turntable system can be excited by a number of agents, the first group of which includes the modulations present on the record as well as disturbances arising from center-hole eccentricity and from surface warps.

The next group is comprised of vibrational disturbances caused by an eccentricity or imbalance of any rotating component, such as the motor, a rubber idler wheel, or the platter. Additional sources of turntable vibration include electrical irregularities of the motor, defective bearings, shudder disturbances arising in the power transformer or motor windings, and the sometimes considerable effects of accelerating and braking rotating masses.

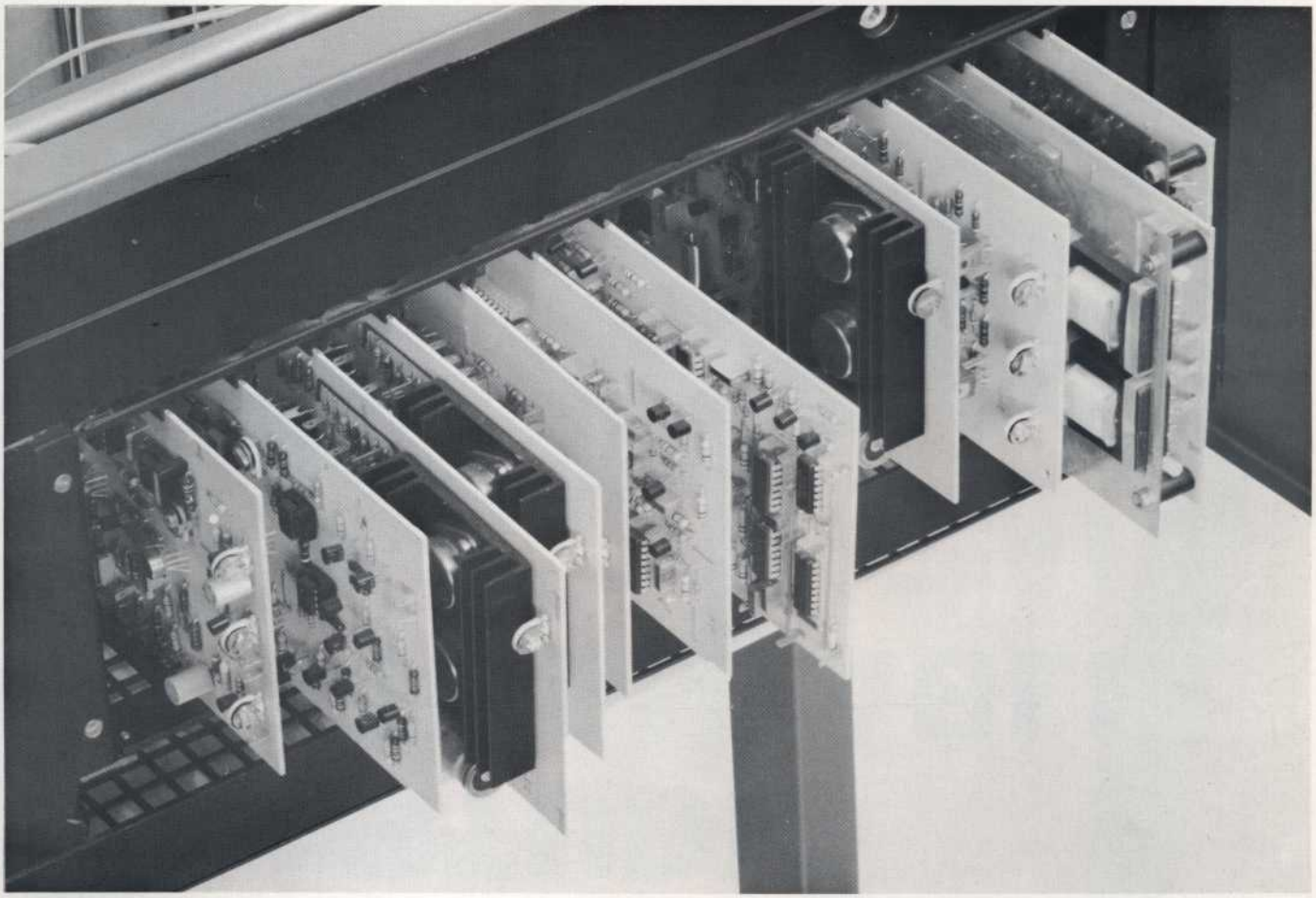
Finally, the usual external disturbances which occur as airborne waves, structural vibration, and mechanical shock, may all excite turntable system resonances. It is clear from this discussion that the realization of a design concept must include more than mere consideration of operational and electrical requirements. It is requisite to optimum performance to identify the numerous mass-spring pairs and to tune their resonances with respect to one another.

Amplifier

In broadcast studios, a phonograph record reproduction device is considered a program source with standardized electrical specifications, so that equalized amplifiers are generally integrated into the units. In addition to the standard equalization curves with time constants of 3 180, 318, and 75 microseconds, the last time constant can be switched to zero for the reproduction of test records. Also worthy of mention are the band-limiting filters, which sharply attenuate the frequency response below 30 Hz and above 25 kHz to eliminate disturbances outside the audio spectrum. The amplifier is capable of providing an output level of +22 dB on a 200 ohm load, thus reflecting the trend toward higher recording levels and the resulting requirement for greater signal headroom.

Electronic circuitry

contained on standardized, easily replaceable plug-in boards: equalizing preamplifiers, line amplifiers, monitor amplifier, optional 10 watt amplifier, control function logic, motor control circuitry.



System of a modern Studio Turntable

Operation

Broadcast programming schedules are relentless in their demands for exact timing. Insuring optimum program efficiency is therefore required not only of the studio operator but of the turntable designer as well. As a consequence, particular attention has been paid to providing functionally oriented controls in the EMT 950. The right hand remains free at all times for manipulation of the tone arm and the record. The left hand initiates all control functions on the pushbutton panel, which has been arranged according to usage sequences. Thus, the pushbutton for selecting record speed and mono/stereo mode are located in the upper part of the field next to the power switch. A pair of buttons switches operation to either local or remote control. A vertical row of three buttons determines the direction of the platter, forwards or backwards; the motorized backward rotation of the turntable represents a "first" in studio turntables and facilitates cueing functions conventionally performed by hand. Accurate cueing to any point in music or speech modulation is possible Two additional buttons control the motorized raising and lowering of the tone arm. While raising of the arm occurs rapidly, the lowering function insures full protection of both the pick-up stylus and the record while proceeding more swiftly and safely than manual means. An additional pushbutton turns on a broad beam of light, refracted through a special cylindrical lens, to illuminate the stylus contact point. Additional features include the built-in monitor loudspeaker with volume control and the automatic audio shut-off during the exceptionally short record-starting interval.

EMT 950

Through isolation of the elastically suspended turntable chassis from the cabinet and control elements. The right hand remains free at all times for manipulation of the tone arm and record. The left hand initiates all control functions, on the pushbutton panel, which has been arranged according to usage sequences.

User oriented, single-handed Pushbutton Operation

From left to right:

power switch

speed selection buttons

stereo/mono switching

Perforated panel for monitor loud-speaker.

Upper panel from left to right:

monitor loudspeaker level control

motorized reversed rotation of the turntable platter

pick-up cartridge illumination

Lower panel from left to right:

local/remote control selector

pilot lamp, for indicating when the console fader is turned up

start/stop buttons

motorized tone arm lift/lower

Alternative Versions

The standard model of the EMT 950 studio turntable is designed to be built into existing consoles. Alternatively, mounting two floor supports onto the sides of the frame converts the turntable to a free-standing unit.

Should installation space be restricted, as may be the case in broadcast vans or when two or three turntables are to be mounted adjacently and control of each from the front of the unit is desirable, then the narrowline version of the EMT 950 may be employed. In this model, a somewhat smaller control panel is situated in front of the chassis. The monitor loudspeaker has been omitted but may be externally implemented, with the same functional capabilities provided in the standard model, using the 10-watt plug in amplifier.

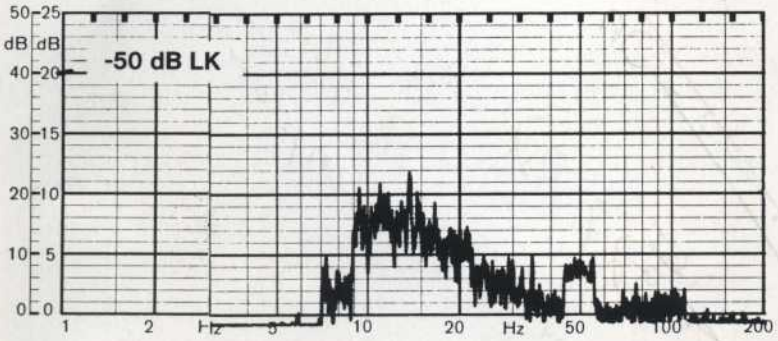
Regardless of what may be dictated by practical considerations, the integrated mechanical and acoustic isolation is afforded in all versions. Installation therefore remains straightforward, even in an unfavorable environment.

Technical data

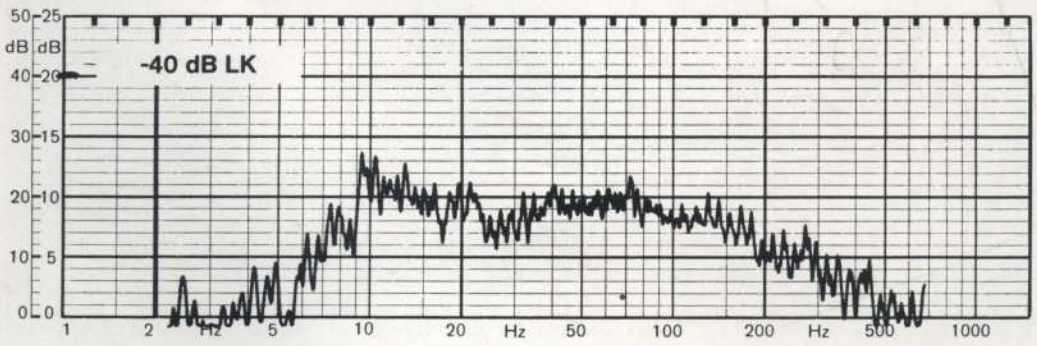
Drive System	
Speed	33 1/3, 45, 78 RPM ±0,1 %
Turntable diameter	33 cm (13")
Wow and flutter (DIN 45 507/ANSI/IEC)	max. ± 0.05 %
Run-up time	max. 0,2 s
Rumble (DIN 45 539) Signal-to-noise ratio, unweighted	greater than 56 dB
Signal-to-noise ratio, weighted	greater than 70 dB
ac mains power connection	100 to 130 V, 200 to 240 V, 50-60 Hz
Power consumption	approx. 100 VA
Dimensions standard model, chassis alone	693 x 462 x 332 mm (27,6" x 18,4" x 13,2")
with floor supports (free-standing)	697 x 466 x 854 mm (27,8" x 18,6" x 34")
narrowline model, chassis	512 x 575 x 332 mm (20,4" x 22,9" x 13,2")
Required mounting recess depth below table top	245 mm (9,8")
Weight	approx. 70 kg (154,32 lbs.)

Amplifier:	(plug-in cards)
Equalization DIN, NAB, IEC, RIAA	75/318/3180 us
FLAT	0/318/3180 us
Input sensitivity	0,2 to 1 mV for EMT-T series pick-ups
	2 to 10 mV with 47 kohms version
Output level	+ 6 dB (1,55 V) max. 4,4 V min. 0,775 V
Max. Output level	+ 22 dB (10 V)
Frequency response	
Frequency response	40 Hz to 15 kHz ± 0,5 dB 30 Hz − 3 dB below 30 Hz approx. 20 dB/octave rolloff above 25 kHz approx. 12 dB/octave rolloff
Total harmonic distortion	less than 0,1 %, 30 Hz to 12 kHz
Signal-to-noise ratio, rms, unweighted	min. 75 dB
Signal-to-noise ratio, peak, weighted	min. 70 dB
Crosstalk	better than 55 dB
Headphone output	stereo, max. 2 V into 200 ohms
Stereo/mono switch	remote controlled (24 V DC or from internal voltage)

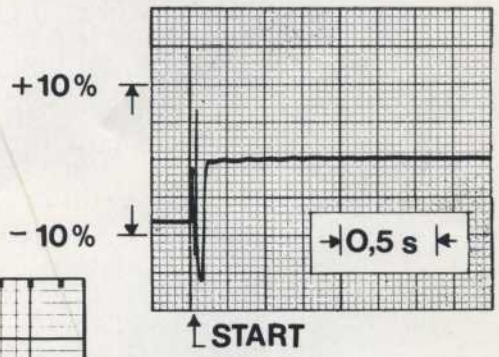
Subject to change without notice



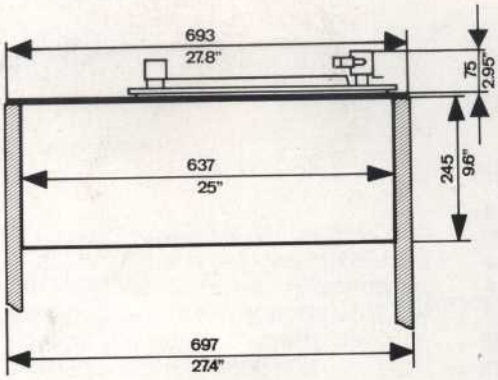
Spectral Analysis of Rumble, measured with adapter (top) and test disk (bottom). The reference level differ by 10 dB.

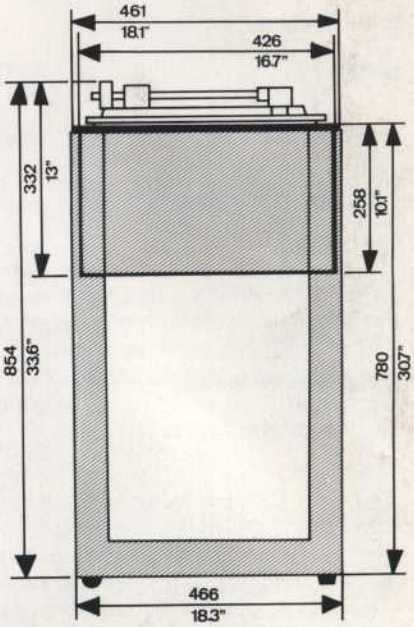


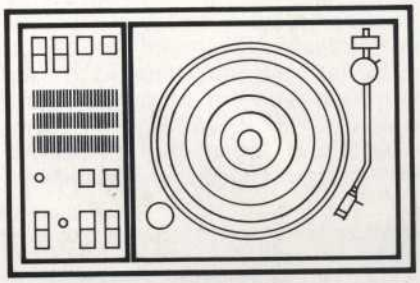
Starting performance, measured with the EMT 424 Flutter Analyzer (Rec 2 output). The impulses immediately following start initiation are produced as the PLL circuit locks in.



Dimensions

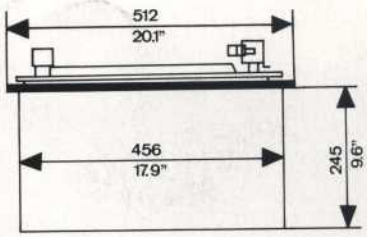


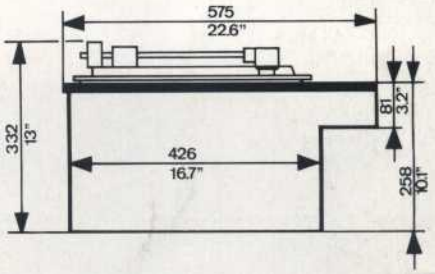


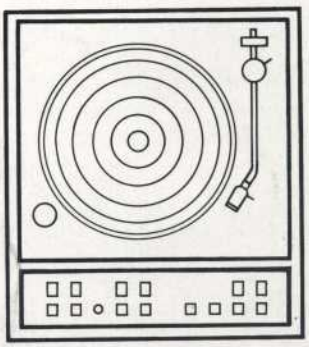


EMT 950

Cut-out for console mounting:
min. 639 x 428 mm (depth: 250 mm)







EMT 950 E
Narrowline Version

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