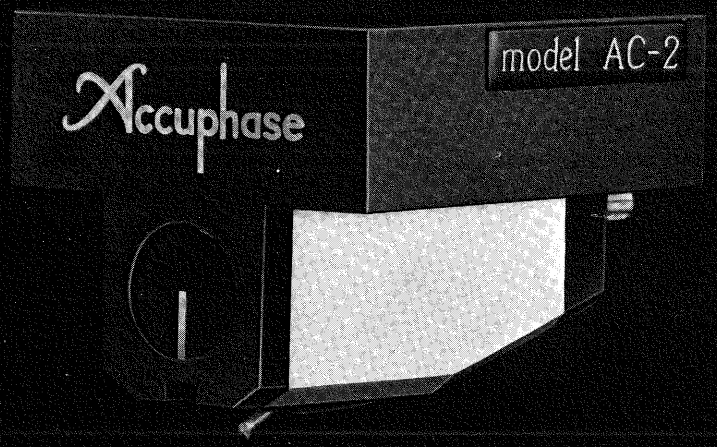
Accuphase

AC-2
MOVING COIL
PHONO
CARTRIDGE

Overkill in sound reproduction, but Vital for musical reproduction.....

- Tubular Sapphire Cantilever • Samarium Cobalt Magnet
- Diecast Aluminum Alloy Housing

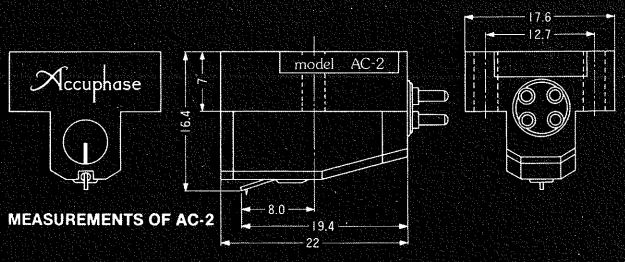


New materials and industrial processes that are continually being developed through technological progress are closely followed in the audio world which constantly seeks to utilize those which might improve sound reproduction quality. It is a well known fact that the introduction of new materials and processing techniques in the past has played an important part in the remarkable improvement of sound in today's amplifiers and speakers.

Accuphase has now made another major breakthrough in further improving MC (Moving Coil) cartridge performance by utilizing ultra-precision processed tubular sapphire to make the cantilever for its new AC-2 phono cartridge. The significance of this is briefly explained below.

A cartridge must convert microscopic vibrations into electrical signals, and the cantilever, which is a part of its vibration system, must be sufficiently lightweight to enable this delicate pickup, yet sufficiently stiff to prevent introduction of harmful vibrations. This specially processed, low mass sapphire provides a better reconciliation of stiffness and lightweight properties so essential for good cantilever action, without which individual timbre characteristics peculiar to different cartridges may seem so unnatural.

A special pillar-shaped synthetic sapphire material known for its hardness is used. A hole is carefully bored into it with high precision technique to produce a tubular shaped, low mass sapphire which is ideal for cantilever use. Its utilization has given the AC-2 cartridge the capability to produce a deeper, more dynamic and clear-cut reproduction sound with smooth, yet firm, characteristics heretofore unavailable. Harmful vibrations are completely absent as they are effectively damped or prevented from originating.



MEASUREMENTS OF AC-2

Accuphase AC-2

MOVING COIL PHONO CARTRIDGE

1 HIGH STIFFNESS, LIGHT MASS TUBULAR SAPPHIRE CANTILEVER

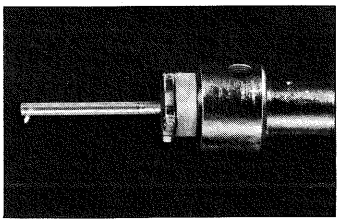
The stylus tip and cantilever of cartridges must have high stiffness and light mass properties in order to deliver true replica electrical energy signals by tracing disc grooves in which sound wave patterns have been recorded. The AC-2 employs an epoch making cantilever made of tubular sapphire which was achieved for the first time through the utilization of an ultra-precision processing technique.

MATERIALS	CRYSTAL STRUCTURE	DENSITY ρ(g/cm³)	YOUNG'S MODULUS E(10^{11}dyne/cm²)	STIFFNESS RATIO E/ρ(10^{10}cm²/sec²)	SOUND VELOCITY $C=\sqrt{E/\rho}$(m/sec)
SAPPHIRE	SINGLE CRYSTAL	4.00	50	125	11,200
ALLUMINUM	POLY-CRYSTAL	2.70	7	26	5,100
CARBON FIBER RESIN	—	1.42	16	113	10,600
TITANIUM	POLY-CRYSTAL	4.54	11	24	4,900
BERYLLIUM	POLY-CRYSTAL	1.84	30	163	12,800
BORON	AMORPHOUS	2.34	42	179	13,400

The above table shows the physical properties of various materials. It shows that sapphire, being a single crystal in structure, has a very low propagation loss, as does amorphous, non-crystal materials. Sapphire also has a high Young's Modulus ratio, which combined with its non-resonating properties, eliminates harmful vibrations of the cantilever itself. Sapphire can also be expected to give a more faithful propagation of the sound groove because of its high Young's Modulus ratio which governs stiffness qualities. The table shows that this ratio for sapphire is from two to ten times that of polycrystal metallic cantilevers.

Despite the above favorable characteristics of sapphire, the table also shows that its density is second only to titanium. This means that sapphire, in solid form, is rather too heavy to be an ideal material, since density governs equivalent mass or weight. This fault was solved by the creation of tubular sapphire which has reduced equivalent weight to less than 50%.

It is no exaggeration to say that this tubular processing technique has resulted in making a truly outstanding cantilever action possible. A more refined sound, with superior high frequency characteristics and improved transparency can now be expected since no phase disturbances are created in any part of the cantilever because of its high sound velocity characteristics.



2 DAMPED DAMPER

The function of a damper is to suspend the armature which includes the stylus, cantilever and signal generating coil, and also to provide a correct amount of braking action to armature vibrations. Therefore, a damper must provide a spring effect to preserve armature movements, while controlling excessive vibrations with the damping effect created by its internal air chamber braking action.

The movements of the armature apply pressure changes to the damper, which, in turn, provides a damping effect on the armature. They will also cause individual vibrations of the damper itself. These vibrations have a close relation to cantilever and shell vibrations, and if allowed, they will induce harmful vibration of the cantilever and distortion in the reproduced sound.

The Accuphase AC-2 cartridge is equipped with a second damper outside the Main Damper to absorb any such harmful damper vibrations.

3 POWERFUL RARE-EARTH SAMARIUM COBALT MAGNET ASSURES PERFECT LINEARITY

Rare-earth samarium cobalt, one of the most powerful magnets available, is employed in the AC-2. Perfect linearity of the armature hysterisis curve characteristic over its entire operating area was achieved by setting the magnetic field strength at 65% of the magnetic saturation point.

4 PERMALLOY CORE AND LARGE DIAMETER COIL WIRE

High quality permalloy, the most stable magnetic substance, is used for the armature core. High purity copper wire of unusual thickness (0.035mmϕ) for a Moving Coil cartridge coil is used in a single layer of relatively few turns to obtain an output of 0.18mV (5cm/sec.), with impedance at a low 4 ohms.

5 DIECAST ALUMINUM ALLOY HARD HOUSING

The moving elements of a cartridge receive strong vibrations from record grooves, but this vibration must not be allowed to create sympathetic vibrations of the cartridge housing because they will cause sound coloration. Careful attention was paid to this matter in developing the AC-2 which uses a diecast aluminum alloy housing body that has sufficient hardness and high internal loss characteristics to prevent such sympathetic vibrations. A flat, smooth shell mounting further assures strong contact.

6 STEADY OUTPUT VOLTAGE LEVEL

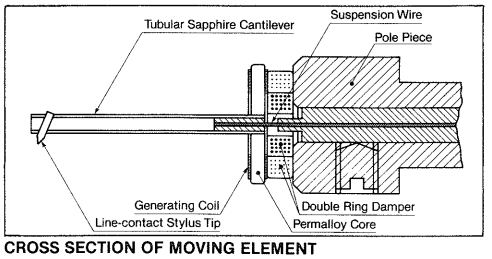
Playing a warped record may cause a phenomenon that can be likened to continuous variations of the stylus force if the record is so badly warped as to affect correct tonearm action and perfect tracking. In some cartridges, this will cause the center position of the signal generating armature to change, and vary the output voltage level. It will have a harmful effect as the warped record will then modulate the signal voltage.

Special attention was paid to prevent stylus force changes from affecting the output level of the AC-2. Its output remains steady, and practically unchanged within the stylus force range of 1.0~3.0 grams.

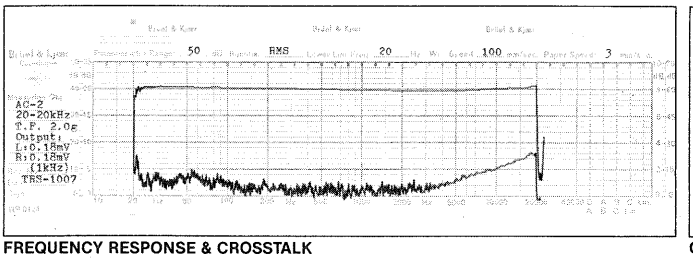
AC-2 GUARANTY SPECIFICATIONS

PERFORMANCE GUARANTY:
All Accuphase product specifications are guaranteed as stated.

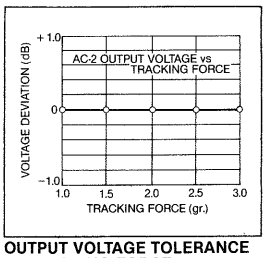
GENERATING ELEMENT	Moving-coil
OUTPUT VOLTAGE at 1kHz, 5cm/sec	0.18mV
FREQUENCY RESPONSE	20Hz to 60kHz 20Hz to 20kHz ±1.0dB
CHANNEL SEPARATION at 1kHz	30dB
CHANNEL BALANCE at 1kHz	0.5dB
DYNAMIC COMPLIANCE: Horizontal	15×10^{-6}cm/dyne
Vertical	15×10^{-6}cm/dyne
OUTPUT VOLTAGE TOLERANCE vs TRACKING FORCE	0dB at 1.0 to 3.0 grams
INTERNAL IMPEDANCE	4 ohms
RECOMMENDED LOAD IMPEDANCE	higher than 50 ohms for head amplifier higher than 3 ohms for step-up transformer
VERTICAL TRACKING ANGLE	20° (new IEC/DIN standard)
TYPE OF STYLUS	Line-contact diamond
STYLUS TIP RADIUS	6μm×35μm
TRACKING FORCE RANGE	1.5 to 2.5 grams
RECOMMENDED TRACKING FORCE	2.0 grams
WEIGHT, net weight	9.5 grams



CROSS SECTION OF MOVING ELEMENT



FREQUENCY RESPONSE & CROSSTALK



OUTPUT VOLTAGE TOLERANCE vs TRACKING FORCE

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