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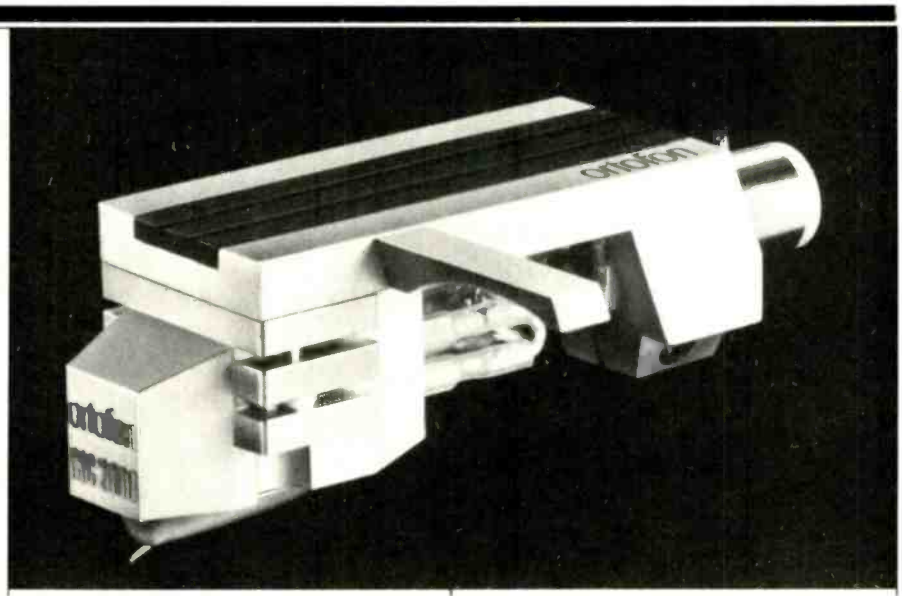
ORTOFON MC 2000 PHONO CARTRIDGE AND T 2000 TRANSFORMER



Manufacturer's Specifications

MC 2000 Cartridge

Type: Moving coil.
Stylus Type: Symmetrical Contact Line.
Frequency Response: 5 Hz to 90 kHz (5 Hz to 50 kHz, +5, −1 dB).
FIM Distortion: Less than 1% at recommended force, per DIN 45 542.
Tracking Ability: Greater than 100 μm at 315 Hz at recommended tracking force.
Dynamic Compliance: Vertical/lateral, 20/20 μm/mN.
Output Voltage: 0.050 mV at 1 kHz, 5 cm/S.
Channel Balance: Within 1 dB at 1 kHz.
Channel Separation: Greater than 25 dB at 1 kHz, greater than 18 dB at 20 kHz.
Equivalent Stylus Tip Mass: 0.27 mg.
Recommended Tracking Force: 1.5 grams, ±0.3 gram.
Recommended Load Impedance: 20 to 100 ohms.
Internal Impedance (D.c. Resistance): 3 ohms.
Vertical Tracking Angle: 20°.
Headshell Supplied: Magnesium, universal-arm type, with 5-mm overhang adjustment; weight, 10 grams.
Cartridge Weight: 11 grams.
Price: $1,000.00.

T 2000 Transformer

Type: Toroidal.
Shielding: Permalloy plus soft iron.
Input Loading: 3 ohms, ±1 ohm.
Recommended Output Load: 47 kilohms, 100 pF.
Frequency Response: 8 Hz to 100 kHz, +0.5, −1 dB; 4 Hz to 150 kHz, +0.5, −3 dB.
Phase Linearity: ±10°, 10 Hz to 20 kHz.
Square-Wave Rise-Time: Less than 3 μS.
Gain: 35 dB (3 ohms in, 47 kilohms out).
Channel Balance: Within 0.2 dB.
Channel Separation: Greater than 80 dB, 5 Hz to 50 kHz.
Price: $1,000.00.

Company Address: 122 Dupont St., Plainview, N.Y. 11803.
For literature, circle No. 94

The moving-coil phono cartridge was invented by the late Arthur C. Keller of Bell Laboratories in 1929, but was not announced until 1980. In 1948, Ortofon introduced the first commercially available moving-coil phono cartridge, a mono unit, which matched the quality level of the moving-coil cutterhead they had introduced in 1945.

The moving-coil cartridge is actually a micro-miniature generator. When a coil moves in a magnetic field, a voltage (EMF) is generated in that coil. Thus, as the stylus tip traces the undulations of the record groove, its movements are transmitted through the cantilever to the coil. In turn, the coils are diverted from their neutral position, cutting through the lines of magnetic force between the poles of the magnet to create an electromagnetic force (voltage). These micro-voltages are an accurate replica of the signal present in the record groove. To be able to utilize such a minute electromagnetic force, a step-up transformer or pre-preamplifier is needed so that the tiny signal can be amplified to the level matching the sensitivity of the phono input stage of the receiver, integrated amplifier or preamp.

In their search for an explanation of the claimed sonic difference between the moving-coil designs and those of the moving-magnet and moving-iron types, Ortofon examined the amplitude and phase response characteristics of moving-coil cartridges ("Phase Testing in Phono Cartridges," *Audio*, March 1983). They found that phase shift occurs when there is a displacement in time between the signal at the input of a device and that signal when it appears at the output of the same device, and that this displacement may change with frequency. From this work, it was concluded that phase shift represents a distortion of the original signal. Ortofon calls this the Ortophase concept and has applied it to the MC 2000 moving-coil phono cartridge design. By optimizing their moving-coil design for both amplitude and phase response, using only a moderate amount of damping, and allowing a slightly rising characteristic (+2 or +3

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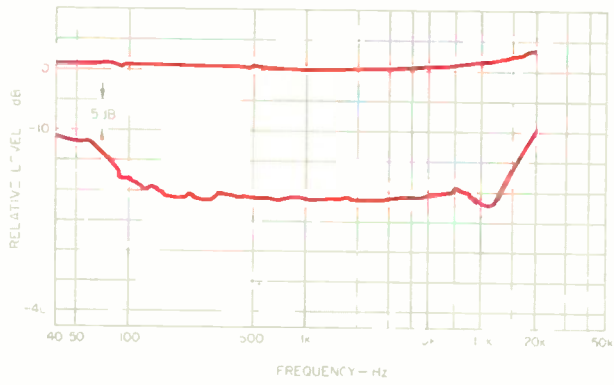

Fig. 1— Frequency response and separation from 40 Hz to 20 kHz using CBS STR-170 test record.

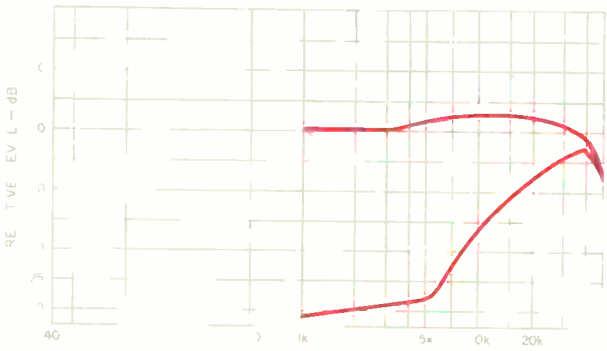

Fig. 2— Frequency response and separation from 1 to 50 kHz using JVC TRS-1005 test record.

dB) in the high-frequency amplitude response, they have improved the phase response characteristics in the audible bands.

Aside from the Ortophase concept, the MC 2000 includes Ortofon's well-known Wide Range Damping (WRD) system. The system comprises, as previously, two pieces of rubber separated by a tiny platinum disc. With the MC 2000's very low equivalent stylus tip mass, it has been possible to incorporate a finer suspension wire and softer rubber compounds for the bearings. These improvements have permitted a higher compliance value than in any previous Ortofon moving-coil cartridge. Further, the rear rubber bearing is asymmetrical, positioning the armature more precisely in the center of the magnetic field when the correct tracking force is applied.

The cartridge body has been milled out of a solid aluminum block, giving the cartridge a large amount of stiffness, resistance to torsion, and insensitivity to resonance so that high frequencies will not be fed back to the cantilever via the arm and headshell in a resonant loop. To further stiffen the cartridge body, the magnetic circuit is mounted to a horizontal bar inside the body. The elements are held together, and the tension of the stylus suspension wire controlled, by a large screw atop the body. A ring, positioned between the screw and the cartridge body, distributes the pressure from the screw over as wide an area as possible. This also contributes to body stiffness which, in turn, is claimed to give the cartridge a neutral and well-defined bass reproduction, as there are no low-frequency resonances present in the cartridge body.

Other improvements include the new Symmetrical Contact Line (SCL) diamond stylus, one of the smallest ever used in a cartridge construction, with its slim profile and wide vertical contact surface. The cantilever is made from hard aluminum. It is extremely light and rigid, has a conical shape, and is 6.15 mm in length. The armature is made from aluminum and shaped as a cross, and the cross has hollow legs to further reduce mass. The coils are made of silver wire, with 24 turns per coil, while the magnet is made of samarium cobalt alloy.

The high compliance of the MC 2000 results in an exceptional tracking ability at low frequencies (greater than 100 microns), while the stylus tip's low equivalent mass allows superior tracking at high frequencies.

The MC 2000 is packaged in an outer cardboard box. Inside this box is a styrofoam packing, in which is housed a beautiful, hinged, plush-lined walnut presentation case with a hinged divider. The top of the divider contains a certificate for the enclosed cartridge, giving its serial number and the exact measured performance for channel separation at 1 kHz and 20 kHz, tracking ability at 315 Hz, and the temperature at which the measurements were made. Next to the certificate is the MC 2000 cartridge, with its removable stylus guard, and a special magnesium headshell that weighs 10 grams. Beneath the hinged divider is a frequency response curve for each channel (but without the separation curves), a screwdriver, a densely bristled stylus brush, a well-designed balance for setting the proper tracking force, and a container with the usual hardware (including four silver-wire interconnects). The manual is included in the outer cardboard box.

The T 2000 moving-coil transformer is also packaged in an outer cardboard box. Inside is a styrofoam container that houses the transformer and a pure silver cable. The T 2000 is designed specifically to match the electrical characteristics of the MC 2000 cartridge. Accordingly, the T 2000 transformer has a high gain (35 dB), which insures accurate and noiseless matching to the 47-kilohm phono inputs of most music systems. The transformer is usable with any moving-coil phono cartridge having an internal impedance in the 2 to 4 ohm range.

The unit consists of two identical, though completely independent, transformers, one for each channel, and each with its own double mu-metal shielding against hum. The two transformers are housed in a heavy metal case, which provides a further shield. The T 2000 uses two mu-metal ring cores, and a new method of winding the coils. The coil windings and wires are of pure silver throughout. The sockets are gold-plated and have been specially designed to give an immedi-

You'd expect the 5.1-Hz arm-cartridge resonance would cause mistracking or distortion. But at no time did I hear any.

ate ground connection to prevent speaker overload during the mounting process. The low-capacitance cable supplied with the T 2000 is made from pure silver and has gold-plated plugs.

Measurements

Where applicable, laboratory measurements of the Ortofon MC 2000 were made using the T 2000 transformer. The frequency response of the transformer was measured and found to be flat from 10 Hz to 100 kHz and −7 dB at 200 kHz.

The Ortofon MC 2000 phono cartridge was mounted in its specially designed magnesium headshell and used with the Technics EPA-A250 (S-shaped) interchangeable tonearm unit attached to the Technics EPA-B500 tonearm base and mounted on a Technics SP-10 MkII turntable. With the weight of the cartridge being 11 grams, and the headshell weighing 10 grams, I was unable to use the combination in any tonearm available to me. To properly balance the tonearm, it was necessary to increase the mass of the counterweight at the end of the tonearm. The MC 2000 was oriented in the headshell and tonearm with the Dennesen Geometric Soundtracktor.

All laboratory tests were conducted at an ambient temperature of 70° F (21.11° C) and a relative humidity of 61%, ±3%. The tracking force for all reported tests was set at 1.5 grams, with an anti-skating force of 1.9 grams. The MC 2000 was connected to the input of the Ortofon T 2000 step-up transformer. As is my practice, measurements were made on both channels, but only the left channel is reported (unless there is a significant difference between the two channels, in which case both channels are reported for a given measurement).

The following test records were used in making the reported measurements: Columbia STR-100, STR-112, and STR-170; Shure TTR-103, TTR-109, TTR-110, TTR-115, and TTR-117; Deutsches HiFi No. 2; DIN 45 549; Nippon Columbia Audio Technical Record (PCM) XL-7004; B & K QR-2010; Ortofon 0002 and 0003, and JVC TRS-1005.

Frequency response and stereo separation were measured from 40 Hz to 50 kHz, using the CBS STR-170 test record for the range from 40 Hz to 20 kHz (Fig. 1) and the JVC TRS-1005 test record for the range from 1 to 50 kHz (Fig. 2).

Using the CBS test record, I measured +3, −0 dB overall from 40 Hz to 20 kHz (+0.66 dB at 40 Hz, +0.33 dB at 100 Hz, +1 dB at 8 kHz, +1.8 dB at 10 kHz, +2 dB at 15 kHz, and +3 dB at 20 kHz). Separation was 22 dB at 1 kHz, 24 dB at 10 kHz, 17 dB at 15 kHz, and 12.5 dB at 20 kHz.

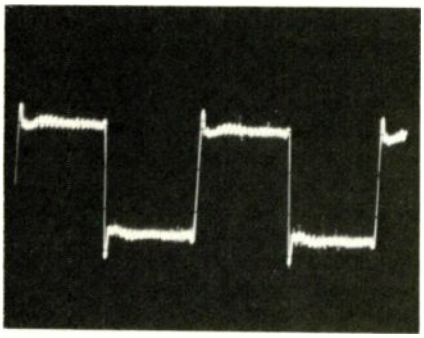

Fig. 3—Square-wave response, 1 kHz.

Using the JVC test record, frequency response was ±0 dB from 1 to 4 kHz, +1.8 dB at 10 and 20 kHz, +1 dB at 30 kHz, −1 dB at 40 kHz, and −9 dB at 50 kHz. Separation was 32 dB at 1 kHz, 20 dB at 10 kHz, 11 dB at 20 kHz, 5 dB at 30 kHz, 1 dB at 40 kHz, and 0 dB at 50 kHz.

The Ortofon MC 2000 is remarkably flat to about 8 kHz, and then it has the response rise beyond 10 kHz that is typical of most moving-coil cartridges. Separation through the same range is excellent. Frequency response and separation beyond 20 kHz are not remarkable, with response at 32 kHz being at 0 dB. The 1-kHz square wave (Fig. 3), using the Columbia STR-112 test record, is one of the flattest I have ever encountered, with minimal overshoot followed by very low-level ringing. From the square wave it is evident that the ultrasonic resonant frequency is at about 36 kHz.

The Technics EPA-A250 tonearm has a built-in anti-resonant device that is absolutely effective. Therefore, to measure the arm-cartidge low-frequency resonance, it is necessary to disable this device. The arm-cartridge low-frequency lateral resonance for either channel measured a surprisingly low 5.1 Hz with a 1.5-dB rise. The vertical resonance was also at 5.1 Hz.

Using the Dynamic Sound Devices DMA-1 Dynamic Mass Analyzer, the arm-cartridge dynamic mass was measured at 31 grams, and the dynamic vertical compliance at 30×10^{-6} cm/dyne at the vertical resonant frequency of 5.1 Hz. The harmonic distortion components of the 1-kHz, 3.54-cm/S rms, 45° velocity signal from the Columbia STR-100 test record are: 1.68% second harmonic and 0.56% third harmonic, with less than 0.28% higher order terms. The vertical stylus angle measured 26° for each channel.

Other measured data are: Wt., 11 g. Opt. tracking force, 1.5 g. Opt. anti-skating force, 2.3 g. Output, 0.92 mV/cm/S with the T 2000 step-up transformer, and 6 μV/cm/S directly from the cartridge across a 3-ohm load. IM distortion (200/4000 Hz, 4-to-1): Lateral (+9 dB), 0.8%; vertical (+6 dB), 4.3%. Crosstalk (using Shure TTR-109): Left, −21.5 dB; right, −25 dB. Channel balance: With transformer, 0.3 dB; direct from cartridge, 0.2 dB. Trackability: High freq. (10.8-kHz, pulsed), 30 cm/S; mid-freq. (1000 and 1500 Hz, lat. cut), 31.5 cm/S; low freq. (400 and 4000 Hz, lat. cut), 24 cm/S. Deutsches HiFi No. 2, 300-Hz test band was tracked cleanly to 114 microns (0.0114 cm) lateral at 21.50 cm/S at +12.10 dB and to 55.4 microns (0.00554 cm) vertical at 10.32 cm/S at +5.86 dB. This is the best trackability I have ever measured at low frequency. It is truly unique for an MC cartridge.

The Ortofon MC 2000 encountered no difficulty in tracking all the test bands on the Shure Era III and Era IV Obstacle Course musical test records as well as level 6 of the Shure Era V trackability disc. It is a rare commercial analog record that has peak recorded velocities exceeding 15 cm/S, and thus the MC 2000 would be able to track any commercially available record, including the audiophile records issued by Sonic Arts, Telarc, Sheffield, Reference Recordings, RCA Point 5, or Mobile Fidelity.

Use and Listening Tests

Listening tests are performed both before and after laboratory measurements. All reported listening tests of the Ortofon MC 2000 were made with

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the Ortofon T 2000 step-up transformer. During the pre-measurement listening period, I was quite impressed with the MC 2000's sonic clarity and transparency of sound, as well as the well-defined and tight bass. However, when the arm-cartridge low-frequency lateral and vertical resonance measured 5.1 Hz, I was wholly surprised and re-checked my test procedure. I finally accepted the 5.1-Hz figure as correct when I got the same result with other test records. That I didn't hear any mistracking or distortion during the pre-test listening period, when the vacuum chuck on the turntable was not used, seemed unbelievable. Further checking, with the arm's anti-resonance device defeated, was no help until I found some badly warped records, and then I finally heard some mistracking and distortion. I've concluded that the Technics EPA-A250 tonearm is so truly excellent that when the super-efficient anti-resonance device is activated, there is no record that it can't play even if the arm-cartridge resonance measures 5.1 Hz. At no time did I encounter any problem with mistracking or distortion during the many additional hours of listening I did with the MC 2000, despite textbook claims that such low resonance would cause these problems. This speaks very well for the Ortofon MC 2000 cartridge and T 2000 transformer.

Warning: The samarium-cobalt magnet in the MC 2000 is one of the most powerful magnets ever used in a moving-coil cartridge. It is absolutely imperative that *no ferrous materials*, such as screwdrivers, platforms for measuring resonant frequency, metal-backed mirrors, etc., be used near the MC 2000. This is particularly true of the small mirrors used to check stylus angle. The cartridge will magnetically snap up such items and, without a question, destroy the cantilever, if not the entire moving-coil assembly.

It has come to my attention that a few improperly cut diamond styli had been polished and set into some MC 2000 phono cartridges. Should any reader find that his stylus has been sheared at the cantilever, he should return it to Ortofon for checking and replacing.

When all the measurements were completed, it was time for a serious and final musical evaluation of the MC 2000. Equipment used in the listening evaluation included the aforementioned Technics tonearm and turntable, an Audio-Technica AT666EX vacuum disc stabilizer, an Amber Model 17FF preamplifier, two VSP Labs Trans-MOS 150 amplifiers (each used in the 300-watt mono mode), speaker and interconnecting cables from Discrete Technology, a pair of B & W 801F loudspeakers, a Technics SL-P10 CD player, and an Electrocompaniet MC-2 pre-preamplifier.

I found no coloration present but did find excellent transient response and applause definition. As I had expected, the MC 2000 reproduced very

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high-velocity cannon shots on a Telarc "1812" (Matrix 11) with no apparent difficulty. Both the human singing voice and the Bösendorfer piano were reproduced realistically. Occasionally, massed violins seemed to be a bit strident, but that could have been the recording I used. Also, there seemed to be some upper midrange thinness, but, again, that could have been my records. Both stereo imaging and depth were truly superb.

It is my practice to try various transformers and pre-preamplifiers with any moving-coil cartridge I evaluate, and the MC 2000 was no exception. (Readers unfamiliar with transformers should be aware that they can all cause hum if not properly oriented.) However, I was at first unable to find either another transformer or a pre-preamplifier that could equal the T 2000 transformer, which was specifically designed for use with the MC 2000. Even my reference pre-preamplifier, the Audio Standards MX-10A, was easily bested. During this period, however, I received for evaluation Electrocompaniet's Model MC-2 pre-preamplifier, a $595 unit with 40 dB of gain. I tried the combination and found the MC-2 to be wholly superior to the T 2000, having improved the sonic quality of the music beyond belief. Subtle musical nuances were suddenly heard quite clearly. It became quite evident that the Ortofon MC 2000 coupled with the Electrocompaniet MC-2 would be hard to surpass.

During my listening evaluation, I also compared the phonograph record and CD versions of a digitally mastered recording. The music included "Wellington's Victory, Op. 91" by Beethoven and Liszt's "Battle of the Huns" and "Hungarian March to the Assault" (Cincinnati Symphony Orchestra, Kunzel, Telarc DG-10079 on LP and CD-80079 on Compact Disc). Although the MC 2000 reproduced the digital-analog recording very accurately, I feel that the sound of the high-energy cymbals and of the great organ chords was not equal to that present on the Compact Disc.

Some of the other "super" recordings I used in evaluating the Ortofon MC 2000 were: *Recital*, Welch, organist (Wilson Audio W-278); Sutherland, Horne, Pavarotti, *Live from Lincoln Center* (NYC Opera Orchestra, Bonynge, London LDR 72009); *Reiner Conducts Wagner* (RCA Red Seal Point 5 ARP1-4738); *76 Pieces of Explosive Percussion* (Sonic Arts Symphonic Percussion Consortium, Sonic Arts Laboratory Series LS11); *James Newton Howard Quintet* (Sheffield Lab 23), and *The Tony Bennett/Bill Evans Album* (Mobile Fidelity MFSL 1-117).

Without a doubt, the Ortofon MC 2000 will elevate anyone's music system by at least an order of magnitude. Never before have I had, or heard, a moving-coil cartridge that reproduces recorded music so realistically, from the finest nuances to the blockbusters present in many music scores.

B. V. Pisha

"The construction of the GFP-1A is, to put it mildly, robust...The cabinet and chassis are made of steel... everything is on a single large circuit board, with an open, uncluttered parts layout and a minimum of point-to-point wiring. All of this indicates probable long-term reliability. Both on the test bench and as part of a hi-fi system, the Adcom GFP-1A left nothing to be desired. It has all the flexibility one could ever want combined with smooth, silent and bug-free operation. An excellent preamplifier at a very reasonable price."

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"The GFP-1A gives us just about everything—in features, technology, and performance—that we've ever really wanted in a preamplifier. That response and distortion measurements are beyond reproach goes without saying... and the feel and appearance of the controls further inspire confidence. Had we not been delighted by what we heard through the GFP-1A, we would have been astonished. But the only real surprise was the price...which was modest relative to some of the high-tech preamplifiers to which its performance invites comparison."

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