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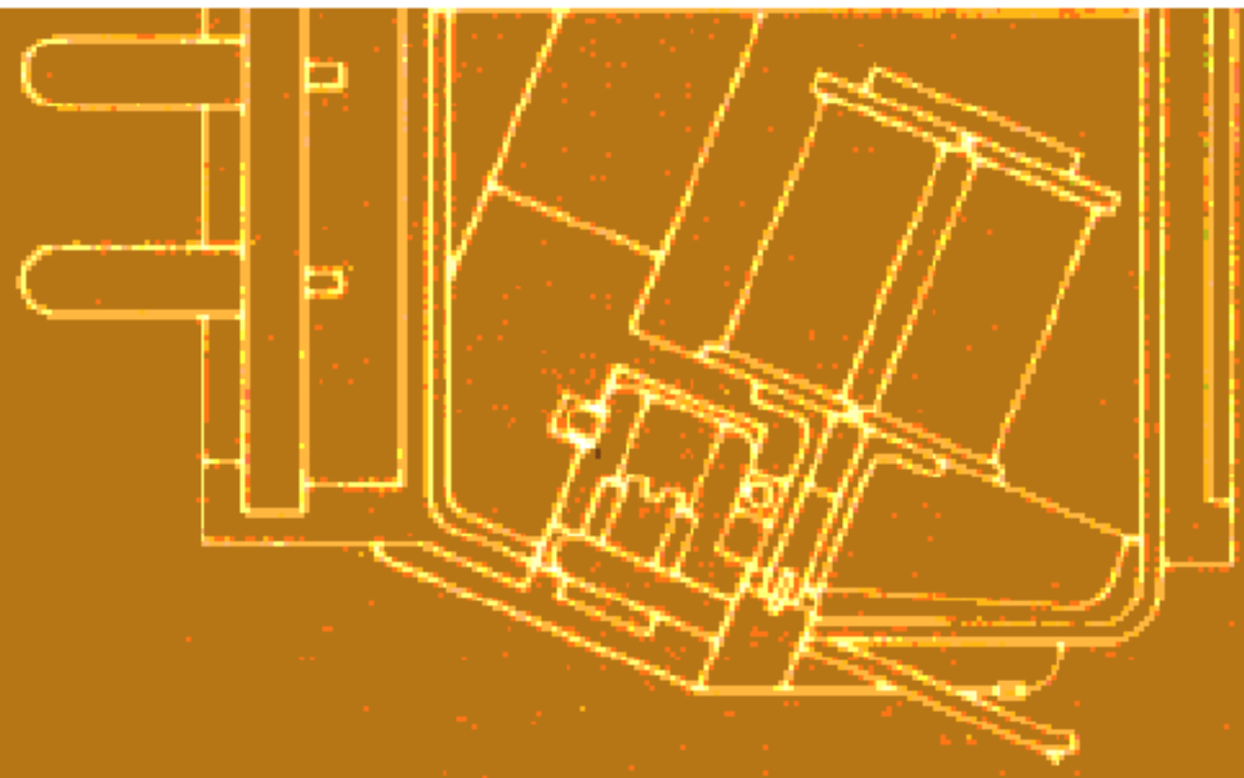


audio-technica®

DUAL MAGNET™ PHONOGRAPH CARTRIDGES

OWNER'S MANUAL

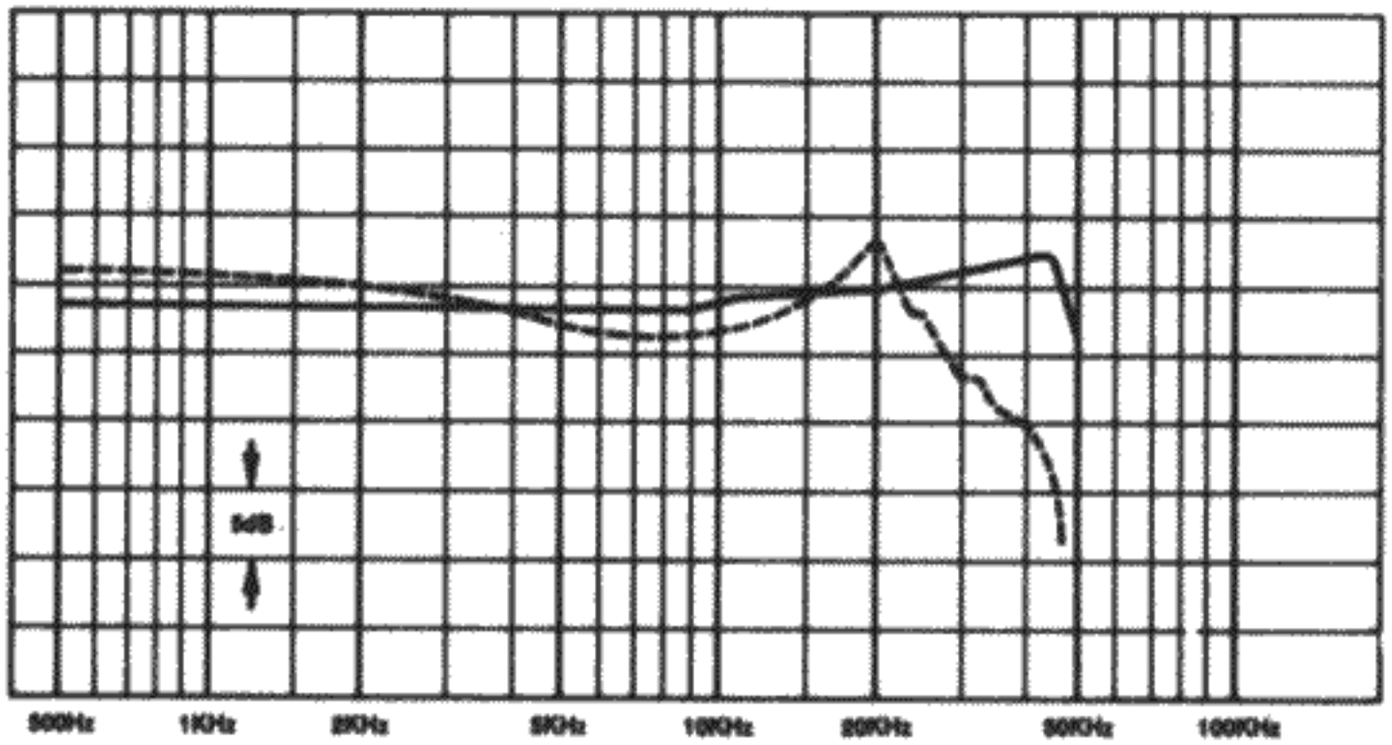
The information in this booklet is intended to aid you in gaining the best performance from your cartridge, along with providing technical information which may interest you. Above all, we hope that your Audio-Technica cartridge enhances your system's performance and brings you increased musical appreciation and involvement.

INTRODUCTION

Your new Audio-Technica cartridge is a significant achievement in precision manufacturing. Completely hand assembled, tolerances are held to just thousandths of an inch. Audio-Technica has specialized in precision transducers for over a decade, building an international reputation for accuracy and uniformity. The Dual Magnet Series of phono cartridges is the latest refinement of this tradition of craftsmanship and advanced design.

Throughout the series, performance advantages over existing cartridges abound. A complete rethinking of basic cartridge principles has produced a group of product improvements—some subtle, some bold advances—unique in the high fidelity industry. Detailed discussion of these product improvements is found further along in this booklet.

Foremost among performance improvements found in the Audio-Technica cartridge is frequency response. Figure 1 indicates typical frequency response of the AT15Sa Dual Magnet cartridge. Also shown is the actual response curve of a high priced, highly regarded cartridge. Note the substantial peak at about 20,000 Hz in the high priced



—— AT15Sa Response

---- High-priced single-magnet cartridge response

Fig. 1

cartridge, followed by a rapid drop-off in high frequency response — a characteristic which has become widely accepted as part of conventional magnetic cartridge performance. Compare the actual response curve of the AT15Sa, which exhibits a flatness and smoothness of response more like that of a good amplifier . . . a flatness and smoothness typical of all Audio-Technica dual magnet cartridges. The sound which results from such a smooth curve is natural and uncolored, without the high frequency harshness which results from peaky response. A major side benefit of smooth high frequency performance is decreased groove wear.

PRELIMINARY INSTALLATION

Before mounting the cartridge, the stylus assembly should be removed for safekeeping. Hold the cartridge in one hand, grasp the plastic needle housing with thumb and forefinger, and pull directly away from the cartridge. The stylus assembly comes away at a slight rearward angle, as indicated by the arrow in Figure 2. Place the stylus assembly out of harm's way until installation is completed.

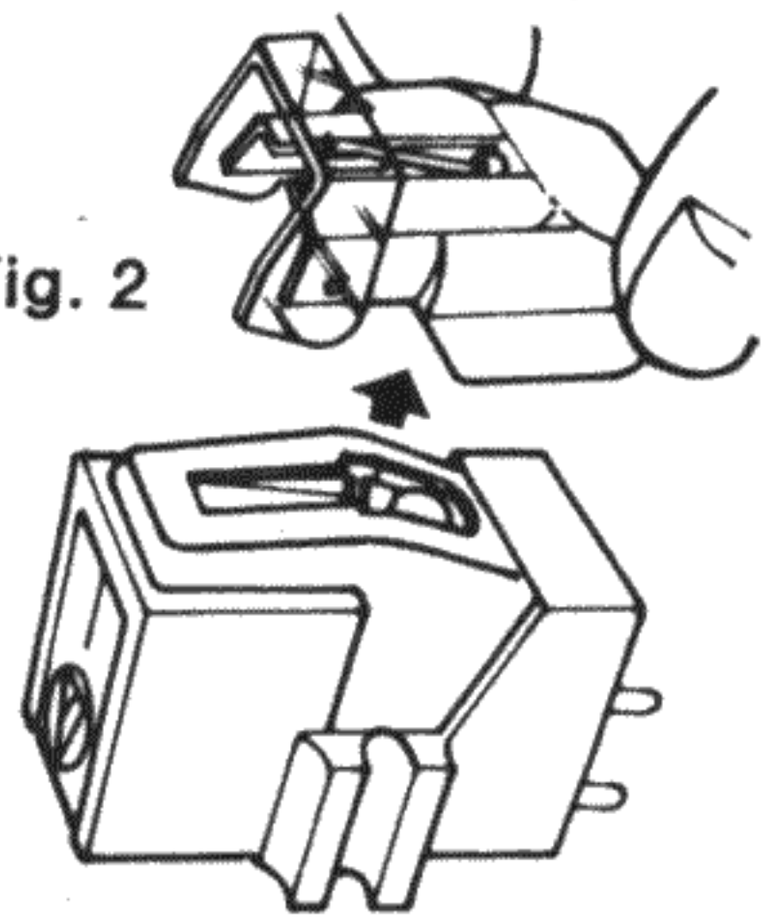


Fig. 2

Using the mounting hardware supplied either with the cartridge or with the turntable, mount the cartridge according to the recommendations of the turntable manufacturer. Hardware should be tightened down slightly, so that the cartridge position does not change, but avoid excessive force which may strip plastic threads or warp delicate parts out of position. After the cartridge is mounted, replace the stylus assembly briefly. The stylus assembly should click into place when fully seated on the

cartridge. Check visually to make sure that there is no mechanical interference with mounting hardware. Again remove the stylus assembly for safekeeping until electrical connections are completed.

ELECTRICAL CONNECTIONS

Four terminals are provided at the rear of the cartridge—an output and ground connection for each stereo channel. For proper performance of your system, the correct wiring must be carried through to the amplifier inputs. Connect the turntable wiring to the cartridge, observing the lead designation furnished with the turntable. The cartridge pins are color coded, using a well-established standard in the turntable industry. DO NOT SOLDER TO THE CARTRIDGE TERMINALS. USE SLIP-ON LUGS TO WHICH TONE ARM WIRES HAVE BEEN SOLDERED BEFORE PLACING ON CARTRIDGE TERMINALS. Heat applied directly to the cartridge terminals will damage the internal cartridge connections.

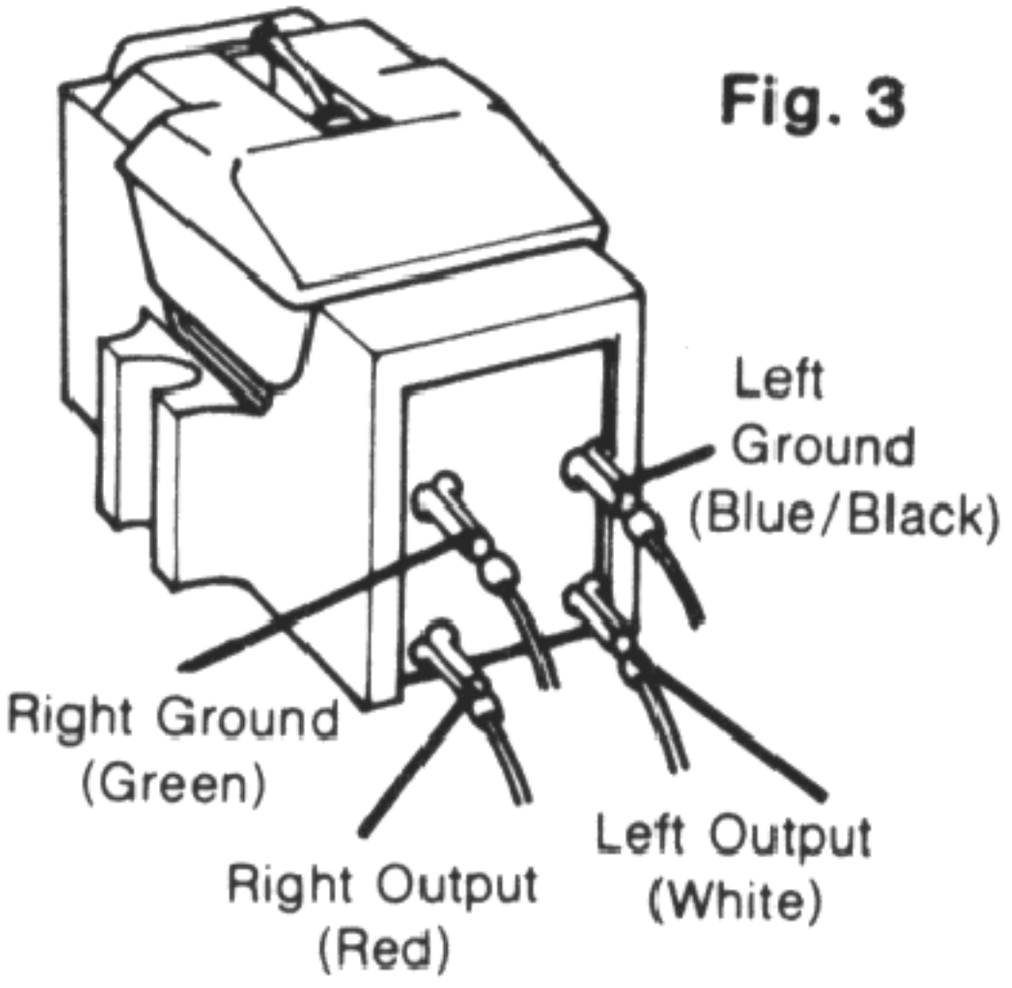


Fig. 3

For monaural operation, the left and right signal terminals should be connected to the monaural signal lead, and the left and right ground terminals should be connected to the ground lead. With these connections, vertical output from the cartridge is cancelled, thus reducing record noise which is primarily in the vertical direction.

FINAL INSTALLATION

Re-install stylus assembly. Following the procedure recommended

by the turntable or tone arm manufacturer, carefully set tracking force within the range shown for your cartridge in the appropriate specifications table. This is a critical adjustment, since tracking force higher or lower than recommended will result in increased distortion and decreased record life. Similarly, the tone arm's adjustments, if any, for stylus overhang and anti-skating must be set properly if maximum benefit is to be obtained from your cartridge. Anti-skate setting for Shibata models should be 1.2 times standard elliptical value, or as indicated on your turntable.

After all tone arm adjustments have been made, the stylus may remain installed in the cartridge. However, the plastic stylus guard should be used to protect against accidental damage, as at any time when the turntable is not in use.

CONNECTION TO SYSTEM

Once the cartridge is properly installed in the tone arm, the turntable may be connected to the rest of the music system. Normally, two shielded audio cables are run from the cartridge connections on the bottom of the turntable to the magnetic phono inputs on the amplifier or receiver, or to the inputs of a separate CD-4 adapter. Make sure to observe left and right channel markings.

To assure maximum performance, the lowest possible connecting cable losses between turntable and amplifier are required. Very short conventional cables may be used. The best choice is Audio-Technica's AT610 Low Capacity Phono Cable, constructed of special foam-dielectric wire.

In addition, a separate ground wire is required between the chassis of the turntable and the electronics chassis to prevent hum. Usually this ground wire comes attached to the turntable, ready to connect to a ground screw on the connection panel of most electronics.

One of the most common problems encountered in system hookup is hum from the phonograph input. Usually this can be traced to a bad audio cable connecting the turntable to the amplifier, or the absence of the separate ground wire mentioned above. The instructions furnished with most turntables cover the method of connection in detail.

Another problem sometimes encountered during initial system set-up is distorted or unbalanced sound from the two phono channels. Usually this can be traced to a mix-up of wires in the turntable. Wires at the cartridge terminals might be interchanged, or slightly touching together. Be certain the cartridge wiring is exactly as shown in the connection drawing, Figure 3.

OPERATING SUGGESTIONS

The extremely low tracking force and high compliance of Audio-Technica cartridges provide the highest levels of performance available, but also make them susceptible to damage if handled improperly. If a few simple cautions are observed, your cartridge will provide excellent service for many years.

Most stylus damage is caused by rough treatment while the tone arm is being operated by hand. A finger used to lift or set down the tone arm should always be placed **under** the tone arm finger lift, never over it. This prevents pressing down on the tone arm, which is likely to put excessive force on the stylus assembly.

The stylus should be set gently on the record, never dropped. A damped cueing device which lowers the tone arm gently to the record is found on many record changers. Model AT6005 Pneumatic Lift is also available from your dealer separately as an accessory.

(Continued on Page 8)

SPECIFICATIONS

Model	AT11E	AT12E	AT12XE	AT12Sa	AT13Ea	AT14Sa	AT15XE	AT15Sa	AT20SLa
Generating Element	Dual Moving Magnet								
Frequency Response (Hz)	15-25,000	15-26,000	15-28,000	15-45,000	10-30,000	5-45,000	5-30,000	5-45,000	5-50,000
Output (mV at 5 cm/sec)	4.8	4.2	4.2	2.7	4.2	2.7	2.7	2.7	2.7
Channel Separation (dB 1 kHz/10 kHz)	21/16	23/17	24/18	26/20	25/20	27/20	28/23	30/23	30/25
Channel Balance (dB)	1.5	1.5	1.5	1.0	1.0	1.0	0.75	0.75	0.75
Stylus Shape	.4 x .7 Elliptical	.4 x .7 Elliptical	.3 x .7 Elliptical	Shibata	.2 x .7 Elliptical	Shibata	.2 x .7 Elliptical	Shibata	Shibata
Stylus Construction	Bonded	Bonded	Nude	Bonded	Nude ◊	Nude ◊	Nude ◊	Nude ◊	Nude ◊
Cantilever	Thin Wall	Thin Wall	Thin Wall	Tapered	Tapered	Tapered	Tapered	Tapered	Tapered
Tracking Force (grams)	1½-2½	1-2	1-1¾	¾-1¾	¾-1¾	¾-1¾	¾-1¾	¾-1¾	¾-1¾
Vertical Tracking Angle†	20°	20°	20°	20°	20°	20°	20°	20°	20°
Recommended Load Impedance (Ohms)	47,000	47,000	47,000	47,000**	47,000	47,000**	47,000	47,000**	47,000**
Cartridge Inductance (mH)	670	670	670	370	670	370	370	370	370
DC Resistance (Ohms)	1200	1200	1200	500	1200	500	500	500	500
Terminals (Dia.)	.050"	.050"	.050"	.050"	.050"	.050"	.050"	.050"	.050"
Cartridge Weight (grams)	5.5	5.5	5.5	5.5	5.8	5.8	8.0	8.0	8.0
Dimensions	5/8" x 19/64" x 11/16"				11/16" x 13/16" x 11/16"		5/8" x 13/16" x 25/32"		
Mounting	½-inch centers								
Replacement Stylus	ATS11E	ATS12	ATN12XE	ATN12S	ATN13	ATN14	ATN15XE	ATN15	ATN20
Stylus Assembly Color	Green	Blue	Caramel	Ivory	Orange	Burgundy	Black	Black	Black

*Recommended tone arm adjustment. Because a Shibata stylus contacts the groove over a larger area, actual groove pressure for Shibata models is comparable to much lower tracking force with other styli.

**Standard for stereo units. Also operates correctly with 100,000 ohm inputs of CD-4 equipment. †20° is new IEC/DIN standard. ◊Square shank for precision indexing.

Use of such a device adds an extra measure of safety for your cartridge and records.

Another common cause of stylus damage occurs when cleaning or dusting the turntable area. Keep the plastic stylus guard in place when not using the turntable. The dust covers made for most turntables represent a good investment not only in keeping the turntable clean, but in preventing this kind of stylus damage.

Another practice common with stiffer and therefore more rugged low-performance cartridges is cleaning the stylus with a finger. While this practice may be safe enough with low performance cartridges, it may well spell disaster to a delicate, high performance stylus. The stylus should be cleaned with the stylus cleaning brush supplied with the cartridge. The stylus should be cleaned with a **rear to front motion** of the brush, never front to rear and never side to side. Best results can be obtained with regular use of the AT607 Stylus Cleaner, available from your dealer.

An accumulation of dirt on the stylus indicates that the records themselves are dirty, a condition which will shorten record life and reduce the potential performance of your cartridge. Keep records stored vertically in their jackets except when being played, and clean each side of the record just before it is played.

You'll be amazed at how much better a clean record sounds, and how much longer it lasts. This is especially important with CD-4 records. Your dealer offers several Audio-Technica record care products. Used regularly, any of them will insure more musical pleasure from every record you own.

PRINCIPLES OF OPERATION

A primary reason for the outstanding performance of Audio-

Technica Dual Magnet cartridges is their unique method of translating the motion of the stylus tip into two electrical signals. Unlike all other stereo cartridges, Audio-Technica models employ two independent permanent magnets mounted at 45 degree angles, perpendicular to the two sides of the record groove. With its associated pole pieces and electrical coils, each magnet becomes an electrical generator reproducing only the signal from one side of the record groove, maximizing stereo separation.

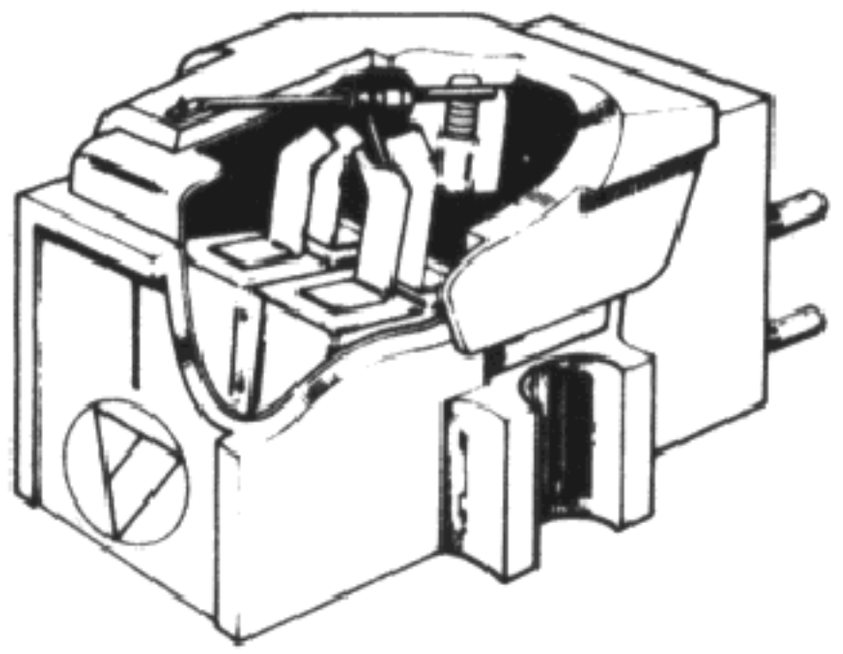


Fig. 4

When only one channel is reproduced, only the magnet for that channel must be displaced by the stylus. Because each magnet in the Dual Magnet design is smaller than that of a conventional single magnet cartridge, the effective mass moved by each groove wall is significantly reduced. The magnets, which are still the heaviest part of the moving system, are mounted near the fulcrum or pivot point of the stylus assembly. As a result of these design features, the stylus is not required to move excessive mass, and is free to respond quickly and accurately to the motion of the record groove. In addition to enhancing response, the extremely low effective tip mass reduces the force applied to the delicate vinyl groove and reduces the possibility of groove wall wear and damage.

The cantilever which positions the stylus tip and transmits its motion to the magnets is selected for rigidity and low mass. Models AT11E and AT12E employ a tube of cylindrical cross-section with a wall thickness less than 0.002 inches. The AT13Ea and Shibata models employ a tapered tube which narrows substantially as the stylus is approached. Tracking ability is improved significantly because the tube taper reduces the amount of mass at the stylus end of the tube.

Models AT15Sa and AT20SLa are assembled in a precision case die-cast from a low-mass high-strength metal alloy. This rigid foundation maintains accurate alignment of internal parts, positions the cartridge properly in the tone arm, and thus assures continued fine performance for maximum listening pleasure over the years.

Model AT20SLa cartridges are identical to the AT15Sa in construction and operation. However, they are individually hand-selected for all parameters, including flattest possible response to 50,000 Hz. The limited quantity of cartridges thus obtained represent "the best of the best."

TYPES OF STYLI

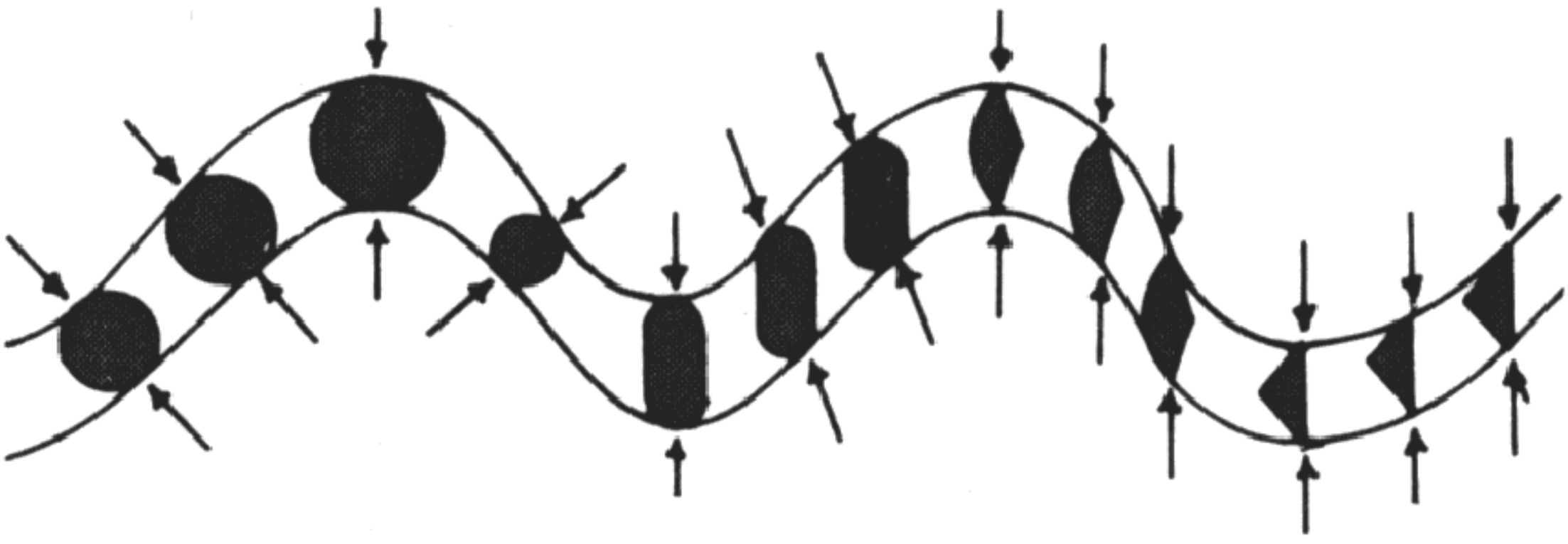
Cartridge styli are of 3 general types—spherical, elliptical and Shibata. While the cone-shaped stylus with a spherical (rounded) tip has long been a standard, Figure 5 shows why more sophisticated styli are now preferred.

As the cutting stylus cuts the original master record, it swings perpendicular to the direction of the record running underneath it (Fig. 5d). During playback with a spherical stylus however, the angle of stylus contact with the groove is constantly changing (Fig. 5a). Thus the cartridge output is not exactly the same as the signal input to the cutter head on the master record.

For this reason the elliptical stylus was developed. With a smaller radius on the sides than on the front of the stylus, the tip more closely matches the original cutting stylus shape (Fig. 5b) providing more accurate tracing of very small (high frequency) groove modulations. However, the smaller effective tip radius requires lower stylus force to avoid excessive wear of both stylus and record. Models AT11E and AT12E have a .4 x .7-mil tip, while Model AT13Ea has a .2 x .7-mil tip to more effectively trace the highest audio frequencies.

The patented Shibata stylus originally was developed to meet the reduced wear and extended frequency response requirements of discrete 4-channel records. Its benefits, however, accrue to all records. The shape of the Shibata stylus (Fig. 5c) is complex, requiring the most sophisticated diamond-shaping equipment and production tolerances expressed in microns (about 4-millionths of an inch). As viewed from the front (6b and 6c), the Shibata stylus contacts the record groove wall with a radius 4 times that of typical elliptical styli, providing a greater **vertical** contact with the record groove. With this "line" contact rather than a "point" contact, tracking force is spread over a greater area. Actual **pressure** on the record is reduced, permitting the small side radius to ride "on top" of the vinyl surface for more accurate groove tracing and less chance of damage. As a result, the Shibata stylus greatly extends and smooths high frequency response, reduces distortion and lengthens the life of **all** records — mono, stereo, and four-channel.

Figure 5. Groove/Stylus Relationships



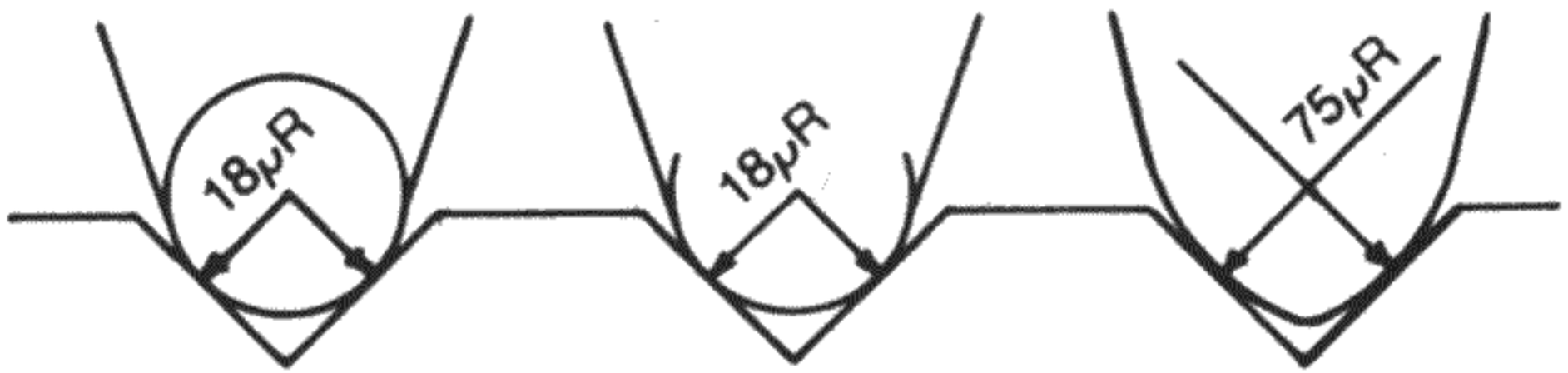
a. Spherical Stylus

b. Elliptical Stylus

c. Shibata Stylus

d. Cutting Stylus

Figure 6. Front View of Styli



a.	b.	c.
.7 mil Spherical	.2 x .7 mil Elliptical	Shibata

REPLACEMENT STYLI

Audio-Technica grain-oriented diamond styli are carefully selected and polished for minimum wear to themselves and to your records. However, after an extended period of play, even the finest diamond stylus becomes worn. For this reason, it is best to have the stylus inspected annually, or whenever it appears that wear or damage may be a problem. The dealer from whom you purchased this cartridge is equipped and competent to inspect and evaluate the stylus.

Should a replacement stylus be required, accept only a genuine Audio-Technica replacement stylus with the same circle monogram as on your original stylus assembly. Only genuine Audio-Technica styli will provide the same level of performance found in the original cartridge stylus.

Audio-Technica Dual Magnet™ cartridges
are protected by the following patents:
United States Nos. 3,720,796 and 3,761,647;
Canada Nos. 856,351 and 909,683;
England Nos. 1,232,210 and 1,283,404;
Switzerland Nos. 478,502 and 505,437;
West Germany Nos. 1,772,685 and 1,941,569;
France No. 6,928,056; Sweden No. 347,636.
Shibata Stylus U. S. Pat. No. 3,774,918.

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