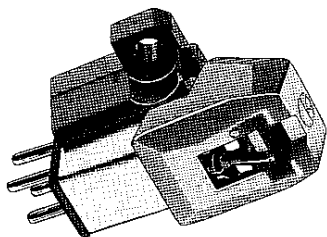


date: mid-late 1990s



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## Audiophile Systems, Ltd. Product Data Sheet

# Linn Moving Magnet Cartridges

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The K5, and metal-bodied K9 and K18  
cartridges from Linn Products, Ltd.

There is much misinformation and old wives' tales about cartridge design. These range from legends about wizards that hand make one cartridge a month to fables about the magical properties of exotic cantilevers.

These stories all have one thing in common. They ignore the fact that cartridge design requires good solid engineering, both electrical and mechanical. An advertising department has never produced a good cartridge design!

### Background

A moving-magnet cartridge is an electrical generator. The modulations in the record groove drive the stylus, which is

attached to the end of the cantilever. At the other end of the cantilever are two very small magnets. Ideally, every movement at the stylus results in a corresponding movement of the magnets. Adjacent to the magnets are two wire coils.

*It is the **relative** movement between the moving magnets and the fixed coils that generates an electrical signal.*

While the stylus, cantilever and magnets must move freely in response to the modulations in the record groove, the cartridge body and coils must remain in a fixed position over the groove.

**Any** unwanted movement in the cartridge body or coils will interfere with their ability to "see"

## Linn Magnetic Cartridges page2

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*"The K5 demonstrated itself capable of fast, involving sound... Bass quality, often a weakness with low cost cartridges, was less wooly than usual and gave a strong impression of pitch and timing." -- Hi Fi Answers*

*"Bass lines also filled out and notes flowed to provide a sense of continuous direction to the rhythmic underpinning of songs. ...the K5 brought a welcome fullness and integration to the sound that encouraged me to sit back and enjoy the development of each piece..." -- Hi Fi Review*

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the minute movements of the magnets. In short, musical information will be lost.

The very high levels of energy being generated at the stylus tip complicate the task of holding the cartridge in a fixed relative position.

To overcome this problem we must rely on the mechanical integrity of the cartridge body itself.

The cartridge must be constructed in a manner that insures that all stationary internal parts are firmly fixed to a very rigid cartridge body.

The body must be strong enough to allow it to be very tightly attached to the headshell of the tonearm. This will, in effect, increase the mass of the cartridge by coupling it to the tonearm. If a reasonably rigid arm is used, the cartridge will actually be coupled to the entire mass of the turntable! This will greatly improve the cartridge's ability to resist unwanted movement and increases the amount of information that can be retrieved from the record.

### Linn Cartridge Bodies

In even the least expensive Linn cartridge, the K5, much attention is paid to the mechanical integrity of the body, which is fabricated from a special ultra-hard plastic.

The removable stylus assembly has an unusually snug fit, and is manufactured from the same material as the body.

The cartridge mounting holes are located in a large block of solid material. This is in sharp contrast to the open-ended mounting ears on many

cartridges that make proper mounting impossible.

Continuing through the line of Linn moving-magnet cartridges, the construction of the body becomes even more robust. The K9 and K18 represent the best of the Linn moving-magnet line and feature bodies machined from aluminum alloy.

On the K18 the removable stylus assembly is actually bolted to the body to provide the tightest coupling possible.

### Tracking Force

Once the problem of the mechanical integrity of the body has been solved, other problems begin to surface. How, for instance, do you keep the stylus in firm contact with the groove walls? Mistracking will not only result in the loss of musical information, but will cause physical damage to the record.

For this reason, Linn ignored the search for unrealistically low tracking weights that look good in print but inevitably lead to serious mistracking problems.

Instead they concentrated on engineering their cartridges so that, when mounted in a proper tonearm, the stylus would remain in firm contact with the groove.

Fundamental to this was selecting a tracking weight sufficiently high to force the stylus into constant contact with the groove walls. While this results in more pressure at the point of contact, it does prevent the stylus from bouncing around in the groove and reduces record wear.

### The Stylus

The quality of the stylus also

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*"The K9 offers the same basic competent performance as a Basik but with far more detail, articulation, smoothness and surefooted tracking."*

*-- The Flat Response*

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affects contact with the groove and the recovery of musical information.

The diamond styli in all Linn cartridges are carefully selected and precision polished to tight tolerances; the size and shape of the diamond is chosen for optimum balance between mass and longevity. (A small diamond can move faster, but it wears out more quickly.) The stylus is then aligned accurately on the cantilever for the smoothest, slowest wear pattern.

To eliminate any scope for loss of information attributable to movement at the joint between the stylus and cantilever, the stylus must be very securely attached to the cantilever. In the case of the K5 this is accomplished with sophisticated adhesives. In the K9 and K18, in addition to adhesives, the stylus is actually pressed through the cantilever, forming a compression fit and providing an exceptionally strong mechanical connection.

### The Cantilever

The cantilevers on all Linn cartridges are formed from high strength aluminum alloys.

The temptation to use gemstone or exotic metal cantilevers (ruby, diamond, boron, beryllium, etc.) on the more expensive Linn cartridges has been avoided because of inescapable problems of stylus attachment.

While these materials make good advertising copy, they are too brittle to allow a compression fit of the stylus. Alternate methods of attachment, while acceptable on moderately priced cartridges, would not be suitable for use on

the K9 and K18 and would certainly compromise the mechanical integrity of the cartridge.

### Listening Tests

The proof of any cartridge design is in the listening. We are confident that any Linn cartridge will, in listening tests, outperform the competition.

Partially responsible for this is Linn's expertise in mechanical, electrical, and materials engineering. Through years of painstaking research Linn engineers have built up a vast storehouse of knowledge on the design and manufacture of audio components.

Equally as responsible, however, is Linn's reliance on the listening test during product development. To put it bluntly, no matter how clever the idea, ***if it doesn't sound better, then it isn't better.***

Every product that leaves the Linn factory must ultimately pass that listening test.

### Cartridge Care

The performance of any cartridge will be limited by its physical condition. The following suggestions will help you get the most from your cartridge:

We recommend that you allow your Linn dealer to install the cartridge. However, should a situation arise that requires you to mount the cartridge, ***fasten the cartridge as tightly as possible to the headshell.***

Two caveats here -- when tightening the cartridge in the headshell, stop short of deforming either the cartridge body or the headshell itself.

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*"The K9 was remarkably neutral and clean... Of all the moving-magnets in the batch, this one had the lowest tracing noise...on par with the moving coils."*

*-- Stereophile*

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Linn Magnetic  
Cartridges page 4

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*"[The K18] is the first cartridge to feature a stylus assembly that actually bolts into place. This unique measure is taken to ensure that the bond between the cartridge body and the stylus assembly has the very highest mechanical integrity whilst still allowing the user to change the stylus easily."*  
-- Hi Fi Review

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And, if your headshell is not detachable, always remove the arm from the turntable when mounting the cartridge. The amount of torque applied when properly tightening the cartridge, magnified by the lever of the arm tube, can easily damage the delicate arm bearings unless the base of the arm can move freely.

*Keep your stylus clean.* The stylus does an unusually good job of cleaning your records. Unfortunately, the build up of debris on the tip of the stylus is very difficult to remove. A special, very fine abrasive is available from your Linn dealer for this purpose.

**Never use liquids to clean the stylus.** They will be drawn into the cartridge by capillary action and may cause damage to the cartridge.

**THE LINN K5**

Introduced during the summer of 1988, this new cartridge from Linn builds upon the framework set down with Linn's earlier *Basik* cartridge, which one reviewer called "...one of the very finest moving-magnets available."

The body has been upgraded by the use of a much tougher plastic, and the *Basik's* conical

stylus has been replaced with an elliptical diamond.

Additional improvements include the use of the coils, wire and shielding of the more expensive Linn K9 cartridge.

**THE LINN K9**

This, the first of Linn's metal-bodied moving-magnets, borrows heavily from research done on Linn's moving-coil cartridges.

Its metal body provides significant advantages in terms of mechanical integrity over other, similarly priced cartridges, resulting in the K9 consistently being rated a "Best Buy".

**THE LINN K18**

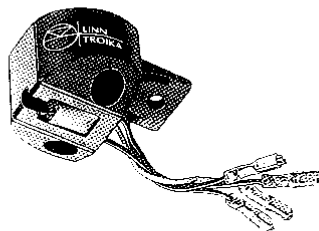
This, the newest cartridge from Linn, represents an all-out effort to obtain the best possible performance from the moving-magnet configuration.

In addition to a metal body, the K18 features a unique, bolt-on stylus assembly that provides a mechanical connection second only to fixed-styli moving-coils.

The coils are of the highest quality PCOCC (continuous cast copper) and the connector pins are gold plated PCOCC.

	<b>K5</b>	<b>K9</b>	<b>K18</b>
<b>Body Construction</b>	Ultra-Hard Plastic	Aluminum Alloy	Aluminum Alloy
<b>Stylus</b>	Elliptical	Vital	Vital/Bolt-on
<b>Cantilever</b>	Straight Aluminum	Straight Aluminum	Tapered Aluminum
<b>Coil Wire</b>	Copper	Copper	PCOCC
<b>Weight</b>	5.8 grams	7.2 grams	7.7 grams
<b>Tracking Force</b>	1.7 grams	1.7 grams	1.7 grams
<b>Frequency Response</b>	20Hz-20kHz±2dB	20Hz-20kHz±2dB	20Hz-20kHz±2dB
<b>Channel Balance</b>	1.5dB at 1kHz	1dB at 1kHz	1dB at 1kHz
<b>Separation at 1kHz</b>	Better than 20dB	Better than 20dB	Better than 20dB
<b>Output at 5cm/sec at 1kHz</b>	4.5mv	4.5mv	4.5mv
<b>Recommended Load</b>	47kOhms 100-300pF	47kOhms 100-300pF	47kOhms 100-300pf

## Audiophile Systems, Ltd. Product Data Sheet



Date: mid-late 90s

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# Linn Moving Coil Cartridges

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The Asaka, Karma, and Troika moving-coil cartridges from Linn Products, Ltd.

Moving-coil cartridges offer significant performance advantages over the more conventional moving-magnet designs. Most of these advantages are derived from the fact that a moving-coil cartridge is a much more linear device. That is, the electrical output of the cartridge more closely follows the mechanical input.

A key reason for this is the relationship between the coils and the magnets. In a conventional moving-magnet design, because the magnets must be able to move rapidly, they are very small. Due to their size, these magnets produce a relatively weak magnetic field that diminishes rapidly as the distance from the magnet increases.

Because of this, the fixed coils surrounding the magnet are not in a uniform magnetic field. (The part of the coil closest to the magnet is in a stronger area of the field than the rest of the coil.)

The non-uniformity of this field is responsible for some of the distortion products in the output of a moving-magnet cartridge.

### **Moving-Coil Cartridges**

In a moving-coil cartridge the magnets are in a fixed position. Since they are not required to move (and in fact, must not move) they can be quite large. The field produced by these magnets is reasonably strong and the distance from the moving-coil to the magnet is

## Linn Moving Coil Cartridges page 2

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*"...I was very impressed with the sound of [the Asaka]. It had sweet, detailed treble lacking the spittiness of other tip shapes, like van den Hul. I also noted a heightened sense of dynamic range through a lowered noise floor, which revealed fine detail, ambience and decays that had not been previously revealed. This is quite a spectacular cartridge to listen to and demonstrates just how much there is on a vinyl LP, if only it can be recovered."*

*-- New Hi-Fi Sound*

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very small (relative to the strength of the magnet). Thus, throughout its range of movement, the coil is in a very uniform area of the magnetic field. This results in a much more linear output signal.

Of course there is a price to pay for this superior performance. Because it is now the coil that must move, the coil must be kept as small as possible. And to insure a linear output, the windings on the coil must be as uniform as possible. This requires a coil that is tediously hand wound under a microscope.

The small size of the coil also results in a very low output signal and does require the use of an amplifier with a phono input designed to properly handle that signal. (While some attempts have been made to use larger coils and thus produce a stronger signal, the extra mass of the coil generally proves to be a limiting factor in the performance of the cartridge.)

### Recovering Information from the Record

The mechanics of recovering information from the record with a moving-coil cartridge are very similar to that of a moving-magnet design. This subject is covered in detail in the *Background* section of the *Linn Moving-Magnet Cartridges* data sheet. When reading it just keep in mind that, in the case of a moving-coil cartridge, it is the magnet that is held in a fixed position relative to the record and the coil that is attached to the end of the cantilever (and allowed to move in response to the musical signal).

The problems discussed in the

moving-magnet data sheet become even more critical when applied to moving-coil cartridges. While a moving-coil cartridge's low compliance (stiffer suspension) does offer some mechanical benefits in terms of recovering musical information from the record, it also results in more energy being transferred into the body of the cartridge.

This makes the mechanical integrity of a moving-coil cartridge an extremely important factor in its ultimate performance. It is critical that the cartridge be constructed in a manner that insures that all stationary internal parts are firmly fixed to a very rigid cartridge body. And, the body must be strong enough to allow it to be very tightly attached to the headshell of the tonearm.

### Linn Cartridge Bodies

All Linn moving-coil cartridges (and even some of their moving-magnet models!) employ metal bodies. The bodies are milled from *solid* high-strength aluminum alloys.

A metal body not only provides for a more secure attachment to the tonearm headshell, it allows the cartridge magnet assembly to be bonded to the body with an aluminum based aircraft adhesive. This added mechanical integrity has led to a dramatic improvement over earlier moving-coil designs.

### Tracking Force

Linn has ignored the search for unrealistically low tracking weights that look good in print but inevitably lead to serious mis-tracking problems, record damage, and the loss of musical information.

## Linn Moving Coil Cartridges page 3

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*"...almost without realizing it, one becomes conscious of things about and within the music which had escaped attention before. ...analogue audio has been advanced by another significant step. The Karma does what all hi-fi is about: it brings one closer to the music."*

*--Hi-Fi Answers*

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*"...certainly with the Troika, Linn has again managed to produce a world-beating cartridge... the complete 1987 Linn player - Troika, Ittok, Sondek LP12 - must be ranked as among the world's best."*

*--Stereophile*

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Instead they concentrated on engineering their cartridges so that, when mounted in a proper tonearm, the stylus would remain in firm contact with the groove.

Fundamental to this was selecting a tracking weight sufficiently high to force the stylus into constant contact with the groove walls. While this results in more pressure at the point of contact, it prevents the stylus from bouncing around in the groove and actually reduces record wear.

### The Stylus

Another factor affecting contact with the groove (and the recovery of musical information) is the quality of the stylus.

The diamond styli in all Linn cartridges are carefully selected and precision polished to tight tolerances; the size and shape of the diamond is chosen for the optimum balance between mass and longevity. (A small diamond can move faster, but it also wears out more quickly.) The stylus is then aligned accurately on the cantilever for the smoothest, slowest wear pattern.

To eliminate any scope for loss of information due to movement at the joint between the stylus and cantilever, the stylus must be very securely attached to the cantilever. On all Linn moving-coil cartridges the stylus is actually pressed through the cantilever, forming a compression fit and providing an exceptionally strong mechanical connection. This mechanical connection is then reinforced by the use of high-tech adhesives.

### The Cantilever

The cantilevers on all Linn cartridges are formed from high

strength aluminum alloys.

The temptation to use gemstone or exotic metal cantilevers (ruby, diamond, boron, beryllium, etc.) has been avoided due to the inescapable problems of stylus attachment.

While these materials make for good advertising copy, they are too brittle to allow a compression fit of the stylus. Alternate methods of attachment, while acceptable on moderately priced cartridges, would not be suitable for use on a top quality moving-coil and would invariably compromise the mechanical integrity of the cartridge.

### Listening Tests

The proof of any cartridge design is in the listening. We are confident that any Linn cartridge will, in actual listening tests, outperform the competition.

Partially responsible for this is Linn's expertise in mechanical, electrical, and materials engineering. Through years of painstaking research Linn engineers have built up a vast storehouse of knowledge on the design and manufacture of audio components.

Equally as responsible, however, is Linn's reliance on the listening test. To put it bluntly, **if it doesn't sound better, then it isn't better.**

Every product that leaves the Linn factory must ultimately pass that test.

### THE LINN ASAKA

The Linn Asaka represents a refinement of the design of Linn's first moving-coil cartridge,

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"I have never heard backing vocals as startlingly real as with the Troika. Also, subtle low level instrumental detail emerges from the general mix to add delightful musical nuances and lifts to tracks you thought you knew so well..."

"The Troika is simply the best cartridge I have ever heard... [It] leaves the rest for dead." -- Hi-Fi Review

the Asak. The addition of the "A" to the end of the name signifies that the Asaka now employs an aluminum body, which has resulted in dramatic improvements over the original model.

THE LINN KARMA

The Linn Karma uses a more sophisticated magnet system than the Asaka and is fitted with a slightly more refined stylus. The Karma, while manufactured in Japan, undergoes a lengthy modification and adjustment procedure at the Linn factory in Glasgow. This technique allows the Linn engineers to extract the last ounce of performance from the design.

THE LINN TROIKA

This, the newest moving-coil cartridge from Linn, represents an all-out effort to obtain the best possible performance from the moving-coil configuration.

The Troika has a number of unique features, the most noticeable of which is a third mounting hole (most cartridges have only two). This three-point mounting system allows the Troika to be affixed more tightly to the headshell and provides, in general, a more stable mounting arrangement.

Surrounding all three mounting holes there are circular rims which are raised by .2mm from the flat top of the cartridge. This technique prevents irregular contact between the headshell and cartridge and, because of the smaller contact area, greatly increases the pressure per square inch at the mating surface, thus providing a tighter coupling.

This technique is obviously only applicable to three-point mounting systems. On a conventional two-point system, the raised rims would result in a significant loss of stability.

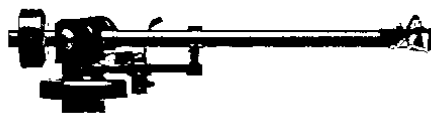
The Troika also employs radiused webs which are connected to the main body and flank the third mounting hole. They act as strengthening struts and prevent flexing of the rear extension of the body.

Rather than using contact pins, the signal leaves the Troika by way of flying leads. These leads and the coil wires are soldered together on a gold insert. This eliminates one connection from the signal path, which (because we are dealing with a very low level signal) makes a significant improvement in the performance of the cartridge.

	ASAKA	KARMA	TROIKA
Body Construction	Solid Aluminum Alloy	Solid Aluminum Alloy	Solid Aluminum Alloy
Stylus	Vital	Vital	Vital
Cantilever	Aluminum Alloy	Aluminum Alloy	Aluminum Alloy
Coil Wire	Copper	Copper	Copper
Weight	6.4 grams	6.0 grams	6.7 grams
Tracking Force	1.7 grams	1.7 grams	1.7 grams
Frequency Response	20Hz-20kHz±1dB	20Hz-20kHz±1dB	20Hz-20kHz±1dB
Channel Balance	1dB at 1kHz	1dB at 1kHz	1dB at 1kHz
Separation at 1kHz	Better than 25dB	Better than 30dB	Better than 30dB
Output at 5cm/sec 1kHz	300 µV	300 µV	300 µV
Recommended Load	470 Ohms	470 Ohms	470 Ohms



## Audiophile Systems, Ltd. Product Data Sheet



Date: mid-late 90s

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# Linn Tonearms

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The Ekos, Ittok, Akito, and Basik Plus arms  
from Linn Products, Ltd. of Glasgow, Scotland

The tonearm is a critical link in any record playing hi-fi system, and is second in importance only to the turntable.

The arm's effect on the final performance of the system is far more significant than that of the phono cartridge. That is, a moderately priced cartridge in a good tonearm will provide a much better result than the best of cartridges mounted in an inadequate arm.

The key to the performance of any arm rests in its ability to maintain a fixed relationship between the cartridge body and the surface of the record.

This is because the stylus is driven by the record groove. And it is the movement of the

stylus **as seen from the point of view of the stationary cartridge body** that generates the electrical signal.

If this electrical signal is to accurately represent the musical information in the groove, the cartridge body must remain in a fixed position over the record groove. In other words, the only movement taking place must be that of the stylus moving in response to the undulations in the groove. If the arm allows the body of the cartridge to move about unpredictably, it will be impossible to accurately sense the motion of the stylus and **musical information will be lost.**

Linn's solution to this problem was to produce a line of *direct*

## Linn Tonearms page 2

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*"...the Akito got my feet tapping with real enthusiasm and brought an automatic smile to my face..."*

*"It easily sets new standards for low-cost tonearms that rival manufacturers will have to work very hard to match... Its performance is polished and refined in a way that budget arms haven't been before."*  
-- *Hi-Fi Review*

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*"...[the Ekos] consistently provided an insight into midband detail I never really imagined I'd hear from an LP."*  
-- *New Hi-Fi Sound*

*"Linn's new Ekos is a true Class A pickup arm!"*  
-- *Stereophile*

*"[The Ekos] is the most remarkably detailed, dynamic and musically coherent arm I have heard. ... I can recommend the Ekos as beyond all doubt the finest arm I have heard to date... You owe it to yourself to hear one."*  
-- *Hi-Fi Review*

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*coupled* arms that provide a very rigid link between the cartridge and the turntable. **At audio frequencies** this link actually does appear to be rigid and allows the arm to maintain the cartridge's fixed position relative to the groove. (Of course at lower frequencies the bearings of the arm allow movement laterally across the record and vertically in response to irregularities in the surface of the record.)

This link follows a path that starts at a very strong fixed headshell. (A detachable headshell, while convenient, is just too much of a compromise.)

The path then proceeds along a very rigid arm tube. The large diameter, very thin wall tube is much stronger than a smaller tube with thick walls would be.

Precision bearings then couple the arm tube to the pillar. To maintain the precise alignment of the bearings regardless of temperature, all critical parts are made from material with the same coefficient of expansion.

The pillar is fitted to a mounting collar using a unique locking system. The height locking screw pushes the pillar against a "C" shaped notch in the collar, resulting in a stable, three point mounting.

The collar is then tightly coupled to the turntable with three machine bolts.

While all of the Linn arms employ this direct coupled path, there are significant differences between the various models.

### **Basik Plus**

The Basik Plus arm was

designed to provide the best performance possible while still maintaining a budget price. As an indication of Linn's success in achieving this goal, one hi-fi critic judged it better than many tonearms costing three times as much!

### **Akito**

The new Linn Akito arm takes the budget approach of the Basik and combines it with the lessons learned in the development of the top-of-the-line Ekos arm.

The Akito features improved bearings, a larger diameter arm tube, and glued construction.

### **Ittok**

The next step up in the line is the Linn Ittok arm. In the Ittok, extensive use is made of machined parts (in contrast to the cast parts of the Akito). In addition the precision bearings are manufactured to a five micron tolerance.

### **Ekos**

While all Linn arms were designed by Linn's R & D department, most are assembled in Japan. The top-of-the-line Ekos is built in Glasgow by a team of skilled assemblers.

All the critical bearing parts are manufactured to the highest possible standard in Linn's own machine shop. Tolerances are controlled to one micron.

The headshell is machined from a solid block of high strength aluminum alloy and is then permanently bonded to the arm tube using aerospace adhesives