Tonearms and Cartridges

SECTION 4 - TONEARMS AND CARTRIDGES

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LINN TONEARMS

As confirmed through demonstration by Linn retailers throughout the world since 1979, the Ittok contradicted popular wisdom. At that time low mass was the over-riding concern of tonearm designers. The result was that the mechanical integrity of the tonearm was compromised leading to the loss of vital musical information from the cartridge. The Ittok became the industry standard and due to continued developments maintains a high level of performance, only bettered the Ekos.

The Ekos arm has established a new level of performance. This is achieved by precise engineering, materials development and the use of advanced technology.

EKOS TONEARM

One of the main considerations when designing the Ekos tonearm was to improve the mechanical integrity of the tonearm, already at a very high level in the Ittok LVII.

The following steps were taking in order to meet the design criteria:

1. Machining the headshell from a solid block of high strength aluminium alloy, far stronger than any casting technique.

2. The armtube is bonded to the headshell and main body using an advanced adhesive which further improves the mechanical integrity of the arm.

3. The bearing assembly is matched with bearings to 1 micron tolerances

4. The lift lower device is damped in both directions to minimise vibrations.

5. Improved tracking and bias accuracy.

ITTOK AND AKITO

Some Ekos manufacturing techniques have been exploited in the Ittok LVIII and Akito tonearms. Arm tubes, for example, are now glued to the headshell and bearing assemblies, rather than screwed together.

LINN CARTRIDGES

Extending the Linn philosophy of the turntable and arm to the design of the cartridge, it is obvious that while the stylus, cantilever, and coils should be allowed to move freely in response to the information in the groove of the record, the rest of the cartridge should remain in a fixed position centred over the groove. This seemingly simple task is complicated by the fact that very high levels of energy are generated at the stylus tip, as the record groove drives the stylus. To best use the mass of the arm and the mass of the turntable, we must couple the cartridge body very firmly to the turntable.

One of the most significant difference between Linn cartridges and other moving-coil cartridges is a body that is rigid and strong enough to couple the cartridge to the arm. To provide the strength necessary, the bodies are milled from a solid block of high strength aluminium alloy. Our unusual recessed cartridge mounting holes allow the mounting screws to be tightened very securely and minimise the risk of the bolt slipping away from the body and/or the allen key accidentally slipping and damaging the stylus. To prevent any movement of the magnet assembly, great care has been taken to couple it to the body of the cartridge.

One of the most critical regions in a cartridge is the junction of the stylus and the cantilever. Any play or give in this junction and the stylus will vibrate independently of the cantilever instead of moving it, resulting in a loss of information. In the Linn cartridges the diamond stylus is swaged through the cantilever, which results in an extremely rigid compression fit. A diamond stylus cannot be swaged or compression fitted through the cantilever without shattering or cracking it. The stylus mounting hole must be over-sized, and adhesive used to affix the stylus in the cantilever. If the adhesive is much more compliant than the cantilever material, the junction allows the stylus to move independently of the cantilever. If millionths of an inch are significant, then this is a serious problem.

Similar problems can arise fixing the cantilever to the coil assembly. Many cartridges, even those using these exotic materials, do not make adequate provisions for rigidly mounting the magnet assembly to the cartridge body, or the cartridge body itself to the headshell. The entire cartridge must be designed as a coherent system. The energy transmitted from the cantilever stylus must be accurately transduced into the output signal.
The diamonds on Linn cartridges are of the highest quality, tightest tolerance, and highest degree of polish that can currently be obtained. The styli are grain oriented, to allow for the smoothest wear pattern, and the longest possible stylus life. Likewise, the stylus size and geometry are selected to provide the optimum trade-off between tip-mass and stylus life.

Phono cartridges:
Moving Magnet (MM) or Moving Coil (MC)

The difference between Moving Magnet (MM) and Moving Coil (MC) are often misunderstood.

Moving Magnet:

In general MM cartridges have very low mass moving parts. The cantilever and magnets are very light and so are capable of moving very large distances very quickly..
Unfortunately the system is not very linear and although the stylus stays in intimate contact with the groove, even when playing very loud records with large groove modulation, the transfer of that movment to an electrical signal (what you hear) is not very accurate. This results in a cartridge which will physically track correctly but never sounds accurate.

Moving Coil

The situation with MC cartridges is very different. The moving coil assembly is heavier and extreme movements are restricted by the lead out wires, however until those llimits are reached, the system is considerably more linear so the sound quality is far better.
If high tracking ability is required then a moving magnet should be recommended, but if absolute fidelity is the goal then a moving coil will always sound better.
It is worth noting that the Linn Arkiv has a significantly improved coil and suspension arrangement which not only contributes to the vastly improved sound quality, but has better tarcking ability , due to a clever, new, wire lead out method.

Arkiv

The 'Vital' stylus fitted to the Arkiv cartridge is a finer line contact stylus than that used on any of out other Moving Coil cartridges. The wear profile is completely different so please use specific Arkiv chart for checking the Arkiv wear.

This Finer line stylus was chosen as it more accurately replicates the original stylus cutter used when the original master record was cut. A completely different wear pattern will be observed when inspecting this type of stylus as the front to back dimension is extensively different.

It is also worth noting that as the contact areas of this stylus are different from previous cartridges the amount of dirt picked up when playing records may be increased initially. However, after the records have been played a few times the amount collected will reduce to 'normal' levels. During this initial period great care should be taken to ensure that the stylus is cleaned regularly. (See cleaning).

Mistracking:

1. Dirty stylus:

   We have encountered many situations where cartridges have been returned for repeated 'mistracking', only to find that the stylus is extremely dirty.

2.Faulty records:

   On occasions you may find that some records which track on other cartridges 'mistrack' when played with an Arkiv. This does not mean that the Arkiv is faulty, but can be caused when the records are badly cut or pressed so that the groove is shallower than other records. As the Arkiv stylus sits slightly deeper in the groove it may bottom out with the result of 'mistracking'

If after you have checked and cleaned the stylus , and have compared the suspect cartridge with another cartridge in the same tonearm and you still encounter tracking problems, please arrange to return the cartridge, tonearm and record to Linn Service so that we can fully investigate the problem.

ARM SELECTION

Linn cartridges transmit significantly more energy to the tonearm than other moving coil cartridges.

It is clear that fitting and mounting of tonearms and cartridges must be to a high standard to fully exploit the performance available.

RECOMMENDED TOOLS FOR TONEARMS AND CARTRIDGES

1 Set of Allen keys as supplied with tonearms

Sizes:	1.27 mm	cable grub screw
	1.50 mm	lift lower grub screw
	2 mm	cartridge allen bolts
	2.5mm	Arkiv Mounting Bolts
	4 mm	collar mounting bolts

5 mm open spanner (for cartridge nuts).

'Kinky' LINN alignment tool

LINN Alignment protractor

Microscope with x 80-120 magnification (stereo if possible)

LINN green stylus paper

Ultrasonic stylus cleaner

Pair fine pointed pliers

Digital multimeter

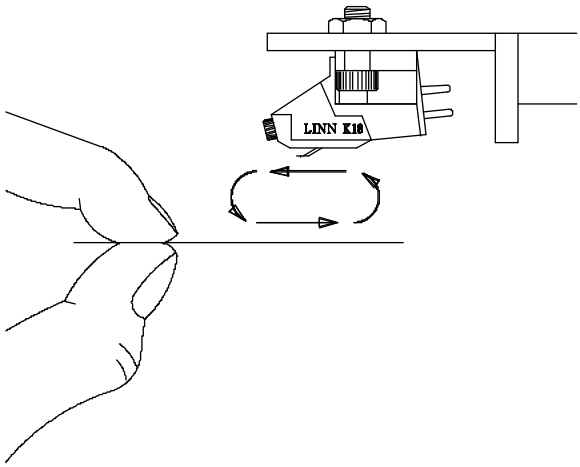
CLEANING CARTRIDGES AND STYLII

1. Do not blow dust off the stylus as this can blow dirt and moisture inside the mechanism and clog up the coils.

2. Do not use liquid cleaner unless you are able to work under a microscope and use the correct fluid (IPA).

3. Two complimentary methods of cleaning:

   a. Linn 'green paper'. Cut in strips approx. 20 mm x 40 mm and support at one end only while drawing in tracking direction (back towards front) across stylus tip. This method will clean and polish the stylus tip.



   b. Ultrasonic stylus cleaner. Use dry, and keep liquid supplied to clean the pad only. This method will clean the complete diamond, if used periodically for 3 - 5 minute sessions.

TO CHECK FOR STYLUS WEAR

Typical sound of worn stylii are:

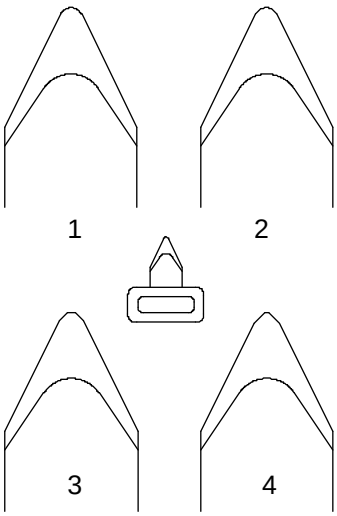
a. 'hardening' of treble
b. increase in surface noise
c. miss-tracking (this may start to damage records)

You require a microscope for evaluating wear on a stylus. If you do not have a microscope, we strongly recommend that you invest in one to offer a unique service to the customer and increase your sales of cartridges and styli.

The following drawings offer a guideline to show wear in various stages.

If you have any doubt about wear of a stylus/cartridge then return the cartridge to Linn Service and we will be happy to check it out for you for a nominal charge.

Moving coil wear profile



1 = New Stylus

2 = Slight Wear

3 = Worn, will need replacing soon (approx. 1 - 2 months)

4 = Worn out, don't use as it can start to damage records

Arkiv Stylus profile

New stylus **Stylus with Wear**

Please note that the Arkiv has a different stylus profile, therefore a completely different wear pattern. The second drawing has been exagerated in order to show the area which wears. This is really a further polishing of the stylus which results in the long life of the cartridge rather than the sharp point seen in picture (4).

GENERAL CARE OF CARTRIDGES

To avoid the possible damage to arm bearings, tonearms should always be removed from the turntables before removing or fitting cartridges.

Moving Coil Cartridges:

Linn MC cartridges have been designed to give many hours of musical enjoyment and if stylii are kept clean normally lasts more than 1000 hours of playing, but this is subject to record and installation conditions. Linn cartridges and stylii profiles are designed for a 1.7 gm tracking force at 20 degrees centigrade.

The vast majority of cartridge returns to Linn are caused by accidental damage to the cantilever. The customer should be warned to avoid the following:

a. Dropping the arm on the record which pushes the cantilever into the body of the cartridge.

b. Hitting the stylus off the side of the record, which risks bending the cantilever to one side.

c. Catching the cantilever and pulling it down away from the body. On the Karma and Troika this will not mark the cantilever but will result in the tracking angle being incorrect. (The Asaka has a closed magnet gap and if the cantilever is pulled down too far it is liable to bend.)

d. Overzealous cleaning - too much force applied with 'green paper', or ultra sonic cleaner.

e. Incorrect arm adjustment of arm or cartridge mounting or alignment.

This can cause:

Bent cantilever

Wrong stylus angle

Wrong cantilever angle

Loss of one channel (internal wire stretched and pulled off coil)

Distortion on one channel or mis-tracking caused by damaged or broken wire only being held in place by the glue on the coil causing one channel to perform intermittently.

Therefore, it is very important to:

a. recommend to all cartridge customers, especially moving coil cartridges, that they insure against accidental damage.

b. check faulty cartridges for accidental damage before giving the customer a warranty replacement. If in doubt, return to Linn Service Dept. for a full report before replacing. Note : There is a nominal charge for Checking cartridges wher no fault is confirmed.

Re-tipping

Linn do not recommend re-tipping of cartridges.

Our experience of re-tipping has been less than satisfactory. The work is often carried out to differing standards and the end results can be disappointing. (Normally the cantilever is cut and a new tip section glued on!)

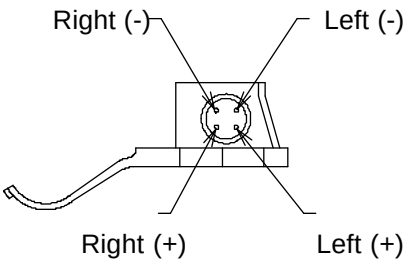
Even if the stylus could be replaced the coils, suspension and some parts of the cantilever remain the same. These wear and deteriorate through time and can account for 'fall off' in performance.

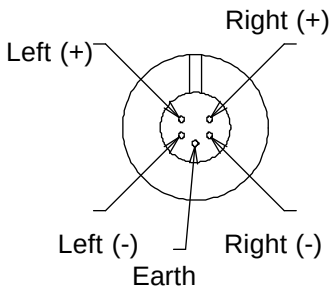
TONEARM AND CARTRIDGE FAULT FINDING

Before carrying out any checks remember to protect stylus.

Symptom	Fault	Solution
Poor sound	Cartridge tags loose fitting so giving poor connection	Replace tags Note: This is the first and most crucial electrical signal connection in the system.
	Tracking or bias force set incorrectly.	Check tracking and bias for correct setting. Tracking for Linn moving coils is 1.6 - 1.7 g and 1.7 - 1.8 g for moving magnet cartridges. Bias should be set to the same figure as tracking force.
	Dirty or worn stylus.	Clean stylus. Check profile for wear under microscope; or return to Linn for checking.
	Poorly mounted or aligned cartridge	Use Kinky arm alignment guage to set position of arm collar. Use cartridge aligment guage to set position of cartridge in headshell.
	LP12 set-up incorrectly	See LP12 Set-up Section.
	Counterweight too light (Ekos weights only)	Try another counterweight. Return c'weight to Linn for checking
	Bearing fault arm	Check bearings. See section on How to Check Bearings.

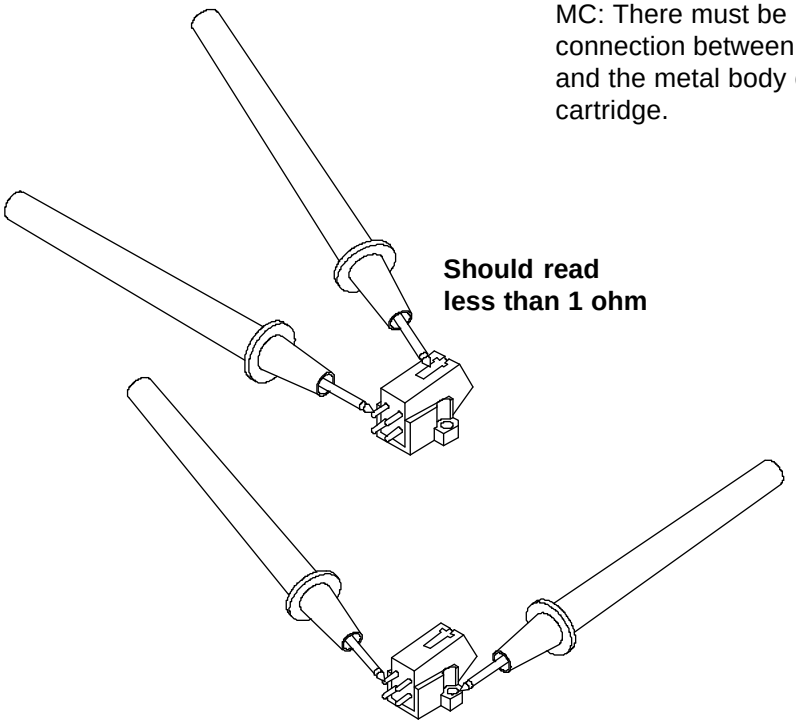
Symptom	Fault	Solution
Dead or low output or distortion on one channel	Signal lead faulty lead	Replace, try with a new signal
	Cartridge tags faulty or shorting to arm	Check tags. If any are suspect replace set (except Akriv or Troika - in which case return to Linn). Check for shorts between tags and tags to headshell.
	Wiring fault in tonearm	Check with meter for o/c or shorts in wiring. All channels should be less than 0.9 ohm. Earth should be less than 10 ohm between earth pin and screw on under -side of headshell.





Cartridge (moving magnet) wiring fault	Check with meter: = @ 400 ohm/channel;
Stylus magnet faulty (mm/only)	Try a new stylus
Cartridge (moving coil) wiring fault/ cantilever damaged	Check with meter: = 1.5 to 2 ohms/channel Caution: See Care of Cartridges section

Symptom	Fault	Solution
Hums on one or both channels	Earthing wire fault	Check continuity of earth lead in arm cable, tag should connect to grub screw in arm pillar
	Short of metal cartridge body to earth (earth loop)	Check with meter: MM: right earth should connect to screening can but not to black mounting lugs. If shorting, then replace. MC: There must be no connection between any tag and the metal body of cartridge.



Should read less than 1 ohm

Should be open circuit.

Hums on one or both channels (Cont'd)	Open circuit one channel	See above
Hums on left channel	Signal lead has been over-tightened in arm pillar with retaining grub screw	Check signal lead plug for signs of damage. Replace if damaged.
Ittok and Ekos tracking pressure will not adjust or cannot balance arm	Tracking dial assembly faulty	Return to Linn for repair.

TO CHECK LINN TONEARM BEARINGS

Estimated Time of Completion for this task ~ 30 minutes

Components Required:
1 set Linn bearing discs

CAUTION:
Remember to protect stylus by fitting guard before carrying out procedures listed below.

Please make sure tonearm has reached room temperature before carrying out these tests: The arm should be at room temperature for at least 12 hrs.

Use a clean work area.

Instructions:

Vertical Bearings

1. With arm fitted to turntable, set bias and tracking force to '0'. We advise that you do this with the stylus guard fitted for safety; therefore, you will need to re-calibrate the balance point of the arm.

   Some tonearms are difficult to balance out or will not return to the exact centre of the balanced out position - this is within our specification, as this means the bearings' resistance to movement is very low.
   When the tracking weight is applied the accuracy of load is within +/- 5%.

2. Place the arm over gap between armrest and record edge.

3. Drop appropriate weight for arm onto headshell from approximately 10 mm above headshell.

EKOS	red coloured disc
ITTOK	blue coloured disc
AKITO/BASIK	yellow coloured disc

Definition of Good Bearings	Definition of Bad Bearings
The tonearm moves smoothly through its operating arc, that is, the movement that would be expected when playing a record.	The tonearm fails to move or sticks at a point through it's operating arc.

4. Observe arm movements and relate to table.

Horizontal Bearings
The horizontal bearings very rarely require to be checked due to the immense strength of the pillar. However, if you wish to check these bearings then it will be necessary to remove the arm from the turntable in order to carry out the following tests which must be carried out with the arm at room temperature eg @ 20 deg. C for a minimum of 24 hrs.

1. Remove arm from turntable.

2. Remove cartridge, tags and counterweight from arm. Set all dials to zero. Ekos only - remove arm clip before carrying out this test.
   Some early arm clips may be glued in place. If so, replace clip with new clip. Contact Service Dept. for f.o.c. replacement clip, specifying round or square peg.

3. Locate arm over bench - see diagram. Slacken lift/ lower device screw and lower barrel to lowest setting (or remove lift/lower platform) to allow bench test.

4. Hold pillar firmly so that the arm is properly located (see following drawings):

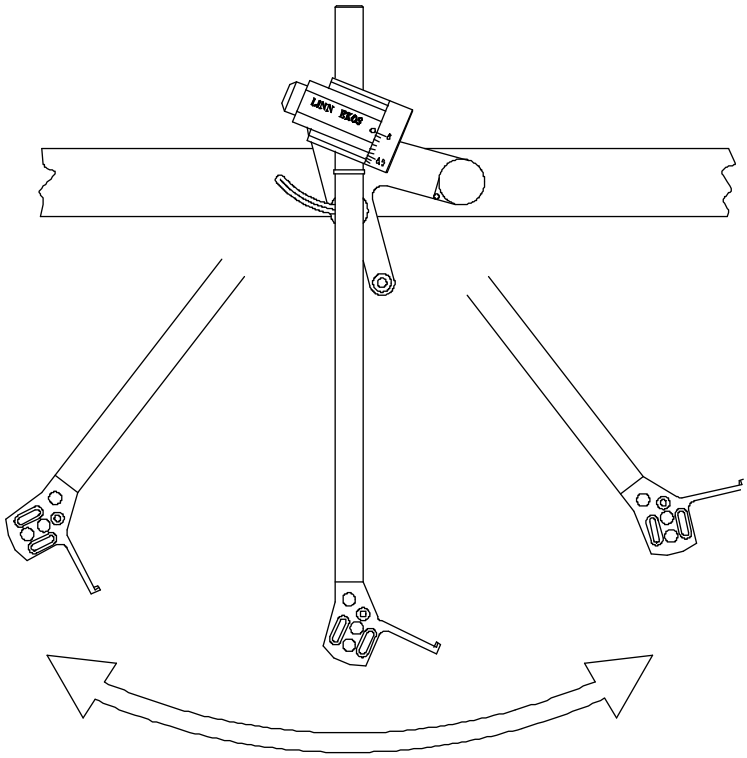
   Ekos/Ittok - armtube to drop directly in front of the lower device pot.
   Akito/Basik-rotate pillar so that the black dot on the bias platform (the one nearest the lift/lower) is at the top.

5. Take armtube to the left to the end of its travel and release, counting how many full swings the arm does before coming to a stop.

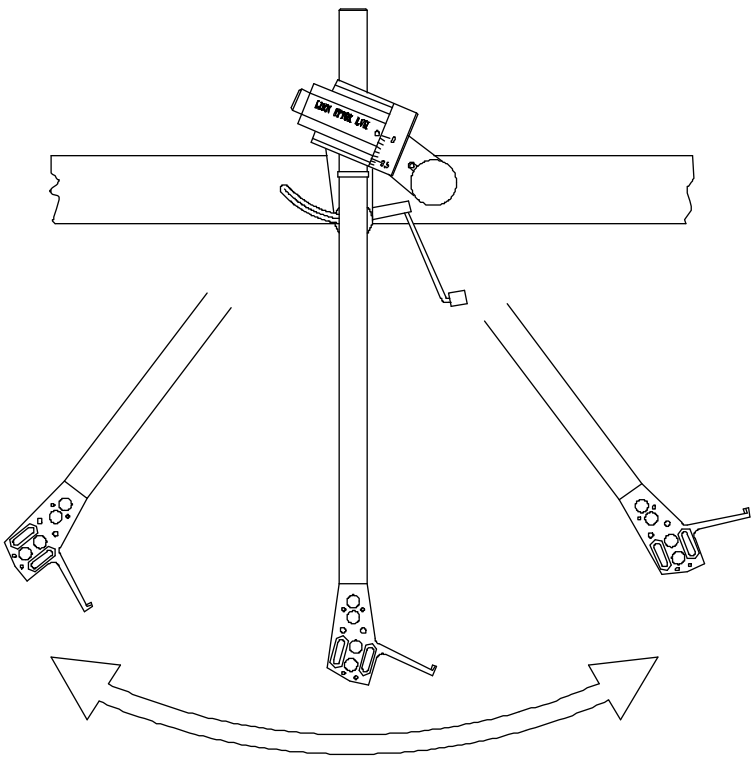
   Ekos - should have 35 swings minimum
   LVII/LVIII - should have 30 swings minimum
   Akito/Basik - should have 15 swings minimum

Observe arm. If it stops suddenly, the arm bearings may have a notch. If this happens, or if arm fails to swing by required number, ensure that the temperature of the arm is at working temperature, (see above) and then retest. If the arm still fails to perform as expected return the tonearm to Linn Service Dept- see returns procedure section 1.

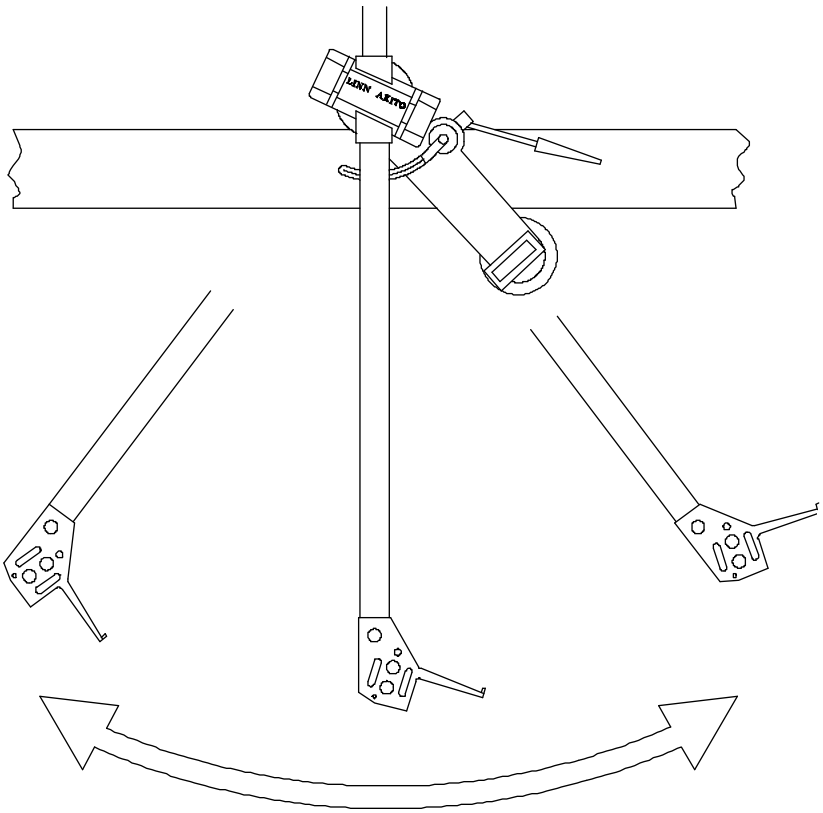
Please note:
Overtightening of the height locking screw , especially with the Akito, will damage the lateral bearings. This is not covered by warranty and the arm may be damaged beyond economic repair.



EKOS (35 swings)



LVII/LVIII (30 swings)



AKITO/BASIK (15 swings)

TO FIT CARTRIDGE TO LINN TONEARMS

Tools Required:
small pair flat nose pliers
5 mm open ended spanner
cartridge alignment protractor

Estimated Time of Completion for this task ~ 15 minutes

Tools supplied with arm and cartridge:
1 set Allen keys
1 set cartridge mounting hardware

Instructions:

1. Ensure you have a clean, uncluttered working space.

2. Unpack cartridge. Ensure guard is in place!

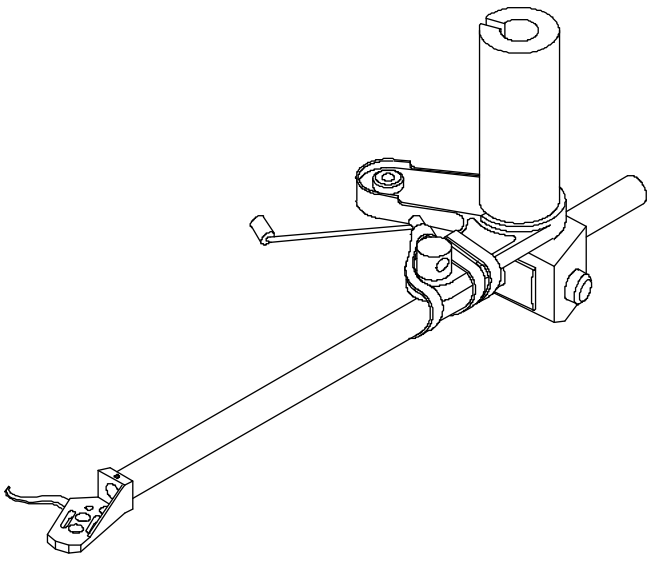
3. Fit cartridge tags to cartridge (except Troika). If tags are old or poor, replace with new Linn tags. Ensure good spring sliding fit is maintained by gently pushing on tag, in straight line with contact pin.

NB: This connection quality is crucial for good performance.

Colour codes for all Linn arms and cartridges are:

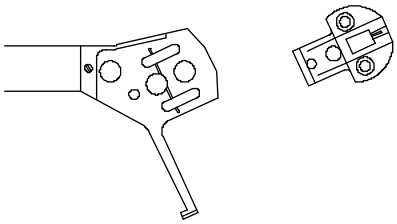
Red = right +ve	White = left +ve
Green = right -ve	Blue = left -ve

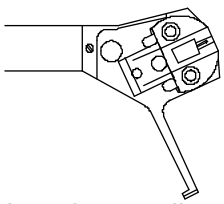
4. Ensure arm is located securely in arm rest clip. In case of the Ittok, LVII and LVIII either carefully rotate arm pillar to the end of its travel, or use rubber band to secure to bias platform.



5. Loosely fit cartridge mounting nuts and bolts. Locate cartridge squarely on headshell. Nuts should be placed on top of headshell and between the grooves.

   Position cartridge roughly in the middle of slots. Leave screws fingertight. Ekos has a line machined on underside of headshell; use this as a guide for Linn moving coil cartridges.





6. Set correct position of arm collar on turntable armboard using Kinky alignment tool. See Turntable section, page 2.59.

7. Fit arm to turntable. Ensure arm is parallel to sides of armboard. Lock loosely in position with allen key at approximate height.

8. Fit counterweight and remove stylus guard. Balance the arm to '0' by adjusting the counterweight position on the tail piece. Set tracking force to 1.7 g.

   Ekos/Ittok - this is done by dialling 1.7 on the tracking weight dial positioned on the right hand side.

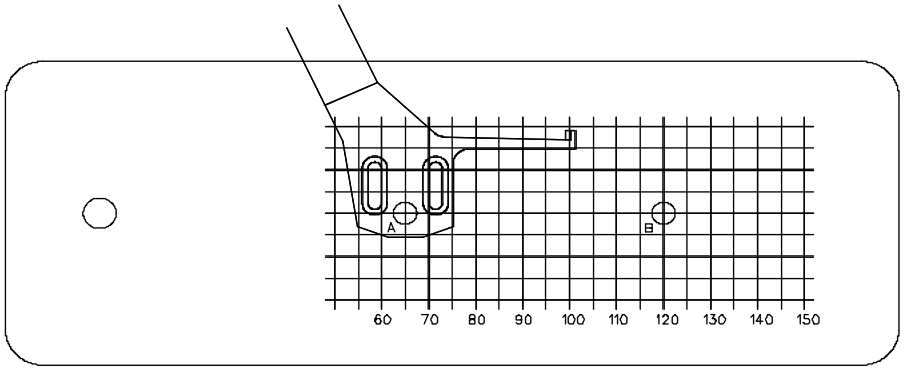
   Akito/Basik -once the balance has been set to 0, hold the counterweight whilst rotating the inner dial with the numbers, until 0 lines up with centre line on tail piece. Revolve whole counterweight toward front of arm until dial reads 1.7.

9. With platters, record and felt mat fitted, place alignment protractor over centre spindle of the turntable.

10. Check armtube is parallel to record. Adjust as required.

11. Position arm on protractor so that stylus tip rests on crosshairs,
position A.

12. Looking from above, check that lines are parallel to square side of headshell.



13. To adjust, swivel protractor around spindle, keeping the stylus on line 65 until the headshell is parallel with lines. This will tell you by how much, and in which direction, you need to adjust the cartridge position in the headshell.

14. Move cartridge to correct position and re-check point 11.

15. Remove arm from collar. Tighten cartridge in position; use a new, Linn supplied, 2.5 mm allen key and spanner to hold nuts in place.

16. Give a final check to ensure cartridge has not moved during tightening.

Set tracking weight and bias at 1.7 gm for Linn cartridges at 20 degrees centigrade.

Remember that final tracking weight should be set by auditioning and depends on the temperature (lower by approx. 0.1 gr/5 deg. centigrade if above 20 degrees centigrade in normal use).

LINN TONEARM HISTORY

Upgrade	Year	Serial No.
Ekos Introduced -	**1988**	
Black grease used for T'Dial	Jan 1991	6.600
Slotless pillar fitted as standard	Oct 1991	6,490
Improved bearing specifications and performance	June 1991	6,200
Signal lead plugs changed to black, smaller types	1990	
Arm clip - base changed from round to square	Mar 1989	2,450
Ittok LVII Introduced -	**1979**	
Ittok LVIII/2 introduced. Armrest replaced with new integral armrest. Headshell strengthened. now similar to Ekos. Discontinnued Sept 93	1991	0001
Ittok LVIII introduced. Screws in armtube replaced by glue.	Jan 1989	31,300
Headshell drilled for Troika third mount	Sept 1986	23,000
Armtube material change	1986	20,000
Bearing shafts material change	1983	12,000
Main pillar diameter increased from 20 mm to 25 mm	1980	3,000
Akito Introduced - **1989** replaced by: **Akito/2 Introduced** **Dec 1994** Scottish built, better bearings, paint.		100,000
Basik Introduced - 1980		
LVX Plus Introduced with fixed headshell and larger vertical bearings Discontinued 1989	1985	
LV X introduced (detachable off-set headshell, straight armtube) Discontinued 1986	1983	
LV V Introduced, 'S' shaped arm Discontinued 1983	1980	

LINN CARTRIDGE HISTORY

Moving Coil:	**Date**
Arkiv introduced	1992
Klyde introduced	1992
Troika Introduced	1986
Discontinued 1994	
Karma Introduced	1983
Discontinued 1994	
Asaka Introduced	1985
replaced Asak	
Discontinued 1994	
Asak Introduced	1978
Discontinued in 1985	
Trak Introduced	1982
Discontinued in 1988	
Asak 'T' Introduced	1982
Hand modified version of Asak, replaced by Karma,	
Discontinued in 1983.	
Moving Magnet:	
K18 Introduced	1988
Upgraded to K18/2	
Improved suspension	1992
Basik Introduced	1980
Discontinued UK 1986	
Export 1988	
K9 Introduced	1986
Colour changed to grey	1988
Upgraded to K9/3	1989
K5 Introduced	1988

TONEARM SPECIFICATIONS

All Linn tonearms have the same alignment requirements:

Effective length	229 mm
Stylus overhang	18 mm
Pivot to stylus	211 mm
Stylus pressure & bias setting	0 to 3 grams (1.7 g recommended)

	Ekos	**Ittok**	**Akito (Basik+/LVX)**
Effective mass	11.5 g	11.5 g	10 g (approx.)
Cartridge weight range	4 - 9 g	3 - 9 g	2 - 10 g

Typical load 220 pF

CARTRIDGE SPECIFICATIONS

Moving Coil:

	Arkiv	**Klyde**
Frequency response	20 Hz to 20 KHz +/- 1 dB	
Separation at 1 kHz	better than 30 dB	
Tracking weight range*	1.55 - 1.75	
Channel balance at 1 kHz	within 0.5 dB	
Recommended load ohms	greater than 50 ohms; Nominal 470	
Capacitance loading	not critical	
Stylus type	Vital	Vital
Tracking angle (deg)	20	20
Weight (grams)	7.4	8
Output voltage at 5cm/s at 1Khz	150µV	150µV

CARTRIDGE SPECIFICATIONS

Moving Coil:

	Troika	**Karma**	**Asaka**
Frequency response	20 Hz to 20 KHz +/- 1 dB		
Separation at 1 kHz	30 dB	30 dB	27 dB
Tracking weight range*	1.5 - 1.7	1.5 - 1.7	1.5 - 1.7
Channel balance @ 1 kHz	within 1 dB		
Recommended load 470 ohms	greater than 10 ohms; Nominal		
Capacitance loading	not critical		
Stylus type	Vital	Vital	Vital
Tracking angle (deg)	20	20	20
Weight (grams)	7	7	7
Compliance (cu)	10	10	10
Output voltage	100µV	100µV	100µV

* Tracking is normally set to 1.6 - 1.7 for moving coil cartridges and 1.7 - 1.8 for moving magnet cartridges. Exact tracking weight should be set by listening at normal room temperature.

Moving Magnet:

	K18	**K9**	**K5**
Frequency Response (20 Hz to 20 kHz)	+/- 1 dB	+/- 2 dB	+/- 2 dB
Separation at 1 kHz (better than)	30 dB	20 dB	20 dB
Tracking weight range*	1.5 - 2 g	1.5 - 2 g	1.5 - 2.5g
Channel balance @ 1 kHz	0.5 dB	1dB	1dB
Recommended load	47 KOhms	47 KOhms	47 KOhms
Capacitance loading	200 pF including arm cable		
Stylus type	Vital	Vital	Spherical
Tracking angle (deg)	20	20	20
Weight (grams)	7.8	7	6
Compliance (cu)	12	12	14
Output voltage	4.5 mV	4.5 mV	4.5 mV

* Tracking is normally set to 1.6 - 1.7 for moving coil cartridges and 1.7 - 1.8 for moving magnet cartridges. Exact weight should be set by listening at normal room temperature.