Setting up your LP12 - a Brief Overview

Volume II

Written by Peter Swain, Cymbiosis.

Setting up your LP12 A Brief Overview – Volume II

I started a thread on the LP12 Section of the Linn Forum when it was in existence some years ago in response to a growing number of requests from owners, who perhaps live a long way from their Linn Specialist Turntable Retailers or wish to learn more about setting up and ensuring they were getting great results with their LP12. The set-up guide proved very popular there and the thread was promoted to a sticky status at the top of the first page on the Forum by Linn themselves!

Many readers asked if I could make a downloadable version of the thread postings I made at that time. So, in response to these requests the guide was produced back in 2014.

Since then, there have been a number of new products launched by Linn for the LP12 and so I have attempted to incorporate these in this new 2020 version of the guide.

It is my opinion that it is better for you to have your Linn Retailer set up your LP12 whenever possible, as there is no substitute for good hands-on training and a lot of set-up experience.

It follows that I do not accept any liability whatsoever for works attempted following your reading of any information contained here. As I said, hopefully you will see this as a useful, general guide, and you will gain a better understanding of the setting up process, consequently a better idea of why retailers need to charge a little for the time and expertise they use while setting up your LP12 and also why they are the best people to set-up and get the best sounds from your LP12.

Care, experience, expertise and attention to detail are paramount.

With this guide, I've tried to keep it to the point and as possible and used photographs to illustrate the points made wherever I can, as I hope this will make it more readable for anyone interested in using it as a guide for reference in future. However, it's not completely all encompassing, so if having read it, you have any questions, please just email me at peter@cymbiosis.com

Kind regards,

Peter Swain

Assembly of the springs and bushes (also known as grommets) is relatively easy. The modern bushes are of a harder material than those fitted originally; otherwise they seem completely unchanged over the years. Anyone unsure as to if they have old bushes can easily compare their relative hardness to new ones by hand and should discard the older softer type.

Modern springs spiral in an-anticlockwise direction as can be seen here.

Figure 37 – Modern LP12 Springs

The springs vary both in compliance and eccentricity! This variation can be turned to our advantage in my opinion, allowing for a better bounce if chosen carefully as mentioned in Volume 1. For the three spring locations, as anyone who sets up an LP12 will know, the position of the nuts on the thread of the three bolts varies when the platters (both inner and outer) are level, with the nut beneath the spring nearest to the arm, which is carrying the greatest proportion of the sprung mass threaded further up the bolt thread (hence greater compression of the spring).

The left spring (nearest the motor) carries a much smaller proportion of the sprung mass and consequently the nut will be threaded up the bolt the least (hence less compression of the spring). The sprung mass supported by the front right spring carries a sprung mass between the other two springs and so the nut thread position and hence spring compression, is also between the other two.

In simplest terms, just compare the relative compliance (stiffness) of the springs between your thumb and index finger by repeated gentle compression of the springs. You will soon come to appreciate that they can feel quite different! This was discussed in detail on K_numigl's excellent spring thread on the Linn Forum (now archived), and so I suggest you can read more there if you wish.

For a long time, I've been selecting springs in this way, and ranking them in terms of their relative compliance. I usually have ten to fifteen springs available to me when I build, and I merely select springs from the stiffest end of the spectrum to be located next to the arm. Springs which feel that they have an intermediate compliance I use for the front right. The softest springs I use at the motor end of the sub-chassis.

By taking time first to grade the springs, I personally think that I have an easier time when trying to optimise the suspension bounce, both in terms of pistonic motion, i.e. uniform and free up and down movement when the outer platter is in place and is carefully bounced. No sideways shudders or shakes and no suspension nocks or rattles either!

The three nuts used to secure the springs need to be M5 Turret lock nuts, not the M5 Nylocks as used elsewhere on the LP12 as these are better than the Nylocks and are very unlikely to move on the threads by themselves, even though they are not locked up against anything solid, only the mudguard washer of course. If any of the M5 Turret nuts appear loose on the threads at any time, even if new, I suggest you replace them.

Figure 38 - An M5 Turret lock nut on the right, and a Nylock on the left with its blue plastic insert

Please note that since about 2016 two other types of nut (not locking) have appeared on the LP12, the first had an integrated shake proof type washer. I tried them initially but found they could easily relax and become loose. This nut appears to have been withdrawn from production now. The second is a flange nut (again not locking) and having experimented with them, my preference is still for the original Nylock nut as shown in the image above and these are still available as spares from Linn and hence Linn retailers.

So, having selected your spring for the particular location on the sub-chassis and with your sub-chassis located on the three spring bolts. Insert the small end of the large bush into the hole in the sub-chassis, ensure it is fully pushed home and located within the hole in the sub-chassis. This must be done with the bush completely dry please, no lube of any sort.

Then the offer up the large end of the chosen spring, followed by a small bush inserted and evenly located into the small end of the spring. This should then be followed by a mudguard washer and a Turret lock nut to secure.

Since 2017 new mudguard washers have been introduced as some of the black mudguard washers supplied since about 2014 were not as flat as their predecessors! I pointed this issue out to David Williamson of Linn and now the better/flatter washer, which is silver in colour, is available from Linn retailers.

My recommendation is that you should use them below the springs where their flatness is most important. Elsewhere, the black washers are fine if you wish to continue to use them, as these areas are not so important.

Figure 39 Showing the old black thicker mudguard washer (right) the newer less good thin black washer (centre} and the much better latest silver mudguard washer (left)

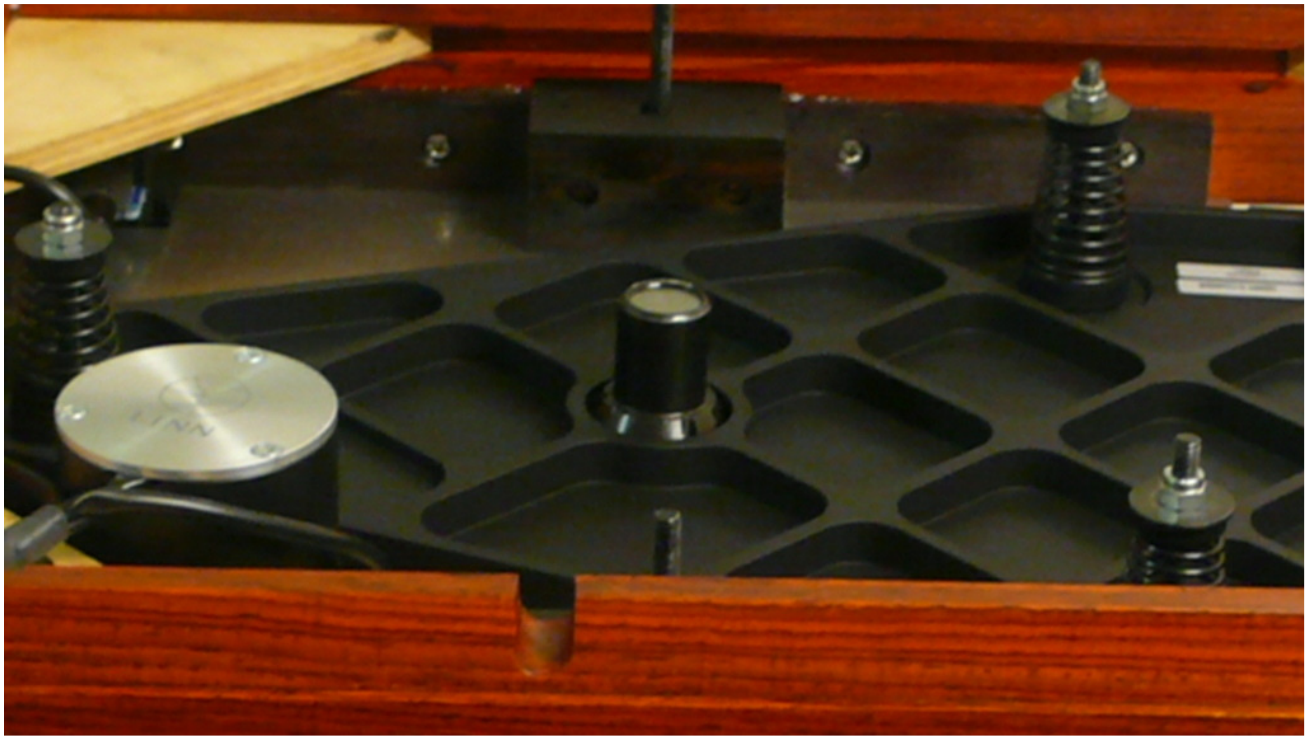

Figure 40 – Turret lock nuts securing springs

As above, absolutely no lubrication on the bushes, as you do not want the possibility of them turning by themselves when subjected to vibration during transportation. This obviously makes turning the bush/spring assemblies where inserted into the sub-chassis much harder (particularly with the Keel), while getting the bounce correctly set up, but it is worth it. Even if you end up with sore fingers!

In my opinion much is discussed about LP12 suspension going out of tune. This I believe is due to flawed and incorrect set-up procedure here. People are just trying to give themselves an easy time and make the springs and bushes easier to turn by using lube and hence set up more quickly, as the springs and bushes will then obviously turn more easily. And yes, they will also move more easily if the deck is transported too! Hence the deck can go out of tune much more easily – not good, so don't do it! Please don't use lube and if you do, don't blame the deck when poor set-up is the culprit!

Likewise the use of talc on the springs to lubricate and hence quieten the springs down when rubbing against the conical face of the large bush is a no-no in my opinion as it is masking a problem that needs to be tackled if there is contact there.

Figure 41 – Deck nearly ready to be to be put the right way up

Once all three springs are fitted correctly and wound up the threads a little, we are at a point where the cross-member/wiring strap should be fitted and then the LP12 can be placed in the jig the right way up. The arm can then be fitted to the sub-chassis, directly in the case of a Keel and via an armboard and arm collar with the other suspension set-ups.

This is a subject to be covered later, but before we go on to it, may I just add that once the arm is initially fitted, check how much you have wound the three spring nuts in before you lower the outer platter on to the sub-platter as until the ride height is correctly adjusted with the armboard level to the levelled plinth on all three sides, there is a chance that when the platter is placed onto the sub-platter, it will flatten the suspension on one or more sides, thus causing the platter to contact the top-plate and potentially cause damage!

So, what I suggest is to lower the platter onto the inner platter upside down initially, as this avoids the risk of the rim of the outer platter contacting the top-plate and you can then check/adjust your spring height adjustment without risk of contact with the top-plate!

Once you are happy with the height adjustment of the suspension you can remove the outer platter and gently replace it the right way up.

Figure 42 – Rough levelling of suspension

So, for the moment, just re-check and re-adjust the lock nuts if necessary so as the armboard sits pretty much level with the plinth and leave it there, as setting the bounce is yet another subject to be covered later!

Main Bearing & Sub-chassis

A brief overview of the various main bearings, sub-chassis and their identification is the next subject to be considered, mainly because one of the most frequent questions I'm being asked is "Does my deck have a Cirkus bearing fitted?"

Of course, the new Karousel bearing (2020) is very different in its appearance, a picture and description is also included below for your reference. The Karousel bearing replaces the Cirkus bearing. It is compatible with any Cirkus compatible sub-chassis.

But first, let's start in the very earliest days, as originally the sub-chassis was a single piece pressed steel affair as shown in the picture below and I'll try and take you through the evolution of the bearings and sub-chassis together as far as it's possible to do so.

Figure 43 – Early pressed steel sub-chassis with bearing

In 1974 and around serial No 2000 the sub-chassis was strengthened by addition of strap, which was spot welded in place.

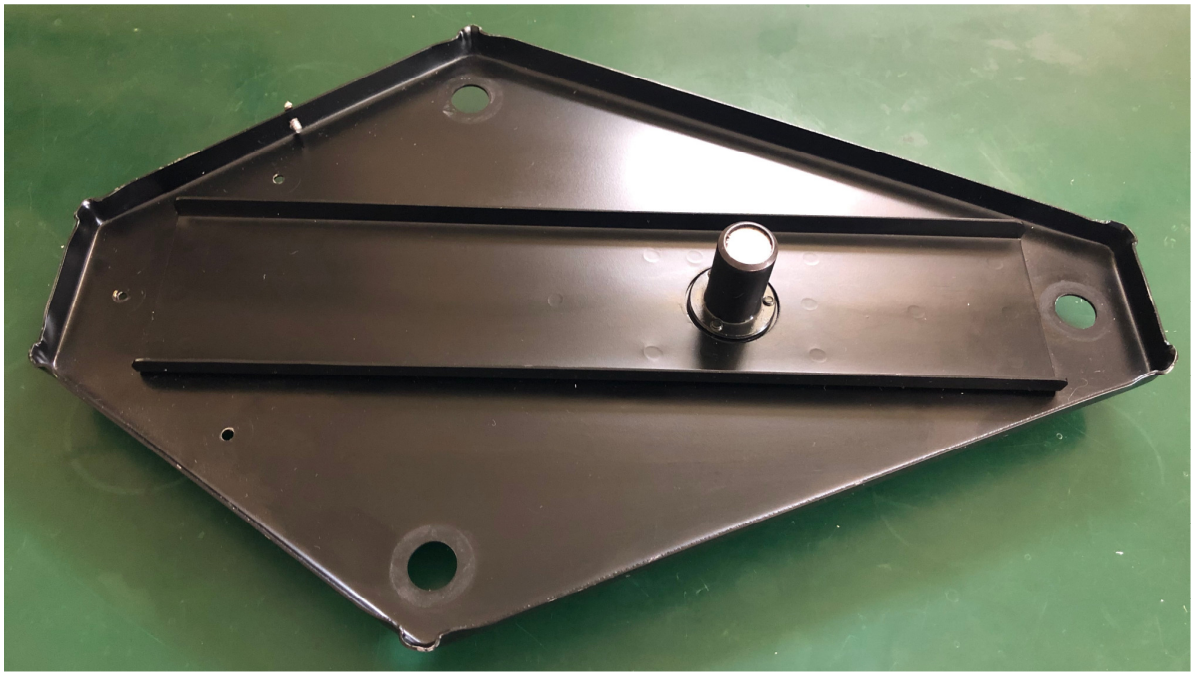

Figure 44 – Spot welded sub-chassis

Ten years later in 1984 at serial No 54,100 an improved sub-chassis with the strengthening bar now being attached using an epoxy glue was introduced. This bonding method increased the rigidity, strength and eliminated the distortion in the sub-chassis, sometimes caused during the

spot-welding process. However, the bearing was still only bolted to one layer of the laminate as you can see in the *Figure 45* below.

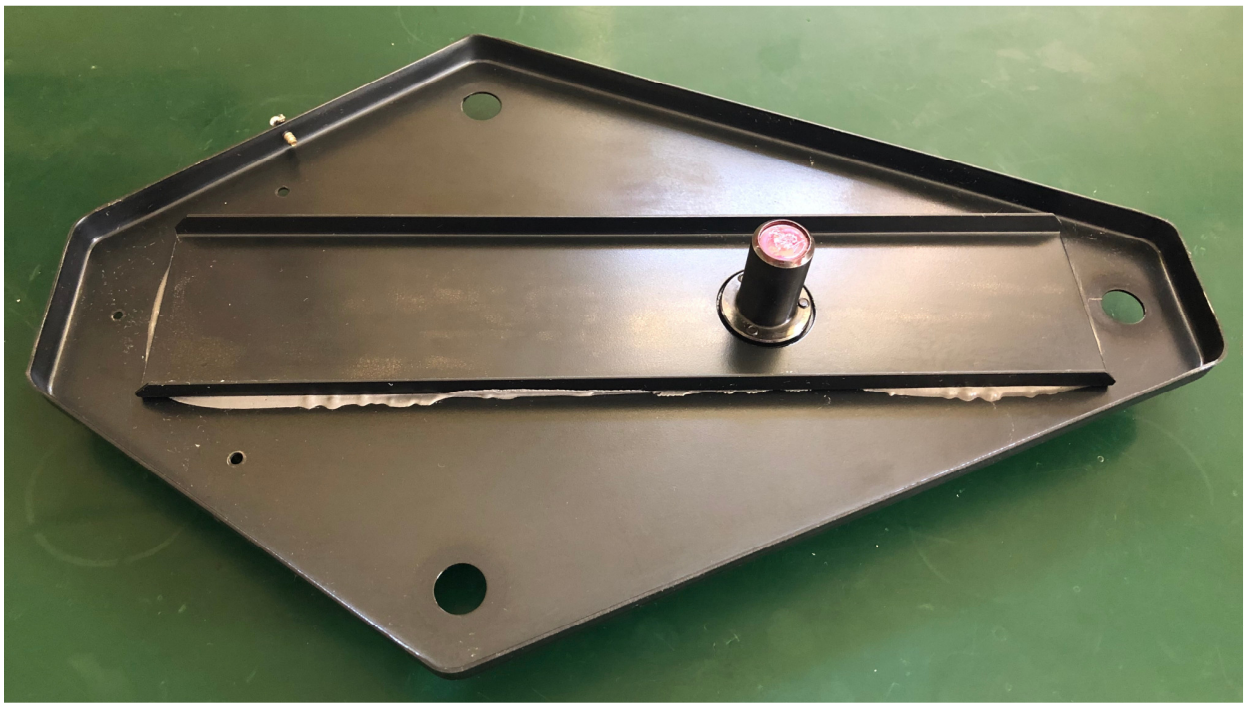

Figure 45 – Epoxy glued sub-chassis

Looking at the earlier bearings from above now.

Figure 46 – Pre-Cirkus bearing, gold housing with white liner; refer to 3 in key below; and also spot-welded chassis can be seen

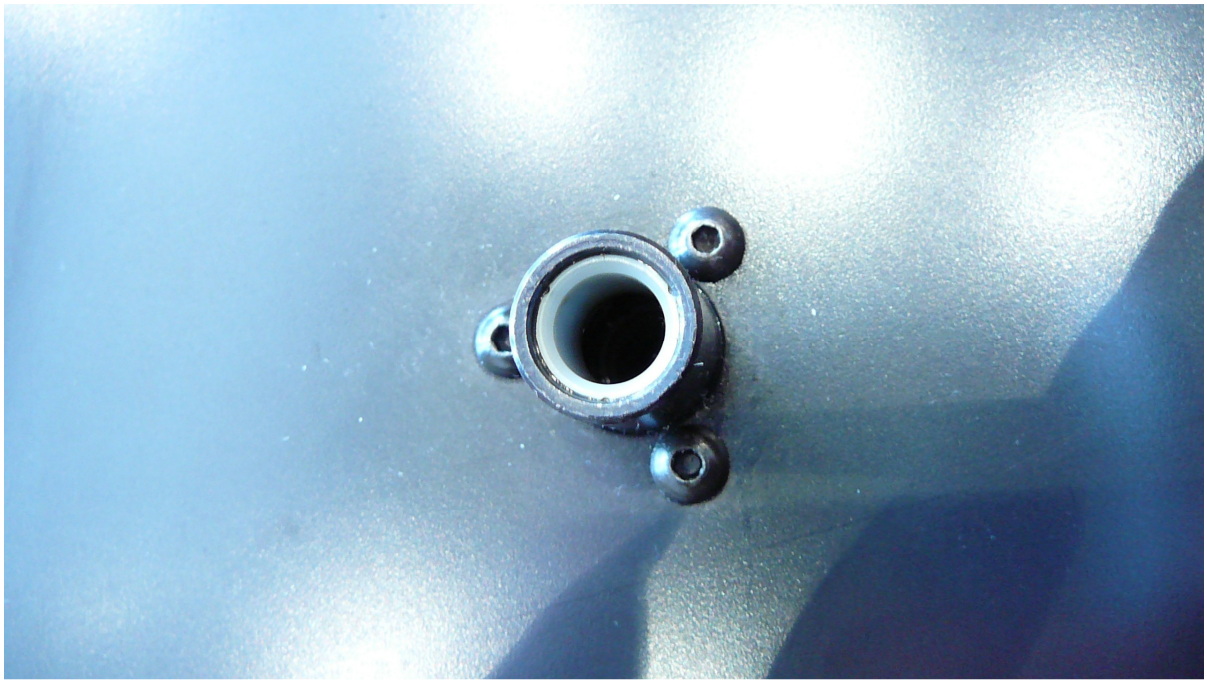

Figure 47 – Pre-Cirkus bearing, black housing with white liner; refer to 4 in key below

Pretty much all the very early bearings have white/off white coloured liners, save the very earliest liner which is again black, but sports a silver bearing housing and so won't be mistaken.

Figure 48 – Pre-Cirkus bearing, black housing with black liner and black Allen bolts; refer to 5 in key below

Figure 49 – Close up of a glued sub-chassis and later pre Cirkus bearing

In 1993 at serial No 90582 the Cirkus sub-chassis was introduced and this was even stronger than its predecessor.

While still using an epoxy glue, this time the bearing bolted to both layers of the laminate rather than one, and now the Cirkus bearing, uniquely as compared to all the previous bearings, has a very substantially stronger and more massive bearing mounting flange to take further advantage of this rigidity as you can see in *Figure 51*.

Figure 50 - Pre-Cirkus and Cirkus sub-chassis together to highlight the increased strength/rigidity of the Cirkus bearing mounting as compared to the pre-Cirkus

Figure 51 – Close up of a Cirkus Sub-chassis and substantial bearing mounting (sub-chassis still epoxy glued)

Additionally, the two bearing guides are more widely spaced within the housing giving greater stability. The top liner being inset, means that lubrication to the top bearing is easier to ensure as compared to earlier bearings as it acts like a mini oil bath, as you can see in *Figure 52*.

Figure 52 - Cirkus bearing, black housing with black liner and silver Allen bolts; refer to 6 in key below

So, what allows a Cirkus bearing to be easily identified in seconds as compared to the other three fixing point bearings?

Well, simply by removal of the sub-platter, as the Cirkus is the only LP12 three fixing point bearing to have the top bearing guide inset about 4mm down from the top of the housing. All the other three fixing point non-Cirkus bearings (*Figures 46-49*) have the top liner pretty much flush with the top of the bearing housing.

The colour of the Cirkus bearing housing is black, as is the visible liner, but so are late non-Cirkus bearings too! This is where I believe the confusion arises. Look primarily for the top black guide being inset by about 4mm and also the Cirkus bearing has three silver headed Allen bolt fixings, quite distinct to other black liner bearings whose liners are almost flush and their Allen bolt fixings are black. This pre-Cirkus black bearing (*Figure 48*) can be easily contrasted with the Cirkus bearing (*Figure 52*).

As for the Karousel bearing, you won't mistake this bearing for anything else I'm sure!

Figure 53 - The Karousel bearing complete with lock nut and a protective plug: refer to 7 in the key below

Figure 54 - The Karousel bearing installed on a Keel: refer to 7 in the key below

The addition of larger, stronger mounting bolts for the Cirkus originally and now in the case of the Karousel where a completely revised and better mounting system has been developed, means that the bearing is more rigidly connected to the sub-chassis than ever before. This minimises, further, the risk of turntable platter movement with respect to the sub-chassis and arm, and also ensures the bearing sits true to the sub-chassis. This mechanical improvement has a profound effect on the sound, and it follows that the Karousel sounds much better than the Cirkus bearing.

When fitting the Cirkus, the three fixing bolts need to be checked that they are nice and tight when you are setting up. Use as much force as is reasonable with the 4mm Allen key but do not use so much force that you start to distort the Allen bolt heads!

There is a good thread on the Linn forum (now archived) discussing specific torques if you wish to know more and wish to use a calibrated torque drive. Basically, the Cirkus was the first bearing to benefit from very secure attachment to the sub-chassis and it benefitted the sound greatly. This was because the Cirkus was so much quieter and more rigid than its predecessors. It could be bolted up and attached pretty much as one with the sub-chassis meaning far more fine detail, more music could be resolved.

The Karousel takes this philosophy to a much higher level and in addition we have a factory recommendation for the torque setting. The recommended torque setting for all sub-chassis types is 3.5N.m using a suitable torque wrench and 20mm socket.The new and very substantial locknut and three pin dowel location fastening system (*Figure 55*) on the Karousel stainless-steel bearing housing increases rigidity at the crucial point where bearing and sub-chassis come together.

**Note: overtightening the bearing can damage both the bearing itself and the sub-chassis.*

Additionally, it has a stronger, stiffer housing for the base of the bearing and for the thrust pad. These and other important improvements mean that the Karousel gives a more accurate and detailed sound and lower noise floor than was possible before!

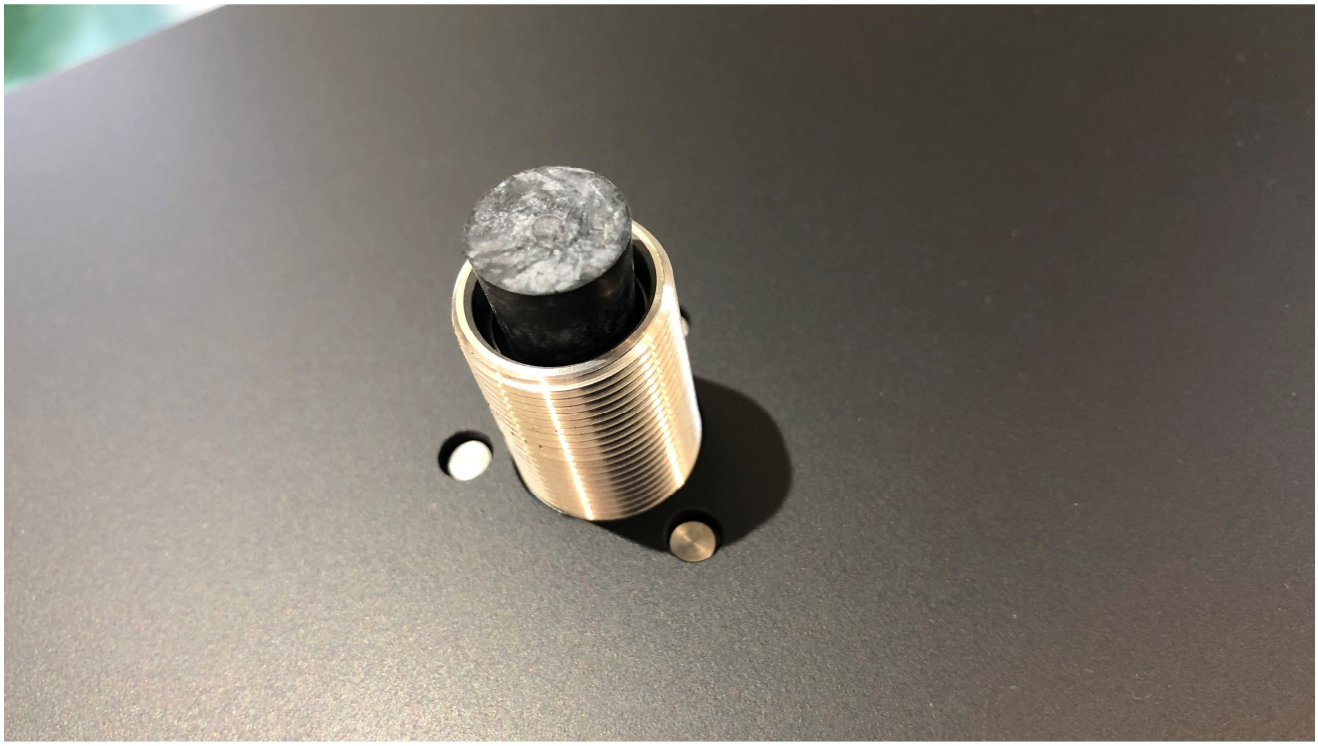

Figure 55 – Karousel showing the three pin dowel location fastening system (minus lock nut)

I enclose a summary chart on bearing types from the retailer manual listing all the bearing types for reference. It also highlights which liner must not be used with the modern black oil.

Bearing Housing	**Bearing Liner**
1. Silver	Black
2. Silver	White
3. Gold	White*
4. Black	White (1984)
5. Black	Black (1987) Serial number(approx.) - 70,000 onwards.
6. Black	Black Cirkus kit Serial number - 90582 onwards.
7. Silver	Black Karousel Serial number - 1503166 onwards (March 2020)

* Use this bearing housing with a light mineral machine oil. Black oil can cause it to seize. All other bearings use the Linn Black oil.

Revised Jan 1998

Oiling procedure for the LP 12 spindle bearing

Whether you are refilling an old bearing or you are fitting a new bearing, both need to be checked that they are scrupulously clean and it is essential to avoid any possibility of contamination getting into the bearing well as we need good clean oil and absolutely nothing else! If you allow dust or any other contaminants to enter the bearing when you are refilling the oil, basically the oil can work like lapping paste damaging the mirror polished surfaces, causing excessive wear to the bearing and consequently poor sound quality.

So please take extra care, use the bearing cap or plug and the spindle sheath where necessary, as these will help protect these critical bearing services. If you are in any doubt, clean these services again before introducing the oil as indicated in the oil in process below.

Oil for the LP 12 is normally supplied in 2.5 ml vials and the recommendation historically has been to ensure that oil completely fills the housing when the spindle is in place. (Not when it's empty of course!!) So, if you drip about 80% of the contents of the 2.5 ml vile into the bearing assembly first and wrap a tissue around the base of the bearing it can catch any overfilling/any oil overspill. See *Figure 56*.

Figure 56 - Wrapping a tissue around the base of the bearing

The tissue can then be removed, and the spindle then reinserted down the bearing shaft (now with the correct amount of oil in place).

This is quite a messy way of achieving the right outcome but given that the various bearings over the years have slightly different capacities of oil, it is probably quite good general advice for all bearings except the Karousel.

However, if you would like to be very precise on the exact number of drops required for the Cirkus bearing, I reckon should be 36. This number of drops should not result in any overspill when you insert the sub platter into the bearing.

If you lift the sub platter a little way out of the bearing well to check the oil level then you should see there will plenty of oil residue from the base of the inner platter gradually running down the spindle as in *Figure 57*.

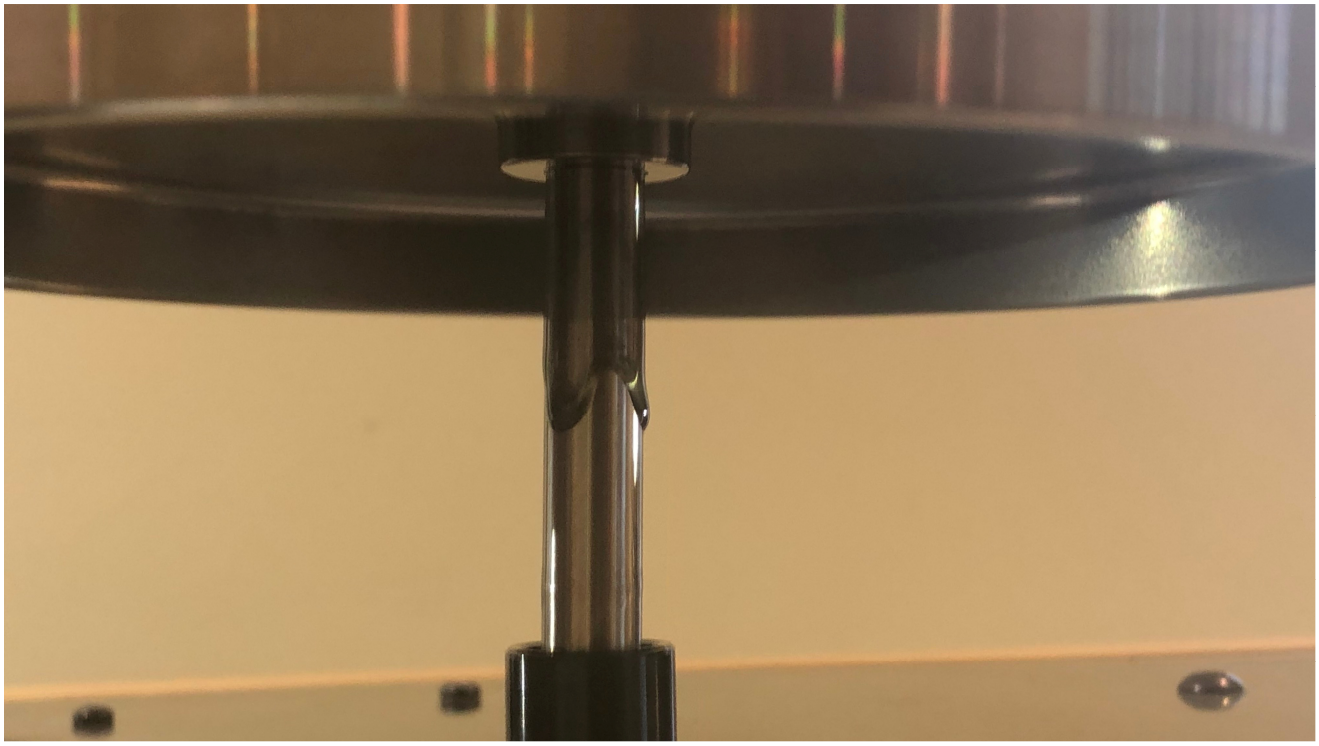

Figure 57 - Oil residue from the base of the inner platter

With the Karousel the number of drops is 24 in my opinion and the advice from Linn is that with the correct quantity of oil in place. This time you will see the oil residue running down from 2 mm below the inner platter base as shown in *Figure 58*. Please always lower the inner platter into the bearing carefully/slowly so as to avoid damage and also the oil ejecting as the air is expelled through the three breather holes between the bearing liner and outer sleeve. Allow at least 8-10 seconds for this, as then all the oil will stay in the bearing!

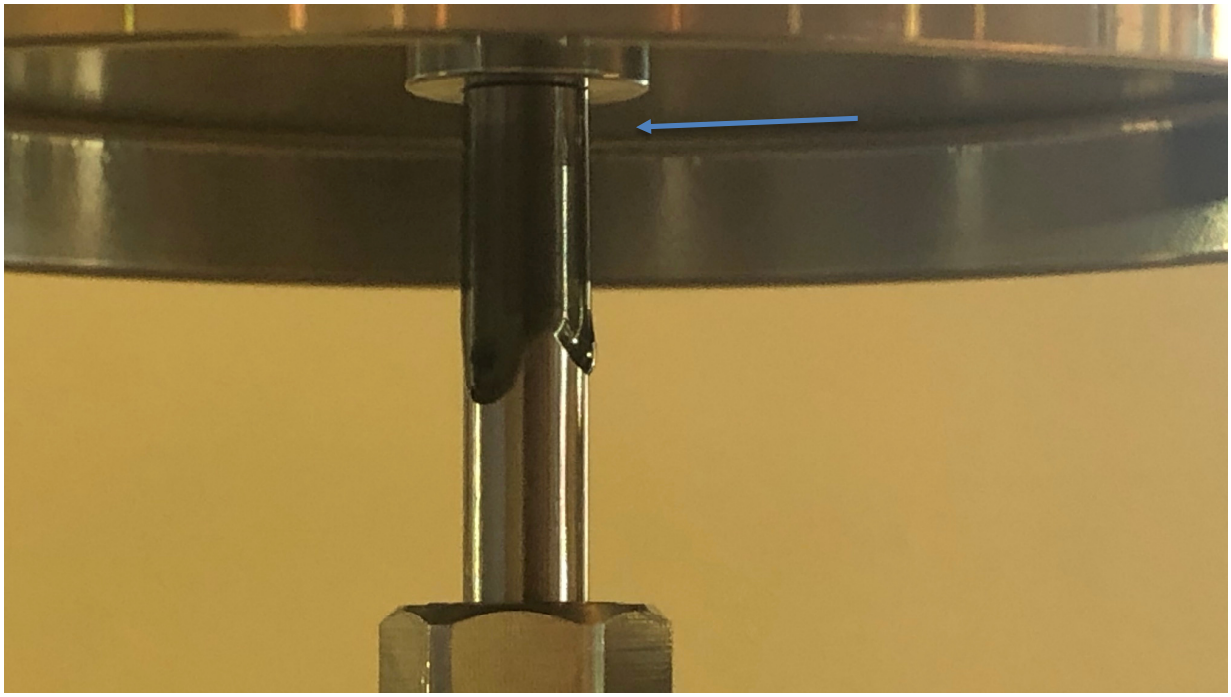

Figure 58 – The correct oil level should show oil residue 2mm from the platter base

The Keel sub-chassis is precision machined from a solid block of aluminium and was introduced as an optional upgrade in early 2007. It takes the performance of the LP12 to the highest level and utilises either the Cirkus bearing or as you can see below, the new Karousel. The bearing needs to be very rigidly attached, as it literally becomes as “one piece” with the Keel.

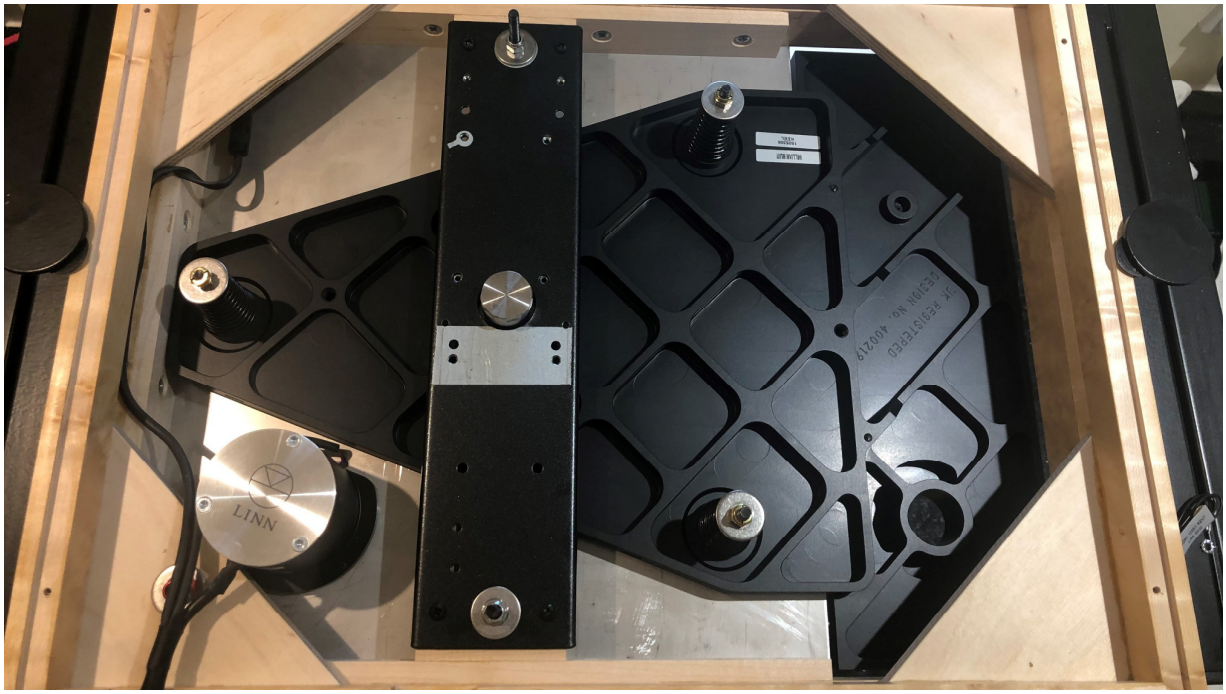

Figure 59 – Karousel bearing fitted to the Keel and note reduced clearance to the cross-member

As you can also see from the picture above, one of the strongest and most reinforced areas of the Keel is at the junction of the notional armboard section, to the sub-chassis part! This is because the Keel can take advantage of the tighter tolerances/higher quality of the Cirkus and now the Karousel bearing. Thus, when the arm is mounted into this “system”, everything is now very directly and rigidly connected across the sub-chassis.

This is completely different to the original bearing and pre-Cirkus steel sub-chassis arrangement where the bearing was only bolted to a single layer of the sub-chassis (not the steel strengthening bar which is present on most steel sub-chassis) and so a lossy interface exists (mechanical filter) and needs to exist, between the earlier steel sub-chassis and standard armboard so as to minimise noise transmission between the early pre-Cirkus bearings and the arm.

With the Cirkus bearing being so much better and quieter originally, this lossy interface was no longer required, indeed it is far better to have the bearing directly/rigidly connected to the arm and so with the steel Cirkus sub-chassis, the Cirkus or Karousel bearing bolts up to both layers of that sub-chassis as there is no longer a cut out in the steel strengthening bar required (Refer *Figure 50*).

This increased rigidity of the sub-chassis allows for far greater sonic performance as far less information is now lost in the sub-chassis/arm “system”. The Keel is the best and most rigid sub-chassis available for the LP12. However, the designers at Linn knew, given their research with the Keel, that so much more sound quality was available from the Cirkus bearing and to a wider range of owners, if the sub-chassis could be made more rigidly than the original diamond shaped steel Cirkus sub-chassis, but at a lower cost than the machined from solid aluminium Keel. This idea allowed the Majik and Kore sub-chassis to be conceived.

Launched in 2013 the Majik and Kore sub-chassis are no longer made from steel. They are an aluminium box section design with the same mass and centre of gravity as before but so much more rigid than the steel Cirkus sub-chassis.

The Majik sub-chassis seen below in *Figure 60* uses the original arm-board secured by the three screws as before but additionally is also secured to the sub-chassis by the mounted arm. In this case; a Linn mounting between the arm collar and sub-chassis, using the three M5 Allen bolts.

This additional clamping and hence rigidity is also true for Aro, Rega, and SME arm versions of this sub-chassis as the attachment of these arms is also used to secure the armboard to the sub-chassis, with the consequent improvement in sound quality over the steel Cirkus sub-chassis.

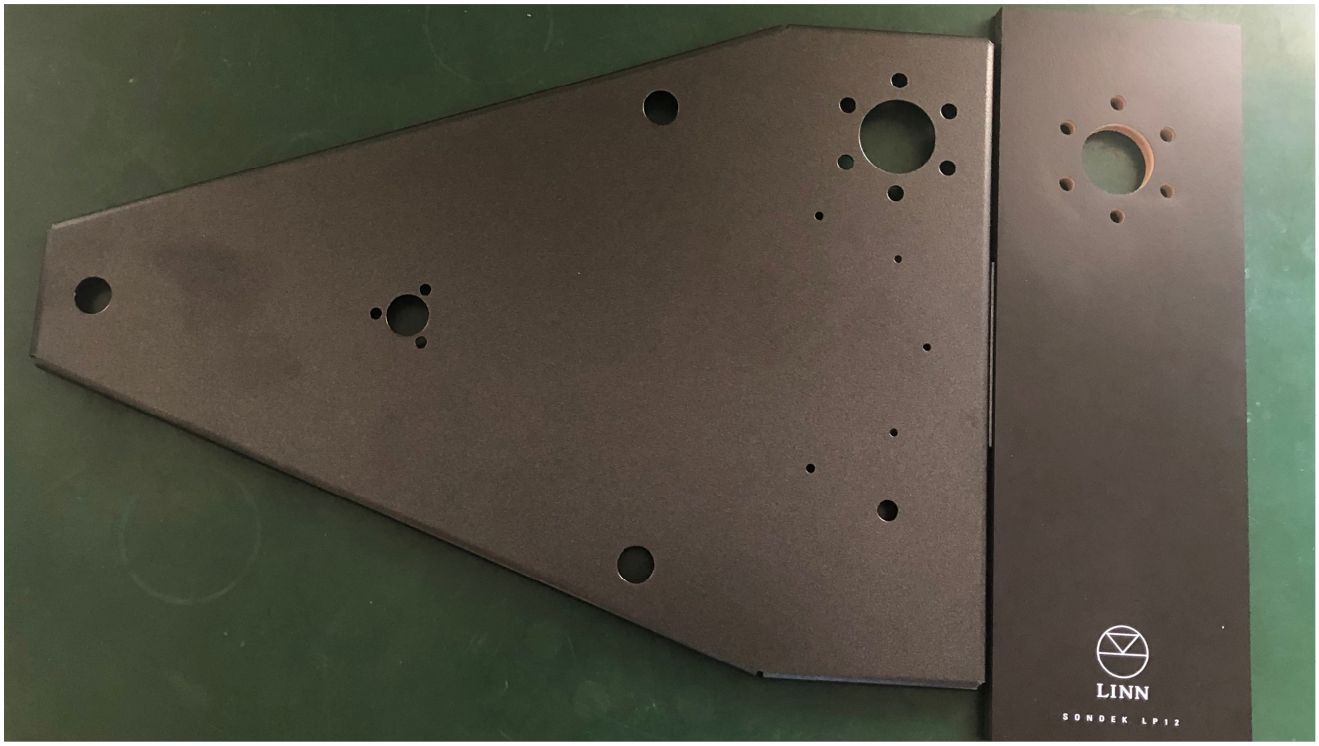

Figure 60 - Majik sub-chassis and arm board to the right

The Kore sub-chassis seen below in *Figure 61* builds on this idea of improving rigidity still further, as now the original armboard is replaced by an armboard machined from solid aluminium (similar to the Keel armboard section) and it is bonded to the Majik sub-chassis, making the Kore sub-chassis as a whole, so it's much more rigid than the Majik with the original armboard.

Consequently, the Kore sits between the Majik and Keel in musical performance but offering owners previously unattainable performance for its price. It is a hybrid of the Majik and Keel with performance between the two.

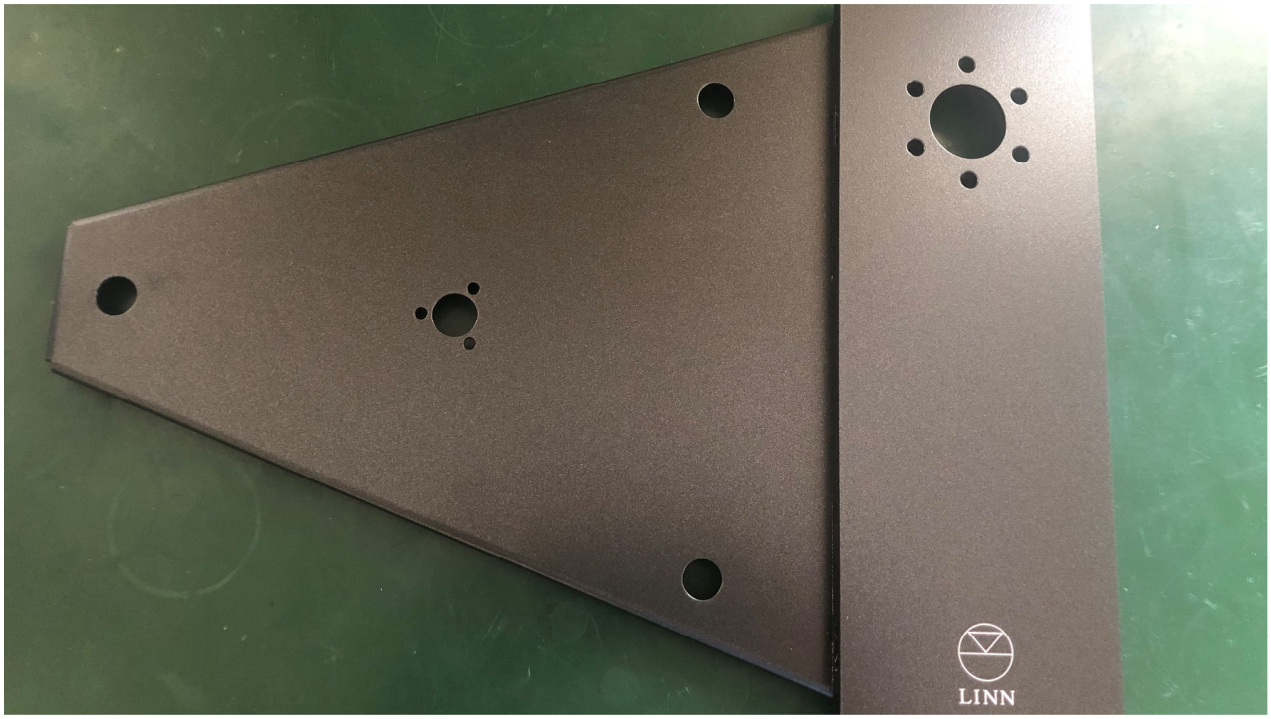

Figure 61 - Kore sub-chassis. The machined arm board is bonded to the sub-chassis

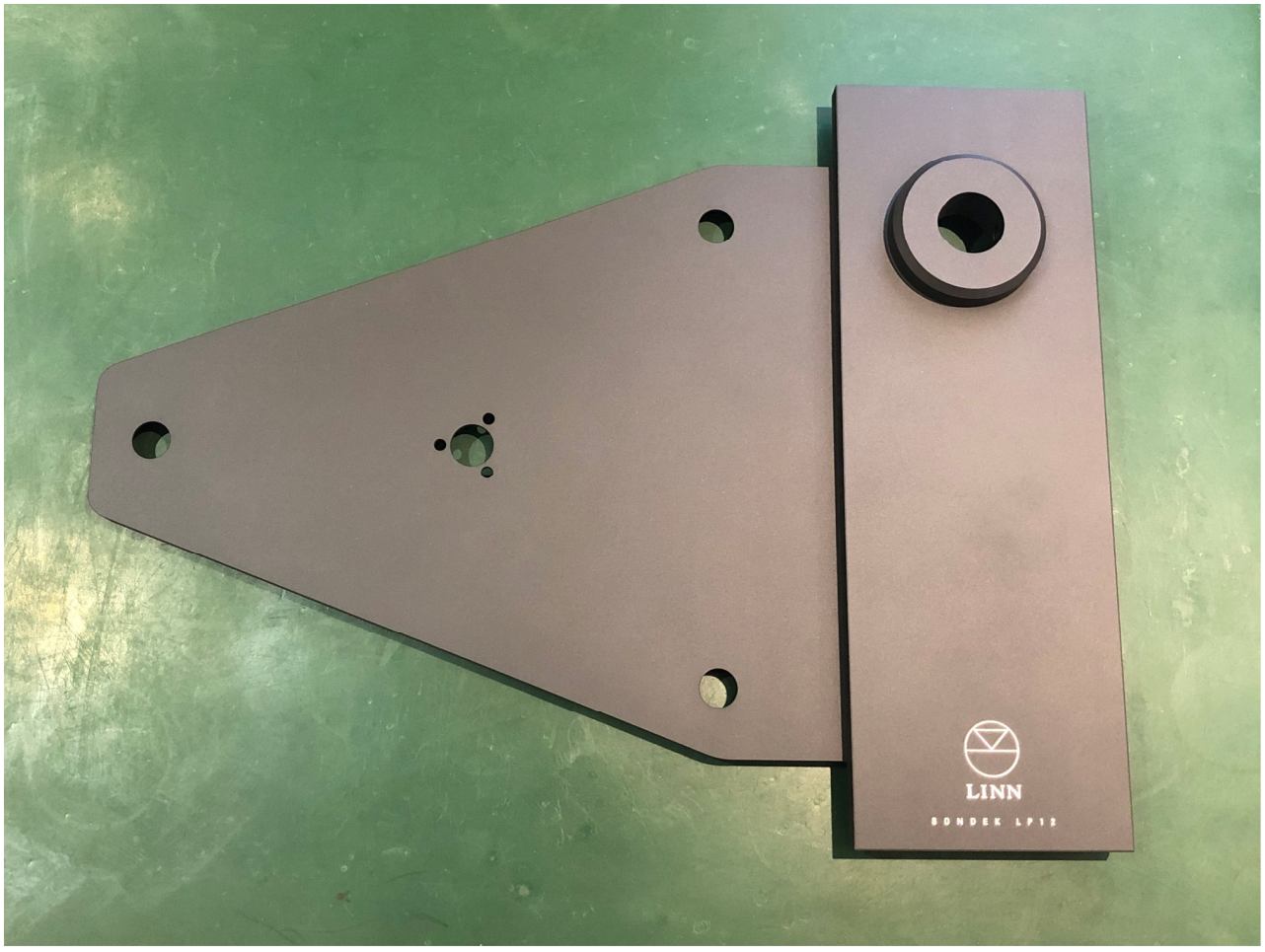

Figure 62 - Keel sub-chassis. One piece machined from a single billet of aluminium for maximum rigidity

Armboards

As with the bearings and sub-chassis, the arm boards have evolved over the passing years. The early arm boards were made of a fairly dense fibreboard. These can be easily identified as the underside is brown and the top side of the board is matt black.

Later arm boards are black on the underside, have a more of a silk finish and are of a laminated construction. Within these, there are three types: one with a harder top and bottom surface with a softer layer between the two; one with an additional single central lamination dividing the softer layer into two and finally, one where there is a total of four harder layers top and bottom with the two internal laminations separated by the three softer layers.

This is the best construction in my opinion. The differences between the three can be seen below.

Figure 63 – Different arm board laminations

The multi-laminate boards are generally later boards, however there was a period in recent history where the board construction reverted to the harder top, one central and bottom lamination arrangement, due to a lack of availability of the multi-layer board material.

So, it is quite possible to find boards with the latest Linn Logo using this arrangement, these boards were also very slightly thinner than their predecessors as you can see in the picture above.

Figure 64 – Armboard screw revisions

Figure 64 above shows the change from the original 1/4” posi screw (single front) to the slightly longer 3/8” posi screw (the three behind). These screws were certainly better from a fixing point of view, but there was a tendency for the screws when fully tightened to cause a slight distortion (mounding) to be visible on the top surface of the board, so at this point there was the need to introduce a small spacing washer under the head of the screw to stop the mounding occurring.

This order is as shown in *Figure 65* below and the washer is not positioned between the board and the sub-chassis, as has been suggested in a few places... and certainly not in the official instructions, as shown in the picture below!

This would space the board away from the sub-chassis and given the board always sounds best when in intimate contact with sub-chassis, not a good idea.

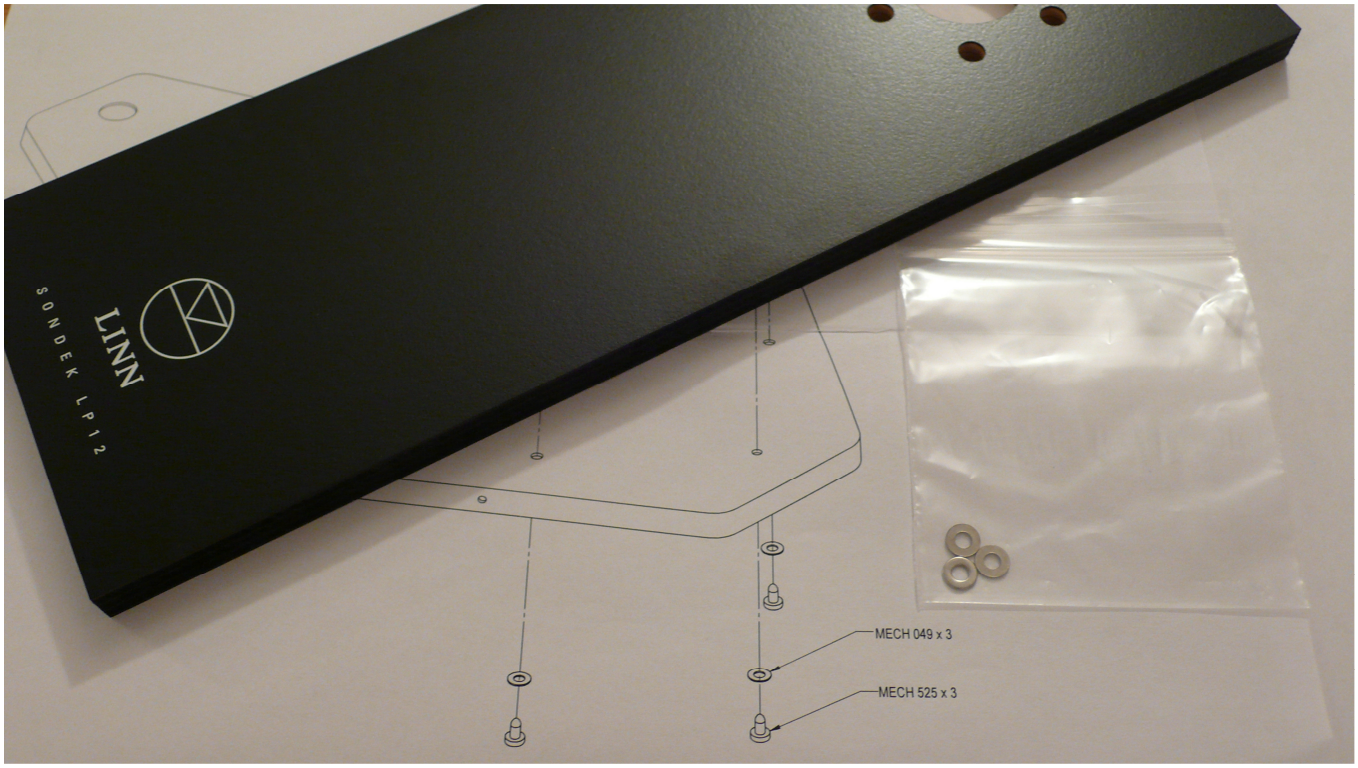

Figure 65 - Linn's new longer armboard screws (2013-2019 approx.) with spacing washers and fitting instructions

Although the longer 3/8 screw and washer arrangement provided a good attachment of the arm board to the sub-chassis, the possible risk of mounding of the upper surface of the arm-board in addition to the use of somewhat fiddly washers under the heads of the screws was not ideal.

So, in 2019 there was a small but very worthwhile revision of these screws and washers to the new slightly shorter Torx screws which do not require washers, shown in *Figure 66* next to their immediate predecessors.

These screws are easier to fit, tighten and grip the board extremely well. A small but worthwhile improvement.

Figure 66 – Arm board screw revisions. Torx screws now replacing the 3/8 Posi screws and washer arrangement

When the fixing screws are introduced to the armboard, there is often mounding of the board material in the immediate area surrounding the screw hole on the underside of the armboard. This is undesirable as it potentially spaces the board away from the sub-chassis, often in an un-even manner!

Historically, some arm boards had a small amount of countersinking around the screw holes, which helped avoid the problem, but others generally did not. So, I have some suggestions below for the initial screw insertion (any arm board screw type) below to help you avoid this problem and consequential loss of performance.

Firstly, when fitting an arm board and before you offer it up to the sub-chassis, is to introduce the screws into the three holes first, with the board upside down on a soft cloth on a work surface. Pilot them into a depth of about 80% of total insertion.

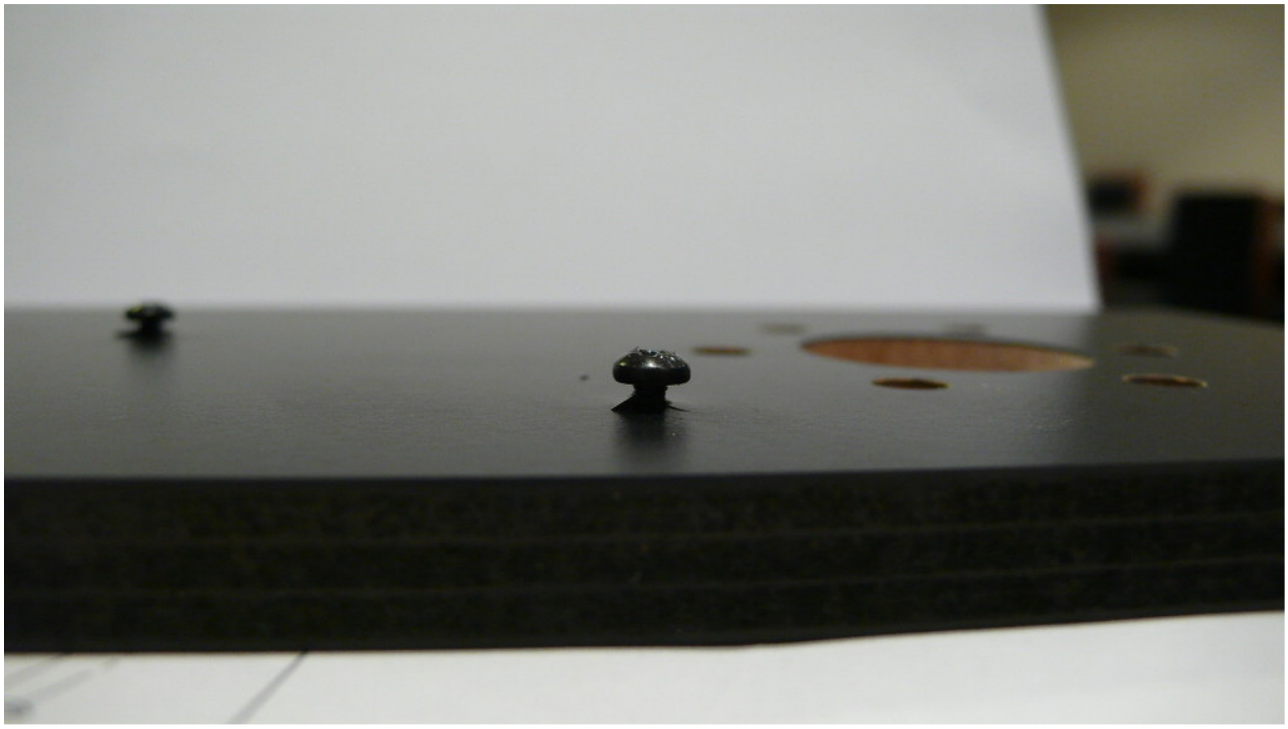

Figure 67 – Piloting screws on a level surface to establish a thread in the arm board

This has several benefits in my mind, as one is easily able to start and cut a nice clean, well defined thread into the board, rather than trying to tighten the screws in from the underside when working on the deck trying to insert the screws from underneath and finding that one's dropping them on the floor!

You will find it's much harder to start a nice clean thread into the board when working upside down. So, let gravity help you and the ease the positioning of the screw into the arm board!

Secondly and on the withdrawal of the screws from nicely cut threads, you will see some mounding immediately round the hole, which you will now be able to shave flat again with a blade or wood chisel (care please!), thus allowing the board to sit nicely, flat, firmly and consequently in intimate contact against the sub-chassis when the screws are now tightened in to attach the arm board to the sub-chassis. See *Figure 68*.

Figure 68 – Screws removed and excess material removed to provide a flat surface for the arm board to sit against the sub-chassis.

As you will have read elsewhere, the quality of these fixings has always been crucial to the design, and if one or more of these screws will not tighten properly and hold into the board, the board should be discarded and another new one used. This is far more likely with an older arm board with the shorter ¼" Posi screws that has been used before.

So as above, an extra few minutes of preparation with a new board is well worthwhile, both in terms of sound quality and the cost of a replacement!

Personally, I am happy to suggest that you use the new type Torx head (T10) armboard screws on all versions of the steel sub-chassis and Majik sub-chassis arm-boards, if you are able obtain them from your Linn Retailer.

Linn currently provide ready cut boards for Linn, Naim Aro, SME, early Rega with the single 22mm hole, now also the later Rega with the single 22mm hole and the new three-point fixing, piloted into the underside of the arm board. In addition to these, a blank board can be obtained if you wish to cut it yourself.

The quality of the arm to board fixing is paramount when attaching an arm, whatever it may be, and so here are a few arm specific suggestions, so as to avoid you getting into trouble:

With Linn arms, avoid over-tightening the three Allen bolts as this will crack the laminate surrounding the three mounting holes being used. So, tighten to a reasonable extent so as to compress the spring washers, but no more please.

Specific tightening torques are discussed in various places on social media if you wish to reference this but suffice to say that if you start seeing deformation in the laminate, that will be tight enough.

Figure 69 – Shows cracked laminate beneath arm bolt mountings (over tightened) and no shaving of the excess material surrounding the 3 screw fixings – not good and in the bin please!

Given that there is a little lateral adjustment with the three screw mounting of the board onto the sub-chassis, you may wish to use a Linn Kinki tool and that will be covered in the later section on arm alignment.

With the SME fitting there is no adjustment of the arm base with respect to the arm board as the four screw holes are ready pre-drilled for you, but the same suggestion for piloting them in first, as with the three arm board fixing screws to the sub-chassis applies.

Older Rega arms like the RB300 use a nut which attaches to the threaded base of the arm pillar, so one would think this is relatively easy. Well, yes it is, but the nut can have a nasty habit of coming loose again, even when a flat washer is used between the nut and the board and the nut is firmly tightened, so I suggest one uses a little Loctite superglue or even nail varnish between the washer and the board, just to stop it wanting to start moving. A loose arm after a few months is a pain!

For the more modern Rega fixing like that with the RB301 onwards, you will need to carefully position the arm in the cut hole, align it so as the arm points directly forward along the board, mark the three points on the board through the arm base while holding it still and then carefully drill the three marked points with a 3mm drill. It is easy to end up with the arm slightly off straight, so take your time!

As mentioned earlier, you can now obtain the Rega arm board with these three holes piloted to make your life easier now.

With the Naim Aro, the mounting of the collar for the bearing is easy and just nip up firmly the two sections together onto the board with the tools provided and aligning them with the Allen bolt to take the anti-skate weight hanger at 9 O'clock when viewed from the front of the board.

However, do take extra care with the little square cable connector, these tiny little M2 screws can be a right pain, especially if you are trying to attach the connector when the board is attached to the sub-chassis. (You almost certainly will drop the screws and probably lose one or two of them)

So, my advice is to attach them and secure the cable connector with the armboard on a work surface first, before attaching the board to the sub-chassis.

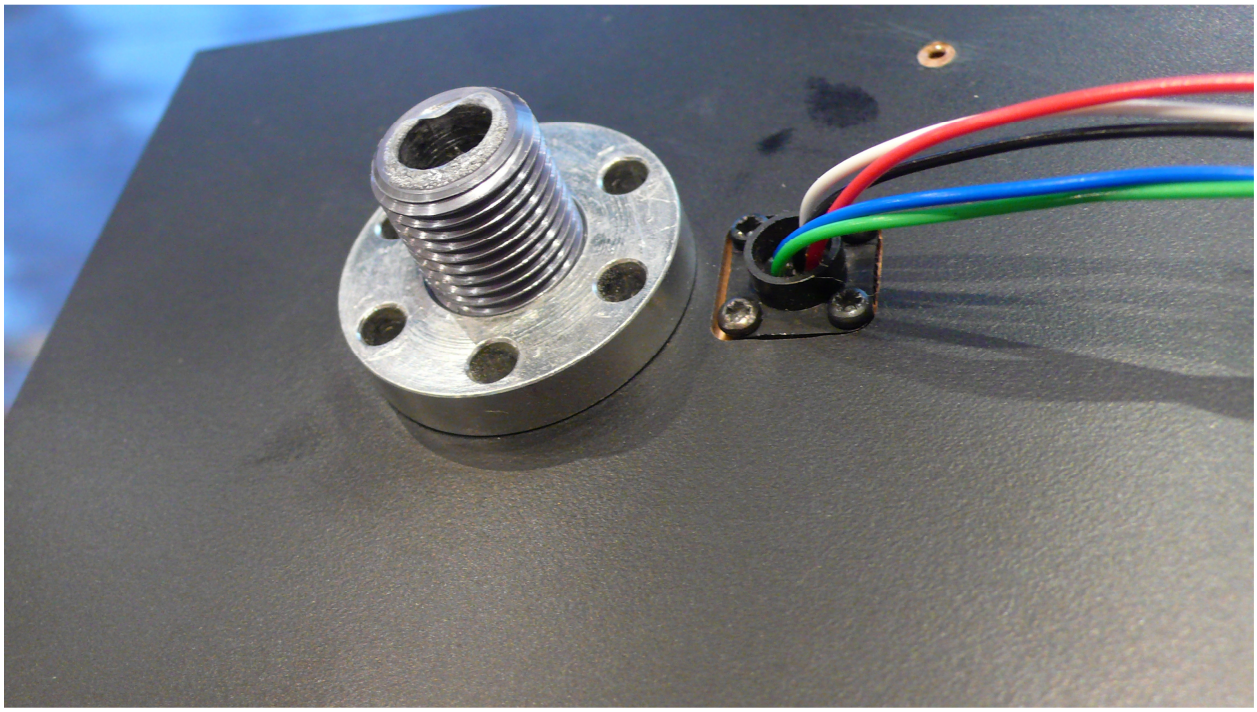

Figure 70 - Fiddly job fitting the Aro plug connector if attempted upside down on the deck - Let gravity help you!

Convention is to have the little keyway in the connector at 6 O'clock. It is also very worthwhile piloting these little screws into their pre-drilled holes first and, because they are so very small and their grip into the soft inner board material can be somewhat tenuous, I suggest that once piloted, you just carefully apply a little Loctite superglue to one of the little screw's thread and gently run it in and out of each of the four holes in turn, each time just adding a spot of glue to the thread again, the idea being to coat/re-enforce each of the four little now piloted holes.

Remove the screw and wipe any excess glue from both the screw and connector cut-out in the board and then leave it for 10 minutes to dry before attempting to finally attach the cable connector. As we want it just screwed, and not glued onto the board!

If you do this, then there is little chance of the board connector disappearing inside the deck when you push the Aro top connector into it. Again, less hassle in the longer term and of course a better, more secure and robust connection. The arm board will attach to the steel sub-chassis with the cable and connector attached, but it will be a tight fit requiring a little manipulation, so again take your time, exercise care with the wires entering the connector and ensure the wires are not trapped against the sub-chassis once installed.

The sub-chassis and attached arm board can now be fitted. Likewise, it is possible to install the Keel and Kore whilst having the Aro plug connector attached to the sub-chassis, exercising care not to stress the wires at the junction of the plug. For the Majik sub-chassis, firstly fit the arm board to the sub-chassis as one needs to fit and tighten up the arm collar with the arm board attached! You can then attach the Aro connector.

N.B. Leave the arm rest attachment on all Aro sub-chassis until it is mounted in the deck as the arm rest will foul on the top-plate if you attempt to fit the sub-chassis with it attached!

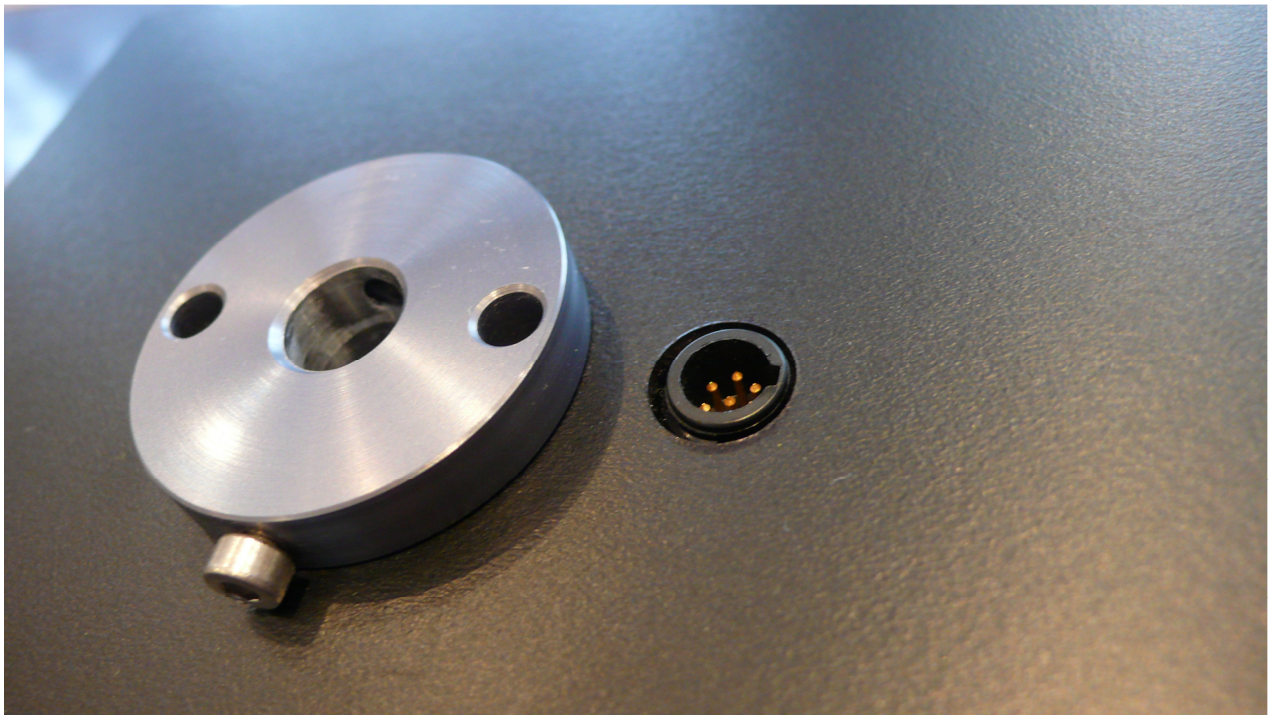

Figure 71 – The standard arm board assembly and connector for Naim Aro

Arm/cartridge alignment and use of Linn Kinki alignment tool with the standard sub-chassis and arm board.

As mentioned earlier in the arm board section, when using the three small arm board screws in attaching the standard arm board to either the Majik or steel sub-chassis, there is a small amount of adjustment possible between the arm board and the sub-chassis. Additionally, there is also a small amount of positional adjustment between both the Linn arm mounting collar and the arm board with its three Allen bolts.

In the case of the steel sub-chassis these bolts attach directly to the arm board and with the Majik the bolts now pass through the holes in the sub-chassis firstly and then through the arm board and into the collar. Consequently, slightly longer bolts are required. These longer bolts are also used to secure the arm collar to the Kore. So obviously given the potential adjustment at these junctions, there is a need for a method of alignment to give the best results.

Arm & Cartridge

There are cartridge protractors available which one can use and Linn make two: A basic two point rectangular one, and the more familiar and much more comprehensive 12” LP sized one which in addition to the above also includes an arc of travel and a 33/45 strobe on it, thus allowing speed to be accurately checked.

Although one might use these protractors to help position the arm on the standard arm board, there is a far better and more accurate way of ensuring correct alignment and positioning of the Linn arm collar, and this is by using the Kinki alignment tool.

As you can see in the picture below, its base has a diameter the same as an arm and it has a solid section with a hole in it at the far end so as to allow it to be positioned over the centre spindle. This very accurately sets the distance between the arm collar and spindle, so the three Allen bolts can be initially nipped up at this point and likewise the three small arm board screws.

I suggest use of the Kinki to correctly align the arm collar with all Linn arms and sub-chassis (even the Jelco 250/Majik arm with its smaller pillar diameter has a specific Kinki available to allow for correct alignment) excepting the Keel of course because the arm collar is part of the machining and hence no adjustment required or possible.

Figure 72 – Arm collar alignment using Kinki tool

The arm with the cartridge loosely mounted on it (mounting covered in the section to follow), can now be introduced and fitted to the collar, and then nipped into rough position. Attach the counterweight, fit the outer platter including mat and balance the arm out setting the tracking weight.

Now that you have the mass of the arm and platter acting on the suspension, this allows you to move on to setting the suspension height and bounce first (this will be covered in a later section).

The reason for this is that once you have achieved a good and pistonic bounce, you may well need to re-position the arm board again with respect to the steel or Majik sub-chassis if you wish to enable it to sit parallel to the plinth in the cut-out.

This means slackening off the three arm board screws and the three arm collar bolts, to allow you to achieve this and it will slightly alter the position of the arm collar relative to the main bearing!

So, having adjusted the arm board position if required, remove the arm from the collar again, re-introduce the Kinki, you are then able to make any minor adjustments to the position of the arm collar.

At this point you may also wish to check the arm is sitting parallel to the sides of the board as, if there is a locating slot in your arm tube (like with earlier Ekos, Ittok and Akito), you may also need some rotation of the collar, as although distance aligned, you would want to ensure the arm doesn’t appear wonky on the board!

Once this is checked and you are happy with the final positioning, now fully tighten up the three screws and the three Allen bolts, but ensure you do not over-tighten any of them and in the case of the arm collar bolts, crack the board laminate – very important!

The arm can now be reintroduced to the collar and one can set about checking the cartridge alignment in the head-shell. Please remember at this point, to just very lightly nip the cartridge mounting screws when the arm is on the deck to hold the aligned position once achieved, as you must remove the arm from the deck for proper and final tightening of the cartridge bolts on the head-shell (for details, including tag wire coding, please see below).

Warning! Serious damage can occur to the bearings if you attempt to tighten cartridge bolts with a Linn arm in situ and mounted on the deck!

Firstly, whether directly attached to the cartridge like with the Kandid, Akiva and Troika (flying tag leads) or not, as with many other cartridges, the tag wires are coloured for identification as you know:

The two positive (or hot) wires are red and white. Red is right. White is left.

The two negative (or cold/ground) wires are green and blue. Green is right and Blue is left.

Is there an easy way of remembering this scheme so as you won't have to reference this information each time you want to fit a cartridge? Yes, and hopefully these associations below should help you.

If you think about it, you need one hot colour and one cold colour for each channel.

So, red hot and white hot are the two positives, but which is right and which is left? Easy really, as red and right (the two R's) go together so red is right positive and white is therefore left positive.

But which cold (negative/ground) goes with each hot? Again, association in my little head comes to the rescue! Think of a traffic light. So red goes with the green and blue being left over, goes with the white... Simple and you will remember this from now on, I hope!

With many arms, tag wires are going to be pre-fitted or continuous down the arm tube but sometimes as with Linn arms, you may be confronted with four pins at the rear of the head-shell.

So, in which order do they attach to the arm pins? Its best to take a look at the pictures below in my opinion, but if you would like a verbal description please read on:

It is worth mentioning that the tags on the two ends of the tag wires are different sizes! The smaller ends are to fit the arm pins, and the larger tags are to fit the cartridge pins. Some cartridges like the Troika, Arkiv, Akiva and Kandid attached tag wires. Please note that tags on these wires have a habit of bending easily and breaking if you are not careful, so take plenty of time and try and position things so as to make access to the pins with some narrow nosed pliers is as easy as possible.

The way I do this is with the arm on a flat surface and upside down and the head-shell facing you, so as to allow easy access to the pins: Right positive (red) is the bottom left pin. Left positive (white) is the bottom right pin. Right negative (green) is the top left pin. Left negative (blue) is therefore top right.

Slightly awkward to follow, but to some extent, but that's because the arm is upside down currently. When the arm is the right way up it makes more sense!

There is another way to remember the orientation with arms like Akito and Ekos (arm still upside down), that is because the left positive pin/tag wire (white) is actually the hardest one to fit, as access to it is reduced by the side reinforcement on the head-shell.

I would suggest you fit this white tag wire first. Then fit the right positive (red) next to it. Finally, the two negative tag wires can then be fitted, green above red and blue above white.

Figure 73 below showing tag wire orientation, with the white being most inaccessible, and why it is a good idea to attach the tag wires before bolting up the cartridge... the Troika shown, just like the modern Krystal cartridge, is a relatively small and easy to fit:

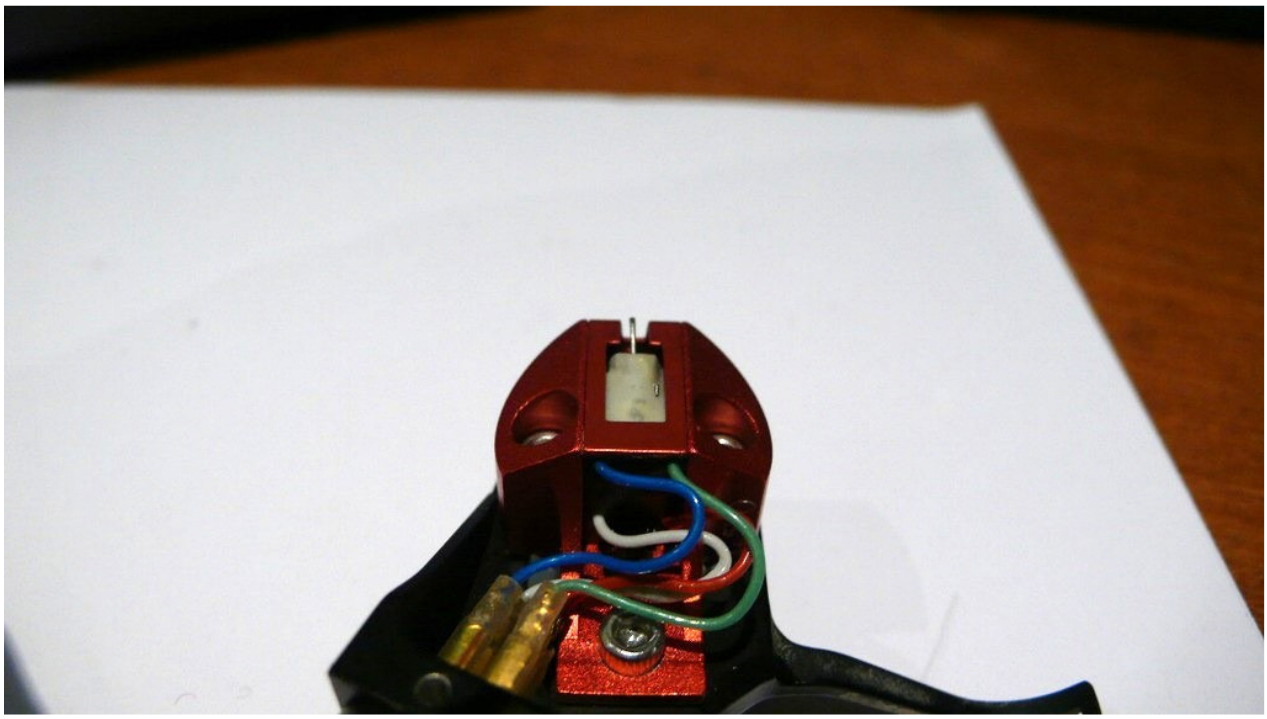

Figure 73 – Easy to fit, the LinnTroika

The Kandid also has tag wires attached (*Figure 74*).

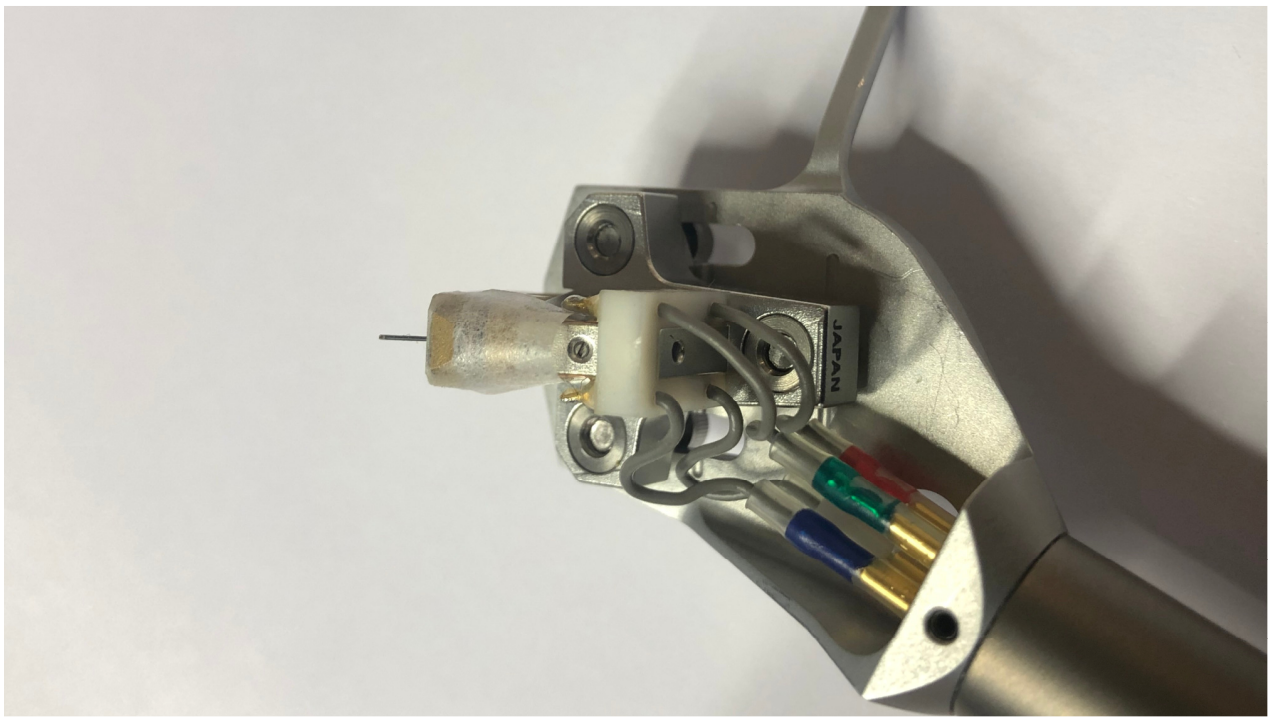

Figure 74 – Kandid tag wire orientation

Cartridge Mounting

Once the tag wires are fitted, ensure that none of them will be trapped between the cartridge and head-shell when you start tightening the bolts. Flattened/crushed tag wires are not good! We can now move on to mounting the cartridge on the head-shell. Linn have made this process very straightforward in the main, with their three current cartridges, and I'll cover these in order below:

The Adikt has two plastic stops moulded to the top of the cartridge where it mounts to the arm and one should just ensure that these sit fully at the back of the mounting slots in the head-shell when tightening, and basically that's it! Just see the advice below regarding how much to tighten the bolts up. If you wish to check the alignment using a protractor as shown below, that's fine, but the Adikt should be aligned by this process anyway. (Note as from early 2021 the Adikt no longer has location lugs following the introduction of the Krane arm.)

The Kandid, Krystal, Akiva, Arkiv and Troika all have three mounting points and once the cartridge bolts are just before the point of holding the position of the cartridge on the head-shell, you will find there is just a tiny amount of adjustment available, so that you can align the cartridge correctly.

Normally, what I do is with the arm de-mounted from the deck. I hold the arm in my left hand up in front of me, so as I can see if the cartridge is absolutely straight and aligned in the head-shell, and then carefully and progressively nip the bolts up a little in turn using my right hand. (I am right handed.)

Once you are happy you have the cartridge as straight in the head-shell as is possible. You can re-mount the arm to the collar, just to finally check alignment with the protractor at this point.

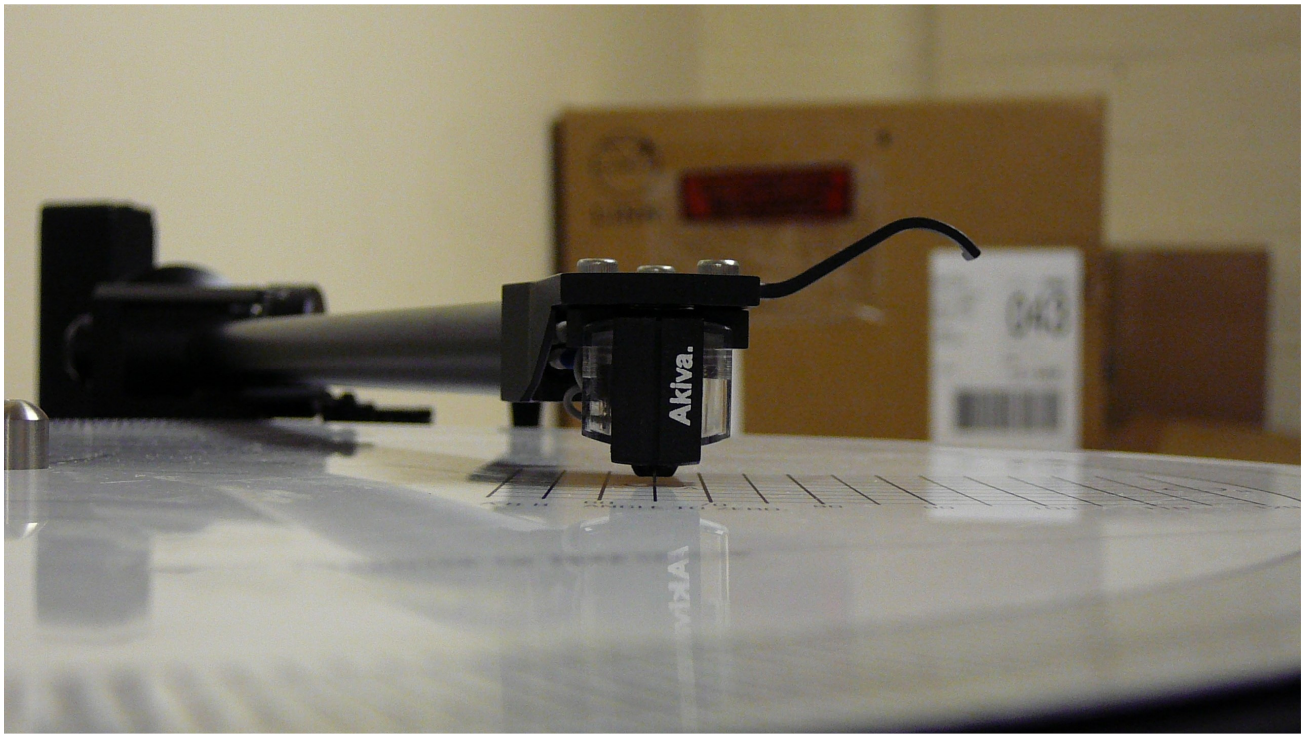

Figure 75 – Aligning the Akiva with the Linn strobe disk and alignment protractor

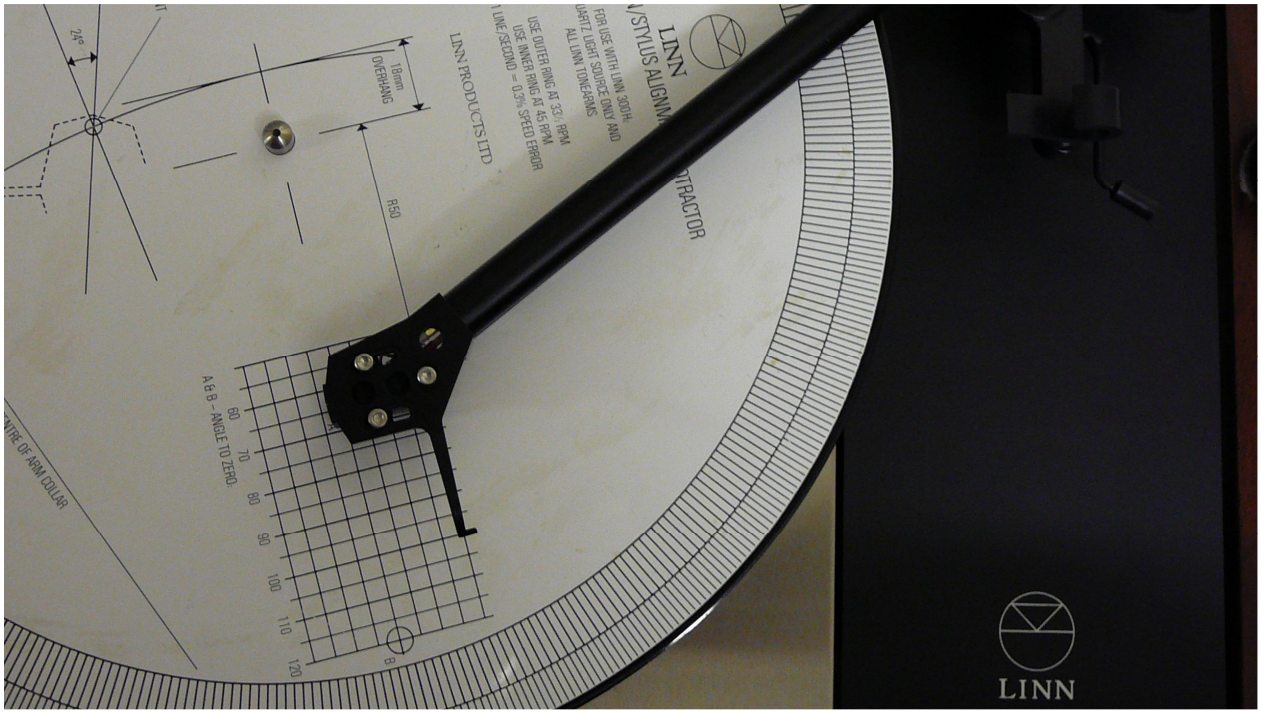

Figure 76 – From above, checking alignment using the Linn strobe disc and alignment protractor, Akiva/Ekos 2 shown here but it's the same for the Kandid and Ekos SE

Once I'm happy, having checked the alignment again with the protractor, I remove the arm from the collar again and holding the arm tube in my left hand and letting the arm bearing assembly just hang loose and free below the arm tube as this ensures the tightening forces are not translated along the arm tube and into the arm bearings. I tighten the cartridge bolts with my right hand, as we really want to avoid any risk of damaging the arm bearings. Additionally, one must ensure the cartridge does not move with respect to the head-shell during this process.

The tightening torques of head-shell bolts and other fixings on the LP12 is a complete subject area in itself and can be referenced elsewhere on social media if you wish. Suffice to say that one tightens up the bolts sufficiently using a bit of common sense as to what is tight, as over-tightening will start to deform the head-shell, and this is undesirable.

It is inevitable that in mounting the cartridge you will cause marking to the paint/surface finish of the head-shell, and the three raised areas "lands" on these cartridges surrounding the mounting points, will also make small impressions on the underside of the head-shell, this is normal and has to be accepted.

As I indicated above, most Linn cartridges are easy to align but the older models like the Klyde, Karma and Asaka have the more typical two mounting point arrangement, without any alignment aids. Of course, this is the same as most other manufacturers cartridges that you may wish to mount in your Linn arm. Here, we really do need to use an alignment protractor, and I will cover this and a couple of other relevant points regarding correct alignment in this section.

Firstly, if you are not mounting a Linn cartridge, I suggest you have a dry run with your cartridge, by offering it up to the head-shell, and just look to see if you are going to have a possible issue with the cartridge size!

The Linn head-shells are very rigid, but with the exception of the Ittok and Ekos SE/1 they are also quite small too, and therefore it is not uncommon for the tag wires to collide and short out against each other, when trying to move the cartridge back in the head-shell slots when trying to achieve correct alignment. This is also true for the Adikt so check first!

So if you think there is a problem you should consider gently offsetting (bending) the tag wires prior to fitting them to the pins at the rear of the head-shell, so as to give you adequate clearance once the cartridge is fitted, as shown in the series of Akito head-shell pictures below.

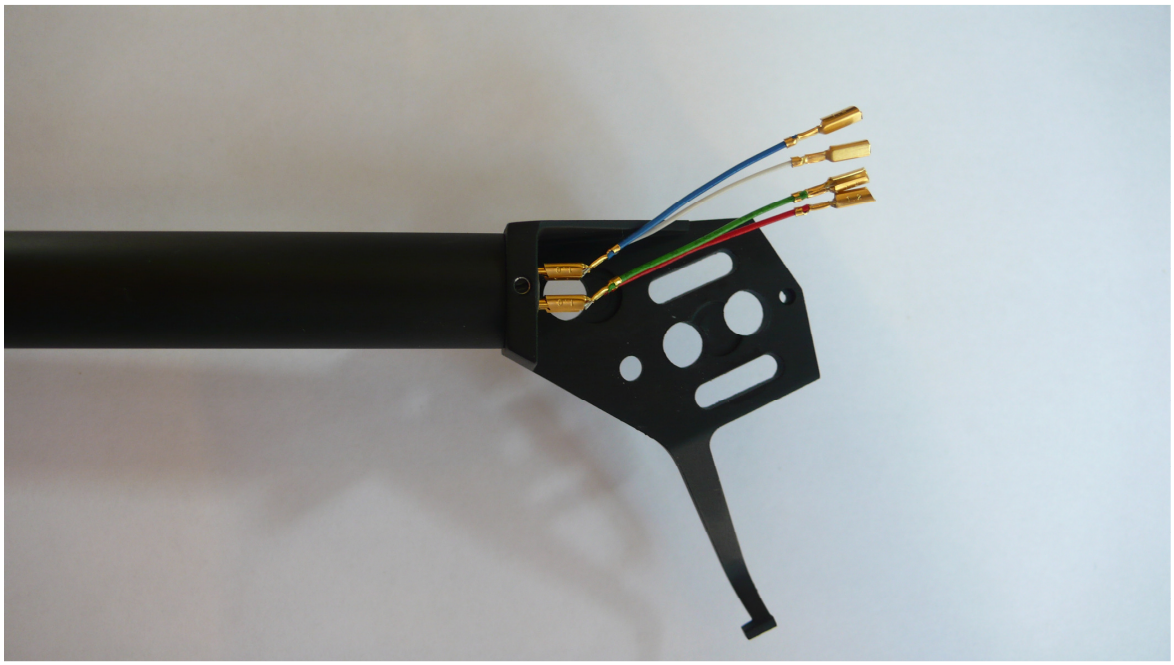

Figure 77 – With smaller Linn headshells; Akito and Ekos 1, 2, SE initial tag offsetting (N.B. Bend them before attaching them to the arm pins!)

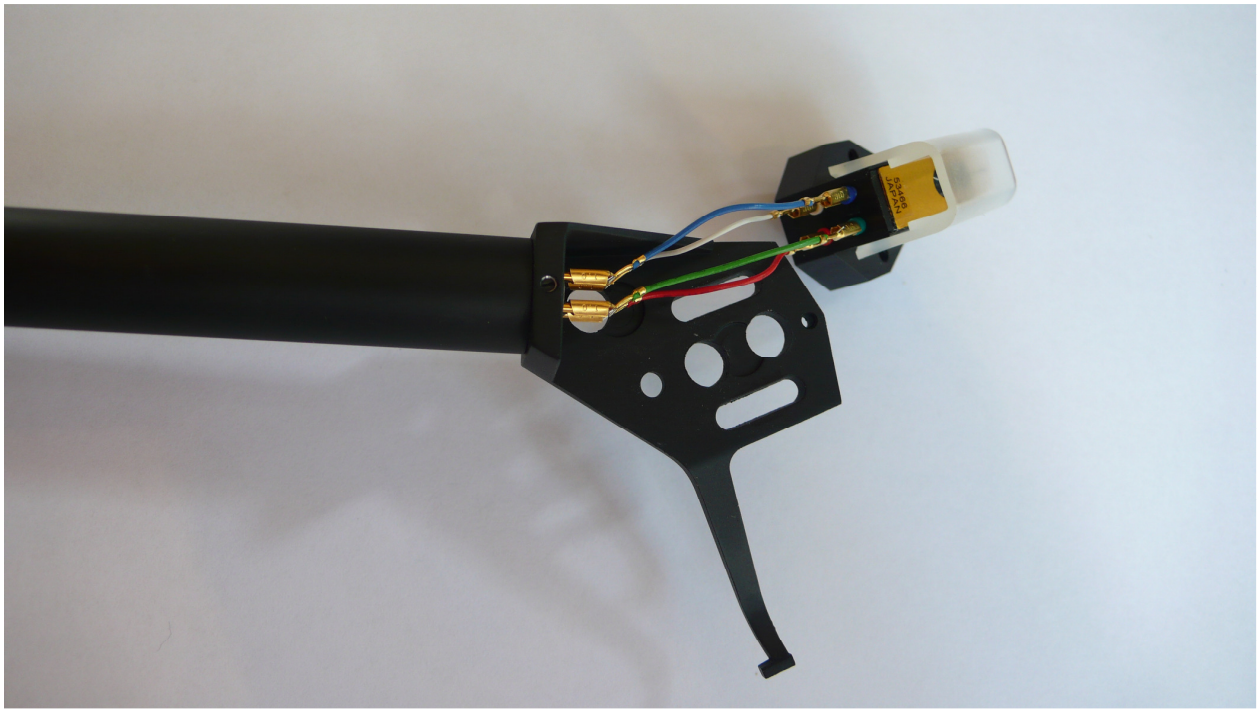

Figure 78 - Cartridge tag wires attached

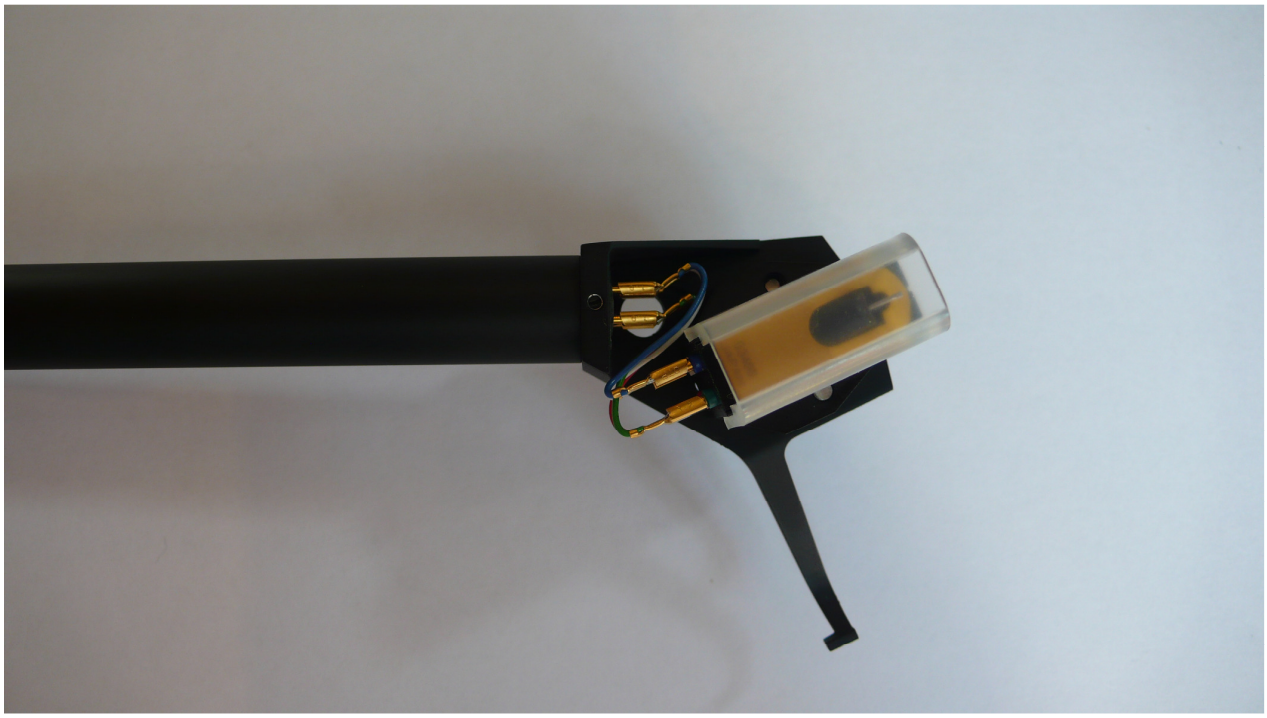

Figure 79 - Bolts now fitted. So, we are ready to check alignment

Once the tag wires are connected to the head-shell pins and also to the cartridge, (note the arrangement of the channel output pins may vary on different manufacturers cartridges, so check the rear of the cartridge for the correct connection layout) fitting of the cartridge bolts and alignment can commence.

With the two cartridge bolts near to nipping up, check no tag wires are trapped between the head-shell and cartridge and provisionally set the cartridge tracking force. Leave the anti-skate off when using the protractor – You will find it easier to position the stylus on the crosshairs. Try and have the VTA with the arm, pretty much parallel to the record playing surface while doing this.

Lower the stylus carefully down onto the protractor at the inner of the two alignment points.

Now see how square the cartridge is with respect to the head-shell, by looking down on it from directly above. Then, with the stylus positioned at the exact centre the alignment point (crosshairs), check to see if the alignment lines (front to back) are running parallel to the flat, finger-lift, side of the head-shell or not?

Initially, it is very likely these will not be parallel, so gently lift the stylus up from the protractor a few millimetres and rotate the platter a little, either forwards or backwards until these lines are parallel. (Tip- remove the drive belt before using the alignment protractor as often the platter will move, recoil a little when moved if the belt is left in place).

The stylus when viewed from the side, will now be just a little in front or behind of the alignment point (crosshairs). This is the distance you now need to slide the cartridge mounting bolts forward or back in the head shell, in order to achieve correct alignment.

So, do this, and then repeat your visual alignment check with the stylus now accurately positioned on the inner checking point again. Is the cartridge now square and parallel in the head shell?

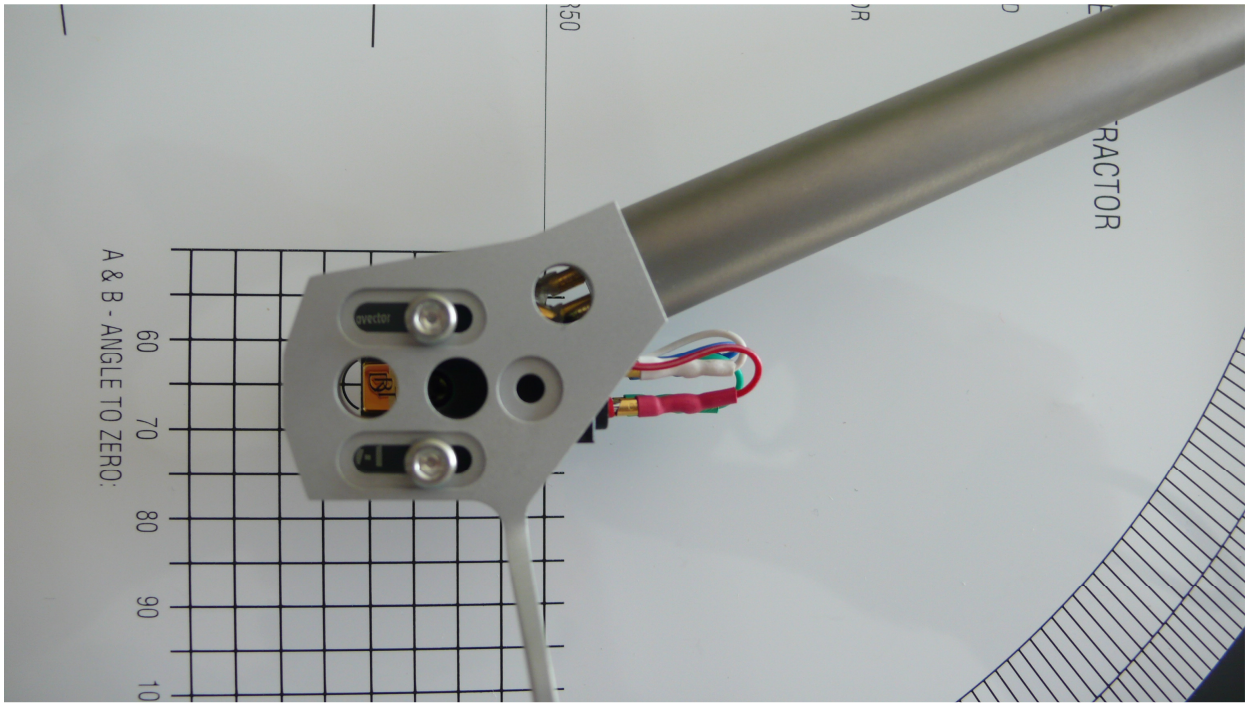

Figure 80 - A correctly aligned Dynavector XV-1t in an original Ekos Se with the smaller headshell – A very tight fit!

No – still not aligned? Then repeat the process above again until you do achieve correct alignment.

Yes? – Move to the next stage which is to gently and progressively tightening up the bolts without allowing any cartridge movement with respect to the head-shell, as detailed before and remember to remove the arm from the deck when you do this, so as to avoid any arm bearing damage. You will also find it's easier to tighten the cartridge bolts in this position too.

Once you are happy with the alignment, you can check again with the second (outer) alignment point. This should also show that you are correctly aligned.

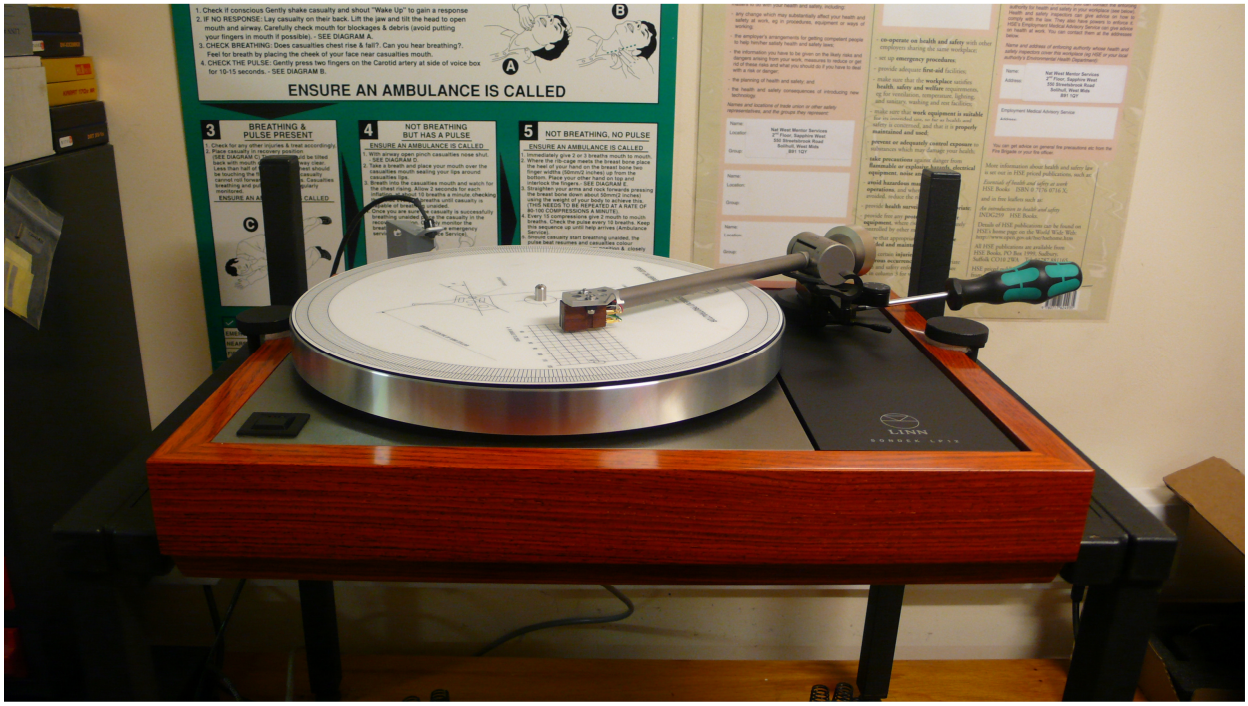

Figure 81 – Alignment in progress a Koetsu cartridge with just two fixing bolts

Finally, if you have the larger protractor and strobe disc, you can check to see if your cartridge follows the arc of travel as marked on it.

So again, how tight does one the cartridge mountings? Well, this will vary depending on the material used for the cartridge body. One wishes to avoid cartridge body deformation, and so I suggest one tightens as far as is sensible. Metal bodies will allow for greater tightening, which is desirable, but again consider how much force you are applying as you have the potential to deform the head-shell slots in particular, and this should be avoided.

Additionally, many cartridges these days are threaded, and therefore do not require nut. This makes fitting and the application of force easier, so again beware over-tightening!

If your cartridge requires the use of bolts and nuts to secure it, then please use a 5mm spanner to hold the nut still whilst tightening, as otherwise it will very likely turn in the head-shell slots, making a mess of the top of your head-shell.

Overall, use some common sense here to get the fixings as tight as is viably possible. The use of a standard small Allen key will allow you to provide enough tightening force for the bolts and don't be tempted to use extensions to multiply this force.

Please remember (and I've reproduced what's written in the dealer manual here):

To avoid damaging critical arm bearings never, under any circumstances, tighten or loosen cartridge mounting hardware with the tonearm mounted on the turntable!
Force applied at the head-shell can, by way of the lever action of the arm tube, be amplified and transmitted to the delicate precision bearings of the arm. This damages the bearings. The main pillar of the arm must always be allowed to move freely (i.e. not be attached to the mass of the turntable) when a cartridge is tightened in the head-shell.

Once you are happy everything is correct, please re-install the arm onto the LP12, re-balance your arm, re-set the correct tracking force and now also apply the correct anti-skate setting as the next thing we need to check is the VTA and hence we will want the cartridge tracking force to be correctly applied as it affects the attitude of the cantilever and hence cartridge too. This will be covered shortly.

VTA, VTA, VTA!!

So, what is VTA and why is it important to set this correctly?

Well, the Vertical Tracking Angle describes the angle between three important points.

Hopefully, my annotation of the picture below is good enough to give you the idea:

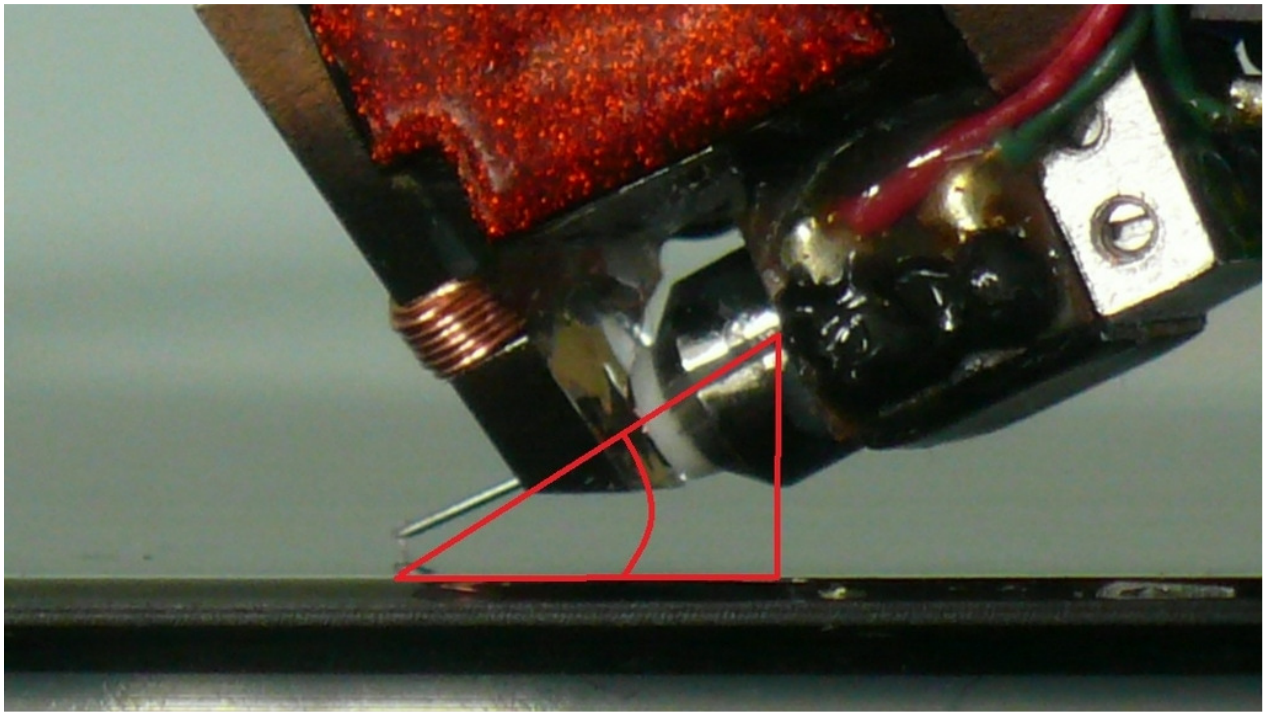

Figure 82 – Shows the Vertical Tracking Angle on a Dynavector DV-1T

The pivot point of movement on the cantilever within the cartridge body, the stylus contact point, and the record surface.

So, broadly, it is the angle the cantilever makes with surface of the LP and consequently and most importantly, how the stylus tip contacts the record surface. Once this is defined, the manufacturer can then ensure the optimum performance for the design.

With most of the cartridges I have installed over the years, this angle is around 20 degrees. In order to achieve this angle as accurately and as consistently as is possible by eye when installed on an arm, convention is to have the arm tube itself, as parallel to the playing surface as possible.

Why? Well, if a manufacturer wanted to specify something different, it would be far more difficult to consistently reproduce, and so one would get variation in the VTA and so the stylus would be presented to the record surface at varying angles! So, this is why setting the arm tube parallel to the record surface is best

If you think about it? Lowering the arm bearing assembly would lower the VTA, conversely raising the arm would increase the VTA. Tracking force also plays it's part here too as the greater the tracking force, the greater the deflection of the cantilever, so before you start, please check you are happy the tracking force is as close as possible to the final tracking force you intend to use.

Some cartridge manufacturers, try and make the setting of the optimum angle with their cartridges easier, by making the lower surface of their cartridge flat. However, for increased accuracy one would normally look at the attitude of the entire arm length, ensuring the tube was parallel to the record surface along its length. This is fine if the arm tube itself is straight, parallel and not either tapered or "S" shaped of course!

If this happens to be the case, often manufacturers will help with some visual cues to enable correct set-up of VTA. For example, the Project CC9 arm as used on early Majik LP12s is tapered, but Project have conveniently marked a lateral line along the centre of the tube to make life easier.

Of course, all the above would be fine if all our LPs were of the same thickness, but they are not!

So how does one adjust/allow for this? Well, as for many things in life, one has to come up with the best compromise. I suggest you have a think as to which records you play most these days. Are they standard pressings or maybe 180g? Or perhaps like me, a mixture of standard and heavier vinyl.

If you play just one type of pressing, then your choice is easy, you just use a representative thickness LP from your collection (maybe an older or one where you don't mind using it for set-up) and set it as parallel as possible – Please refer to the pictures below.

Figure 83 – Arm looks low at the back when viewed from the side

The very edge of LPs are often slightly raised to help ensure the needle cues into the run-in grooves properly, rather than sliding off the side of the LP, this means that you need to allow for this when setting VTA, and so I find looking from the front as shown in *Figure 84* below, better and more accurate.

Figure 84 – The same arm with nothing changed is parallel when viewed from the front, so watch out for this!

Additionally, I suggest you try and set VTA with the record turning as you are better able to take an overall /average view. While if you set the VTA with a record static, there is always a chance that you might be compensating for a small amount for warpage in the record that just may be present at that point of stylus contact!

I also find it easier to see what I'm doing these days by holding a white card or the reverse of my Linn speed checker behind the deck (as seen above). I just find a blank white background easier, when judging minute variations and ensuring parallel positioning.

However, if you play a mixture of different weight vinyl, then you will encounter variations in thickness of your LPs, and although these are relatively small, this becomes an additional challenge when trying to get the very best results.

In a perfect world, it would be nice to have an arm that automatically compensated for this. However, in real life we need to seek the best compromise to allow for everything to sound as good as is possible, no matter what you choose to play.

My suggestion here is that you set the arm to be parallel with the heavier vinyl. – Why?

Well, in my experience, given the choice, I find records sound better with the bearing assembly fractionally high (tail up) as is the case if you set the VTA parallel with a 180g pressing, and then play standard thickness records, than if the bearing assembly is fractionally down (tail down), as would be the case if you were playing a 180g record with the VTA set parallel on a standard thickness pressing.

It's just less of a compromise solution. Not perfect, just better in this mechanical system in my opinion. Remember, this difference in VTA is very small, and may well be in your margin for error when trying to set this accurately anyway! So if you are struggling to see the differences in actual VTA when playing different weight pressings, I'm inclined to say, don't worry then, or just experiment playing some tracks with slight differences in VTA and see if you can hear any improvements between one position and another. Trust your ears on this as that's what matters.

Interestingly, views vary on the importance of VTA between some manufacturers. For example, one well known arm manufacturer offers shims for altering arm height and hence VTA down to a thickness of 1mm, which in my opinion is just not enough!

Fortunately, with most arms, like the Linn arms for example, height can be adjusted to a small fraction of a millimetre, normally via an Allen key, which is far better in this respect as far as I'm concerned, as it really does make a difference!

One final thing to note: If you change your old Linn felt mat to a new one, please check your VTA again, as the new mat is very likely to be thinner than the old, as they do tend to pucker up with age! The same advice applies if you experiment with other third-party mats too of course.

Continued in Volume III with setting the bounce of the LP12.