

Turntable System Setup

By Laura Dearborn

Tip: Also have a look at our PHONO FAQ: A.J. van den Hul has written down his answers to the questions most commonly asked to him during the years. A very comprehensive "question and answer styled" list which treats phono replay, cartridges, turntables and nearly all matters related is the result. Both the novice and experienced record enthusiast will come across many points of interest here. Well worth browsing through...

When you're suffering the itch to improve your system but can't find the money, a possible solution is to spend some time fiddling with your turntable. (If you've gone CD-only, you're out of luck here.) Like everything else, the delicate mechanics of turntables are subject to the laws of entropy and will gradually drift out of tune, causing you too perhaps to gradually drift away from listening. Returning every six months or so will restore your faith (if it was flagging) in vinyl and perhaps your system.

If you need a demonstration of retuning's musical impact read this paragraph, stop, and do the following. Pick about ten bars of a familiar record and play it a few times. (use a record you don't like if you're concerned that quick successive replays will hurt.) Become familiar with the sound (female voice is best). Now change the tracking force. No, don't get out the gauges — just add or delete what might be a tenth or two of a gram. Hear the difference? — whether for better or worse. That's one small change in a series of small changes is available.

Being picky helps you get the most from your LPs because you're operating on such a minute scale. The grooves of a record are a few thousandths of an inch wide. Depending on the loudness at which the system is being played, you can usually hear down about 60+ dB, which means you're hearing groove displacements of the order of a few millionths. (That's like splitting a hair into one thousand pieces.) Every bit of motion or vibration allowed at this level can be heard through your speakers — greatly amplified.

What follows is a basic primer for table setup. To be more comprehensive here is impractical, if not impossible — spelling out how to optimize one product alone would take up pages. Instead, this gives the basic rationales for each procedure, along with some guidance as to what to do in each case. It offers a starting point for your own explorations or at least introduces you to the essentials of setup and fine-tuning, which may then encourage you to seek out someone familiar with the particularities of your own table. If you feel you're a fumblefingers, don't proceed. (You could cause some expensive damage.) Find instead a local expert to perform the magic. (Just be sure this person is an expert, is familiar with your particular table, and has set them up before.) This primer does not supersede the owner's manual, which should be your primary guide.

Another factor to consider: If your cartridge is getting on in life, much of the following may not have the sonic impact it should. There is even a small chance that a worn stylus is damaging your records. Cartridges are one of the most difficult (and most expensive) purchasing decisions in hi-fi because it is impossible to get them on loan. As an interim measure (before chancing big money on a major "name" cartridge), you might investigate one of the highly-rated inexpensive units. On the other hand, don't get hooked into the cartridge-of-the-month syndrome. Older, top-rated cartridges with thousands of hours use can sound nearly as good as the best of today.

At various steps along the way in this retuning, your system may not sound as sweetly musical as at other times. Beware of thinking you have made the wrong adjustment. Many times, you will make a technical improvement which will reveal a previously underlying nasty sound. Try and fix the nasty sound, don't just go back to the previous setup. If it sounds cleaner in the very bottom, and less "wooly," you have probably improved things. On the other hand, if nothing has changed except that it now sounds "nasty," then you probably erred in the adjustment.

Turntable Adjustments and Maintenance Support and Vibration

The first area to examine is the foundation of the entire turntable system, whether shelf or stand. No matter how good the table's suspension, some vibration will get through and muddy the sound from the bottom end to the midrange. Setting up the foundation to convey as little vibration as possible will help minimize the muddying. This is even more important for a turntable with no suspension.

If you can feel any motion of the foundation by lightly touching it with your finger tips while playing music, this is degrading your sound dramatically. To get a hint of just how great the effect is, listen to it through a stethoscope placed on the table or on its support. Or place a glass of water on the support and watch the water's surface while playing music or walking around — this is a simple and graphic way to see how much acoustic and mechanical vibration is reaching your system. Remember that your hi-fi is trying to reproduce groove modulations as small as a few millionths of an inch — about 1/1000th the thickness of the hair on your head. Not an easy task within this vibrating environment.

There are several steps you can take to minimize motion induced by the playing of the system as well as motion present in the environment. The record player stand must be on a stable surface — flexing floor boards do not make a secure base. If you have the option, mount your table support on a masonry wall or floor — remember the table can be either inside or outside your listening room. If your floor is wood, perhaps you can stiffen it from beneath, for example by bracing a strut between basement floor and turntable stand. If you cannot cure floor-flex, mount your table on a rigid wall.

Be aware that moving your table to a more stable location may result in an apparent decrease in bass. Since the more stable location has less vibration, the support vibrates less and therefore feeds less back into the system. This is not a mistake. You have indeed improved matters; you've just altered the apparent subjective frequency response. Don't reverse the move; correct the balance. To rebalance the system, you can try moving the speakers, or improve cartridge alignment, or play with room changes or even component changes.

Next, turn your attention to the stand or mount itself. All universal stands have some flat plate or bars which form the top and on which the turntable rests — this itself will vibrate harmfully (the weak point of universal record player stands). The thicker (read: stiffer) this is, and the more inert, the better the sound — and standard units are none too stiff. Don't wimp-out on the replacement. Get something very heavy (at least 25 pounds, preferably much more) and thick (over three inches). The stand should be spiked to the floor — nearly all come this way.

(Tip: Experiment with the sonic differences of placing Sorbothane vs. spikes between table and stand. The Sorbothane partly isolates, while the spikes tighten the connection.)

More About Vibration

Turntable screws may loosen over time, allowing more parasitic resonances to occur. Be aware that overtightening can warp the mating surfaces and make matters worse. Then use your noodle, look at the size of the screw, and snug it up. This goes for all screws used to hold anything together, be it cartridge-to-arm, or wire-to-box. A few tables are designed to need tuning of some elements by fastener tightness; in these cases, follow the manufacturer's recommendations.

(Tip: Consider adding damping material between two contacting pieces to dampen vibration, especially over big flat areas. The idea is not to have a squishy interface but to fill in the very small gaps left through manufacturing tolerances. Take apart the pieces, add a very very small amount of Blu-Tac [now available here] or any other non-hardening putty, then reassemble and tighten down until the parts are solidly back in contact. Where there are accurately machined, ground, or lapped surfaces in contact, use some sort of inert grease such as an industrial vacuum grease.)

Levelness

When a turntable goes out of level, generally the platter bearing's performance and the arm's dynamics, specifically anti-skate, are negatively affected. Because the platter bearing is round in a round sleeve, unlevelness alters how the bearing floats the bushing (except cases like the Well Tempered and the Versa Dynamics); the better the bearing, the less the effect. Sonic problems due to being out of level are greatest with a pivoting arm; least with a linear tracking arm under motor control.

So be sure your table's platter and tonearm mounting board are on the level. Don't just eyeball it — use an accurate level. If the platter is out of level, adjust the suspension (in the case of a suspended subchassis design). If the arm board is not level (which means the arm pivot is not vertical), either return it to your dealer for repair or re-level it yourself by shimming between the mounting board and its support.

Platter Bearing

About the only thing you can do here is to replace (or top up) the bearing oil. Follow the manufacturer's recommendation as to how often and with what. Lift out the platter, sop up the old oil with a lint-free cloth (or suck it out with a clean eyedropper or syringe), then pour in the new, being careful not to make a mess by overfilling the well. (The shaft of the bearing takes up most of the room in the bearing well.)

(Tip: Most oil bearings will be improved sonically by a stiffer [higher viscosity] oil. However, if the motor drive system is not very robust, this stiffer oil could slow the system down. Most manufacturers sell their own high viscosity oil; on the other hand, experimentation can be fun.)

Drive Belt

Some belts are meant to be talcum-powdered, some to be slick; some are meant to be soft-faced (matte rather than shiny), some to be clean. Check with the manufacturer about the need and method for cleaning to maintain proper traction. Some tables, because of their motors, require slippage to start up and slow down smoothly so belts on these most likely are talced. Years of slippage will wear the talc off and then start to buff the belt shiny. In a case like that,

replace the belt with a manufacturer's original.

Platter speed is sometimes controlled by what part of the pulley the belt rides on, so be sure to get this right. Belts can be finicky about just where they ride on platter and pulley — be patient. Everything that is on the table when playing a record — platter, mat, record, clamp — must also be on the table when you install or adjust the belt on a suspended subchassis table. On a two-part platter, place the outer ring upside down on the inner and lay everything else on top. This will accurately weight the suspension while allowing you to view the belt on the pulleys.

Suspension

There's not much you can do in the way of adjusting a non-suspension table, except to regard its entire support system as being a part of the table's suspension. Refer back to that section and consider even more strongly how to improve the foundation's vibration protection.

Suspension designs are all a little different so to adjust your suspended table, follow the manufacturer's instructions. As suggested earlier, if you aren't familiar with working on your table, find someone who is an expert at it. Tweaks peculiar to each record player which can significantly benefit the sound are discovered by users and fine-tuners over time.

If, you adjust the springs, you need to gain access to the underside of the table, raise it up on four soda cans. Everything that is on the table when you play a record — platter, platter mat, record clamp, and record (use one you don't care about) — must also be on it when you tune the springs so the weight (and therefore position) is accurate.

Generally, you rotate the entire spring to adjust the suspension's up and down motion, or rotate the nut at one end of the spring to adjust height and levelness.

Make small incremental alterations and check the results each time. The platter should float exactly the same distance about the plinth all around and the tonearm board must remain horizontal with the plinth. Pushing at the center of gravity of the suspended part of the table should, with most designs, cause the suspended part to move straight up and down very freely and not transition to sideways or rotational motion before the motion subsides. Keep adjusting until you can achieve this condition.

Arm Adjustments

The arm is pretty much maintenance and adjustment-free. Snug up the arm mounting screws. Check, on a typical pivoting arm, that the bearings are sound: grasp the headshell and very, very gently attempt to move the arm back and forth along the length of the tube and rotationally. If you can feel any free play at the headshell, you've got a serious problem — get it fixed or replaced. Exceptions are the Well-Tempered or unipivot arms where by doing this you are causing it to ride up off the pivot.

If you have a viscous damping trough, be sure it contains the correct amount of damping fluid; it doesn't evaporate but it does migrate. If there is dust and lint in there, clean it out and refill with the manufacturer's damping material. Also, in the case of a variable paddle system like the SMEs, reassess whether you are using the correct paddle. Too much damping will make the sound tight, but will lose lots of fine detail; too little and the sound will be open and relaxed but also more hazy and smeary.

(Tip: To minimize arm tube resonances [which can add much high frequency hardness to the sound], damp the arm tube with a brushed-on coating of liquid latex [thin cosmetic grade for theatrical use is good], or heatshrink tubing, or a non-hardening putty like Blu-Tac.)

You're trying to align the cartridge stylus with the record groove in as close a replication as possible to how the cutting stylus originally cut the record groove. You're trying to untrace with your playback stylus what was traced with the cutting stylus — the closer the alignment of the one mirrors the alignment of the original, the more accurately it can read the grooves. Alignment needs to be optimized in three different planes. However, it cannot be equally perfect in each of the three, so it must be optimized for an overall best balance or compromise. Final adjustment must always be done by ear and over an extended period of listening time. Just to add to the complexity, each record is cut a little differently. Here again, optimize for an overall balance of good sound over a wide range of records (or adjust VTA for each record, which some people do if they have an easy VTA adjustment on their arm).

The three alignment planes are as follows. (Please note that it is the stylus, not the cartridge, that is being aligned.) First, viewed from above, the cartridge's arcing movement across the record must maintain the stylus in the same relation to the groove as that of the cutting stylus's straight-line tracking; this is Lateral Tracking Angle, or Tangency. Viewed from head on, the stylus must be perpendicular in the groove so as not to favour one groove wall, and therefore one channel, over the other wall/channel; this is Azimuth. Viewed from the side, the stylus must sit correctly in the groove, at the same angle as the original cutter; this is Vertical Tracking/Stylus Rake Angle. (VTA, however, varies from record to record. Therefore, this alignment must be set by ear, even more than is the case with the other adjustments.)

Also confirm that the distance from the center of the arm pillar (the upright post) to the spindle (usually fixed by the arm mounting board) is correct as this will affect the ability to achieve the tangency adjustments. This "L dimension varies with every pivoted arm — check your manual or with the manufacturer.

Essential tools are an alignment gauge, a tracking force gauge, a record you don't care about as accidents can happen, a strong light you can focus where needed, and screwdriver. Small needle-nose pliers and a magnifying glass or plastic magnifying card can be handy. It's very difficult to make an accurate alignment gauge (do not rely on the accuracy of the gauge that comes with every arm), so get a good one. If it doesn't snugly fit over the spindle, throw it out and get another.

Make sure that the arm's wires, wire clips, and solder joints are in very good condition. At minimum, clean the contact between cartridge pins and wire clips by removing and replacing each clip. Holding the clips with needle-nose pliers can make this easier, but be careful that you don't strain the wires where they join the clip. Check your cartridge mounting screws. Because these must be snugged tight, plastic screws are no good. Aluminum, brass, or stainless steel screws, provided they are new and the threads aren't distorted, are fine. Allen head screws are great because the Allen wrenches used on them provide excellent leverage. To exert sufficient tightening force on a slotted head screw, you need a screwdriver with at least a 3/4" diameter handle — jeweler's screwdrivers just don't do it.

To Get Started

Tape the platter securely to the plinth. If it can rotate during setup, your alignment measurements won't be accurate. Just be sure taping does not alter its height or levelness. If this is not already done, mount the cartridge in the headshell and the headshell on the tonearm. The headshell screws should be finger-tightened just enough that the cartridge cannot fall off but is still loose enough that the cartridge is easily moved around. Work whenever possible with the stylus's safety cap in place.

Set tracking force at nominal, then do the tangency alignment procedures, then the azimuth. Do not deviate from this sequence as each step affects the subsequent one — change the order and the setup will be wrong.

Tracking Force

This adjustment on the tonearm counterbalances the weight of arm and cartridge. At this point, use your tracking force gauge and setting tracking force according to your cartridge instructions — final adjustment will be done later by ear. If you do not have a tracking force gauge, but the arm does have a calibrated counterweight, defeat the arm's anti-skate mechanism or set it to zero. Set the counterweight so the arm is level and balanced. Be very careful of the unprotected stylus — you cannot do this with its safety cap in place. Once the arm is balanced, lock it in its cradle and, using the calibrated counterweight, set the tracking force according to your cartridge's recommended weight.

Tangency Alignment

Follow the instructions in your owner's manual and those provided with your alignment gauge — different gauges use slightly different methods. As you square up the cartridge body with the gauge's markings, be sure that the cartridge sides are square or your alignment will be wrong. When all adjustments are correct, carefully snug down the cartridge mounting screws. Keeping a firm grip on cartridge and headshell together so nothing shifts, delicately tighten each screw down a turn or so, then repeat until tight. Snugging down one screw all the way before tightening the others is almost certain to twist the cartridge out of alignment. However careful you've been, always check the alignment again after tightening.

Azimuth

The old mirror alignment technique for azimuth may work fine for some cartridges, but a hand-made moving coil cartridge cannot control this alignment well enough. The stylus may be several degrees away from perpendicular to the top of the cartridge.

Remark:
Our handbuilt moving coil cartridges maintain high precision standards; Our cartridges' stylus azimuth error remains < 1°. —**A.J. van den Hul B.V.**

There are two accurate ways to adjust azimuth. One is using your ears for the best sound. Rotate the cartridge in tiny, tiny increments, in different directions, getting a feel for the area where you get greatest stage width, depth, and so forth. The drawback to this approach is that, until you develop a good deal of experience with it, you can be confused by the changes in sound, so be patient and work carefully — it will give you the best results. The only remaining foolproof method requires using a voltmeter and a test record. Set the azimuth so that crosstalk at 1,000 Hz is the same for both channels.

Vertical Tracking Angle

Unless your tonearm has a special VTA adjuster, adjusting arm height can be a major nuisance, and particularly so if the arm pillar is held at a selected height only by a set screw. In these designs, altering height means releasing the setscrew, which usually results in the arm pillar dropping precipitously, leaving you in the dark about the original point from which you are now trying to add or decrease height. (I speak from bitter experience.) Jam the gap between pillar neck and collar with business cards so the pillar cannot fall when released or find/make a block that fits between the arm mount and the underside of the arm structure. See your tonearm manual for its recommendations on adjusting arm pillar height.

The best approach is to tune-in VTA gradually by listening to music. You know the arm needs to be lowered at the arm pillar when the overall sound is hard and bright, with thin bass or no deep bass, edgy highs, and harsh midrange (of course, this could also be tracking force which is too light). Distortion obscures low level details between the musical notes so dynamic range is reduced. Transient attacks may be too sharp. Raise the arm when the sound is dull and damped, the highs rolled off, the lows muddy and lacking definition, and transient attacks are dull. Mind you, this sounds an awful lot like the effects of changes in tracking force (too light is edgy, too heavy is heavy and dull). They are different sounding but hard to explain.

Start with the arm a little low and very gradually raise it, first to where it is parallel to the record, and then so the back of the cartridge is tilting up. Keep track of your settings so you can return to the one you like best where everything snaps into focus. The range of adjustments can be quite broad, as much as 3/4" or even more (at the arm pivot). Play with the full range so you know what it sounds like and don't be diffident.

Antiskate Force (pivoting arms only)

This applies an opposing, balancing force to the natural inward drag of a pivoting arm while playing. Left uncontrolled, the stylus would push up against the inner groove wall, causing distortion both from mistracking and a cantilever skewed in relation to the cartridge generator. To set, lower the stylus down near the label of a record with a wide run-out to it. Increase antiskate until the arm starts to slowly drift outward, away from the label. Again, this should be finalized by ear as you listen to music. If image placement is a little off-center, or if things don't seem to be locked in solidly, experiment with antiskate. Also, watch the stylus when you set it into a groove. Does it move to the right or left relative to the cartridge body? This indicates too much or too little antiskating.

Fine Tuning

You've got three adjustments roughed in at this point: tracking force, VTA, and azimuth. It's a matter of reiteration to optimize the sound. The change in sound with each of these individual adjustments can be similar. It's therefore necessary, in optimizing all three, to experimentally move from one type of adjustments to the next, then to the next, in order to balance the optimization for all three. Listen to female voice as you work; got for the maximum vocal character and a tactile sense of a person.

You want to start to deviate from the cartridge's recommended tracking force by small increments. You are trying to put the electromagnetic system in its most linear position. Too much tracking force and you're moving the coils (or moving magnet) out of the center position of their range. A tiny increment may be 100ths of a gram or less; but try as much as 0.2 of a gram deviation above and below the manufacturer's basic recommendation in your experiments. Don't worry about record damage from heavy tracking; most record damage is actually caused by mistracking in the middle-to-high frequencies with too little tracking force rather than with too heavy tracking. (Besides, 0.2 gram over is not heavy tracking at all.) That's providing that the stylus is reasonably clean and in good condition. If you're getting mistracking at the low (lightest) end of the range and yet the low range is generally sounding the best (and on moderate signals, not The 1812 Overture), then chances are you have either a dirty stylus, a bad record, an accumulation of crud in your cartridge, or a cartridge that's getting old.

Changes in tracking force can change how you want VTA and azimuth adjusted. If azimuth was initially adjusted by ear, experiment with it. However, if it was set with instrumentation, leave it be and instead play around with VTA and tracking force. I sometimes think of this process as being a little like tightening down a series of screws — you do each a turn or two at a time and keep going round and round until you've got them all evenly snugged down and the surfaces mated without warping. Keep on patiently adjusting until you recognize that the sound is right and just locks into place.

(Tip: Some people find that degaussing [Fluxbuster] of a moving coil cartridge is recommended as often as every day, even if the cartridge hasn't been used.)

Remark:

Regarding this subject, A.J. van den Hul would like to stress the following:

Never use a cable enhancer on a cartridge, because you will really burn the cartridge's coils. I've had in many cartridges in which people had used a cable enhancer to break-in the tonearm wires — forgetting that the cartridge was still attached at the other end of the arm. The coils were completely burned out — the enhancer even heated them up so much that the rubber and everything was melted together into a sticky paste. I'm not referring to cartridge demagnetisers — I'm referring just to the regular cable burners, to warn everyone. . .

Furthermore, contrary to the conventional wisdom, A.J. van den Hul sternly advises against fluxbusting your moving coil cartridges. Van den Hul avers that degaussing a cartridge reduces the number of magnetic complexes in the magnet for all moving coil designs. On one hand, fluxbusting helps realign the magnetic complexes which become more disorganized over time. On the other hand, the cure may be worse than the disease because fluxbusting reduces the number of Weisz complexes and realigns the atoms into larger, less refined aggregates. The end result according to van den Hul is that you need to fluxbust your cartridge more and more often — with a gradual decrease in overall resolving power. So, while a cartridge may sound better after each degaussing, its resolving power will gradually decrease due to incrementally coarser reorganizations of its magnetic complexes. Or as A.J. would say “you will end up having to degauss your cartridge after each Beethoven symphony.” —**A.J. van den Hul B.V.**

OK, you're now basically done. Final-most tuning will take days or weeks and is a matter of listening to the system in a relaxed way. Eventually little aspects of sound from one record to another will begin to annoy out of the overall good sound. This may range from too light tracking force to VTA. (Most good cartridges are temperature sensitive (*). When too warm, they get muddy, when too cold, they can get strident. Keep up with this as the seasons change.) Excluding people who adjust VTA with every record, most people will be very happy with a VTA position which is a good overall compromise for the records that are their favourites. So turn on the system, let it warm up, sit back and relax, and enjoy listening to the music even as you keep one ear peeled for further refinements.

(*): We regard temperature independence to be an important quality aspect. With our cartridge designs we therefore employ special materials which minimize temperature effects. —**A.J. van den Hul B.V.**

One last, and important, word on stylus cleaning. There are multiple recommended stylus cleaning procedures, ranging from ultrasonics, manually brushing, even using sandpaper, and with various solutions—anything from the proprietary Freon-based solutions to just alcohol or alcohol and water, as in record cleaning solutions. These can have an effect on the shape and condition of contaminants left on the stylus. With some modern cartridges with very fine-line styli, it might be necessary to clean the stylus once per LP side (*). Different methods of cleaning may result in different sound a more or less frequent need for cleaning. Experiment with different methods — some sort of cleaning is essential.

(*): Contrary to what often has been claimed, the van den Hul fine-line stylus is not more prone to accumulate dirt from a record than common stylus shapes. —**A.J. van den Hul B.V.**

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