

Radial Audio Stealth One – Setup Manual

This manual addresses the setup of the Stealth One on your turntable. Refer to the Owner manual for day-to-day care and maintenance of the Stealth One.

Congratulations!

You have purchased the finest tone arm in the world. The Stealth One is a precision electro-mechanical device. It plays vinyl recordings in the same manner in which the recording was originally cut on the mastering lathe, in a straight line. The Stealth One completely eliminates “skating” forces during playback, along with the tracking errors present in all pivoted arms. With normal care and minimal maintenance, the Stealth One will bring you consistent imaging and accurate sound reproduction from the outermost groove to the innermost groove of every vinyl record. Since the arm is unlike pivoted arms, you are strongly advised to read these instructions thoroughly before beginning installation.

Unpacking Instructions

Follow these steps:

1. Grasp the Plexiglas channel with one hand, and steady the shipping container with the other hand. Gently pull both the arm and the attached two foam end panels entirely out of the shipping container. Set on a smooth, uncluttered workspace.
2. Remove the two foam end blocks, and replace them in the shipping carton.
3. Remove the accessories box from the shipping carton, and place it on the workspace.
4. The tone arm is mounted upon a 12"x2.5"x3/8" thick black Plexiglas base plate. The arm and base plate are held together by four Neodymium magnets (visible from the bottom of the base plate at the four corners, where the front and back elevator towers meet the base plate).
5. The next page provides a complete listing and photos of the accessories provided. The accessories list shows the quantity of the items and the installation step in which the accessory is used (steps A to F). Please review the list and find the picture of the accessory below the list. Some of the accessories are provided to assist in the initial setup of the arm on your turntable. Select those accessories now (step A), and set the other accessories aside for midstream or optional installation later.
6. Please contact Radial Audio if any accessories are not present, or need to be replaced in the future.

Accessories Inventory: (quantity),(install step A to F), description

1. (1)(A) Base Plate shipping block, and 5mm “L”-shaped hex wrench.
2. (1)(A) Stylus overhang setup protractor: Plexiglas center hole with engraved line.
3. (1)(A) 5 volt AC adapter: power supply for the Stealth One.
4. (1)(B) Counterweight, counterweight rod, two blue knurled locking nuts, 5mm “L” wrench.
5. (2)(B) Wands: one higher mass (medallions), one lower mass (ladder), finger lifts.
6. (2)(B) Cartridge mounting pads: one pre-mounted in each wand.
7. (1)(B) Cartridge “simulator” block, for verifying cartridge verticality.
8. (10)(B) M2.5 x 1” nylon screws, Philips head: for cartridge mounting, straight Razor blade, microfiber cloth, small Philips head screw driver.
9. (1)(C) Stylus overhang adjustment tool: Blue knurled nut mounted on a threaded rod; M2 hex “L” shaped hex wrench: sets depth stop inside the cartridge mounting pad.
10. (2)(D) Elevator adjustment knob: round black knurled knob with hex socket at bottom.
11. (2)(E) Stylus spotlights: curved LED’s, one bright white, one warm white spectrum.
12. (1)(F) Vial of damping and/or mass adjusting lavender “silly putty” -like viscous material.
13. (0) base plate shims,



Tone Arm/Turntable Setup

Since Radial Audio does not manufacture a matching turntable for the Stealth One arm, these setup examples present general approaches to the “unknown” partner.

It would be best to start the process on a quiet day, allocated for just this activity. This is an iterative process, as the best alignment position of the tone arm on the turntable in try and retry.

Having done the setup and alignment on various turntables capable of hosting the Stealth One (but not all), what follows are some techniques that you can evaluate and adapt to your turntable.

Since most turntable arm mounting boards are intended for a pivoted arm, there may already be a pre-drilled hole where a pivoted arm would be fastened. Ignore the hole.

Review the turntable’s physical design to find a straight surface that can be used as a 90 degree reference from the center spindle. The best reference would be a plinth cast with a straight body on the turntable’s right-hand side. Failing that, then look for a straight surface on the exterior of the turntable’s frame. Right side is best, but it’s possible to extrapolate a 90 degree line from a straight front or rear turntable frame.

Turntables that are “organic” in design may still be conquered, but with more ingenuity required. If the turntable resembles an unidentified flying object, it might be best to opt for a more standard design. The only absolute requirement is that the mounting surface for the tone arm be flat, and parallel to the turntable’s platter surface. The mounting surface should be continuous, not a ledge where the tone arm would extend out without support below.

Setup Overview: (General Objectives 1 to 5):

1. Setup tone arm base plate parallel to an imaginary line emanating from the turntable’s center spindle outward to the edge of the turntable platter.
2. Mount cartridge in wand and adjust stylus overhang.
3. Setup tone arm and tone arm base at a vertical height where the wand and cartridge is parallel to the platter surface.
4. Setup tone arm displacement to the front of the platter so that cuing (dropping the stylus under control of the lift/lower motor) results in the stylus making contact with in the lead-in groove area, safely inside the 12” vinyl record perimeter (lip).
5. NOTE: Objectives 3 and 4 can be done together in multiple iterations, gradually achieving the end result. They are explained separately for clarity.

Setup Objective 1: Aligning the tone arm base plate 90 degrees to the center spindle

Standard method: The first tool needed is in the accessories, a stylus alignment “protractor” with a hole and a straight line running from the center hole to the edge. Use tape or shims to immobilize the platter to the plinth. Place this tool on the platter and approximate 90 degrees in relation to the future tone arm base plate location. To get an exact 90 degree tool position, use a carpenter’s square and a flat “board” or “sheet” to reference some straight surface on the turntable’s frame. Now position the tool at 90 degrees, and use tape to immobilize the tool to the platter.

Don’t want to use the stylus alignment protractor?

Alternate method: not using the accessory. Using a white vinyl LP and a fine Sharpie pen, draw a fine black line on the LP, perpendicular to the center spindle (white vinyl LP now drafted as an alignment tool). Notice that the carpenter’s square is being referenced from the front of the turntable plinth, by association with a flat sheet of Plexiglas. Not in the photo is a parallel wooden offset whose thickness equals half the diameter of the center spindle ($9/32''$, $.28125''$, 7.3mm). Sharpie line was drawn when the wooden offset was in place.



Example 1: Rectangular Plinth

Setup is more straightforward if the plinth is rectangular, or has a straight surface that can be used as a 90 degree reference and constant distance from the center spindle.

In this example we have a rectangular plinth with a totally flat surface, meaning that the plinth has no ridge to butt the tone arm base plate against.

So, to utilize the plinth's rectangular form, position the Stealth One with base plate only (no arm) and "eyeball" it parallel to the turntable plinth's right-hand edge. Place the scribed line white LP on the platter. Iteratively, adjust the tone arm base plate's "eyeball" position by zeroing in on the stylus overhang scribe line on the white LP, as below:

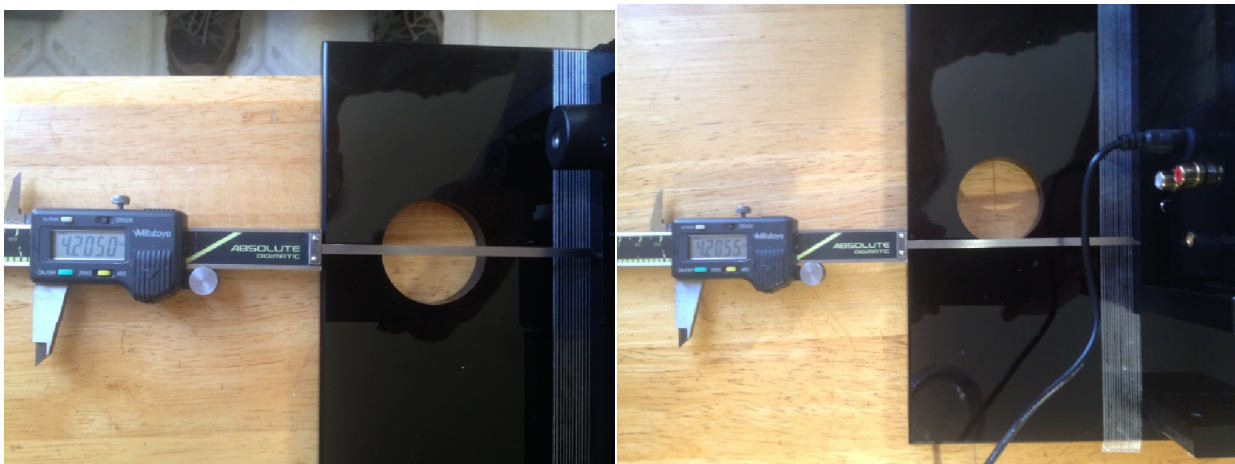


This process gets close to the final tone arm base plate position. Leave the tone arm base plate in place and grab some strapping tape.

Place two lengths of strapping tape exactly adjacent to the tone arm base plate. This is a “ballpark” reference marking, which will be improved upon.



Use a depth gauge, or a digital calipers (this example) with a depth extension rod. First, measure near the front of the turntable plinth (left below), and then near the rear of the turntable plinth (right below):



On the tone arm base plate, locate the four mounting holes (with a slotted sliding depression between each pair). Use a sharp pointed compass needle to scratch the outer rim of the four mounting holes on the turntable plinth’s bottom. Center drill the four mounting holes into the turntable’s plinth.

Example 2: Custom turntable mounting board:

You may prefer to have a custom Stealth One mounting board for your turntable.

This example relates how a custom Linn Sondek LP-12/Stealth One mounting board was developed. Hopefully, this process demonstrates certain techniques you may find useful.

Remove the Linn Sondek LP-12 supplied board.

Create a new mounting board from material of your choice, but make the rectangular dimensions the same as the original Linn Sondek mounting board. Except, the plate is 2mm thicker than the original.

Position the custom tone arm mounting board squarely equidistant against the inside of both the right-hand and left-hand sides of the Linn Sondek's wooden frame. Several parallel wooden slats of constant thickness are used to maintain equal distance within the turntable frame's mounting board void area.

With the wood slats tightly in place: On the custom mounting board's underside, mark the position of the three original Linn Sondek mounting board holes (using a sharp metal point, like a compass center). The three underside holes are drilled on center, and then hand-tapped for 3mm screws.

Fasten the custom mounting board to the Linn Sondek's plinth mounting board extensions, while the parallel wood spacers are still in place. Finally, remove the parallel wooden spacers. The mounting board appears to float with an equal mote on all four sides. This process transfers the square accuracy of the Linn Sondek's wooden frame to the custom mounting board's position.

Sometimes, it is just more direct to replace the manufacturer's tone arm mounting board with a board that is a perfect interface between the Stealth One and the turntable. See photo on next page.

Notice the four Neodymium magnets embedded in the custom mounting board. These magnets are aligned with four corresponding magnets on the bottom of the Stealth One base plate. To drop the Stealth One onto this custom mounting board, simply position the Stealth One base plate approximately along the base plate scribe lines in the custom mounting board (look hard, some can be seen).

The Stealth One base plate will "snap" into a magnetically "locked" alignment. No need for mounting screws between the tone arm base plate and the custom turntable mounting board.

The standard Linn mounting board is 10mm thick. The custom replacement is a 12mm thick black Plexiglas sheet, beveled 2mm all around on the top surface. The extra 2mm thickness assures that the tone arm will not bottom out on the Linn Sondek LP-12 turntable frame, as the tone arm base overhangs the frame slightly in the front.

This custom Plexiglas mounting board is available from Radial Audio as a special order.



Above: custom Linn Sondek LP-12 tone arm mounting board using magnets for alignment and hold down.

Setup Objective 2: Mount cartridge in wand and adjust stylus overhang.

Objectives:

1. Counterweight mounting
2. Wand insertion/extraction procedure.
3. Vertical cartridge alignment tool.
4. Mount your “test” or “production” cartridge.
5. Adjust stylus overhang.

Counterweight mounting.

The counterweight is Delrin, cast with Bismuth alloy, and then milled into a cube. It is shipped with the accessories to prevent damage during transport. Find the counterweight, the black counterweight rod, and the two blue round knurled thumb nuts (5x20mm). Notice that the counterweight has semi-circular voids on two sides, hosting the two thumb nuts. To get a feel for the fit and rotation, do a “dry-fit” of the thumb nuts and the counterweight onto the counterweight rod. Position the counterweight and thumb nuts, untightened, approximately in the middle of the counterweight rod.

Find the 5mm “L” wrench and insert it into the hex head end of the counterweight rod. Point the opposite end of the counterweight rod at the “hole” end of the breech block and insert therein. Rotate the wrench until you feel resistance to further rod insertion. Give it an additional eighth turn, and pull the “L” wrench out of the counterweight rod.

To adjust the position of the counterweight loosen the blue thumb nut in the direction that the counterweight should move, and then rotate the other blue thumb nut in the same direction, to again snug up to the counterweight.

When setting stylus tracking force, pay close attention to the counterweight’s distance from the outer gimbal. The wand and breech block must swing freely, not touching the outer gimbal. Binding could occur if the counterweight is adjusted too close to the gimbals.

Wands: insertion/extraction procedure.

The lower mass “ladder” wand comes with the green vertical cartridge alignment tool pre-mounted. The end of the wand that inserts into the breech block has a pair of sliding square grooves. These grooves will fit snugly into the breech block’s square grooves.

You should insure that the volume level is at zero prior to all wand insertions and extractions.

Wand Insertion: Wand top facing UP: with your left hand, grasp the wand by the thumb and forefingers approximately in the middle where vertical grip grooves reside. With your right hand, firmly grip the two smooth (non-rod) sides of the counterweight and hold the counterweight and breech box steady. Now, with your left hand, begin sliding the wand onto the two grooves located at the front of the breech block. Slow, steady sliding is recommended, no fast or irregular movements. Eventually the wand will

“bottom-out” onto the breech block when the six male gold connectors fully seat inside the six female gold connectors located near the front/center of the breech block. Connections for the 4 signal wires and two LED stylus spotlight wires are now complete.

WARNING: The bearings are stainless steel, the pivot points are 10.9 steel, but the inner gimbal is Delrin. The bearings and pivots are rigid, but Delrin has some flexibility by nature. If pushed without any constraining support it is possible to flex the Delrin enough so that a pair of bearing/pivots could be pressured to unseat (as opposed to break). The method described here for wand insertion and extraction works well, and **MUST** be practiced without any exceptions.

Vertical Tracking Force: For normal cartridges, now would be the time to utilize a vertical force gauge and adjust the counterweight position to comply with the cartridge manufacturer’s stylus force recommendations.

Vertical cartridge alignment tool .

The green vertical cartridge alignment tool comes pre-mounted on the lightweight ladder wand. It is the last check that is made before shipment. Since the green vertical alignment tool can be pressed down onto the platter surface manually by finger pressure, setting tracking force is not yet required

This tool insures that the stylus will be standing up perfectly straight when attached to the cartridge mounting pad. Less than perfect vertical could be the result of either the front tower’s elevator or the back tower’s elevator not being adjusted to exactly at the same vertical displacement from the tone arm’s base plate surface.

Press the blue LED button to send the lift/lower motor into cycling the wand down toward the platter. Manually push the green cartridge alignment tool down onto the platter and observe whether any light is present at the left or right bottom edge. If present, then adjust one of the tower elevators to compensate. Read the next paragraph for wand extraction process, then remove the wand, dismount the green cartridge alignment tool for placement back into the accessories box.

Wand Extraction: With your left hand, grasp the wand by the thumb and forefingers closer toward the channel where a second set of vertical grip grooves are present. With your right hand, firmly grip the two smooth (non-rod) sides of the counterweight and hold the counterweight and breech box steady. Now, with your left hand, begin pushing against the Plexiglas channel, while sliding the wand straight back and away from the breech block. Slow, steady sliding pressure is recommended, no fast or irregular movements. Eventually the wand will “free” itself from the breech block, with signal and LED connections being disengaged.

Stylus overhang adjustment.

Traditional cartridges have the stylus located wholly under the cartridge body. Some recent cartridges have a cantilever/stylus that is naked, extending beyond the front of the cartridge body. To handle both architectures, the cartridge mounting pad has five pairs of drilled and tapped holes. These holes are precisely drilled on a CNC mill, and are guaranteed to be perfectly parallel to each other and aligned to the imaginary line emanating from the center spindle.

Cartridges vary in distance from the stylus to the cartridge mounting holes. To address this non-standardization, there are five pairs of holes in the cartridge mounting pad. Some experimentation is needed to select the pair of holes that best accommodates both the stylus placement within the cartridge, and the need to bisect the parallel line on the stylus alignment protractor.

Aesthetically, the cartridge mounting pad looks best when its front edge is close to the front edge of the wand. Turn the wand upside down and place the cartridge on it. Select the pair of holes where either the naked stylus or the front of the cartridge is nearest to the front edge of the mounting pad. You may prefer that the cartridge extends somewhat beyond the wand front, or be recessed inside the wand front. However, too much extension, or too much recess is a sign that the neighboring pair of holes may be a better choice.

Select a pair of black nylon screws from the accessories box, and the straight edge razor blade. (a sharp Xacto knife or sharp shipping carton knife work as well.). Insert the two black nylon screws thru the cartridge mounting holes and hand-tighten both screws as much as possible onto the cartridge mounting pad. Tighten securely with a small Philips head screwdriver. Turn the cartridge and mounting pad on its side, and cut off the excess nylon screw threads flush to the top of the cartridge mounting pad.

Slide the cartridge/cartridge mounting pad into the front of the wand. You will note that the slide and fit is snug, needing a modicum force to move. Delrin has a self-lubricating property. At close tolerances between two Delrin parts, when the sliding stops, a tiny amount of “grab” takes over. Try to slide the cartridge mounting pad slightly further into the wand than you want the final position to be. No signal wires need be fitted at this time, as the cartridge may be pulled for another iteration.

Iterations:

The tone arm base plate’s position (right to left) on the turntable tone arm mounting board can now be “finalized” thru iteration. We will be sliding the cartridge mounting pad, to set the stylus overhang. Exact overhang position is determined with a cartridge in the wand, and cuing it down onto the scribe line. The goal is to have the stylus land in the center of the scribe line in two places, typically near first band and last band on an LP.

Large iterations: Up until now, we made “large” moves. We were either moving the entire arm on its base to the right or left; or, selecting a different pair of cartridge mounting holes. We can assume that those choices are “golden”, and so now move on to small iterations.

Small iterations: Iteratively tweaking the position of the cartridge mounting pad at the front of the wand. Repeat the process, as needed.

There is an accessory that assists in the final stylus overhang “focusing”. Select the blue knurled nut with a (2”, 50mm) black threaded rod attached. This tool slides into the cartridge mounting pad at the front, right hole. It slides for most of the distance, but requires threading for the last quarter inch. This tool is rotated clockwise to push against the wand’s internal wall, moving the cartridge mounting pad outward toward the wand front edge. Rotating counterclockwise, does not change the cartridge mounting pad’s position, because there is no internal wand wall to push against. For this reason, it is necessary to push the cartridge mounting pad into the wand too far, so that this tool can push the cartridge mounting pad out in the finest of increments.

Cartridge mounting pad’s front surface

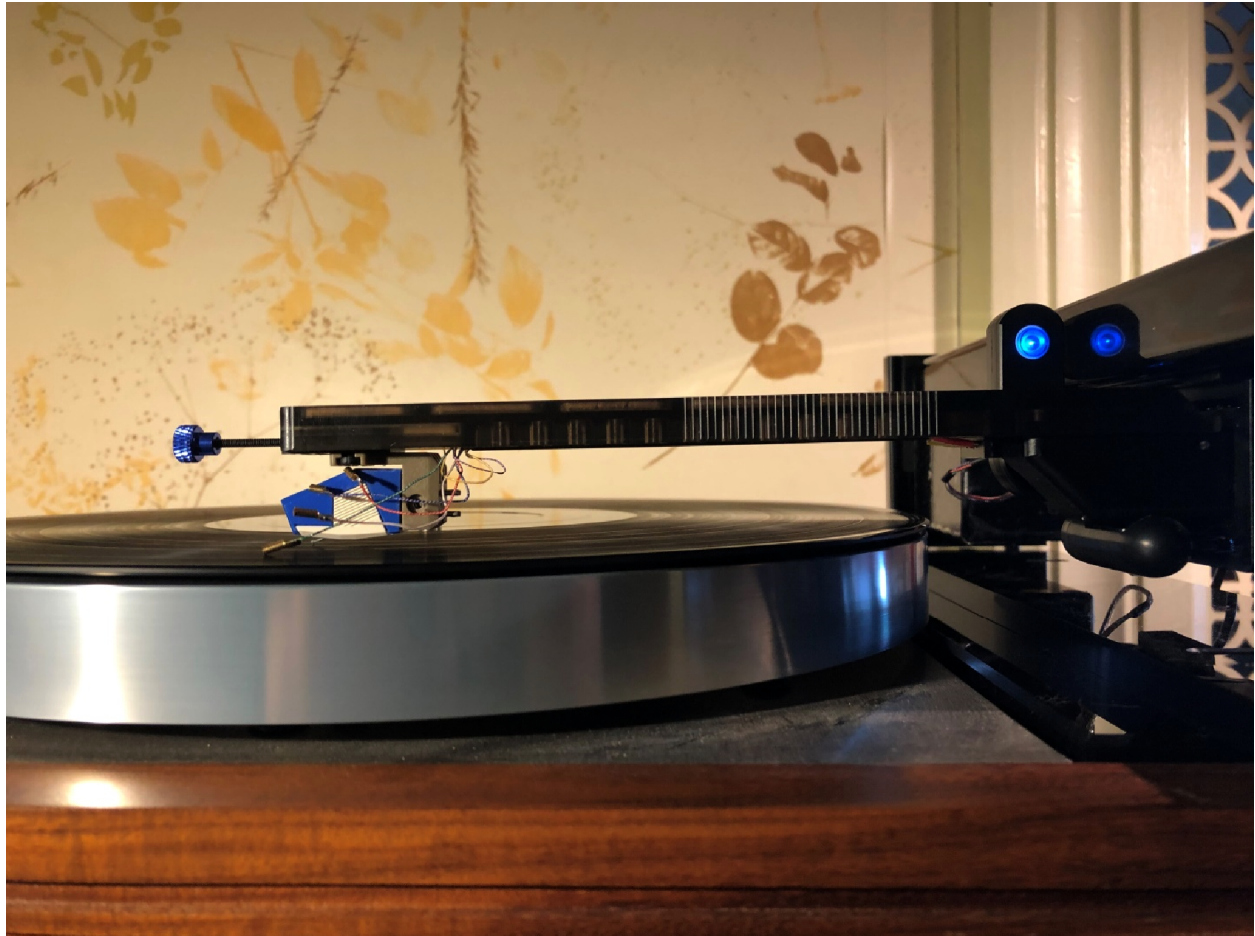
On the opposite side of the gold female pins is another hole. This hole is preloaded with a small threaded screw, a depth-stop that “remembers” the exact overhang position of the cartridge mounting pad, should the cartridge mounting pad be removed for cleaning, etc. After the stylus overhang position is finalized, then use the M2 “L” wrench to gently turn the screw hidden within this hole to contact the wand’s internal wall. With this screw in place, the cartridge mounting pad can be removed, and subsequently remounted to the exact former position, even if the blue knurled nut with threaded rod (2”, 50mm) was removed to, reduce wand front-end mass. Dual purpose: the threaded rod may remain in the cartridge mounting pad to increase mass, or used as a front-end manual cuing tool. The picture on page “**Setup Objective 3**” following illustrates this situation.

Cantilever/Stylus Illumination

The two gold female connectors at the front of the cartridge mounting pad accept an LED spotlight found in the accessories. Two spotlights are provided both bent into a semi-circle. One LED has a warm bright light. The other LED has a bright full spectrum white light. Choose the level of illumination you prefer by testing one and then the other. The spotlight adds a small amount of mass, so the total stylus force will need to be adjusted when adding or subtracting the spotlight’s mass. The spotlights can be re-bent more or less severely, as needed. They were originally bent around a ½” rod.

Setup Objective 3: Tone arm vertical distance above turntable plinth

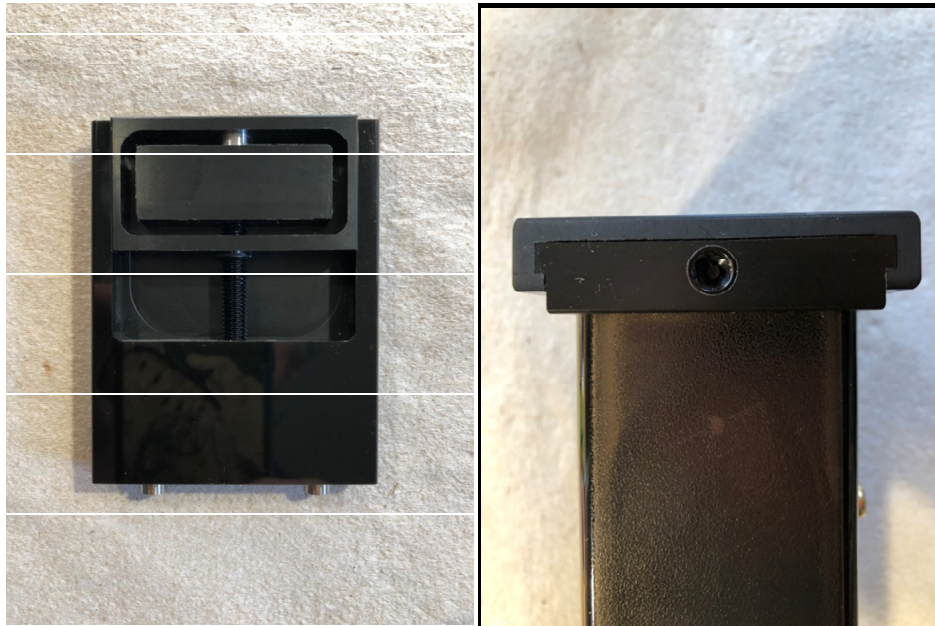
Setup the tone arm and base at a vertical height that allows the wand to “operate” in a vertical range where the wand appears to be parallel to the turntable’s platter. Ideally, this range would then accommodate numerous cartridges of similar heights. Quick estimate: the top of the Plexiglas channel should be approximately (2.5”, 63mm) above the turntable platter surface, LP included, as shown below.



Objective: set the vertical height of the Stealth One channel so that the wand presents parallel to the platter surface. The standard Stealth One base is (.354”, .76mm) thick, correct vertical height for the Linn Sondek LP-12 and other turntables where the platter is approximately (1.125”, 28mm) above the plinth. The elevators can rise above the towers as much as (.75”, 19mm) but should not be lowered below the tower top edge more than (-.125”, -3.175mm), as the counterweight will “bottom out” on the base plate upon lifting the wand. The elevators can adjust the channel height, both when switching to a new cartridge, or handling turntable platter heights up to (1.75”, 45mm) above the turntable plinth.

Aesthetically, the “best look” is when the top edge the elevator is level with the top edge of the tower. For turntable platters significantly above (1.125”, 28mm), adding a flat “shim” structure below the tone arm base is a means to getting the “best look”. A simple and inexpensive way to determine the needed shim height is to purchase large auto body washers and place sets of four washers under the tone arm

base plate until the stack of washers provides a rough estimate of just how much more vertical height is needed. Once the total base plate thickness is determined, then decide what “shim” material you want as the final solution. You may also contact Radial Audio to request a special order for a Plexiglas shim milled to match the base plate, or for a single standard base plate for the total base plate height needed.



Above: (left) tower internal, with elevator and elevator rod; (right) top view with channel in inside.

Each vertical tower contains an elevator that raises or lowers the Plexiglas channel in minute increments. An M6 aluminum bolt runs vertically thru each elevator part. At the top of the aluminum bolt is a hex void where the elevator adjustment knobs can be inserted. Using the elevator knobs in duality, you can raise or lower the tone arm’s channel by approximately (+.75”, -.125”) A thicker base plate is simulated, matching the turntable platter’s height.

For turntables with massive height platters, start by adding pairs of “blocks” under the base plate, until an acceptable height is achieved. At this point, fabricate a sub-base with the same (length x width) dimensions as the base in hand: 2.476 x 12”, plus the additional height needed). Radial Audio can mill an additional height sub-base, or a single thicker base to your specification.

Setup Objective 4: Stylus cuing position at lead-in dead wax.

Objective: Setup tone arm position with regard to the front of the platter so that manual cuing (dropping the stylus under control of the lift/lower motor) results in the stylus making contact within the lead-in groove area, safely inside the 12" vinyl record perimeter (lip).

This objective gets separate treatment, because it's a heart-stopping experience to watch your multi-thousand dollar cartridge stylus slide off the outside of the LP rim. It could happen, so special attention is paid to stylus cuing during setup.

Cuing Problems:

1. The operator may not be able to hover directly above the LP and wand, so that his eye is exactly vertical to the LP lead-in groove (parallax error).
2. Cuing from one or more oblique side angles, so as to get a better view of the stylus is also subject to parallax error from those angles.
3. The cartridge may obscure the exact stylus position, especially if the stylus is located under the cartridge body proper.
4. Viewing the stylus position from front may not be possible.

Cuing Solutions:

1. When the wand is setup and viewed as parallel to the LP surface during playback, the architecture of the Stealth One is such that the fully raised stylus is around 1/8" above the LP surface at end of lift.
2. The wand is normally lifted above the vinyl record just enough to clear the ridge at the LP outer rim. The stylus drops a minimum vertical distance from above the LP. Parallax is greatly minimized, at the expense of being able to stack only one LP on the platter at a time.
3. The wand rests on, is dropped by, and is lifted by the lift/lower "bullet".
4. The wand slides onto the breech block, which has a blue upside-down button-head screw mounted underneath, approximately midway in relation to the diameter and length of the "bullet".
5. The "bullet" has a "well" with two vertical depressions and an angled slide zone.
6. **On-record detent:** One "depression" is placed so that the blue button-head screw can be setup to drop within the LP's lead-in dead wax area. During the lift cycle, the wand should slide into this depression, self-centering the wand to the lead-in dead wax zone. This depression is the lowest point in the "bullet" well. For manual cuing of LP's, the blue round-head screw should be sitting in this depression so the vertical drop is "true".
7. **Off-record detent:** A second, shallower well "depression", is located outside the first depression. The second depression is used to manually "cock" and "gravity lock" the entire wand at about a 10 degree angle outside the platter rim. When the entire wand is outside the platter rim, an LP can be deposited or removed from the platter without touching the wand at all. When ready to play, gently slide the wand back into the On-record depression, and press the blue lift/lower button to drop the wand safely onto the LP.

Setup Finale:

This is the final adjustment step before the tone arm base is finally fastened to the turntable mounting board. In this step the whole tone arm and base is moved forward or backward to align the On-record depression over the lead-in dead wax area.

1. Place the wand in the deepest depression (On-record detent).
2. Adjust the front end of the Stealth One by sighting down as best as possible to center the stylus near the middle of an LP's lead-in dead wax.
3. Depress the blue LED button and verify the actual landing position.
4. When satisfied that the stylus is dropping where desired, tighten the tone arm base and graduate to listening.

Make your own stylus overhand gauge

You can make your own template for stylus overhang. Cut a strip from an 8 1/2 by 11 sheet of paper, cut parallel to a long edge of the paper, the strip about 1 1/2 inches wide. Use a hole punch to punch a hole for the spindle near one end of the strip, hole is centered along the short dimension of the strip. Draw a line through the center of the punched hole and along the center of the strip of paper, the length of the strip. Mark two points on the line. When the paper is on the spindle and lying on the mat, one point should be near the outer edge of a record, the other point should be near the end of the music grooves near the label. Now move the paper so the line is approximately parallel to the Stealth One Plexiglas channel. You will try to get the stylus to fall exactly on the two points you marked. You can start with the point near the outer edge. Lower the stylus to see whether it falls on the point on the line. Then change to use the point near the label. Lower the stylus to see whether it falls on the point on the line. You will learn through practice (practice, practice) whether the paper needs to be rotated on the platter or the cartridge overhang needs to be changed. The goal is to get the stylus to fall on both points without rotating the paper or changing the overhang. Then the line is parallel to the tone arm and the lateral tracking error is minimized. If you changed the overhang, the tracking force will have changed. Reset the tracking force and check with the two points on the paper again.

a. Wand

1. Off-record wand detent position: the wand can be cocked back toward the user at a 5-degree angle, so that no part of the wand is over the record. There is a detent at the bottom of the bullet well that can catch the blue screw on the underside of the breech block, provided the blue screw is extended enough vertically for the catch to occur. The detent will hold the wand off the 12" platter while an LP can be lowered or raised off the platter surface. The 5-degree cock-back angle is also available when the On-record detent does not latch, due to the blue screw height being insufficient to latch.
2. On-record wand detent position: the wand can be cued using the On-record detent in the bullet, sitting at about 89-degrees. The wand can be cued and dropped onto the record surface at a consistent position that is not likely to trip the lift circuit.

b. Setting Cartridge tracking force

1. Be aware of counterweight distance from the outer gimbal (arm must swing freely, not bind against the outer gimbal, as when too close to cartridge).
2. For lightweight cartridges, mass can be added to the cartridge-end of the wand in five ways:
 - a. Wand finger lift: (.5 gr: optional mounting, but handy for cuing). Two stubs on either side of the arch fit into the same two slots used to hold the cartridge mounting pad. If the fit is a little loose, bend the arch out just a bit and try again. The finger lift is fixed to the wand by inserting it in place at about a 30-45 degree angle, and then forcing it into a 90 degree angle, where it locks into place.
 - b. Cartridge overhang threaded rod and blue knurled nut: (1.6 gr). Use for lightweight cartridges (e.g. Micro Benz Ace series). Part can double as a front-end wand finger lift.
 - c. Cartridge overhang memory screw: (.n gr)
 - d. LED illumination: (.2 gr)
 - e. Dampening putty (variable grams): place small "sausage" form into the milled depression at the top of the cartridge mounting pad, and let set overnight. The "sausage" will flatten overnight to fill the milled void area.

1. User Adjustments

- a. Stylus height: (vertical open gap between stylus and record) there is a blue round-head hex screw hanging vertically from the breach block, into the bullet lift well. This screw can be adjusted from below, thru the hole in the bullet. Extending the vertical length of the screw tends to raise the wand to a greater vertical distance above the record (as in the lift operation). Distance above the record can vary from a minimum of 1/8", where the bullet's flat surface is in full contact with the breech block (not contacting with the blue screw

head), to about 1/2" where the blue screw contacts the bullet well before the breech block body can make contact. To adjust the blue screw, turn the arm over on the channel back and move the wand to the 90-degree angle. Insert the hex wrench and turn counter-clockwise to extend the blue screw, setting more vertical stylus distance above the record surface. A word of caution: it's possible to extend the blue screw sufficiently so that the screw is contacting the bullet-well while not allowing the stylus to contact the record fully at the desired stylus force setting. Over-extending the blue screw approaches when a gap of 1/16" of the blue screw's thread is visible between the bullet and the breech block.

- b. Stylus overhang:
- c. Wand/Arm height: The general objective is to be able to have the wand/cartridge at level to the record surface when in play. Ideally, the tone arm carriage elevators should be level with the two (front and back) vertical towers. Since the height of turntable platters varies widely, the wholesale height of the arm is first set within the proper range by supplying a base that spans the vertical distance between the plinth surface and the platter surface. In general the bottom of arm's base plate (the Plexiglas plate with holes and slots) should be "N" inches below the turntable's platter surface. On turntables with tall platters, a extra mating vertical base extension will be required.
- d. Horizontal bearings: horizontal bearing pressure can be set thru a hole in the outer gimbal. It is best to set the horizontal bearing pressure before setting the vertical bearing pressure. Delrin is not as rigid as metal, so the horizontal bearing pressure is set first, followed by the vertical bearing pressure.
- e. Vertical bearings: vertical bearing pressure is adjusted with the exposed grub (set) screw on the outer gimbal's bottom surface. A reset may be needed if the wand extraction operation unseats the inner gimbal's bottom vertical bearing. The top vertical bearing inside the carriage should never be adjusted, as the vertical clearance of the M2 horizontal stainless steel rod (upon which the servo flag is mounted) is calibrated by the distance between the top vertical bearing and the inner gimbal's top surface.
- f. Johnson RAS-70 Polystyrene Rafter Triangle/Square: use to observe the 90-degree progression of the wand across the record. The square has a double-flange on the base of the triangle that can be hooked over the arm's Plexiglas channel with the other 90-degree side presenting parallel to the wand. The most accurate approach to viewing the 90-degree angle is for the observer's head to be positioned at the end of the wand or further away, closing one eye and sighting down the length of the wand and the triangle. This is similar to sighting down rifle barrel sights. In this manner, viewing errors introduced by head and body movements are eliminated.

2. Appendix

- a. Wand weights
 - 1. Delrin Ladder (cartridge mounting pad, signal hat, signal wires, finger lift): 18 gr
 - 2. Delrin (medallions)