SUMIKO

Starling

Moving Coil Cartridge

Dear Starling owner,

Thank you for your purchase of our new moving coil cartridge. Our intention in producing the Starling is simple and unequivocal: to deliver the highest level of real world performance to the vinyl lover. We wanted real people, music lovers like you and us, to be able to enjoy the greatness contained with-in their record collections.

In the next few pages, we will take you on a tour of the design choices made during the development of the cartridge. The second half of the manual is intended to provide you with simple, visual clues to get the most music from your new Starling.

Enjoy the Music!

Design Specifics

No aspect of the cartridge's design was left to chance. To avoid unwanted external resonance storage the conventional cartridge body was eliminated. This allowed for the construction of the most efficient path for evacuating internal resonance through the structure of the cartridge directly into the tonearm. This low mechanical impedance mounting system, combined with the optimization of mass, provides the perfect environment for the carefully chosen working elements of the cartridge.

The boron cantilever chosen for the Starling provides optimal energy transfer from the stylus to the coils.

Suspension Design

Virtually all conventional moving coils get by with a suspension element made from a butyl material. For the Starling, we chose to use a synthetic rubber where the hardness (10 degrees) and repulsion factor (8%) of the

material can be tightly controlled with molding temperature, cure time, and skin tension. Additionally, with this synthetic material, the specified parameters of the suspension are held to design tolerance for a longer period of time. These steps help insure the cartridge will perform as designed for a longer period of time, and will last considerably longer than other designs. The final result provides a combination of superior dynamics and excellent long term tracking ability.

Why a MicoRidge Stylus Shape?

Your Starling is fitted with a specially ground, low mass MicroRidge stylus. With care and precise adjustment, tremendous amounts of detail can be extracted from the Starling.

Old World Craftsmanship

Each Starling is painstakingly crafted by hand in a process that involves hours of labor. After assembly, final adjustments are made using a battery of test records, and performance is hand-calibrated. Each cartridge is subjected to this process and is critically auditioned before it is shipped. No computer or machine is yet capable of matching the precise adjustments necessary to extract the highest level of performance from a reference quality phono cartridge.

The Point of the Exercise

The purpose of fine adjustment of a phono cartridge is simple: you are trying to optimally align the playing surface of the stylus with the groove wall in the record, doing so in a way that the stylus is securely seated against the groove wall with neither too much, nor too little force, in all directions. All of these adjustments would be child's play if the stylus was the size of a baseball, and the groove was the size of a rain gutter.

The tricky part comes in the fact that the stylus is so tiny that no one can possibly see the scanning surface of the stylus (the part that actually touches the record groove) without the aid of a microscope. Add in the fact that the stylus is moving at the equivalent of about three hundred miles per hour and is being asked to maneuver faster than a Formula One race car and the problem becomes quite complex. Luckily, with a little patience and training, there is a grand equalizer: your ears.

So, let's get to it!

Before You Begin Setting Up the Cartridge

Preliminary User Note:

Before we begin, it might prove helpful to obtain an overview of correct set-up, why you are doing it, and what you hope to accomplish. This is not intended as a theoretical treatise, but merely as good, simple, practical tips on how to go about getting the most from your new Starling.

WARNING: Phono cartridges are inherently delicate things. Work *SLOWLY,* and in a methodical fashion with lots of light and enough space to work comfortably. Rushing to make an adjustment is likely to have the unhappy result of, at best, performing a lousy adjustment, or at worst, damaging the cartridge. Don't forget the wisdom in the old adage, "There never seems enough time to perform a task properly the first time, but there is always enough time to do it again." Slow down and enjoy the process!

All of the adjustments we speak of in the following pages are small incremental adjustments. As a general frame of reference, virtually any change you make will be less than one-eighth of an inch. Some, such as vertical tracking angle adjustments, may end up being a few thousandths of an inch!

Basic Mounting Instructions

There are two basic functions you are seeking to accomplish: physically bolting the cartridge to the tonearm and making the necessary four electrical connections to complete the audio pathway. Note: Make sure the volume control is turned all the way down or an alternative to the phone input is selected when you are making any electrical connection.

Handle with extra care! The Starling does without a body for very apparent sonic reasons. As with any "nude" cartridge, additional care must be taken when installing the Starling. The extremely fragile inner workings, the nearly microscopic internal wiring, the motor assembly, and the cantilever, are exposed, requiring that the cartridge be held solely by the top mounting plate or the back plate that contains the connecting pins. Under no circumstances should any other part of the cartridge be touched, as permanent damage will occur. It probably does not need to be mentioned that his kind of damage is not covered under the warranty. So, again, please handle with care.

We prefer first to bolt the cartridge to the headshell, using the supplied stainless-steel mounting bolts. Next, attach the audio leads. The order in which you perform these tasks is functionally irrelevant, but if you should slip while trying to affix one of those tiny wires, at least the cartridge will not drop to the ground!

Using a pair of small needle-nose pliers or tweezers, fasten the color-coded audio leads to the appropriate color-coded pins on the cartridge. If the headshell space is limited, as it is on some tonearms, loosen the mounting screws and move the cartridge forward to give yourself more room to fit the wires. If you still don't have enough room, remove the cartridge entirely and then reattach the cartridge when you're done with the wiring.

A Tip to Remember

One helpful little tip learned from a technical mentor years ago was to remember that "Christmas colors go together to form the right channel, and hot colors are 'hot.'" By this he means that red and white (red hot and white hot) are the positive leads, so white is left channel hot and red is right channel hot. To complete the Christmas color scheme, green attaches to right ground. The only wire left is blue which is, by process of elimination, left channel ground. We may have thoroughly confused you by this, but try it once or twice and it should make more sense.

And the Setup Basic Terms are ...

Before we press on too far ahead, let's identify the basic concepts and terms that define the setup procedure. Basically, there are four different alignment angles to be concerned with: 1. HTA, 2. Offset Angle, 3. VTA, and 4. Azimuth. There is also the pre-loaded weight of the arm

and cartridge combination, which is Tracking Force. Additionally, there is the amount of compensation required to counteract the inward pull developed by tracking a spirally-wound groove. This is called Anti-Skate. A discussion of these parameters will follow later on in this manual. Careful attention paid to the adjustment of all of these parameters, as described below, will result in optimal performance.

Setting Tracking Force

Now that you've got the cartridge mounted and wired, the next thing you'll want to do is set the basic tracking force, or the amount of down force that will be applied by the stylus on the record. This setting not only determines the amount of stylus force in the record groove, but also loads the suspension system and aligns the coils to the yoke. This setting determines the tracking ability and properly aligns the coils to the magnetic field of the magnets, contributing to the linearity of the cartridge. The cartridge should be set to 2.0 grams of tracking force.

To set the tracking force, first balance the tonearm. Locate the counterweight. On virtually all pivoted tonearms, it will be located at the rear of the tone arm (meaning at the opposite end from the cartridge). Generally, it looks like a fairly large, shallow cylinder, usually black in color and often has numbers ranging from O to 3 or more grams printed on it. As you move the counterweight back-

wards, the cartridge end of the arm will lighten (reducing stylus tracking weight), while moving the counterweight forward will increase the stylus tracking weight. The first objective is to "statically balance" the arm, which is to achieve the proper weight balance such that the arm "floats" level. Practice a bit and you'll find it's fairly easy to achieve. Remember to exercise caution so that the stylus and cantilever are kept clear of any obstructions and are prevented from striking anything that could cause damage. After achieving static balance, adjust the counterweight to apply 2.0 grams tracking force by bringing the weight in toward the cartridge.

A Brief Discussion on Tracking Force

Tracking force is primarily responsible for pre-loading the cartridge's suspension system so that it works optimally. It is useful to think of a cartridge's suspension as being similar to an automobile suspension. Too stiff a shock absorber on too light a car will result in poor dynamic performance and a rattley, uncomfortable ride. Similarly, a relatively stiff performance suspension on a phono cartridge, set at too low a tracking force, will result in performance that is bass light, and harsh sounding in the high frequencies. While the mechanical characteristics of the tonearm (how inert it is, how well it allows energy to pass through it, etc.) also bear on this, the tracking force is something we can exert control over.

HTA (Horizontal Tracking Angle) and Offset Angle

We've combined these two categories because they are essentially interrelated. Other than to give a brief description of what you are adjusting for, we will leave these adjustment parameters to the maker of whatever tonearm you intend to use. The reason? Many tonearm manufacturers supply alignment templates with their tonearms and their tonearm alignment geometry may be maximized around this template. Briefly, HTA or Horizontal Tracking Angle is the fore/aft adjustment of the cartridge within the headshell (though some tonearms, like SME, use a fixed cartridge position in the headshell and require the entire arm be moved). By moving the cartridge position forward or backward in the headshell, the angle that the cartridge will describe over the entire playing surface of a record can be altered and optimized. Within the headshell the angle of turn-in required is a function of the amount forward or backward the cartridge is moved. Suffice it to say that obtaining a good alignment gauge and following its instructions is the best way to go about making these adjustments. Note: When the HTA alignment process is completed, remember to re-check the tracking force of the cartridge as any movement of the cartridge in the headshell forwards or backwards will change the tracking force value.

Anti-skate Adjustment

It is now time to adjust for anti-skate On all tonearms, the anti-skate is located towards the rear of the tonearm, in the vicinity of the bearing housing. The adjustment device typically takes one of the following forms. 1. A dangling weight hanging off the side of the arm, with some adjustment mechanism, such as slots cut into a fixed post. The further away from the tonearm the string is attached on that post, the greater the anti-skate applied. 2. More commonly, a dial with numbers printed on the dial face indicating 1, 2, 3, grams and fractions thereof.

Anti-skate, as defined earlier, is a force applied in such a way as to approximately counteract the inward pull created by the record's decreasing radius spiral groove. We say approximately because the record groove is constantly changing and no existing anti-skate is up to the task of correcting for all the non-linear forces present. The velocity of the groove changes with frequency, amplitude and position of the stylus, relative to the center of the record. As the velocity changes, so does the amount of inward pull being exerted on the stylus/suspension system. There is no way to completely and accurately correct for this dynamic situation. While it is common for manufacturers to suggest setting the anti-skate to exactly match the tracking force indicated (e.g., 2 grams tracking force equals 2 grams indicated anti-skate force), our data

suggests that an alternative approach is called for since the compliance of the suspension is not at all taken into account in this approach. In particular, modern moving coil cartridges, such as your cartridge, are lower in compliance and are not as affected by the vector force applied by the record's groove.

In the case of the Starling, we suggest about 2/3 as much anti-skate as tracking force indicated, so in the case of the cartridge, about 1.25 - 1.3 grams anti-skate indicated. If more anti-skate is applied, the sound may begin to lose delicacy, and a sense of constriction will set in. Test records will not yield particularly good results because they are testing for worst-case scenarios. Using our method in real world conditions, the user will obtain higher average results. Going back to the automobile analogy, running a higher anti-skate setting is like driving on snow tires year-round on the unlikely chance you might run into a snowstorm. Additionally, some will recommend the use of mono records to set anti-skate. The problem with this method is that a mono record is cut quite differently from a stereo record. Additionally, some recommend a blank record, however this does not duplicate actual stereo record tracking either. Setting the anti-skate should be done in a real world situation and not a steady state or laboratory experiment simulation.

Fine Tuning, VTA and Azimuth are the Tricky Parts

To this point, all the adjustments we've had you do have been relatively straightforward, intended to obtain and set a specific parameter. From this point on, though, the work becomes more qualitative and good judgment enters into it, as you will be called on to make assessments entirely subjective in nature. Relax and go slowly. It is unlikely that you will totally foul things up. With a little patience and finesse, you can obtain a much more musically satisfying performance from your turntable.

The Line Drawings

As the saying goes, "a picture is worth a thousand words," so we chose to add some simple illustrations to this section of the manual for use as a guide, illustrating what your cartridge will took like when both properly and improperly adjusted for VTA and azimuth in your tonearm. Although there is no way to show you exactly what a perfectly adjusted cartridge will look like, the line drawings can serve to give you a mental template for your particular setup. Found on pages **19** and **22,** these line drawings will illustrate gross problems found in VTA and azimuth adjustments. Directly after the text on adjusting VTA and Azimuth, the illustrations on page **23** will allow you to see what your cartridge should generally look like when properly set-up.

For instance, if your particular cartridge sounds best with a more exaggerated negative rake, so be it. If the visual aspect of your particular cartridge looks as if the azimuth is tilted very slightly to one side, but this is the attitude that allows for the best sound, this too is okay. So, use the guide as just that, a guide. Explore the possibilities of what you can extract from your cartridge, and you will be rewarded with great music.

VTA Adjustment

Vertical Tracking Angle (more precisely, Stylus Rake Angle) is the front-to-rear rake of the stylus within the groove and is controlled by raising or lowering the pivot end of the tonearm. Look for a small screw, possibly two, located low on the mounting collar where the tonearm meets the turntable. You should always refer to your owner's manual to familiarize yourself with all the functions of your arm, so now would be a good time to do that for this function. VTA adjustment's primary effect is upon the time domain behavior of the musical presentation.

Often, we hear and read about tonal balance differences attributed to changing VTA. But in the changing of the time signature, one necessarily affects the arrival of high frequencies relative to the low frequencies. The more one rakes a cartridge back, the more the high frequency content is "slowed" resulting in, to a point, subjectively richer, rounder sound. Inversely, raising the VTA will have the effect of sharpening up or focusing the sound; too high a setting and stridency results.

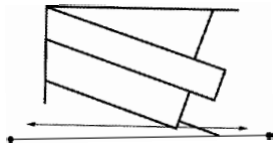
When you get very close on VTA adjustment, note that adding a touch more or less tracking weight (assuming your initial tracking weight is 2.0 grams) is a simple way of fine-tuning the VTA. Adding a tiny bit of weight is effectively lowering the arm height and reducing the weight will have the apparent effect of raising the back of the arm. Be careful, since adding force also changes the mechanical damping of the system as well as the relationship of the coils to the magnets. Still, for all but the most talented among us, adjusting the weight is, at the very least, a useful interim tool in fine-tuning VTA.

Always, always, always start with the arm lower than necessary and slowly raise its position. Trying to start above the eventual point and lowering the arm will not work, we guarantee it. Please refer to the line drawings on the facing page. On page **19,** illustration No. 3 shows a cartridge with 2° of negative cartridge rake, which is a good starting point for you to work with.

Remember, the time domain will not lie, and the ear is quite sensitive to time arrival cues, whereas trying to guess whether a piece of program material has too much or too little bass, for example, is an exercise in madness. When VTA is right, the sound will take on a properly large image scale (not bloated, simply full in size), with an easy

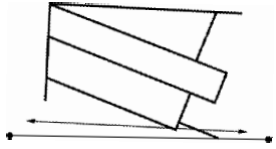
"breath" to the music that emulates the natural ebb and flow of live music. when wrong, the sound can be either too dull at one extreme, or pinched and small sounding at the other. Remember, you are working within a very small window of acceptability. The total height differential you are working with is perhaps 1/4" and that includes the "falsing zone", that area above and below the correct position that you will wind up finding by trial and error.

Illustration No. 1 shows a neutral attitude of rake. The cartridge will almost never look like this on the turntable. There will always be some negative rake angle to correct the cartridge set-up.



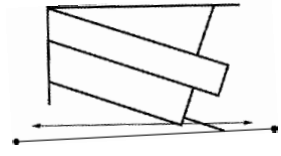
0° Stylus Rake Angle

Illustration No. 2 shows a positive rake of 2°. This too will never be the correct adjustment in a properly set-up cartridge. This altitude will result in a thin sound and could result in record damage



2° Positive Stylus Rake Angle

Illustration No. 3 shows what a negative rake angle looks like. This illustration shows a negative 2° attitude. This degree of rake angle is too great for the cartridge, but serves to show what your cartridge should generally look like when starting the VTA adjustment process.



2° Negative Stylus Rake Angle

Please refer to the section in the manual titled <u>VTA Adjustment</u> (p.16) for further suggestions

Azimuth Adjustment

This is probably the most misunderstood adjustment in analog audio. We believe this stems from the fact that its primary effect can be relatively subtle, but when it is not precisely correct, its effect on other parameters such as VTA can be dramatic. As you can see from the diagram on the facing page, azimuth describes the left-right angular orientation when viewed from the front of the cartridge. Necessarily this affects the balance of left-versus-right information, but not as dramatically as you might expect. Because of the tiny dimensions involved, its effect will be most noticeable in the lower treble (basic high frequency performance). Additionally, groove-tracing ability will be affected by incorrect azimuth adjustment. Because the stylus does not sit perfectly vertical in the grooves (see VTA), an azimuth misalignment will also result in the stylus "scrubbing" in the grooves, resulting in mistracking and contributing to poor high frequency performance.

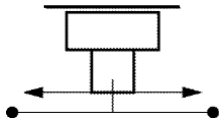
Your listening cue is to listen for stridency, sibilants, or an unusual metallic clang on instruments that do not normally produce a sibilant or clang. The sound of an unnatural "tssk tssk" on cymbals and other leading-edge transients, are telltale signs of misaligned azimuth. A very slight adjustment will correct for this problem. Only in grossly misadjusted arms will you hear an actual channel imbalance whereby the left channel actually sounds as though it is playing louder than the right, or vice versa.

Note: When you have achieved correct azimuth, the sound will take on a tidy, integrated character that simply sounds "right."

Some people have reported good results by playing mono records and listening for focus of image as a determinant for azimuth. We are reluctant to recommend this method, since the groove geometries of mono records are different from those of stereo records. We believe that a real world, dynamic set-up is the way to achieving a satisfying cartridge alignment, and using mono records to set-up for stereo records is not applicable.

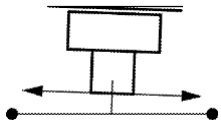
Addendum: Further experimentation will reveal that small changes made to azimuth may necessitate an additional slight change to VTA. This area is the trickiest part of fine-tuning. That is, the interactive nature of and VTA changes can be misleading. A legitimate improvement to one area can lead to a subjective degradation in another simply because an initial error has been exposed. As always, it is important to listen rationally and build up enough of an experience base so that you can easily determine whether the changes you made are a true improvement or simply an irrelevant alteration.

Illustration No. 4 shows the attitude of the cartridge when the azimuth is set correctly. The bottom of the cartridge may be used to set azimuth by eye. However, the final setting will be done by ear.

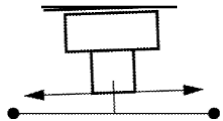


0° Azimuth Error

Illustration Nos. 5 and 6 show azimuth errors of 2°, lilted severely to the right and left. These angles may result in volume imbalances, biased toward the right or left channels.



2° Azimuth Error To the Right



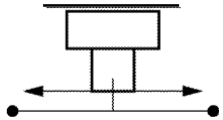
2° Azimuth Error To the Left

More importantly, this azimuth error will not allow proper tracing of the grooves resulting in mistracking. An edgy, hyper-detailed high-frequency sound will result if the azimuth is set wrong.

Please refer to the manual section titled Azimuth Adjustment (p.20) for further suggestions.

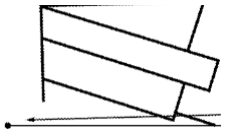
These illustrations show what the cartridge should look like when properly mounted and adjusted in the tonearm.

Illustration No. 7 shows azimuth at 0° of error in side-to-side tilt.



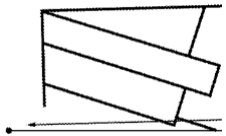
0° Azimuth Error

Illustration No. 8 shows a negative rake angle, (VTA), of 1.2°. This angle will result in a very fast, dynamic, and robust sound.



1.2° Negative Cartridge Rake Angle

Illustration No.9 shows a steeper negative rake angle than Illustration No. 8 where the angle has been increased by only 0.3, barely perceptible to the naked eye. The negative angle of 1.5° will result in a more rounded low frequency dynamic structure, less clarity in the midrange, and a reduced high frequency component.



1.5° Negative Cartridge Rake Angle

Wrapping Up the Installation

Now that you have gone through the basic set-up procedure of your cartridge you can expect the solutions that are outlined in this manual to aid you in optimizing your cartridge as it breaks in over time. You will find, that for the first 10 - 20 hours of playing time, the cartridge will go through changes in character, sound quality, and perceived output. As the suspension system settles in and becomes mechanically "free", the VTA position you originally found to be satisfactory will become less and less optimal and aberrations in the presentation will appear. Typically, the VTA will have to be changed so that the back of the tonearm is raised, which is why we advise you never to start with the VTA at a point that requires that you work your way downward. As the suspension settles in and the VTA becomes more and more wrong, the dynamic structure of the music will become compressed, leading to the perception of reduced output. We recommend that you not fiddle with the VTA too much for the first twenty hours of play time as the frequency and degree of changes required to keep the cartridge performing optimally during this time might drive you crazy. So, sit back and relax, accept the performance through the initial break-in period and listen to lots of records.

Warranty

This product is warranted to be free of all defects in material and workmanship for one year from the date of original purchase by the original owner. A purchase receipt or other proof of original purchase will be required before warranty service is rendered. This warranty is not transferable and does not apply to any defects caused by negligence, accidents, misuse, modification, disassembly, or repair by other than the manufacturer, or by other than normal use for which this product was intended. Within the period of this warranty, Sumiko will repair or replace at our service center located at 2431 Fifth Street, Berkeley, CA 94710, any part proving defective in material or workmanship. All expenses, except collateral expenses, related to replacing or repairing a defective part under warranty will be assumed by Sumiko, except for the cost of transporting and insuring the product to our above-named service center. The buyer must notify Sumiko of any defect, malfunction, or nonconformity promptly upon discovery. Within 30 business days after receiving the defective product from the buyer, Sumiko will repair or replace the defective part. We neither assume nor authorize any representative or other person to assume for us any other liability in connection with the sale or shipment of our products. We reserve the right to make changes or improvements in our products without incurring obligation to similarly alter products previously purchased. The buyer has the right to bring any action at law or equity to resolve disputes concerning or to enforce the provisions of this warranty.

Starling Specifications

Type	Moving Coil
Series	Reference Series
Stylus	Nude Micro-Ridge (2.5µm x 75µm)
Tip Material	Natural Diamond
Cantilever	Solid Boron (Φ0.28mm)
Magnet	Alnico
Coil Wire	15µ Pure Copper
Core	Pure Iron
Internal Impedance (1kHz)	28Ω
Load Impedance	>100Ω
Frequency Response	12Hz - 50kHz
Output (3.54cm/sec @ 1kHz)	0.5mV
Channel Separation (1kHz)	30dB
Channel Balance (1kHz)	0.5dB
Compliance (100Hz)	12x10-6cm/dyne
Tracking Force Range (Rec.)	1.8 - 2.2g (2.0g)
Tracking Ability (315Hz, 2g VTF)	70µm
DC Resistance	28Ω
Internal Inductance	38µH
Load Capcitance	100-200pF
Vertical Tracking Angle	20°
Cartridge Mass	7.4g