オーディオ資料室収載

Turntable Setup Video Tutorials

https://www.analogmagik.com/turntable-setup

註：本文は analogmagik 社のサイトの Video tutorial から Video 情報を除き、補足説明文を抽出したものである。

The goal of turntable cartridge setup is to retrieve what was recorded on the grooves as accurately as possible. With the right tools, anyone can be a setup guru !

We will guide you every step of the way, from the initial mounting of the cartridge to aligning the cantilever at the proper angle, to fine-tuning every setup parameters using the AnalogMagik software. Our goal is to help you achieve a more accurate cartridge setup using scientifically repeatable methods.

Cartridge alignment involves fine-tuning multiple setup parameters which are all interdependent on each other. We strongly advise you to read over the contents under each section to help you understand the concepts more clearly. We have created a video for each of the setup parameters:

(1) Basic Cartridge Alignment

https://www.analogmagik.com/turntable-setup

Pivot to Spindle Distance

Cartridge cantilever alignment using the Acoustical System Professional Alignment Set (or any other protractor of your choice)
Introduce the concept of "Landing Behavior"
Optimizing torque on the Cartridge mounting screws

AnalogMagik - Anyone Can Become a Cartridge Setup Guru!

https://www.analogmagik.com/turntable-setup

After you have performed a basic cartridge cantilever alignment using visual methods, then comes the part where AnalogMagik comes in. The naked eye cannot see what the stylus is actually doing in the grooves of a moving LP. Using scientifically repeatable methods, the AnalogMagik software will perform detail analysis of every setup parameter to help you improve the accuracy of your setup.

AnalogMagik Tutorial No. 1: Basic Cartridge Alignment

https://www.analogmagik.com/basic-cartridge-alignment

Basic Cartridge Cantilever Alignment

Before you begin using AnalogMagik, you will need to perform a basic cartridge alignment. In this free video tutorial, we will show you how to:

1. Mount the cartridge onto the tonearm
2. Determine the Pivot to Spindle Distance
3. Perform a basic cantilever alignment using the Acoustical System Professional Alignment Set or any alignment protractor of your choice
4. Introduce the concept of landing behavior
5. Optimizing Torque on the headshell screws

After the basic alignment, you will then deploy the AnalogMagik software and Test LP to fine tune all the setup parameters. We have made one video tutorial for each of these parameters. They include:

- Achieving proper turntable speed
- Setting up Azimuth (Horizontal balance & leveling)
- How to set Vertical Tracking Angle or Stylus Raking Angle (VTA & SRA)
- Determine proper Anti-skating force
- Optimizing Loading & Gain on the phono stage
- Measuring Vibrations & Resonant Frequencies
- Optimizing Vertical Tracking Force (VTF)

An optimal cartridge setup is one which delivers the most accurate retrieval of recorded signal on an LP. In order to achieve that, each setup parameter must be calibrated carefully. Each setup parameter is interdependent on each other, and no single parameter can be set up in isolation. You cannot simply setup Azimuth while ignoring Anti-skating, because if your Anti-skaing is off, chances are your Azimuth setting is inaccurate. This sames applies to VTF, VTA and vice versa, they are all inter-dependent and correlated with each other.

AnalogMagik is the only software which will allow you to calibrate ALL the setup parameters. We do not guarantee that meaningful measurements can always be derived from each of the setup parameters, because this is limited by the quality of the cartridge, tonearm and phono stage, but taken as a whole, if you can achieve good measurements with as many of these parameters as possible, we believe it will result in a much higher level of accuracy and a better sounding system.

(2) Speed and Wow & Flutter

AnalogMagik Tutorial No. 2: How to set proper turntable Speed, and measure Wow & Flutter

https://www.analogmagik.com/speed

The starting point for any turntable cartridge setup and calibration is to have the proper turntable speed because an incorrect speed will affect all other setup parameters.

The most popular tool for setting turntable speed is to use a strobe disk. A strobe disk has is easy to use, but accuracy is based upon visual observations and the result will only be a close approximation. Secondly, when the cantilever is landed on the record, the dragging force of the cartridge stylus on the LP, albeit small, will slow the platter down.

The most accurate method of measuring is to use a test tone signal. This brings us to AnalogMagik's speed test function. The Analog Magik test LP contains a 3150Hz Test Tone on both a 33 1/3 rpm and 45 rpm Test LP. Because the test tone is recorded at exactly 3150 Hz at 33 1/3 rpm or 45

rpm, only an accurate speed will play back the test tone at exactly 3150Hz.

To achieve the proper turntable speed, simply play back the test tone on the 33 1/3 TEST LP, adjust the turntable speed until it registers exactly 3150 Hz on the laptop screen. Repeat the same procedure using the 45 rpm TEST LP.

The AnalogMagik software will also perform a WOW & FLUTTER calculation on the speed of the turntable. In layman's term's, WOW & FLUTTER is basically speed variations which your turntable is experiencing. The AnalogMagik WOW & FLUTTER calculation is based upon the Audio Engineering Society's standards which require the sampling of a minimum of approx. 30 seconds of test signals, therefore the WOW & FLUTTER test will talk approx. 30 seconds to complete.

Users can experiment with a variety of adjustments to minimize speed variations. For example, on belt driven tables, adjust belt tension or motor distance until the WOW & FLUTTER number is minimized. For idler wheels, the pressure exerted onto the platter can sometimes be adjusted.

The Speed and Wow & Flutter test bears a strong correlation to adjustments, meaning the results are always meaningful.

A good setup should display a Wow & Flutter reading of below 0.2%. A very good setup should be below 0.1%. Above 0.2%, the human ear may be able to detect a very small change in pitch on a constant test tone.

(3) Azimuth

AnalogMagik Tutorial 3: How to Set Azimuth on Your Cartridge.

https://www.analogmagik.com/azimuth

Azimuth

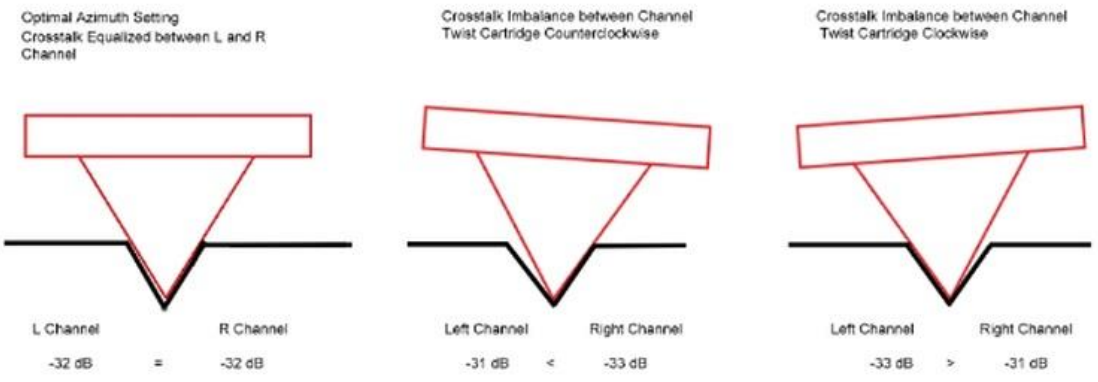
Azimuth refers to the horizontal balance of the cartridge when viewed from the front. This, in turn, determines at which angle the stylus sits on the record groove.

The theoretical assumption is that when the Cartridge is perfectly perpendicular to the record groove, the stylus will sit perfectly in the record grooves. Visual methods using tools such as the Acoustical System SMARTStylus (an acrylic block with grid lines) or bubble levels offers an excellent starting point.

All cartridges are made by hand and therefore, the stylus may not actually be perfectly perpendicular to the cantilever, or the cartridge body. This means visual methods, can only provide you with an approximation. As soon as the record spins, whether your stylus is sitting at the optimal spot is unknown, so it is impossible to achieve an accurate setup by eyesight.

If azimuth is set incorrectly, the Stylus will not sit perfectly in the record groove, signals recorded on the Left Channel will leak to the Right Channel, (or vice versa), this is leakage between Channels is called Crosstalk, and it is expressed as a negative decibel number. The higher the negative number, the lower the crosstalk, the better the channel separation.

All cartridge will have some inherent crosstalk, high-quality cartridges will usually have a crosstalk above -30dB for both channels, whereas the average cartridge will usually have a crosstalk between -25 to -30 dB.



The AnalogMagik software and test LP contains two test tracks which all allow you to determine the level of crosstalk between two channels. To determine the optimal azimuth, take readings of the two Azimuth tracks on the test LP, and AnalogMagick will compute the Crosstalk number for you.

If Left channel Crosstalk number is > than the Right channel, twist the cartridge by slightly (by approx. 0.5 to 1 degree), and repeat the measurement, or vice versa for the other direction. An optimal Azimuth setting is achieved when the difference between the L and R Crosstalk numbers are as small as possible.

For Example, if you start off with -25.5dB on the left and -28.5 dB on the right, you adjust the azimuth and the numbers will change. Keep adjusting and measuring until the Crosstalk number is as close together as possible, .to say -27.5 and -27 On a good cartridge, it is possible to achieve a number that is as close as 0.5 dB between Left and Right Channel. On others, you can sometimes get as close to within 1-2 dB difference between channels. If you have the patience to take into account alignment errors, VTF, VTA, as well as Anti-skating adjustments, we have reports from users that they can achieve as close as 0.2 dB between channels!!

We emphasize that meaningful results are highly dependent on the quality of the cartridge. Crosstalk bears a very strong correlation to changes in Azimuth setting, meaning you can almost always observe meaningful results.

Some cartridges have an imbalance to begin with, and no amount of adjustment will yield optimal results. Some cartridges have zenith errors which will require changing alignment which will affect other parameters, in such cases, we consider it a manufacturing defect.

There are several important factors which one may pay attention to when adjusting Azimuth:

1) Landing Behavior

Azimuth is highly affected by "Landing Behavior" which we talked about in the Basic Alignment Tutorial. If your cartridge has uneven pressure exerted by a cantilever landing behavior which is not going straight up and down, chances are you will never achieve a satisfactory Azimuth Crosstalk reading.

2) Azimuth cannot be set independent of VTA and Antiskating.

Due to the offset angle of headshells, as soon as you change VTA, geometry dictates that it will cause the horizontal level to change, ie) As soon as you change VTA, Azimuth needs to be reset.

Azimuth is also highly affected by Anti-skating and VTF (Vertical Tracking Force). If Antiskating is set incorrectly resulting in uneven pressure on the groove walls, this will often (but not always) cause an imbalance to the Crosstalk numbers. Therefore, you should try to optimize Anti-skating in order to achieve an optimal Azimuth setting. Changing VTF and VTA may also affect Crosstalk to you may have to go back and forth between different parameters and find an optimal point which results in a good set of numbers between all parameters.

3) Incorrect Zenith Angle on Cartridges:

Zenith angle refers to the angle in which the diamond is glued onto the cantilever. Sometimes it is not perfectly straight, it actually happens quite frequently.

If there is an inherent imbalance with the cartridge or zenith angle errors, the program CANNOT fix that for you. It is a cartridge problem. But there are things we can do to compensate.

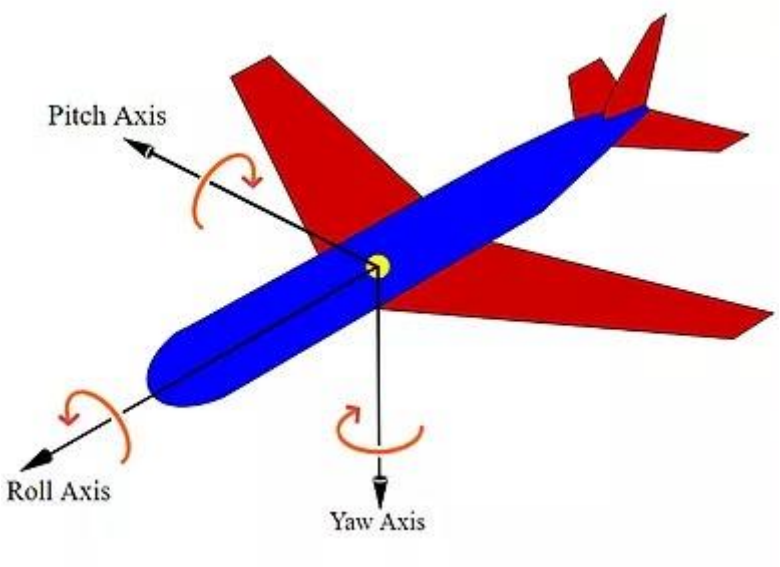
When you are setting up Azimuth, sometimes you will notice no matter what you do, the crosstalk numbers between L and R will not come together. Usually (but not always), we will also see:

- Crosstalk between L vs R reading remains far apart (say 5-6 dB difference)
- VTA (IMD% above 10%)
- Channel Imbalance

This behavior is highly indicative of incorrect zenith angle on the stylus diamond tip, and measuring phase angle will NOT solve this problem. You can use a 200-400x Microscope to examine the zenith angle on the stylus (whether the diamond is mounted straight on the cantilever, or is it off-axis), but the problem is a visual observation on a microscope, is difficult to transpose the degree angle to actual adjustment.

Incorrect zenith angle will result in an incorrect alignment geometry even though the cantilever may be aligned correctly to the gridlines of your template. The way to fix this is to change the alignment geometry (you can try going from Baerwald to Uni) which will rotate the cartridge slightly clockwise if you look at it from the top. By trial and error and patience, you will begin to notice the Crosstalk number will narrow.

In airplane terminology, changing the "Roll" would be changing the azimuth. Changing the Pitch would be changing the VTA, changing the Yaw would be changing the Alignment angle.



To compensate for zenith angle errors, you change the Yaw angle. The difference between Baerwald, Lofgren or Uni, is a change in Yaw angle of the cartridge.

For example, I once mounted cartridge with a crosstalk number of -20 vs -30 dB,, 3dB difference between channel and IMD% of 12%. After adjusting for zenith angle error by changing alignment angle, the cross talk came much closer together, -25 vs -25.7 (0.7 dB between channel), channel imbalance is now less than 0.5 dB, and IMD% lowered to 5%.

With more patience and fine adjustment, the numbers will likely narrow to within 0.5 dB on crosstalk. VTA IMD% will likely come down to 2-3%.

When numbers do not make sense, it takes patience. It will make sense when all inherent errors with the cartridge, Tonearm, has been accounted for. Visual methods can NEVER achieve this level of accuracy.

If the cartridge is good, you can achieve readings as good as less then 0.3dB between channels, on a very very good setup. On an average setup, you should be able to achieve 0.5-1 dB between channels.

Do not assume it is easy to get there, it involves many hours of very fine adjustments across many parameters to achieve such results. It may take 4-5 hours.

Also, an optimal setup optimizes readings across ALL parameters, it is a balancing act. Do not be pre-occupied with 1 bad reading. Sometimes it is caused by equipment quality limitations and not your setup abilities.

In rare instances where a correlation cannot be found, the AnalogMagik software also allows you to detect the phase shift as well as amplitude difference between the L and R channel, as a secondary measurement. You can adjust azimuth until the phase shift number is as close together as possible. However, this is not a very common occurrence and Phase shifts bear a weaker correlation and it is sometimes not repeatable unless if we incorporate a lot of averaging to stabilize the number.

In our opinion, Crosstalk measurement is usually sufficient.

If your crosstalk analysis leads you to have to tilt the cartridge by more than 1-2 degree, the cartridge is tilted too much and will likely throw off the other parameters. Over time, it will also cause suspension problems due to weight imbalance.

In such cases, we suggest that you go back and carefully examine your cantilever alignment's landing behavior, and particularly anti-skating. Also reexamine VTF, and VTA.

Keep in mind that some cartridges have an inherent uneven L/R output as well as Crosstalk numbers out of the factory. In such cases, it is an equipment limitation - ie, there's nothing wrong with the program.

Again, an accurate analog setup is a balancing act between ALL and not just one parameter. The goal is to obtain optimal numbers in as many parameters as possible, so do not sacrifice one parameter at the expense of all others. This is why an All-In-One tool is so important because no parameter can be optimized on a stand-alone basis.

4) What numbers to look for?

For the Azimuth Crosstalk measurement, you are trying to equalize the numbers between L and R channel. The goal is not to try to achieve an absolute value of specific target. If you cartridge specification says 36 dB Channel Separation, it does not necessarily mean you will see -36dB on L and -36.5 dB on L. In fact, a lot of cartridges registers numbers below 30dB. This is your cartridge's limitation and a deviation from specification. There is no need to contact the manufacturer.

The goal of this test is to get the number between L and R channel by less than 1 dB, or as close together as possible.

An FAQ on Azimuth:

I tried the Azimuth Function, and I find slightly different results when I use other tools or other test LPs?

Most test records on the market use 140 grams LP, so the number you see will correspond to 140-gram records. Our record is 180 grams, this will cause a change in Azimuth because VTA, as well as VTF, has changed.

Our programming also incorporates algorithms to account for the imperfections of the LP format, including slightly off-centered spindle holes, slight warpness as well as the effect of Wow & Flutter. Do not be surprised if you see slightly different results because almost all distortion analyzers do not take these factors into account.

We also do not advocate using Azimuth as the sole reference and stand-alone parameter as the ultimate determinant for setup accuracy. A true accurate setup takes into account VTA, VTF, Anti-skating as well as alignment, there fore the optimal setting should take into ALL other parameters, rather than just over emphasizing on Azimuth. You have to go back and forth between all test parameters rather than treating them independently.

You will find that Azimuth's optimal setting will be different when you have optimized Anti-skating, VTA, and VTF, so do not be surprised when you see slightly different results.

In an ideal world, all test LPs are accurate. In reality, nearly all test LPs are slightly different in terms of thickness, groove distance, cutting angle, etc. We believe our test LPs are accurate, and we have verified our test signals to the best of our abilities and verified by world class recording engineers and sound producers.

(4) Vertical Tracking Angle

AnalogMagik Tutorial No 4: How to set Vertical Tracking Angle (VTA)

https://www.analogmagik.com/vta

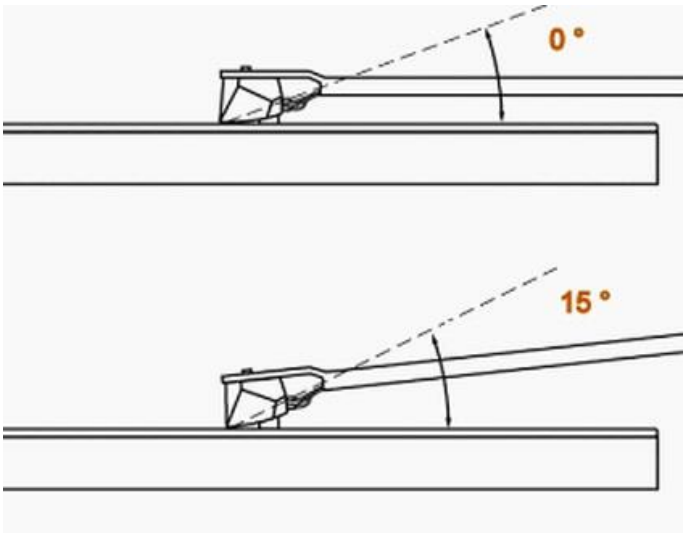
Vertical Tracking Angle

The Vertical Tracking Angle generally refers to the angle of the tonearm when viewed from the side. (Technically speaking, it is actually the angle of the cantilever vs the flat record surface). This, in turn, determines the Stylus Raking Angle (SRA), it is the angle in which the stylus is raking the record grooves at.

An excellent place to start the VTA Angle is to visually observe horizontal leveling of the tonearm viewed from the side. If you have a magnifier, or USB Microscope, you can observe the actual VTA Angle of the Cantilever, or stylus raking angle.

Whatever the technical terminology, the result is to achieve the same thing, that is to optimize the angle at which the stylus is raking the LP at, when viewed from the side.

The generally accepted theory is that the optimal SRA Angle is the angle at which the LPs are cut at, in most cases, this will be 92 degree, but a certain amount of variability is possible. Without a microscope, it is often difficult to observe the SRA, so an approximate starting point will be to adjust the VTA, or the horizontal level of the tonearm to about 15 °.



The Acoustical System SMARTstylus is an excellent tool which will allow you to visually gauge an initial Stylus Raking Angle. The Uni-Scope

Magnifier will also allow you to visually magnify the stylus to magnify the stylus 200x on your computer screen.

The theoretical optimal angle of 92° is based on the assumption that this angle will produce the lowest intermodulation distortion (IMD%). Visual methods provide a good starting point, but as soon as the platter start spinning, the dragging force created by the stylus raking on the LP will produce a downward force which will cause the raking angle to change.

Only an actual measurement performed while the recording is spinning will produce the most accurate results. This is unachievable using visual methods.

The AnalogMagik software has a VTA function which allows you to determine the actual intermodulation distortion number and it will be displayed on the laptop screen. Simply fine tune adjust the VTA angle until you reach a level which produces the lowest intermodulation distortion percentage (IMD%).

While performing this measurement, you may discover a small nominal difference between the left and right channel. All cartridges will experience a small difference between channels, this is limited by cartridge quality, and it is not a programming error.

Again, we emphasize that an optimal reading is also affected by Azimuth, Anti-skating, as well as Vertical Tracking Force (VTF), you may need to go back and forth between parameters to achieve an optimal setting across all parameters.

Establishing Correlation & Obtaining Meaningful Results

The most important thing to achieve with the VTA/ASA function on AnalogMagik, is to establish a correlation between VTA/SRA changes versus the results displayed on screen.

AnalogMagik is just a distortion analyzer, it is not guaranteed to deliver a low baseline IMD% number, because a low baseline number has to do with your equipment. AnalogMagik simply display what it reads.

Please note that meaningful results of the VTA/SRA function is highly dependent cartridge quality, as well as the inherent noise level of the entire setup. Our experience is that if the initial observed Intermodulation Distortion distortion is higher than 5-7%, then the chances of establishing a correlation or obtaining meaningful results will be smaller than in cases where the baseline is, say 2-3%.

We have also observed that some cartridges are more sensitive to VTA/SRA changes than others. Some users report a very strong correlation, others report utterly meaningless numbers. So if you are unable to obtain meaningful results, it only means the program is not able to establish a correlation between VTA vs IMD% changes. It does not mean the program is not working, it only means your cartridge is not sensitive to VTA changes, or the baseline vibration level is too high, interfering with the measurement.

We have discovered that a few factors may contribute to a high baseline number or an unstable number:

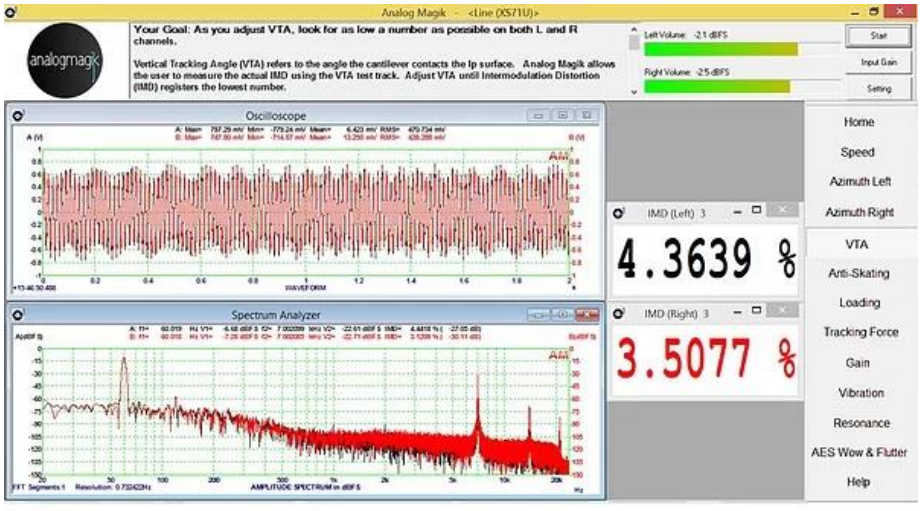
1) If the measurement is jumpy, meaning if there is a jump in the number of more than 1% between readings, you are likely picking up inherent vibrations which are interfering with the measurement.

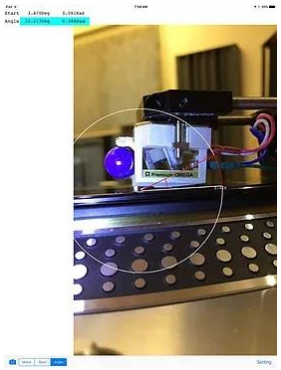
2) If a high baseline IMD% number coincides with bad azimuth reading, it is strongly indicative of a small zenith angle error on the stylus Once zenith angle is compensated, we have seen Azimuth crosstalk and IMD% improve dramatically

3) In cases where the resonance frequency of the arm/cartridge combo doesn't fall within the range of 8-12Hz, IMD% usually gives out bad numbers.

User Feedback

http://bingrungtsai.blogspot.tw/2018/02/analogmagiks-vtasra-tuning-function.html





(5) Anti-skating

AnalogMagik Tutorial No. 5: How to Optimize Anti-Skating

https://www.analogmagik.com/antiskate

Anti-Skating

The market has no shortage of controversies on the existence, definition and setup methods when it comes to anti-skating. Some manufacturers do not believe in Anti-skating.

Here is a good paper we found on the subject: Anti-Skating

AnalogMagik is more interested in how the "skating" force will show up on a distortion analyzer and how to compensation can be adjusted on your tonearm instead of debating about the cause or existence of anti-skating. We are more interested in finding a solution for it in cases where distortions are detected on the distortion analyzer.

As the turntable spins, the cartridge stylus of pivoted tonearms may experience uneven pressures on the groove walls, a side-thrust which makes the stylus lean harder against one side of the groove than the other. This side-thrust - normally compensated by an anti-skating adjustment - is caused by the offset angle for headshell, groove modulation, and other factors. If there is no compensation for the skating force, the distribution on the vertical tracking force on the groove walls is increased in the Left Channel (Inner Groove Walls, resulting in distortion in the Right Channel, and vice versa.

Not all tonearms provide for an anti-skating adjustment. On a 12" tonearms, anti-skating is sometimes not required, but on a 9" arms some anti-skating force is usually needed.
Some suggest using a blank record groove and "to eyeball" the speed at which the cartridge slides across the surface. Some use a Mirror cut into the shape of an LP, and anti-skating is determined by watching the cartridge slide across the surface. Some employ the use of torture tracks or complex DIY devices which measures bearing friction. Some use test tracks and their ear to detect audible distortions.

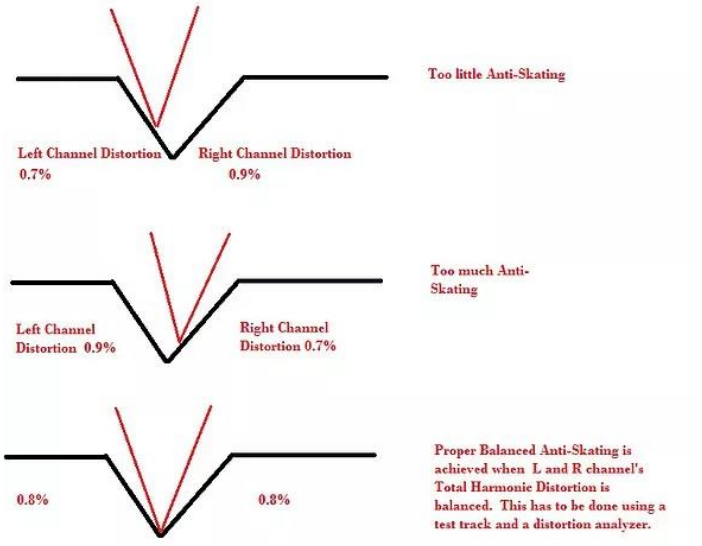
However, none of these methods bears any correlation with what you are trying to measure, and will result in an arbitrary anti-skating force which may not correlate to what you are actually trying to compensate.

In our opinion, any tools which attempt to measure anti-skating force without the stylus sitting on the LP grooves while the record is spinning introduces a different friction coefficient experienced by the stylus which bears no correlation with the actual level of pressure and frictional

force experienced in real time play settings. For example, if you use a mirror or a blank/grooveless record, the friction coefficient will be different from a normal LP with actual groves. They bear no correlation to one another so they will lead to inaccurate results.

We need to take a step back to see what anti-skating actually does.

When there is too little anti-skating force, the stylus will apply more pressures to the left or inner groove walls, causing a higher level of distortion on the R channel. When there is too much anti-skating force, it will cause too much pressure to be applied to the right or outer groove walls, causing a higher level of distortion on the L channel. This can only be measured while the stylus is sitting in the grooves with the LP playing. Our theory of optimizing anti-skating is to equalize the level of distortions between the right and the left channel.



Play the anti-skating test track on the AnalogMagik Test LP, and use the Anti-Skating function on the AnalogMagik software. Repeat the measurements with increased or decreased anti-skating force.. The anti-skating force is optimized when the distortion figures between the Left and the Right channel is balanced or as close together as possible. We also

believe a distortion analyzer is much more accurate than utilizing our ears to detect audible distortions.

Again, meaningful results are highly dependent upon the VTF, the cartridge, as well as the design of the tonearm. On good setups, we have observed a distortion percentage difference of approx. 0.05% between channels, while the net number should be below 1% on good setups.

Some tonearm and cartridge combination will require different methods of measuring Anti-skating (such as using pulse modulation, sine wave observation, etc), but is beyond the method we have chosen which we believe will work most tonearm combinations.

Establishing Correlation & Obtaining Meaningful Results

In some setups we are able to establish a very strong correlation with Anti-skating adjustments. On the Schroder Reference tonearm for instance, you can detect a change in numbers with the slightest change in anti-skating. But on some tonearms we are simply unable to observe a correlation no matter what we do, and the numbers do not change regardless of your adjustments.

We believe Anti-Skating is so controversial precisely because of this reason.

The effects of Antis-kating is dependent on many factors:

- Mass of the armwand
- Vertical Tracking Force
- Cartridge suspension
- Stylus Shape
- VTA/Azimuth/Alignment Geometry
- Bearing chatter
- Vinyl Materials
- etc.....

If you are able to observe a correlation, it means the anti-skating adjustment falls within the range where anti-skating will matter. In such cases, you will be able to optimize Anti-Skating using the AnalogMagik Anti-Skating THD% analysis.

On 12" tonearms tracking at 2g or above, you may notice a number where the L and R channel distortion is already very close, or you may observe that numbers do not correspond to anti-skating changes. In such cases, the anti-skating force is not required.

Some tonearm designs have inherent imbalances and will register numbers which will be skewed towards one channel, in such cases, nothing can be done. Some tonearms have too much anti-skating force even at the lowest setting, so the results are highly dependent upon equipment quality.

One must realize that the force exerted on the stylus is not linear, therefore the amount of anti-skating force required will be different depending on the relative location of the cartridge towards the record spindle. The curve is somewhat of a parabolic shape, with the skating force higher at the outer groove than at the inner groove, and lowest in the middle. Some tonearms designs have a mechanism which will increase anti-skating force gradually to counteract the non-linear nature of the centripetal force.

Optimizing anti-skating adjustment at the outer grooves where the skating force is the strongest will cause over-compensation across the inner groves. This is why the anti-skating track is placed near the inner grooves.

Anti-skating affects crosstalk measurements. We have observed that when anti-skating is set incorrectly, the imbalance will sometimes (but not always) cause crosstalk readings to be skewed so that in an optimal number can never be achieved. Therefore it is important to go back and forth between Anti-skating and Azimuth, as well as VTF and VTA to achieve an optimal set of numbers.

Again, we emphasize that no setup parameter can be optimized in isolation. One must try to achieve optimal settings in as many setup parameters as possible. For example, when meaningful numbers cannot be achieved under the Anti-Skating test, it could be caused by an incorrect VTF, Azimuth or even alignment. You may have to go back and forth different parameters to achieve meaningful results and optimal setting.

(6) Phono Stage Loading & Gain

AnalogMagik Tutorial No. 6: Optimizing Load & Gain on your Phono Stage

https://www.analogmagik.com/loading-gain

Optimal Loading

Most Phono preamps for MC cartridges or Step-up Transformers will allow users to choose different loading choices to match with their cartridges. Cartridges manufacturers will also provide a suggested loading range. However, the actual loading requirements for each cartridge is affected by a number of different factors such as different tonearm cable lengths, which will affect capacitance and resistance. Most manufacturers will advise users to choose a loading which "sounds best" to their ears. We believe there is nothing wrong with going with your ears, but AnalogMagik attempts to provide for you a more scientific and repeatable approach to optimizing loading.

Changing the resistive loading has the same effect as "Pushing the bars" on an equalizer up or down, it will affect the frequency response, and to a lesser degree the amplitude of the signal. If accurate signal retrieval is our goal, then the optimal Loading would be one which causes the least amount of change to the frequency response of what was originally recorded on the LP.

With the Analog Magik "Loading" Test track, AnalogMagik will display the flatness of the Frequency Response curve specific to your choice of loading. Simply change the loading and repeat the measurements to compare the flatness of the Frequency Response curve which is expressed in

decibels. The optimal Loading will correspond to one which displays the lowest number in decibels.

Meaningful numbers are dependent upon cartridge quality as well as the accuracy of all the setup parameters. You should always perform the loading test after adjusting all other setup parameters.

When performing this test, the volume knob on the sound card should remain constant. The only variable should be the loading on your phono stage.

It is essential to play the track in its entirety and observe the result only when the entire track has been played. This is give you a more accurate result.

Optimal Gain

Some Phono stages will offer different GAIN levels to accommodate different cartridges, however, most manufacturers will simply ask you to choose a GAIN level best suited for your ear. There is nothing wrong with that, and we do that too. But if we are selling a tool with the goal to deliver accurate vinyl playback, then around to tell you that "our ears are the benchmark", then we are not doing our job. Our sensitivity to high frequencies diminishes over time, so it is not quite reliable a benchmark.

AnalogMagik attempts to come up with a more scientifically repeatable method of setting gain levels.

AnalogMagik believes the Optimal Gain level is one which yields the highest Signal to Noise Ratio. Play the OPTIMAL GAIN TEST TRACK on the 33 1/3 rpm TEST LP, and observe the behavior of the Signal to Noise Ratio. Repeat the measurement under different GAIN settings on your phono stage. If a correlation can be found, chose the GAIN level which yields the highest Signal to Noise Ratio, look for the highest set of numbers in decibels.

In some very high-quality phono stage and preamplifiers, the Signal to Noise Ratio can produce excellent readings across all gain settings, in such cases, there will be no observable differences in the S/N Ratio. We have also encountered scenarios where external factors such as tube noise, oscillations or grounding problems which will render unstable numbers. Under circumstances beyond our control, the numbers will be rendered meaningless. It does not mean the program is not working, it just means the unstable noise level is adversely affecting the reading leading to unstable results.

It is essential to play the track in its entirety and observe the result only when the entire track has been played. This is give you a more accurate result.

User Feedback

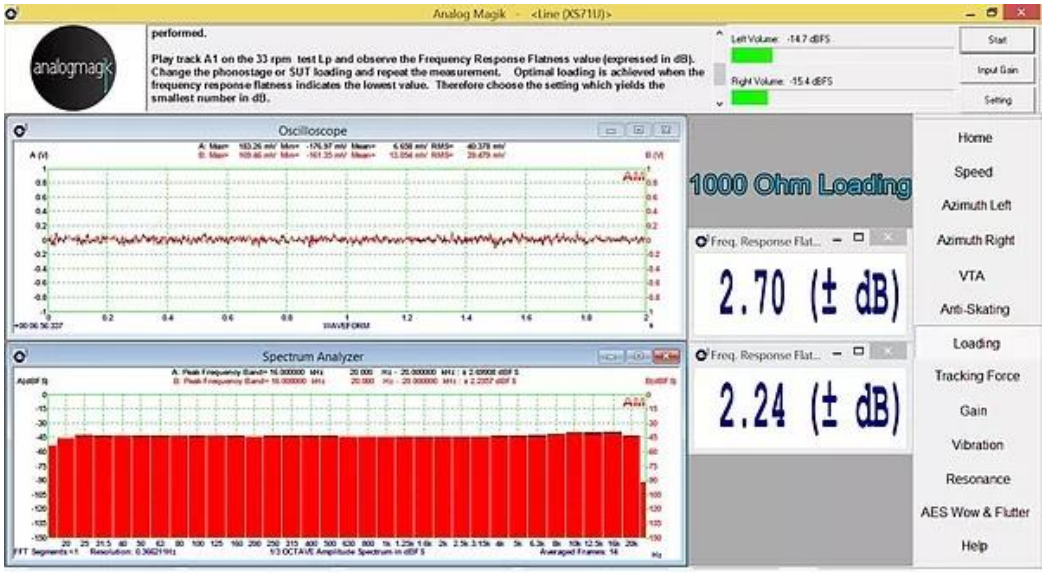
Check out the positive feedback by the Audio Measurement & Analytics Group:

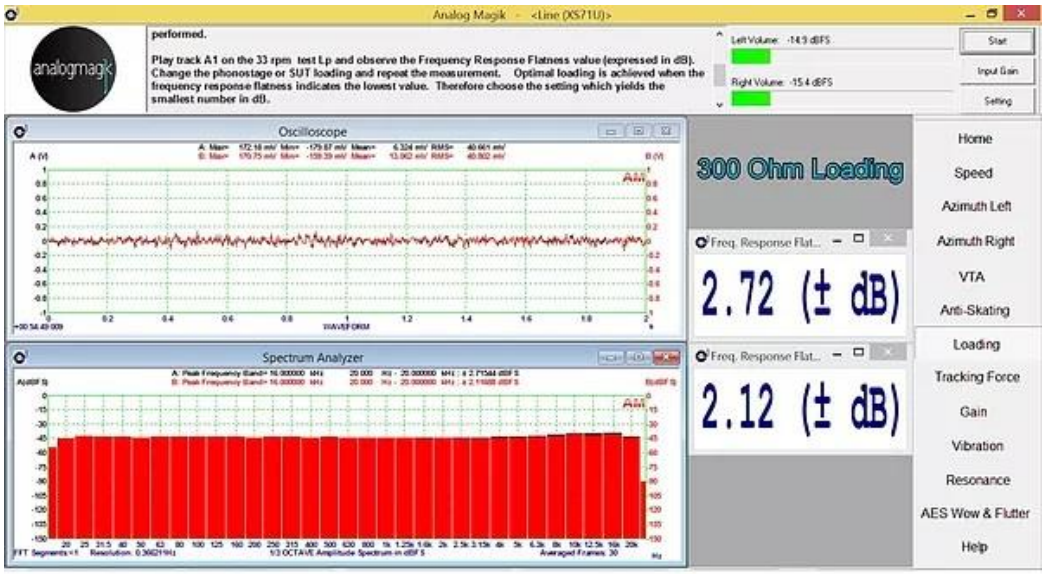
Verifying AnalogMagik's Loading Optimization Function (By Bing R. Tsai):

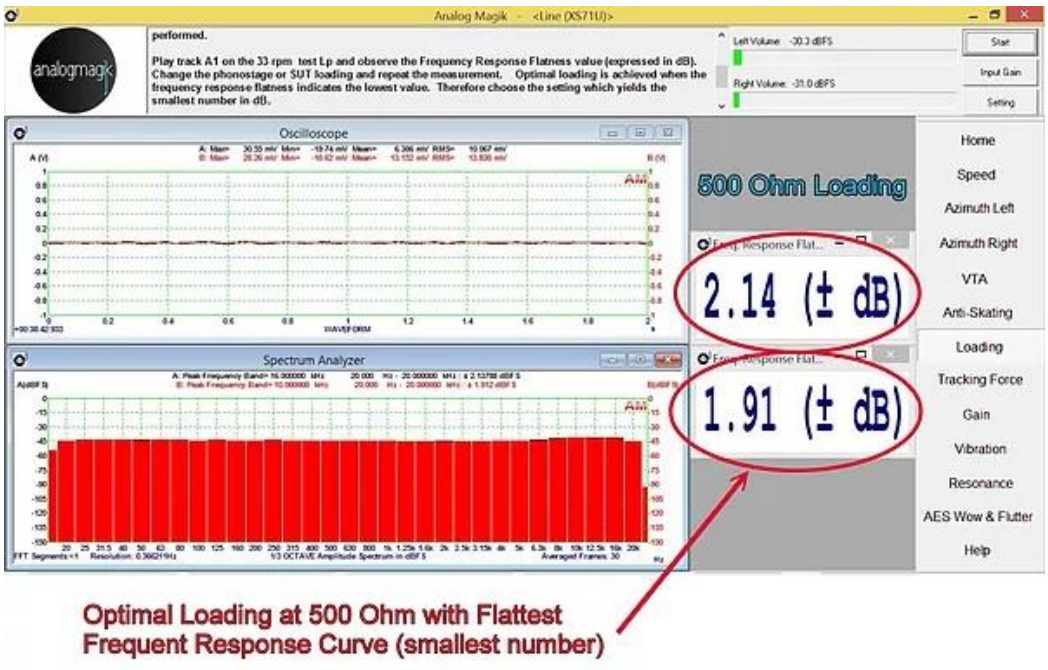
"I was somewhat doubtful this would actually work before running this set of tests. In my earlier experiments, I've found using a MC step-up transformer with various loading values in the phono stage would definitely impact the measured frequency responses. But I had been of the belief that, for the case of MC cartridges without using a step-up transformer, even though the impedance settings would impact the perception of overall tonal balance, the effects should be only in the harmonic compositions or even in the ultrasonic frequency range, presumably expecting no difference in normal frequency response measurements.

However, the test results below quite clearly indicate the 500-ohm value indeed leads to the best "flatness" measurements in AnalogMajik. And in fact, this is the value I had found most agreeable with my ears before running the measurements.

I have run the tests using the Avid Pulsare II phono stage, with easily adjustable resistance settings of 10, 30, 100, 300, 500, 1k, 5k, 10k and 47k ohms. Only the most relevant data is shown below. All other values clearly result in inferior flatness data to the 500-ohm setting."







(7) Measuring Vibration & Resonances

AnalogMagik Tutorial No. 7: How to measure Vibrations & Resonant Frequencies

https://www.analogmagik.com/vibration-resonance

Measuring Vibrations

Accurate signal retrieval during vinyl playback is highly dependent upon reducing vibrations which the turntable is subjected to. Vibration can come from many sources: foot stomping, motor rumbling, airborne sound waves, or improper turntable isolation, which will all translate into unwanted signals being picked up by the Cartridge. There are many ways to measure and quantify vibrations.

A good way to quantify vibrations is to measure the Intermodulation Distortion Level (IMD) between two frequency signals. Intermodulation Distortions are essentially signals not recorded the LP and are being picked up by the stylus, therefore it would be desirable to have the lowest IMD% number as possible. We have incorporated two low-frequency signals in this test. Note the test frequencies and algorithm in our formula employed in this test is different than the VTA IMD% analysis.

Play the "Vibration Measurement" track on the test LP and the Analog Magik software will display the amount of Intermodulation Distortion expressed in percentage on the computer screen. A good setup should yield a number lower than 2% to 3.0%. If the level of vibrations is too high, to begin with, it will mask the incremental changes which you are trying to measure on the different parameters and render them meaningless, therefore it is important to reduce vibrations to the minimal.

This measurement is designed to reflect immediate feedback which means the numbers should respond quickly to tapping or other external vibrations.

You can make changes to your turntable, such as going from direct drive to belt drive, adjusting the tension of the suspension, changing the isolation platform, or changing the location of the turntable. You can then repeat the measurement, a lower IMD% number would indicate an improvement has been made.

We wish to say that the test we have incorporated is only one of many which can be used to measure vibrations. In our product development engineer's laboratory, we have ultra-precise vibration measurement devices which are 100x more accurate than what we have provided, but the device cost more than a car. While there are far more sophisticated tools and test equipment available, we have to balance between cost, effectiveness and market demand. We believe the one we have provided will provide a good starting point to help users quantify vibrations.

Resonance Frequencies

When selecting cartridges, the total mass of the tonearm will interact with the compliance (elasticity) of the cartridge and produce a resonance frequency.

There are complex formulas which can be found online which will compute the theoretical resonance frequencies, however, we caution that such

formulas are often overly generalized, and ignore factors such as temperature changes, barometric pressure, different resonant frequencies with different materials, etc. We have discovered that the computed numbers bear very little correlation to the actual measurement, so in reality, you really don't know what the numbers are unless if you actually measure it in a live setting.

It is generally agreed that the optimal resonance frequency should be between 8 to 12 Hz. A resonance frequency outside of this range will degrade playback performance.

The AnalogMagik Test LP has a test track which will work with the AnalogMagik software to determine the Lateral/Horizontal resonance frequency of your cartridge and tonearm combination. Play the Lateral test track in its entirety and if a Resonance Frequency is detected, it will will be displayed as a static number on the screen, under the 'Peak Frequency' window.

If the "Peak Frequency is not within the 8 to 12 Hz, you can attempt to change the frequency by changing the mass of the tonearm or the cartridge weight. Sometimes, the frequency is also affected by changing the tightness on the headshell screws or the counterweight. Temperature changes, as well as barometric pressure, will also affect the results so the numbers observed during hot and humid climate, may be different in cold and dry winters.

We have included a Vertical frequency track for reference against the lateral frequency, but the this track will show a static peak frequency only if significant resonance is detected. Otherwise the number will follow the frequency detected under on the test track, where the peak frequency number will not be static and correspond to the frequency detected on the test track.

Caveat emptor: In our lab, we tested a number of sound cards below $ 1000 dollars, and the majority of the them do not provide a linear response below 20 Hz. Also the LP format itself is incapable of delivering accurate signals

below 10 Hz. The reliability of this test is subject to the limitation of the LP format, and equipment limitations.

(8) Vertical Tracking Force

AnalogMagik Tutorial No. 8: How to set Vertical Tracking Force (VTF)

https://www.analogmagik.com/vtf

Vertical Tracking Force

Most cartridge manufacturer will specify a number which the Tracking Force should be set at. More often than not, this number is a range instead of a fixed number (eg. 1.8g to 2.2g on most cartridges). One must never adjust VTF outside of the range provided by the manufacturer, otherwise, damage may result. DO NOT ever deviate from this range. It is NOT endorsed nor recommended by AnalogMagik to go outside of manufacturer's specification.

We have spoken with a number of cartridge manufacturers, and not a single manufacturer or individual was able to provide us with a definite and consistent answer on how to how to determine an exact number except to "go by ear".

As far as we know, AnalogMagik is the first to attempt to propose a methodology on calibrating tracking force scientifically.

We have discovered that changing the VTF will affect the Total Harmonic Distortion differently at different frequencies. For example, if you increase the VTF, the THD% on high frequencies will go up while the THD% on low frequencies will go down. But after a certain level, both sets of numbers will go up again. We have discovered that VTF can be optimized by finding a setting which yields the lowest possible Total Harmonic Distortion across both high frequencies and low frequencies.

The Analog Magik test LP contains two test tracks for VTF calibration, one with a high-frequency test signal, and one with a low frequency. Repeat

the measurement by using different tracking force levels. You may discover that different VTF settings will cause the THD% to go up or down between the two frequencies. The optimal VTF is one which yields the lowest set of THD% numbers in both high and low frequency test tones.

We have received enough feedback from users that the optimal VTF can be found using this method in approx. 70-75% of all cases. There are myriads of interference which may interfere with this test method, such as cartridge quality, stylus shape, tonearm bearing chatter, resonance, and other uncontrollable factors. In cases where a correlation cannot be found, more rigorous test methods such as sine wave observation, or using other test tones may be needed. Depending on market demand and returns, we may introduce these in-depth tool in future releases.

Within our labs, we have experimented with a countless number of different distortion tests on different VTF, and we can certainly produce an entire LP with 10 different test signals and perform 10 different sets of test on VTF alone. But if it is too complicated, no one will understand it and very few will spend money on the product. At the end, we have decided to include one test which is easy to use and understand and will likely yield meaningful results.

Lastly, we do not want to discredit anyone who decides to choose a setting most suited for their ears too. We do that too, but that is not a scientifically repeatable method.

We welcome emails on constructive and friendly exchanges of ideas, user feedback or questions.

Field Test Results

Bing R. Tsai, Analog Reviewer of Audio Art Magazine, and the Audio Analytics and Measurement Group, has performed extensive testing on AnalogMagik. One of this reports can be found HERE:

After finished writing the Part-1 of AnalogMagik review (Audio Art Magazine, July 2018), I started to test the remaining features I haven't spent much time on. The Tracking Force function are verified on two cartridges here, Lyra Kleos (recommended VTF=1.73 according to the user manual) and DS Audio DS 002 (recommended VTF=1.7). Figure 1 is the final VTF for the Kleos after optimizing for the lowest THD using AnalogMagik. Figure 2 is for the DS 002. For the Kleos which is my main reference cartridge for the past 2+ years, even though the change is only -0.04g from the original setting, the sound has become much more refined with high-frequency extension unheard before. Similar improvements are also heard on the DS 002, but somewhat less drastic even though the change in VTF is much greater.

Why is an All-In-One Tool important?

https://www.analogmagik.com/turntable-setup

All setup parameters are highly interdependent on each other, no parameter can be optimized in isolation. For example, you cannot optimize Azimuth in isolation because Azimuth is highly affected by Anti-skating, as well as VTA and VTF. If your anti-skating is set incorrectly, your chances are your Azimuth number can never be optimized. If you have a tool which only does one parameter in isolation, the setup will always be less than optimal.

Meaningful result of a specific measurement is highly dependent upon equipment quality as well as all other setup parameters. It is normal that you will have to go back and forth between parameters to find a balance

which gives the best possible outcome across all parameters. This is why you need a tool which will allow you to perform analysis on not just one, but ALL the setup parameters.

AnalogMagik does not guarantee that meaningful measurements can always be derived from every setup parameter, but taken as a whole, if you can achieve good measurements with as many of these parameters as possible, we believe it will result in a much higher level of accuracy and a better sounding system.

In the internet age, very few people reads instruction manuals the size of a phone book. We have designed AnalogMagik to have onscreen instructions which will guide you. Our single sheet on screen help file will also tell you what test results to look for.

Disclaimer: Our setup videos are provided FOR FREE and are presumably for your benefit. The contents of the video reflect our opinions and we make no guarantees on the video's accuracy and methodology and they are for educational purposes only. Be free to contact us if you have any questions, but we make no guarantees whatsoever on your satisfaction, nor will we be responsible if you damage your own equipment after watching the videos.

Should you wish to employ a different setup method after watching our videos, we encourage you to do so and have no interest in heated debates other than friendly constructive discussions with mutual respect.