

The "Lyceum" Speaker System

A Renaissance in Listening



The Linn Audio Lyceum speaker system is the culmination of decades of research and development, as well as countless hours of expert and critical listening. It is so clear and distortion free that it is unique in the high-performance music market today. It gives the cleanest sound you will ever hear. It's very high efficiency will perform well with tube amplifiers, even very low power ones, such as single ended triodes, for the purest possible sound.

We call our systems "a Renaissance in listening." Music so clear and distortion free that it has never even been heard before in other speakers systems.

History of the Lyceum

The Linn Audio Lyceum speaker system is the culmination of decades of research and development, as well as countless hours of expert and critical listening. The founder of Linn Audio, David Linn, has a lifetime of experience with high performance audio equipment, having worked in the audio industry starting way back in 1965, when he was a sales rep for JBL. At that time, JBL was the highest of the high end of its day, and Mr. Linn has not forgotten the design principles and objectives of the JBL engineers. He utilizes many of these same principles today. Mr. Linn has since had training as an Electrical Engineer, and has applied all his engineering training and expertise, as well as a lifetime of listening and enjoying high-end stereo, to the development of his speaker systems. This most special system was designed around some of the classic JBL principles, including large, paper cone woofers, with 3" voice coils, and a mid-range horn with a large compression driver. (See the section on "drivers" below, for more words about horns.) Both these driver elements were used on some very famous, and still desirable systems, such as the Paragon, which still commands a very high price for aficionados today.

The Current Status

So the result that we have come up with in the Lyceum design is something a little different than what is typical for home audio speakers, most notably the compression driver/horn for the mid range. Why do we still go for this old JBL design element when a cone mid range is more typical in today's designs? Simply because it sounds so good! Years of testing and listening has convinced us that this design is still the best for home listening. Also, as implied above, we have searched the world over for a compression driver that sounds great, and have located the one that we now offer in the Lyceum system.

By searching the world over for drivers that sound the best in this design and cabinet configuration, we have found what we consider to be the most desirable and musical. We have not prejudiced ourselves by only considering the known name brands that are currently and commonly used in today's high end offerings, though we have tested and auditioned them all. We are being bold enough to take this unorthodox departure from the current doctrine of high performance design, in order to present the best possible musical performance to the buyers of these units, who will seek to enjoy the great sounding music that this system is capable of producing. We do, however, utilize the best available, and most famous brands of other components of the system, namely the binding posts, capacitors, resistors and internal wiring used in the system.

Those of you who are sometimes bothered by the so-called "digital edge" on some CDs may find that there will be a lot less of it in the use of this system! A lot of this "edge," we have found, is "component edge," that it is in the speaker systems themselves, and the components used in them. We have sought to eradicate it, as much as is feasible, in our systems, so that the Lyceum, combined with other good quality components, amps, CD players, turntables, cables, etc., will reward the listener with the most pleasing and enjoyable music possible.

Design Overview

A key design element is the use of very high sensitivity drivers, both the woofers, and the mid-range compression driver/horn. In the old days, the only kinds of amplifiers available were tube type, so the efficiency had to be good. But today's high-end preference is also for tubes, using much the same designs that were popular then. So this speaker system is especially suited for those who still lean towards tubes. The system is set up for bi-wiring or bi-amping, however, and this is a modern improvement. We have found that this system sounds the best when a good solid-state amp is used on the bottom end, and a tube amp on the mid range horn. The mid range driver is extremely efficient, at 110 db, so that when run separately, a very low power tube amp may be used, such as a single ended triode design, which usually have quite low power, but the lowest distortion and most pleasing sound. See the "Drivers" section for more information about the drivers. The cabinet is constructed of very heavy MDF, a material that was not available in the old days, when plywood was the most common material.

We have searched the whole world over to find the ideal drivers for this design philosophy, spending many years in the search. JBL itself now makes drivers that are more suited to commercial

applications, such as theaters, and PA systems. Though we have tested the current equivalent JBL speakers, just to see if they are still suitable for a good home system, we have found others that we like better. We have even gone so far as to obtain the old original JBL drivers on the used market, to see how they stack up to what is available new today, and again decided that we could do better elsewhere.

The Cabinet

As stated above, the Lyceum cabinet follows through on a classic design of the 60's and 70's. It is built with the very best materials, selected for their sonic merits, and constructed in a rigid and durable fashion. The walls of the enclosure are one to three inches of MDF, the preferred material for high performance speakers. We use only the densest and heaviest grade of MDF. The front-ported design is also a follow through from the original JBL design concepts, since it matches these kinds of drivers well, and further enhances the high sensitivity, low power requirements of the system, though this generally requires a larger cabinet than a sealed box design. But of course we are using a particularly large and heavy cabinet here, so the design follows through on the original concept. The cabinet is lined with 2 ½" thick variegated foam pads, which prevent internal reflections that may adversely affect the sound, especially at the low end. The feet (4 per side) are very attractive and robust, in keeping with the size and weight of the cabinet, being machined out of solid brass bar stock, and weigh 1 pound each! It is an all natural wood cabinet, with all surfaces covered in real wood veneer, as well as some solid wood parts, rosewood, in the current model, and all finished in a very durable and hard satin varnish.. It has a very interesting grain structure, which is matched in the left and right channels.

The Drivers

The woofers are 12" paper cone type with extremely large and heavy 16 pound magnets, working on 3" ribbon wound voice coils. This bass driver, when used in a ported cabinet, has very high efficiency, and also an extended coverage from the bass into the lower mid range. Part of the reason for the smooth response and low distortion of this system is this extended range aspect of the woofers.

The mid-range compression driver has been super selected to be the sweetest sounding for mid range and lower highs than any other driver of any type we have auditioned. It has a 1 7/8" diaphragm, and a neodymium magnet assembly for very high sensitivity, and smooth response covering from the mid-mid range all the way up to 20 khz. So, this two-way design does not really need a tweeter, though a super tweeter option is available that will take the high frequencies all the way to 40khz. The horn has been specially developed for its smooth distribution of the sounds in its frequency range, with an emphasis on both vertical and horizontal coverage to create a broad "sweet spot" for good stereo imaging, whether standing or sitting.

The horn is a special design which is free of resonance, and all other typical colorations that are usually found in plastic or aluminum horns. The shape of the horn is also unique. It is specifically designed for home audio use (most stock horns are intended for performance and theater use) in that

it has a very broad polar dispersion (which is more characteristic of cone drivers) so that it does not “beam” high frequencies (again, typical of most stock horns) and thereby provides a very broad “sweet spot” for the listener.

This is an unorthodox use for the typical home music system, which almost universally utilize cone mid-ranges, but we have dared to depart from the doctrine, for the sake of musicality and sonic purity. Also, the typical practice of multiple midrange drivers, in order to get some “punch” in loud passages of music, is not necessary here. The single compression driver has way more “punch” that you will ever need, and lower distortion, at all levels of sound.

A Few More Words About Horns: It should be noted that engineers have long recognized that compression driver/horns have much lower distortion and more musicality than cone type midrange drivers. But manufacturers began to design away from them after the 1960’s, primarily due the high cost of compression drivers, vs. the cost of cone mid-ranges. But today’s high-end manufacturers have continued to specify cone midrange drivers, even when the lowest cost is not the primary concern. This, we believe, is just a “follow the leader” approach, and continues to be the practice because (it is believed) that this is what people are used to seeing, and expect in a system. We know what we hear, and have selected the compression driver/horn configuration for the Lyceum based on long listening experience, and know “in our hearts” that a horn system is superior to cone midrange configurations.

A 100% efficient speaker system has theoretically zero distortion. Horn systems are approximately 20% efficient, cone speakers are 2% efficient. Horn systems are capable of giving a closer approximation of musical reality. With precision alignment, their performance achieves the highest performance in linearity, fidelity, dispersion, efficiency and power. Horn systems are expensive to manufacture. Quality compression drivers are machined to exact tolerances within microns. Unfortunately today, selling is driven by marketing, not consumer understanding. So we think that our somewhat unorthodox employment of the compression driver/horn for the midrange in the Lyceum Speaker system makes the most sense, in today’s high performance market, and is a big reason why we believe that there is no better sounding system on the market today, regardless of price.

Horns have very special properties, including lower distortion than conventional drivers, faster transient response than conventional drivers, and are easier to drive at high SPL's than conventional drivers. Details in the following paragraphs:

Lower distortion at a given SPL: For an equivalent SPL, horns require a smaller diaphragm, and since distortion is directly proportional to the size of the diaphragm, a large diaphragm electromechanical transducer (conventional cone driver) has to move much more than a horn diaphragm in order to create the same SPL (sound pressure level). The larger the excursion, the worse the distortion. So, for a given SPL, a horn loaded system will generate much lower distortion than an electromechanical transducer.

Faster transient response: Since the diaphragm is smaller, it is lighter and thus it accelerates and decelerates faster. This, in the real world, means superb, fast snappy transients. As the excursion of the diaphragm is very small as compared to a typical electromechanical transducer, the voice coil is

much smaller and again, this translates to a lower moving mass, which again, results in fast transients.

Higher SPL's with a given input wattage: Small voice coils also take full advantage of the flux in the pole piece gap. This increases the efficiency of the transducer allowing the amplifier to work with greater ease. Since the amplifier has more headroom and the driver handles peaks and high outputs more efficiently, horns are able to produce much higher SPL's before they distort.

Thus, in the normal operating range, horn designs are faster, more dynamic, have a better transient response, have less distortion, and are easier for an amplifier to drive than conventional driver designs.

Why don't all manufacturers of high-end speakers choose horns for their midrange drivers? For one thing, as stated above, audiophiles are just more accustomed to seeing cone-type midrange drivers, so the manufacturers just follow the market expectations, rather than lead the market with innovations that have superior sound, as Linn Audio has done. But also there can be problems with horns, mostly due to resonances, and other undesirable colorations in the horn part. This resonance, though technically not distortion, can nevertheless sound like it. So, in other words, normally what superior low distortion performance that you can get with a good compression driver, you can lose in the horn part. But Linn Audio has overcome this problem, and has designed and produced a resonance-free horn, that is also free of other undesirable colorations, so that you get the full advantage of the compression driver, without any losses in the horn part. Also our compression drivers use a polymer type diaphragm that is much sweeter and more natural sounding than the typical metal diaphragm, and more suitable for home audio. It does not have the "tinny" or "honky" sounds that some people identify with typical compression driver/horns. In short, Linn Audio, after years of R&D, has developed a horn system that has overcome all the shortcomings of horn systems, and left just the superior performance characteristics of this type of system.

So, with the use of this special horn, you feel the music, you become part of the music, and the music becomes part of you. The full-range phase coherent wave front of horns produces a solid image and presentation, as opposed to the phase impaired, smeared, and diluted imaging of typical low efficiency conventional (cone) driver designs, no matter what exotic material the cone is made of. Horns will never sound veiled or compressed. The performers will be there, in your room, performing for you in the same way and location as the original recording venue. If the performer was six feet from the microphone during the recording session, he will be six feet away from you when the performance is reproduced through your system, not fifteen feet behind the speakers. Why would one want the performers to be fifteen feet behind the speakers if that was not how the material was recorded? We want the performers to be in the same room we are in, in front of us, so that we can feel the music, front row center.

Due to their inherent benefits of low distortion, high efficiency, fast and accurate transient response, and wide dynamic range, Linn Audio's special horn drivers provide a pure, unadulterated musical presentation, a more organic and natural recreation of the acoustic event. As a result, each different musical selection is portrayed with its own character and life, not that of the playback medium.

The High Frequencies

The Lyceum system does not use a separate tweeter for the very high frequencies, those above 20 khz. The special compression driver used has the necessary extended range, that performs all the way to 20 khz, so that a tweeter is not really necessary. However, Linn Audio does offer an accessory tweeter system that can extend the range up to 40khz, so that the very high frequencies may be reproduced.

Crossovers and Wiring

Linn Audio has a unique design philosophy regarding crossover design. We abide by the principle that the fewer components the better. All components, no matter how high quality, alter and color the sound, and at worst, add distortion and phase shifts to the signal. This is especially true of crossover components; capacitors and inductors. Most system designers of high performance speakers choose or design random driver components, which may not be good matches for each other, and compensate for these mismatched drivers by the use of massive and complex crossover designs, necessarily requiring many components in the signal path. We believe this philosophy is flawed!

We have started at the other end of the system, the drivers themselves, and have chosen not only the best we can find with regard to musicality and low distortion, but that match each other well, in terms of sensitivity, impedance and complementary frequency ranges. By taking this path to design of the system, we can minimize the components required to create a full audio spectrum, held to within +/- 3 db. It is very difficult to do, but we have done it, with the Lyceum system. To take this design philosophy one step further, we have set up the system for bi-amping, to further reduce the components necessary for a full spectrum, yet flat frequency response. It has been said that: "the best sounding component is none at all!" So, we cannot have absolutely none, but we have provided the next best thing; minimal components in the signal path. And as stated, when the system is bi-amped, an absolute minimum of components need be employed. This is one of the main reasons why the Lyceum has a very pure and clean sound, one that cannot be matched by systems that use complex crossover designs.

All the internal components are of the highest quality available, with the use of polypropylene film and foil capacitors, air core inductors, and WBT type insulated gold binding posts. The internal wiring is also selected from the best grades and sizes of high-purity, oxygen free copper wire, while all connections are point to point, and soldered with WBT silver solder. Resistors used for balancing the separate driver components (when mono-amped) are Mundorf brand and are of a high wattage, and flame-proof type, that will handle plenty of power.

Unique 3-way Connectivity

A new feature of the Lyceum is the addition of two extra pairs of binding posts. The internal wiring is such that there are 3 different possibilities to connect the system to amplifiers, according to the taste and preferences of the user. The first two are as stated above, a single amp driving the entire system, or a second amplifier driving the mid-range, using the internal crossover networks.

The 3 Options for Connecting the System

- 1.) A single amplifier connected to all the drivers, using the internal crossover components, and a jumper wire to the second set of binding posts.
- 2.) Mono amp with bi-wiring by connecting the second set of cables to the second set of binding posts, and eliminating the jumper wire.
- 3.) Bi-amp, with a fairly powerful, and preferably, solid state amp driving the low end, and a second amplifier, preferably an SET type tube amp (and one of very modest power may be employed) driving the mid-range, using the internal crossover components, but using the third set of binding posts, and thus eliminating the resistor network.

The three sets of binding posts, on the rear of the newly designed Lyceum cabinet, may be connected and configured for any one of the above 3 connection options, giving the user ultimate control of the resultant sound.

Time and Phase Coherence

Much has been said about this issue in construction of high performance audio loudspeaker systems. It is very important when it comes to accurately reproducing the sound stage, as well as the spatial relationships of the various instruments, and reproducing the overall “presence” of the music. Time and phase coherence add a dimension of clarity and spatial realism that cannot be achieved by other means. Only a very few of the top-end speaker manufacturers properly address this problem, and Linn Audio has sought to improve on all the solutions, to provide the best overall performance of any high performance audio speaker system available today.

In order to achieve this desired effect, all the frequencies of the music should reach the listener at the same time, that is, in the same “coherence” as that of the original source. This is a problem with most speaker systems that use complex crossover networks, with many components in the signal path.

Crossover components create phase shifts in the audio waveform, so that the sound is “smeared out” relative to the original signal, and different frequencies are reproduced by the drivers at different relative times than in the original source. Different speaker drivers have voice coils and/or dispersion points that are at different depths from each other, so when the audio signal reaches all the drivers at the same time, the distance from the driver source, for the different frequencies, reach the listener at slightly different times. Both these issues, though not contributing to distortion of the signal, can adversely affect the “presence” of the music, as well as the breadth, depth and height of the sound stage. Timing errors also create the loss of much directional or imaging information. Also affected is the placement of the various instruments within the sound stage, in comparison with the original performance. Outputs of the various drivers must be heard in unison to preserve the original structure of the sound.

Linn Audio’s solutions to the first problem, that of phase incoherence, is to reduce the number of components of the crossover in the signal path to a bare minimum, thus eliminating the phase shifts associated with these components. (See the “crossovers” section for more information on this issue.)

Linn Audio also uses very wide bandwidth drivers, so that more of the frequencies are reproduced in synchrony with each other from the same source/dispersion point. With the Linn Audio Reference System the drivers are also mounted to achieve optimal driver dispersion for the listener's position, both in time and phase relationships.

Overall Specifications

Enclosure type: Front ported

Woofers: Two – 12" paper cone type; 16 pound magnet, 3" voice coil

Midrange: One – compression driver/horn (1 7/8" diaphragm)

Sensitivity: 96 db overall for mono-amp; 110 db on high end, when bi-amped

Nominal impedance: 4 ohms, when mono-amped; 8 ohms on mid-range when bi-amped

Minimum/Maximum Power: 15 watts/900 watts

Frequency response +/- 3 db 25hz – 20khz

Overall dimensions: Height: 56 1/2" including feet.

Width: 17" at widest point

Depth: 21" at deepest point

Weight: 200 pounds each.

Finish: Real rosewood, both solid wood parts and veneer; satin varnish

For further information, check the website: www.LinnAudioLoudspeakers.com

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