

WHY BOTHER?



Salient Points in Speaker Design

- Listening Window and Sound Power
 - Lack of Dynamic Compression
 - Double-Blind Listening tests
 - On Site Anechoic Chamber
 - Custom Speaker Drivers
 - Matching Components
 - Active vs Passive
 - Family of Curves
 - Cabinet Integrity

Design Criteria for Bryston Speakers

At first glance it would seem like there are enough speaker brands on the market to go with our world-famous amplifiers. But a Bryston amplifier is capable of far higher dynamic output than the typical amplifier on the market, and this creates a problem with the vast majority of loudspeaker offerings in the market. Typically, you have to choose between accuracy of sound reproduction and dynamic capability when choosing a loudspeaker. We needed to solve this problem. Bryston customers were demanding both.

The Bryston mantra is essentially **“PERFORMANCE FIRST”**



There has been a tremendous amount of research over the last 30 years regarding how real speakers perform in real rooms and our design criteria follows and endorses this research. We all listen to our speakers in rooms and the performance of a given loudspeaker has to be coordinated with this fact. It really depends on what you want the speaker to do. There are many different philosophies about how real world speakers in real world rooms should behave. Do you want the speaker to beam the sound at the listener so there is little on and off axis energy in the polar/power response? Do you want a Dipole or Bi-Pole design? Do you want an Omni design etc.?

The two most critical parts of any loudspeaker system choice is the listening ‘ROOM’ and the loudspeakers ‘POLAR’ response. Recognizing how the room imposes its boundaries (floor, ceiling, walls) on the speaker and how that speaker radiates its energy (polar response) into a specific room is critical to the understanding of the overall performance of any speaker and it is no different for the Bryston loudspeakers.

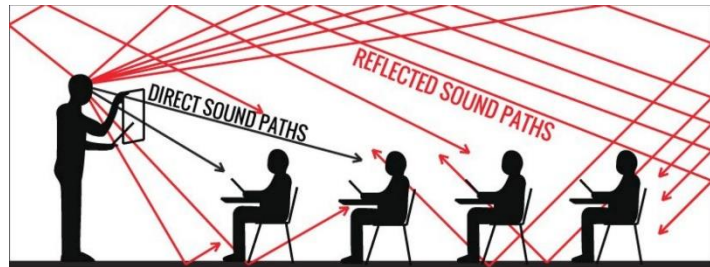
When you are listening to a loudspeaker in a room you are always listening to a balance between the ‘Direct Sound’ and the ‘Reflected Sound’ from the boundaries of the room – this is called the ‘Power Response or Sound Power.’ It is that balance between direct and

reflected energy which changes depending on the frequency radiation pattern (polar response) of the given speaker and the boundaries of the room the speaker is placed in. Dipoles, Bipolar, Omnipoles, Direct Radiators, Horns etc. all behave differently due to their specific radiation patterns and therefore exhibit different power responses in any specific room. Bryston has chosen a direct radiator approach in the design of the Bryston loudspeakers for numerous reasons but one critical reason is because we feel it is currently the best way to accomplish the correct balance between direct and reflected

energy in real world listening rooms and it definitely supports the research that has been done over the past few decades.

DIRECT and REFLECTED SOUND:

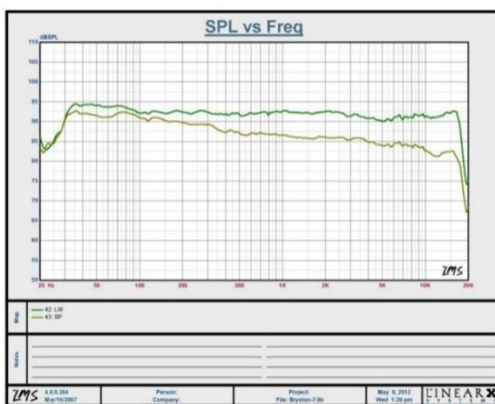
The 'direct sound' is the sound radiating from the front of the loudspeaker, typically referred to as the "Listening Window" and the 'reflected sound' is all the sound your ears perceive after the sound waves have interacted with all the different boundaries in the room, typically referred to as the "Sound Power".



It is important given real world conditions that the on axis response and the off axis frequency response of a loudspeaker be as uniform as possible. This on and off axis characteristic is generally referred to as Polar response. The smoother and more uniform the on and off axis polar response of the speaker the better the tonal balance between the direct sound and the reflected sound will be. In other words, the reflected sound will have the same overall tonal balance and sonic characteristics as the direct sound if 'on and off' polar response is smooth and even. This approach also provides the optimum overall 3-dimensional soundstage presentation as well. The Bryston loudspeakers are a very wide dispersion design so the polar response is very flat on axis and very uniform all the way out to more than 45 degrees off axis in both directions from center to provide a very wide and even listening window.

LISTENING WINDOW and SOUND POWER:

In a loudspeaker the 'listening window' is an average of a front set of curves whereas the 'sound power response' is an average of all the curves right around the whole speaker. What we actually hear seems heavily weighted to be a balance between these two conditions. The listening windows frequency response should be very linear (flat) across the entire audio band but the sound power should fall off by 8 – 10dB by the time you get to 10kHz (see diagram below) while still remaining linear in its march down from the bass frequencies. Striking the proper balance between these two is extremely important to the sound of the speaker. Keeping the listening window and the sound power both linear is not an easy task and is where most speakers fail to perform well.



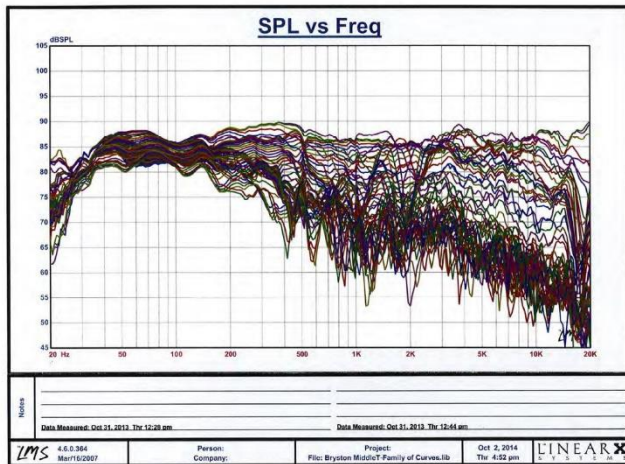
Typically there is a lot of attention paid to the linearity of the direct on-axis frequency response by reviewers and knowledgeable consumers but it is really just one curve in the mix of many hundreds of curves Bryston utilized in the design of our loudspeakers.

'Sound Power' is what we hear when we listen in real rooms and the ability to measure all of the radiated energy from the loudspeaker is critical to its predicted performance.

Typical Bryston Model T Speaker Anechoic Response

What you see below are measurements of radiated sound taken from points on a sphere in our anechoic chamber surrounding a Bryston loudspeaker. Only those of us with decades of experience researching the correlation between measured performance and

perceived excellence could see such chaos and know the speaker will sound amazing. We all know that on-axis frequency response—the balance of tones we hear from directly in front of a loudspeaker—is a critical function of perceived neutrality. A less understood component of sound quality is the proper balance of sound loudspeakers radiate from all directions not directly in front of a loudspeaker.



These sounds reflect off of our surroundings before arriving at our ears and cue our brains to synthesize spatial information about the recording and our listening rooms. Bryston's goal is not to eliminate the listening room; that's impractical. Rather, our loudspeakers work with your listening room to transport you to the space in your favorite music and movie soundtracks. More than three decades of psychoacoustic research has resulted in proprietary algorithms which process these seemingly chaotic plots to calculate listening window and sound power. Our

algorithms have matured into highly reliable correlations with preferences identified by listeners in controlled double blind listening sessions.

So how is this approach different than other brands? Many other loudspeaker manufacturers emphasize on-axis response with less regard for in-room behavior. The result is a loudspeaker that can't be depended on to happily co-exist in your room in two ways. First, perceived tonal neutrality depends on the 'color' of reflections in a room as well as direct sound. Our aim is to make sure that reflected energy sounds like direct energy. Second, proper recreation of soundstages including correct scale, width, and depth depends on maintaining proper harmonic relationships of recorded sounds. Without the integrity of these sounds, our brains are unable to synthesize placement of sounds in three dimensional space.

Because Bryston loudspeakers are designed to sound realistic across a broader than average listening window, you don't need to sit up straight in just the right sweet spot. Feel free to relax a little off the center line where you'll be most comfortable. You'll still be able to close your eyes and swear you're hearing the real thing.

PASSIVE CROSSOVER:

The passive crossover in a loudspeaker provides the correct frequency response, levels, roll-off slopes, phase etc. to the different drivers (woofers, midranges, tweeters). The crossover uses very sophisticated parts that allow for very precise tailoring and control over each of the drivers. This attention to details in the crossover provides the utmost in spatial and depth imaging performance as well as overall realism. Proper application of the integration of the drivers/crossover and box is critical in determining uniformity of the speaker's output in all directions (sound power). The crossover the drivers and the cabinet all work in tandem and cannot be designed independently. The Bryston speaker crossovers are meticulously engineered to achieve extreme tonal neutrality and is constructed with extensive use of



high quality components. The result is astonishing clarity, transparency, and true three-dimensional realism.

CUSTOM DRIVERS:

Achieving excellent results starts with the drivers. Briston drivers are both massively powerful and capable of wide bandwidth. Their robust metal diaphragms, carefully tuned suspensions, and FEA optimized magnetic motors are pistonically well beyond their primary operating range ensuring no audible breakup.



All the drivers in the Briston speakers are custom made in our Canadian factory. The advantage of custom made drivers is you can design the driver to do a specific job in a specific cabinet with a specific crossover. Many loudspeaker manufacturers use off the shelf commercially available drivers but that severely restricts their design options because the manufacturer has to design around the specific drivers characteristics. We have developed our drivers to be part of the overall design

window and have integrated them with the crossovers and cabinet in a way not possible with off the shelf components. We use cast baskets, substantial magnet assemblies and custom motor systems in all our woofers and midrange drivers.

CABINET:

The cabinet plays an enormously important role in the quality of music reproduction, and so the engineering of the cabinet incorporates several innovations that contribute to the speaker's stunning clarity, its utter tonal neutrality and its exceptionally realistic imaging. Another task the cabinet must perform is to allow the sound from the drivers to radiate freely without encountering cabinet edges or cavities that will diffract some of the energy, causing interference and delayed sounds that produce tonal colorations and obscure spatial information.

The Briston speaker cabinets are made from a high quality MDF and precisely constructed in our Canadian manufacturing facility. The cabinet was designed with exceptional attention to reducing cabinet resonances. You want the cabinet to be as inert as possible so that only the drivers are contributing to the sound emanating from the speaker.



Bracing in the correct areas is critical and contrary to popular belief you can easily end up with improper bracing – too much or not enough. Everything vibrates or has a natural resonance at which it will vibrate and the ear is much more sensitive to higher frequency vibrations as opposed to lower frequency vibrations. The general thought is the more bracing the better but it actually doesn't work quite that way. There are two things to be cognitive of in brace design. One is that you can actually increase the SPL of the "cabinet output" if you put the wrong

number of braces in the wrong place and the other is that as you add braces you will increase the frequency of the “cabinet output” which at some point, even though the SPL will likely be substantially lower, the cabinet output will become audible because we humans are far more sensitive to noise at higher frequencies. So measuring and optimizing at what frequency vibration occurs and at what amplitude is critical to producing as resonant a free cabinet as possible.

The cabinets are shaped and contoured to provide the practical elimination of diffracted driver energy from the driver’s specific dispersion characteristics and to reduce or eliminate any internal standing waves in the loudspeaker cabinet. Less vibration contributes to greater clarity, while the absence of diffraction allows for very open, box-less reproduction. The cabinet sides achieve great stiffness by a construction of shaped panels and bracing using accelerometers to measure precise movements and bracing them appropriately to reduce resonances. This construction preserves the nuances and delicacy of the music by reducing unwanted sonic artifacts that would otherwise obscure musical detail.

UNIT TO UNIT MATCHING:

One of the critical requirements for creating a quality three-dimension image in your room is that each and every loudspeaker must be synchronized as much as possible to one another in all aspects of their performance. Small variances in performance from unit to unit can inhibit the audio systems ability to place instruments in the proper location and create a believable soundstage where the speakers disappear and the performance fills the room with a convincing performance. We take great care in making sure this continuity is maintained for each and every loudspeaker we manufacture.

ANECHOIC CHAMBER:

This is a ‘Biggy’.



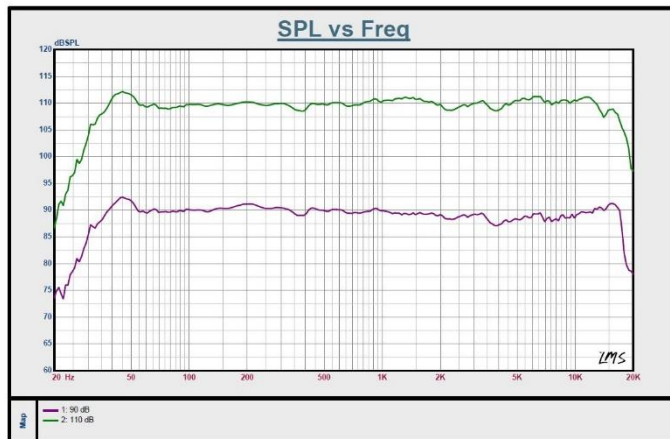
Our speaker design and manufacturing facility in Canada has a very unique advantage – an on-site ‘anechoic chamber’. Anechoic chambers are reflection free rooms and are used by the superior speaker manufacturers to do all the loudspeaker testing in an environment where early reflections and outside noise issues are eliminated from the measurement curve(s). Anechoic chambers are very, very expensive to build but they are invaluable when designing a quality loudspeaker.

Measurements can be made showing exactly how the on and off polar response of the speaker is performing, cabinet resonances due to improper bracing are easily measured with accelerometers, driver abnormalities and resonances are easily detected etc. It allows one to move in a constructive direction in a calculated manner because it brings to the forefront many of the discontinuities not necessarily obvious with other test methods.

The Bryston speakers were meticulously designed utilizing the factory anechoic chamber and then fine-tuned and adjusted utilizing double blind listening tests to provide our customers with as accurate a loudspeaker as is currently obtainable.

DYNAMIC COMPRESSION:

One of the major issues with many speakers is ‘dynamic compression.’ In the real world if you hear a loud (dynamic) sound like a gun-shot or a back-fire or a scream etc. there is a huge dynamic range associated with the sound. Many speakers, especially small 2-way or 3-way speakers are terrific for what they do but the vast majority fall short trying to recreate the huge dynamics necessary to produce the kind of sound pressure levels needed to reproduce these huge volume swings in your listening room. With the Bryston loudspeakers one of the foremost priorities was to create a speaker that could truly reproduce these real world dynamics without compression. Utilizing multiple drivers in a vertical array was the best way to achieve this goal.



Dynamic compression, or the inability to maintain composure under high playback levels plagues many loudspeakers. Bryston’s astonishing lack of compression brings a lifelike realism to dynamic events in music and movie soundtracks without introducing artifacts that might disrupt your enjoyment.

At left, note that the frequency response of the speaker at a punishing 110dB is virtually identical to that of the speaker at a more

common level of 90dB. This is astonishing performance regardless of price.

STAYING ACTIVE:

The Bryston T Series loudspeakers (Mini T/ Middle T and Model T) are also available in a fully ACTIVE version. These models use external amplifiers and an external electronic crossover to achieve performance levels far above what can be done with passive systems. Passive components can distort the signal’s time signature and it will also be frequency dependant to some extent. The other big area of benefit is that fact that the passive filter network has intrinsic losses and these losses translate directly into a reduction in the amplifier power that actually makes it to the loudspeaker drivers. Removing those losses from the equation translates into a more efficient transfer of energy between the amplifier and the loudspeaker. We will also be developing active speakers with internal active crossovers and internal amplifiers using DSP technology going forward.

Active loudspeakers differ from passive speakers in that the crossover that determines which drivers (Tweeter, Midrange and Woofer) get which audio frequencies is controlled by an ELECTRONIC crossover (Bryston BAX-1) placed between the preamp and the power amplifiers rather than the passive crossover version which is typically built into the loudspeaker. Also all the drivers in the loudspeaker have an independent amplifier channel controlling them as opposed to a passive crossover where one amplifier channel controls all the drivers in the speaker. So an Active 3-way speaker like the Bryston T Series requires 3 separate amplifier channels per speaker whereas the T Series passive’s only requires one amplifier channel per speaker.

The advantage of an electronic crossover placed between the preamplifier and the power amplifiers is all the speaker control (crossover slopes, crossover points, gain etc.) are performed at what is called low level signal levels whereas passive crossovers are

operating at what is referred to as high level signal levels. Manipulating and adjusting signals at low levels is far more accurate than attempting the same with high level signals. So if you look at the frequency response, the crossover slopes and the volume levels per driver required the Active crossover provides much more accuracy than the passive option. With an Active crossover we can adjust and design these two performance areas of the speaker separately and independently whereas with a passive crossover they have to be adjusted in tandem. So in a passive system an adjustment on the listening window affects the sound power directly and vice-versa.

So the flexibility and accuracy that Active crossovers provide cannot be underestimated from a performance perspective.

BRYSTON BAX-1 DIGITAL ELECTRONIC CROSSOVER:

The Bryston BAX-1 is really a very specialized and unique active digital crossover. Most active crossovers just provide the customer with a 'generic' approach to adjustments. By that I mean you can choose the slope and the crossover point and sometimes the Q but they do not take into account the Sound Power or total radiated energy of the speaker. The BAX-1 on the other hand is designed with a specific speaker in mind.



The Model T has different software than the Middle T and the Mini has different software again. The reason for this is we put each of the Model T's in our anechoic chamber and we make over 300 measurements both vertically and horizontally around the speaker and adjust the software to provide as accurate as possible the best Sound Power for the specific Model T speaker.

The other advantage of Active loudspeaker systems is the fact that the amplifiers output stage is directly connected to the loudspeaker driver. So the Woofer, Midrange and Tweeter all have separate amplifiers controlling their movement directly rather than having to deal with passive components (capacitors, inductors, resistors etc.) required by passive networks.

If you recognize that music is essentially a transient condition, a 'stopping and starting' as the music signal requires then any system that can control this stopping and starting of the drivers is much more capable of an accurate rendition of the input signal. The transient response improvement with the direct connection between the amplifier and speaker in the active system is mainly due to the fact that the main filter components in a passive crossover network, the inductors and capacitors, are energy storage devices. By definition they both suffer from forms of hysteresis where there is a delay between the energy storage and the release of that energy.

The above is not in any way meant to demean the excellent performance you can achieve with a well-designed passive loudspeaker. A well designed passive speaker will outperform a poorly designed active speaker without question. But the reality is that a well-designed active speaker overcomes many of the technical hurdles a passive design faces.

LATEST DEVELOPMENTS:



For too long, music enthusiasts have had to sacrifice the exceptional performance they have come to expect from a Bryston audio system when selecting components that offer wireless connectivity and a smaller form factor. To that end, Bryston is introducing a collection of outstanding new products designed to make quality audio a breeze to own and fit in just about any space while still providing inspirational sound quality.

The passion and the goal was to create ‘State of the Art’ Wireless products. These wireless products needed to perform just like the wired version, have inputs for other equipment, and be easy to operate. Over the past few months we have accomplished these goals. And more is still to come! The current wireless lineup includes the Model A1, Model A2 and Model Mini A as well as all our Subwoofers.

SUMMING UP:

A ‘state of the art’ audio system involves what some refer to as a “suspension of disbelief”, which means that the playback system transcends the recorded medium and transports you to a live venue. You forget it’s a recording and believe you are there at the live performance.



Our goal with the Bryston loudspeaker system was to provide our customers with a superior level of ‘disbelief’.