

# Electronic Musician

## Bag End Studio System A

By Lawrence E. Ullman

**This high-end studio monitor speaker package tells the whole truth.**

**I**n his recent face-off of five near-field reference monitors (“Boom Boxes,” November 1994), EM Editor Michael Molenda succinctly described the role of a professional studio monitor: “As far as audio signals go, a studio monitor is The Truth. Without really knowing what an audio signal sounds like, you can’t make educated decisions about instrument and vocal timbres, equalization, signal processing, and stereo imaging.”

And to that I say, “Amen.” Yet the five small studio monitors he went on to compare and laud—indeed, all small loudspeakers—can only tell part of The Truth. No matter how good they may be in other areas, few of the small 2-way speakers commonly used for near-field monitoring have much usable output below (to be generous) 80 Hz. None go low enough to accurately reproduce the lowest octaves.

In large professional studios, the small near-field reference monitors on the console are supplemented by large, full-range main monitors, which are often soffit-

mounted (flush) into the control room walls. However, such large systems are not an option for studios tucked into a small bedroom or a corner of the living room, nor do they offer the advantages of near-field monitoring. (See “Square One: Nearer My Monitor to Thee” in the June 1995 EM.)

Similar problems are faced by designers of high-end, car-audio and home-theater systems. These installations must be capable of powerful bass response, but the speakers must be small due to space constraints. Fortunately, a simple solution is readily available: The restricted low-frequency response of the small “satellite” speakers can be supplemented by adding a separate subwoofer system.

Adopting the same approach to studio monitoring allows you to have your cake and eat it, too: The small monitors can remain perched above your console, while the relatively nondirectional nature of low-frequency sound allows the subwoofer enclosure to be placed in an out-of-the-way location. In addition, most



**Consisting of a pair of MM-8 near-field monitors, two D10E-S subwoofers, and an ELF-1 integrator, Bag End's Studio System A takes near-field monitoring to new heights by reaching new lows: The system's bass response extends all the way down to 8 Hz.**

subs have a built-in highpass filter that relieves the satellite monitors (and the amp driving them) from onerous low-frequency duties. This allows the small speakers to operate solely in the midrange and treble frequencies, where they are the most effective.

For the past month, I've been using a remarkable studio-monitoring system that not only implements the satellite/subwoofer approach but does so at a level of performance way beyond anything I've experienced to date. Bag End Loudspeaker Systems' Studio System A package consists of a pair of MM-8 near-field monitors (\$1,788/pair), two D10E-S subwoofers (\$568 each), and the company's unique electronic crossover, the ELF-1 integrator (\$2,460). Although all of these products are available separately, buying them as a matched set can save you money.

### LET'S GET PHYSICAL

The MM-8 monitors have a 2-way, coaxial design with a 1.75-inch aluminum compression driver mounted at the center of an 8-inch woofer. Designed by audio pioneer Ed Long and manufactured by Bag end under a licensing agreement, the MM-8s were engineered using Long's Time Align system.

Originally used in another Long design—the larger UREI Time Align monitors that are a fixture in many professional studios—this approach uses a unique measuring device called a Time Align generator to verify the speaker's performance. The goal is to ensure that high and low fre-



**FIG 1: The 90 DIP switches hidden behind the front panel of Bag End's ELF-1 2-channel Low Frequency Integrator are used to configure both the highpass filter and the ELF. The switches add precision resistors whose value establishes a DC voltage that controls the appropriate circuits inside the unit.**

## Bag End Specifications

System	Type	Woofers	Tweeter	Crossover	Sensitivity	Max.Power	Impedance	Weight
Coaxial 2-way	8"	1.75"	2.9kHz	84dB	SPL	100W	8W	28lbs.

▼  
I was initially pretty skeptical about the validity of the EQ switch.

quencies reach your ears at the same point in time, without the smearing and phase shifting that can occur in some other designs.

Finished in matte black, with solid walnut tops and bases, the cabinets are solidly constructed with thick, medium-density fiberboard (MDF) and measure 17.5 x 12.25 x 8 inches. With its exposed driver, a large, slot-shaped port, and two rocker switches, the baffle (front panel) presents a no-nonsense, industrial look. As is usual with studio monitors, no grilles are provided, and the rather busy graphics on the switch panel leave no doubt that the manufacturer intends a vertical orientation.

The switches are visible manifestations of two of the MM-8's most distinctive features. On the right is a large rocker that reverses the speaker's absolute acoustic polarity. (Absolute polarity dictates that the polarity of the source signal is maintained intact throughout the recording/reproduction chain. In other words, a compression wave captured by a microphone at the recording session is reproduced as a compression wave by the speaker cone, not as a rarefaction.)

Some experts take the position that, as long as the polarity of both channels is reversed, there's no audible difference; others insist that the difference is obvious. Bag end obviously falls into the latter camp, pointing out that the switch can be used to check the polarity of new material before adding it to existing material of an unknown polarity. I was unable to hear any obvious difference with any of the recordings I auditioned. However, those who can hear the difference may find the switch useful.

The effect of the other front-panel switch is much more apparent. The equalization switch has three positions: Distant/Final, NFM/Original, and NFM/Final & Distant/Original. The first of these is essentially flat, while the other two introduce varying amounts of rolloff above 5 kHz. According to the manufacturer, the three equalizer settings "create a uniform monitoring environment at different listening distances and different

points in the recording process."

The manufacturer's argument goes something like this: Original source signals monitored prior to entering the recording chain are inherently brighter than final recorded material, which suffers high-frequency loss due to the vagaries of the recording process. At the same time, because high frequencies are attenuated by the listening environment, material monitored in the near field will sound brighter than when listening at a distance.

The Distant/Final position is used to monitor final recorded material at a distance (outside the near field). Because both of these conditions cause high-frequency loss, no additional attenuation is necessary; this position is the brightest of the three. The NFM/Original setting is used to monitor original material (bright) in the near field (also bright). It compensates by providing the greatest degree of attenuation. Used in two possible situations, near-field monitoring of final material (bright/dark) or distant monitoring of the original material (dark/bright), the NFM/Final & Distant/Original position is, as you may have already guessed, intended as a happy medium between the other two.

### SWITCH HITTING

I was initially pretty skeptical about the validity of the EQ switch. As a dyed-in-the-wool audiophile, I found deliberately altering the tonal balance of a speaker sacrilegious. Although I find it easy to accept one part of Bag End's argument-near-field and distant monitoring do impose different requirements on a speaker, and the switch may enable the speaker to do double-duty-I had a little trouble swallowing the idea of using the switch to compensate for losses due to the recording process itself. Even if such losses are still a significant factor in today's direct-to-digital world, aren't they something engineers have been compensating for intuitively all along?

However, the proof is in the listening, and the more I listened to the MM-8's, the more I found myself appreciating the logic behind Bag End's approach. The darker NFM/Original position really is well suited for near-field monitor-

ing of live sources such as synths and microphone feeds. Subtle details such as reverb decays, imperfectly looped samples, and the like are quite apparent without resorting to the excruciating brightness and artificially etched detail so common in many small near-field monitors.

The midbright NFM/Final & Distant Original position also lives up to its billing. In fact, most of my listening was performed in the position. The slight treble rolloff actually made extended monitoring sessions-in the near field at high levels, no less-a pleasure, rather than a torture.

On the other hand, the Distant/Final position was just too bright for my taste. I suspect this is because my bedroom-cum-studio is simply too small to make "distant" monitoring practical. In a larger, more absorbent space, this setting-and the MM-8's ability to play quite loud without strain-should enable them to pinch-hit quite effectively as small "main" monitors when coupled with an ELF subwoofer system.

### THE LOW DOWN

As I said at the beginning of this review, small monitors can only go so low. The MM-8, for example, offers excellent bass response down to about 100 Hz, which is typical of similar models. However, there's a hole lot of shakin' going on below that point. This is subwoofer territory, and Bag End knows it well.

Bag End's claim to low-frequency fame is based on a technology called Extended Low Frequencies, or ELF (see sidebar "ELF Magic"). The Studio System A package includes an ELF system with two D10E-S subwoofers driven by the company's top of the line ELF-1 integrator. Used together, these components produce some of the tightest and most articulate low-frequency performances I've heard, all the way down to a remarkable 8 Hz.

Specifically designed to be used with an ELF integrator, the D10E-S subwoofer is smaller than other conventional models. At just 22 x 13 x 13 inches, it's about the size of a large "bookshelf" loudspeaker. Finished in matte black with walnut tops that match the MM-

## ELF MAGIC

Bag End's Extended Low Frequencies (ELF) system consists of two complementary components that work together to provide extended bass response while attempting to avoid the drawbacks of other designs.

Named after the common electronic circuit on which it is based, the ELF integrator is a 2-way, active electronic crossover. Used in a dual configuration in the ELF, the integrator circuit produces a 12 dB/octave rise as frequency is decreased. Unlike conventional lowpass filters, which introduce a frequency-dependent phase shift that can make blending the bass into the upper frequencies difficult, the integrator produces a short, uniform phase shift for which it is easy to compensate.

The low-frequency output of the ELF integrator is connected to a power amplifier, which drives and ELF subwoofer. Unlike typical designs, which use ports, active servo electronics, or other techniques to provide extended bass response, and ELF subwoofer has

a relatively small sealed cabinet. When speaker drivers are operated below resonance in a sealed box, they operate in a linear, predictable way. Their frequency response is just the inverse of the dual-integrator circuit's: It rises 12 dB per octave as frequency is increased.

When you combine and ELF integrator with an ELF subwoofer, the result is a flat acoustical response from below the speaker's resonant point all the way down to the low-frequency limit of the integrator, which in this case is -3 dB at 8 Hz.

The ELF approach has several other advantages. The impedance of an ELF loudspeaker is uniform below resonance, presenting an easy load to the amplifier. And with no ports or other resonance peaks in the operating range, the speaker doesn't favor any one note, a common problem with ported or "bandpass" designs. (Manufacturers of car subwoofers often take advantage of port resonance to produce the delightful "boom" you hear going by in the

8's, the sealed enclosures each contain a pair of 10-inch drivers. Their impedance is 4 ohms.

Although Bag End claims the perforated-metal grille is much more acoustically transparent than cloth at low frequencies, it rings when you tap on it and can clearly be felt vibrating during playback. However, the grille's ruggedness outweighs any inaudible, aberrant acoustic behavior when you consider that the sub will most likely be placed on the floor. Of course, you can always remove the grille if the speaker is placed out of harm's way.

The ELF-1 integrator functions as a 2-channel, 2-way electronic crossover. The single-rackspace unit accepts two full-range, line-level signals from your mixer or preamp, processes them through a highpass filter that feeds an amp driving the monitors and through an ELF dual-integrator circuit that outputs to an amp driving the subwoofers. (This is a "biamped" system that requires four amplifier channels.) Additional circuits in the ELF-1 protect the low-frequency channels with a unique form of speaker protection called ELF Concealment, while the highpass channels are protected with another unique circuit Bag End calls a Continuously Variable Recovery (CVR) limiter (More on these later.)

The back panel of the ELF-1 has six

balanced XLR jacks (two inputs, four outputs), a fuse, and a permanently attached power cord. The unit can also be connected to unbalanced lines; a wiring diagram for the necessary cable is provided in the manual and pinouts are screened on the back panel. Because I wanted to connect the ELF-1 to my unbalanced home-theater system, as well as the RCA monitor outputs of a TASCAM multitrack machine, I took the plunge and built

### Product Summary

#### PRODUCT:

Bag End Studio System A

#### PRICE:

\$4,906

#### MANUFACTURER:

Bag End Loudspeaker Systems

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Barrington, IL 60011

tel. (847) 382-4550

fax (847) 382-4551

EM METERS RATING PRODUCTS FROM 1 TO 5

AUDIO QUALITY	●	●	●	●	●
VALUE	●	●	●	●	●

cables with XLRs on one end and RCA plugs on the other.

## DIP-SWITCH HEAVEN

Of course, the front panel is where the action is. Here you'll find no less than 90 DIP switches (45 per channel) that are used to configure both the high-pass and ELF sections (see Fig.1). Note that the main signal does not actually pass through the front-panel switches. Instead, the switches add precision resistors whose value establishes a DC voltage that controls the appropriate circuit deeper inside the unit. This approach keeps the signal path clean and allows the settings to be changed while a signal is present without causing noise or pops. In addition, the settings are precise and can be easily read and written down for reference. Once you have the switches set, a cover plate can be installed to keep the uninitiated from screwing things up.

Each channel of the highpass section includes five switches that set the low-frequency limit (cutoff) of the highpass filter. The switches add 80, 40, 30, 10, or 5 Hz to a basic value of 50 Hz. Thus, to select a highpass cutoff of 120 Hz (the value I used), you open the 40, 20, and 10 Hz switches. Put another way, this method allows the highpass-filter cutoff point to be set anywhere from 50 Hz to 205 Hz in increments of 5 Hz.

The next six switches adjust the highpass section's gain. Five values are available, which combine to yield a range of plus or minus 15.5 dB in 0.5 dB increments. The sixth switch determines whether the value selected is added to or subtracted from unity gain. (I left my unit set at unity gain.)

Other switches in the highpass section include a polarity-reversal switch, a 10 dB output attenuator, and a channel mute. The final seven switches are concerned with a speaker-protection device unique to the ELF-1. Called a Continuously Variable Recovery (CVR) limiter, this circuit rapidly reduces the gain when a signal exceeds a threshold value set by six DIP switches. (The seventh switch, Stereo/Dual, links the channels so the limiter affects gain equally on each, or allows them to remain independent.)

Unlike typical limiters, however, the recovery rate of the CVR limiter is not a fixed linear or logarithmic slope. Instead, it is dynamically dependent on the amount of limiting called for, with a fast initial recovery that gradually slows as it nears full recovery. The CVR limiter is never activated under normal conditions (a yellow LED on the front panel flows in varying intensity to indicate CVR operation), so to get an idea of its effect, I set the threshold level all the way down and the high-pass gain all the way up. For a

limiter, it is subtle and benign sounding. Nevertheless, under critical monitoring conditions, you don't want either the CVR limiter or the ELF Concealment circuit (discussed shortly) to activate. If they do, you're not actually hearing what's going down on tape.

Many of the ELF switch settings are similar to those in the highpass section: The gain, polarity, 10dB pad, and mute switches are essentially identical to their high-frequency counterparts. The Sum/Dual switch is similar to the Stereo/Dual switch: It combines the left and right ELF channels for installations using a single subwoofer.

The ELF cutoff section resembles the highpass cutoff section, but with different frequency settings. The five switches set the ELF cutoff from 8 Hz to 70 Hz in 2 Hz increments. Normally, you want to leave the unit set to its nominal value of 8 Hz, which, according to Bag End, yields the best overall system phase response. However, in some non studio applications (bass guitar or P.A. systems, for example) you may want to raise the LF cutoff frequency to eliminate string or mic-handling noise.

Similar to the CVR circuit, the ELF Concealment section contains six switches that are used to set a threshold. Unlike a limiter, which would simply (and, no doubt, audibly) attenuate all low frequencies upon detecting an overload, Concealment works by dynamically adjusting the ELF cutoff point. Thus, if there is insufficient headroom to reproduce a very low frequency signal, the Concealment circuit raises the ELF cutoff point until the low frequency can be reproduced to the fullest level possible without distortion. This approach leaves other, higher frequencies relatively untouched.

During the course of testing, the red Concealment LEDs on the front panel flashed briefly during some extremely dynamic percussive passages, but the Concealment was quite inaudible. The circuit's effect only became apparent when playing very low synth sounds very loudly, and then only as a slight lowering of LF gain. This is a musical, effective solution.

## GET WITH THE SYSTEM

After spending most of a day breathing solder fumes and building cables, I was ready to get down to some serious listening. The MM-8s are designed to handle up to 100W/side (continuous), while the subwoofers handle up to 400W/side (con-

tinuous). Wanting to use amplification commensurate with the quality of this system, I was fortunate to be able to borrow several amplifiers I had recently reviewed for Home Theater Technology magazine. I ended up with three powerful and extremely fine amps from Bryston of Canada: A 2-channel, 250-watt 4B-THX (\$2,245) drove the MM-8s, while a pair of 500-watt 7B-THX (\$2,345 each) served the subwoofers.

The system was set up in my studio with the MM-8s on a riser over my master keyboard and mixer. The drivers were at ear level, as they should be. I placed both of the D10E-S subwoofers on the floor, one to the right on my mixing desk, under a table, and the other to the left, near a wall.

As you might expect, the sound was awesome, with bass seeming to extend down into the abyss. After listening to a few tracks, it became apparent that the bass was a little too awesome; instead of seeming to emanate from the satellites, as it should, the low frequencies could clearly be localized as coming from speakers on the floor. Reducing the gain of the ELF section by a few dB took care of this, and the system snapped into focus.

The subwoofers revealed a whole new world of heretofore inaudible sounds. Bass drum hits that had been little more than dull beater thuds were now accompanied by the full body of the drum. Bass guitars suddenly had depth and impact. Male voices were deep and rich, without the boxy coloration so common in small speakers. Room ambiance in live recordings was also dramatically evident.

I've heard dozens of subwoofer systems in the last few years, and this is easily the most coherent and musical. You quickly forget about the subs themselves; your near-field monitors just seem to extend all the way down. As a trombonist and bassoonist, I know that low-frequency sounds should have clearly defined pitch. Many of the consumer subwoofers I've reviewed can produce a greater quantity of bass than this system, but it's a dull roar by comparison, without much articulation or pitch.

Freed of low-bass duties and supplemented by the subs, the MM-8's excellent imaging was enhanced even further. Instruments remain solidly defined and stably placed, even in the most complex mixes. Of course, the ELF system can be used with any monitors you own. I experimented with a pair of Tannoy NFM-8s, and although the Tannoys are no match for the MM-8s in terms of high-end detail

and dynamic punch, they benefited greatly from the having the low frequencies filtered and directed to the subs.

## IN THE BAG

The Bag End Studio A is a versatile, professional-quality system. At nearly \$4,906 without amps, it is obviously not for everyone. Fortunately, a less expensive Studio B package is also available for \$2,996. It includes a pair of MM-8 near-field monitors and a single D10E-S subwoofer, and it substitutes an ELF-M integrator for the more expensive ELF-1. The ELF-M (\$798) doesn't go quite as low (18Hz vs. 8 Hz), has a mono subwoofer output, and is less configurable. (The ELF and highpass cutoff frequencies are preset, for example.) In smaller studios such as mine, the single sub would be plenty.

If you really want to hear The Whole Truth and nothing but The Truth, a pair of small near-field monitors by themselves aren't going to give it to you. Bass is the rhythmic and harmonic foundation of nearly all music, and small speakers just can't go low enough to do it right. If you think it doesn't make any difference, that consumer systems can't reproduce low bass either, you haven't experienced a modern car audio or home-theater system.

Think about it. Your synths and samplers can produce sounds well below 80 Hz; so can drums, bass, and many other instruments. Many objectionable noises, such as mic-handling and air-conditioning rumble, also lie at very low frequencies. Can you afford not to hear what's going down to tape or disc at the two lowest musical octaves?

*When the neighbors complain, EM Associate Editor Lawrence E. Ullman assures them that those loud noises in the middle of the night must have been from an earthquake or, perhaps, the space shuttle passing overhead.*