

Reprinted from

**STEREOPHILE****Guide to Home Theater**

September 1998

**SUBWOOFER**

# Bag End Infrasub-18

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The whimsically named Bag End Loudspeakers (a name that pays homage to *The Lord of the Rings*) has been around for more than two decades, making products aimed primarily at the pro market. The Bag End S18E/ELF-1 subwoofer/crossover combination was reviewed very favorably by Larry Greenhill in *Stereophile* (Vol.18, No.5), but it has not been a runaway best-seller in the consumer market. This is probably because it's quite expensive, difficult to set up, and requires the purchase of an extra amplifier.

The Infrasub-18 is designed to be a more consumer-friendly product. It includes a built-in amplifier and crossover, and routine user-accessible controls have been reduced to only two: volume and polarity (phase). Connections include line-level

inputs and highpass-filtered outputs; the filter's cutoff frequency is adjustable by changing the resistor network in a module beneath the screw-on-cover. In addition, there are speaker-level inputs but no speaker-level highpass outputs.

Like the pro model S18E, the Infrasub-18 uses an 18-inch cone cover driver in a three-cubic foot enclosure. The Infrasub-18's driver has a 3-inch voice coil, the same as the S18E's, but the magnet is a bit lighter (105oz. vs. 120oz.). The cabinet is made of 3/4-inch MDF with extensive bracing.

Subwoofers are seldom considered *objects d'art*, and the Infrasub-18 is less so than most. It's a plain black box with a rough textured vinyl finish, and the input/output connections are in the back, which is covered with a 1/8-inch thick sheet

of high-grade aluminum. The RCA jacks are gold-plated, but the speaker-level inputs are the spring-clip types normally found on \$199 receivers. Few Infrasub-18 users are likely to use the speaker-level inputs, but one expects a bit more for \$1495.

**Time alignment**

A number of speaker manufacturers claim that their speakers are time-aligned, but the Infrasub-18 is—ahem—Time-Aligned™. This is a trademark of E.M. Long Associates; the names of the ELF crossover and Concealment limiting circuits used in the Infrasub-18 are also trademarked, this time by Long/Wickersham Labs. The ELF (extended Low Frequency) crossover exhibits a short, fixed delay that characterizes most lowpass filters.

In addition, the ELF crossover provides a boost that increases by 12dB/octave as the frequency drops; the lower the frequency, the greater the boost. This exactly compensates for the falling mechanical response of the driver and thus produces an overall flat acoustical response—or so the theory goes. With the help of the ELF crossover, the Infrasub-18 is claimed to respond down to 8Hz, although Bag End's literature points out that the system's acoustical power at that frequency is not high enough to hear or feel, and it can be measured only at close range with sensitive instruments.

The main benefit of the ELF system is not sheer bass volume, but the clarity and

**SPECIFICATIONS**

**Infrasub-18** front-firing, sealed-box, active subwoofer with enclosed electric crossover and power amplifier

**Driver:** one EL18P 18" Kevlar-impregnated paper cone

**Amplifier power:** 400W

**Crossover:** ELF Dual integrater, -6dB @ 95Hz (not adjustable)

**Frequency response:** 8-95 Hz,  $\pm 3$  dB (2 $\pi$  steradians)

**Dimensions:** 23.5" x 21.25" x 18.25" (HxWxD)

**Weight:** 92 lbs.

**Finish:** black matte vinyl laminate

**Ser #** 6L00258

**Warranty:** 1 year parts and labor

**Price:** \$1495

**Manufacturer**

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bass definition that are said to result from time alignment. To achieve response in the subsonic region, you need a lot of power from the amplifier at the lowest frequencies, but very little power (<1W) at the upper frequencies.

Protecting the driver from overload is the job of the Concealment circuit, which selectively reduces the lowest frequencies to the maximum safe level (3 dB below the amplifier's overload point), leaving the bass content in the higher frequencies unaffected. This is different from conventional limiters, which affect the entire bass range and, according to Bag End, are more prone to audible "pumping" artifacts. The amplifier also has a thermal-protection circuit, which automatically shuts the amp off in the event of sustained high-level signals.

#### Setup

For the past six months or so, our house has been undergoing major renovations. There is no space here to chronicle this event (I'm negotiating a book deal with the publishers of *War and Peace*), but suffice it to say that the side wall of my home-theater room now has a 3-foot opening leading to a newly built section of the house.

This changed the room's acoustics. Placing a subwoofer in the usual spot—about 30 inches out from the corner along the side wall—now yields substantially less bass than I am used to. After considering various alternatives, I decided to try the corner location, which worked out well.

The Infrasub-18's operating instructions tell you to connect your surround processor/preamp's left, right, and center outputs to the crossover's line-level inputs and the crossover's highpass outputs to the appropriate amplifiers. Bag End doesn't specifically recommend against the more common procedure of using the surround processor's subwoofer output, so that's what I tried first. This seemed to work just fine, with no measured or audible suckout at the crossover point. In addition, the response was flatter with the polarity reversed.

However, when I asked Jim Wischmeyer of Bag End about the appropriateness of this setup, he said that using the processor's

subwoofer output is okay, but he suggested that I try their recommended method for optimum performance. I followed his suggestion, but my experience did not convince me that this is the best way to go.

For example, you need six interconnects rather than just one for this scenario. Given that these interconnects carry the critical front-channel signals, they should be good ones, and the extra expense can be signifi-

cantly improved—more coherent and better focused—but the difference is by no means night-and-day. In my system, however, this configuration resulted in a significantly higher level of noise (buzz/hum) in the front channel speakers, very likely because of EMI/RFI picked up the long (5m) interconnects.

In addition, the ELF crossover's relatively gentle 12dB/octave slope allows the

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cant. Also, by running the subwoofer from the main outputs, you give up remote control of subwoofer level, which is an important feature when you consider the varying bass balance of different source materials. If you fiddle with the Infrasub-18's own volume control, you have no simple way of getting back to the calibrated setting. (Some surround processors have a "bass boost" button which at least partially gets around this problem.)

Apart from these practical concerns, I feel that using the Infrasub-18's crossover with the surround processor's main outputs is not entirely beneficial from a sonic perspective. On the plus side, the bass is

Infrasub-18 to respond well into the midrange; playing the sub by itself, I could hear pure tones reproduced as high as 2kHz. With the subwoofer in the corner, this produced a slight left/right imbalance. Although the imbalance was easily correctable in the surround processor, having a secondary source of midrange sound, however faint, is not the idea for imaging. (Using the surround processor's subwoofer output, with its additional filtering, resulted in less midrange contribution from the Infrasub-18.)

Finally, on repeated comparisons with music CD's and laserdiscs, I thought the

## BAG END INFRASUB-18

upper midrange/treble was not quite as clean in the recommended configuration; vocal sibilants became a bit splashy. This effect could be due to the crossover's high-pass filter, or it could be a function of the EMI/RFI noise. Whatever the cause, I found that using the surround processor's internal highpass filter for the main speakers resulted in sound that was easier on the ears overall.

### The lower depths

Bag End's advertising makes much of the Infrasub-18's lower response limit of 8Hz. Although the user is told not to expect high level reproduction of 8Hz tones, I felt I would be Doing *SGHT* readers a disservice if I didn't check out this claim. Using my Hewlett-Packard 204c oscillator and a RadioShack SPL meter (C-weighted, slow response) placed in the listening area, I tested the Infrasub-18 by itself (main speakers off) using frequencies from 200Hz down at a level that I would describe as "pretty loud." (The reading on the SPL meter was in the low to mid-90s at 200Hz, but I wouldn't want to rely on the absolute values; the numbers should not be compared with near field measurements taken under more controlled conditions.)

The response held up well down to the sub-20Hz region, with some increasingly audible harmonic distortion but also a good measure of fundamental. The response was still quite good at 12Hz, falling by only 3dB according to the RadioShack meter (although the meter's accuracy in this region is questionable). The Infrasub-18 continued to respond with a 10Hz signal, but at a significantly lower level (an indicated-11dB). After about 30 seconds at this frequency, there was a loud pop and the subwoofer went silent; the amplifier's thermal protection circuitry had apparently decided that a shutoff was called for. The amplifier came back on in a few minutes, after it had cooled down; no damage had been done to amplifier or speaker. (Whew!)

I continued testing at a lower level, and the Infrasub-18 got down to the specified 8Hz this time. Squatting next to the subwoofer, I could feel the air shaking, and the grille cloth was moving back and forth at what I assumed was eight times per second. Using a conservative estimate, I would rate the Infrasub-18's practical low-end at 12 Hz, which still puts it in the number one

spot for bass extension among the subwoofers of my acquaintance.

Apart from sheer extension, the most impressive aspect of the Infrasub-18's performance is the way in which it integrates with the main speakers. Subwoofer integration is a tricky matter; it depends partly on the transition from the main speakers and—if Bag End is right—partly on having the low frequencies arrive with as uniform a time delay as possible. Based on my experience with the Infrasub-18, I'd say Bag End is right. With the Infrasub-18, the low bass is very much integrated with the rest of the range.

This is particularly apparent on transients, like the bass drum that alters the children to the location of the Jumanji game in the movie of the same name. Focused deep in the center of the soundstage, the drum was crisp and solid in its



### REVIEW SYSTEM

#### Audio/Video Sources

Sony DVP-S7000 DVD player  
Pioneer CLD-D604 LD player

#### Display

Mitsubishi VS/VE507CA

#### Preamplifiers

Bryston 5B  
Bryston 3B

#### Loudspeakers

Dunlavy SC-I (5)

#### Cables

Audioquest interconnects (various)  
Audioquest Type 4 and Type 6+speaker cables

#### Misc.

Chang Lightspeed CLS 6400 power-line conditioner

impact, subtle yet powerful enough to impress the loud-is-good brigade. On *Planet Dru*, one of my standard bass-test CDs (Rykodisc RCD 10206), the synthesizer note near the beginning of track 7 shook the floor, and there was clear definition of the different drum sounds, with specific pitches rather than vague thuds.

The Infrasub-18 exhibits an interesting effect that I've noticed with other subs, but not as much: the establishment of a greater sense of ambience, even with music that does not feature bass instruments. It seems that many recordings contain low-frequency "room sounds" that make subtle contributions to the feeling of realism.

Another impressive aspect of the Infrasub-18's performance is that the bass remains audible even at low playback levels. This observation goes against the well known Fletcher-Munson "loudness" curves, which illustrate that auditory sensitivity varies as a function of frequency, and low frequencies require much greater volume to be audible. Bag End's Jim Wischmeyer refers to a recent AES paper that implies the Fletcher-Munson relationship might not hold for transient signals, and he suggests that an ELF-type bass system is able to maintain subjectively even bass response at low levels more effectively than other systems.

### Conclusion

In terms of appearance, the Bag End Infrasub-18 is almost literally rough around the edges, and its ergonomics are not ideal. But its sound is hard to criticize. Of the subwoofers with which I've had extensive experience, the Mirage BPS-400 has more sheer output, and the Veldyne F-1500R exhibits lower audible distortion on pure tones. However, the Infrasub-18 is probably the most *natural*-sounding sub I've tried; it integrates exceptionally well with the main speakers, drawing no attention to itself until room-shaking bass is called for. Bag End subwoofers are used by recording and movie post-production studios in California, Australia, and England. The pros are obviously on to something.