

Bag End

Test Report

ELF-M2 & S10E-C SUB/PROCESSOR SYSTEM

Where there's a will, there's a way to get big bass on the road. Thanks to the "transfer function" that comes with every vehicle ever made, whatever system you use will be bolstered by a natural bass boost- that's why something as simple as a pair of 6 x 9s slapped into a rear deck can produce big bass. Huge amounts of bass are on tap if you're willing to dedicate trunk or hatch space to a big subwoofer box (or more than one).

Some folks-most of them, in fact (if not most CSR readers)-don't want to allocate their entire trunk or hatch to a subwoofer system, though. In response, car stereo manufacturers have worked very hard to figure out ways to get huge amounts of bass from relatively small subwoofer systems. That's why you see people going to the trouble and expense of building things like smallish bandpass or compound subwoofer systems.

Once you figure out how to get big bass from the box of your choice, big or small, only one issue remains: You need your subwoofer system to be able to withstand all of the punishment you're bound to give it. Woofer cones really jump when you've got the volume knob cranked-sometimes, they jump halfway out of their baskets. Manufacturers have come up with several ways to make the speakers themselves more robust, but that hasn't really dealt with the situation.

Enter Bag End, a manufacturer of speakers and

processors for the pro-audio market, and its ELF-M2/S10E-C bass system. Though its 19-inch-wide "rack-mount" size gives the ELF (Extended Low Frequency) M2 processor the look of a home-audio component, it's a bona-fide 12-volt device that combines "integrator" and "concealment" circuits in addition to active

crossovers and a high-pass limiter. The companion S10E-C is a small sub box housing a 10-inch woofer. Together, they deliver a truly prodigious amount of high-quality bass from a woofer that's nearly impossible to damage.

The concept is disarmingly simple: A long-throw woofer is housed in a sealed,

intentionally undersized cabinet. This pushes the resonant frequency of the system up to about 70 Hz (that's very high), and there's a 12-dB-per-octave rolloff below that point. The sub box is then coupled with an electronic integrator circuit, a type of equalizer or filter that boosts response below the resonance frequency by 12 dB per



octave; this characteristic runs all the way down to about 18 Hz. What you get is roughly flat response-down to about 25 Hz in an anechoic lab environment-from a very small box.

That's a tough task for a single 10-inch woofer, of course. All the tricks in the world can't rewrite the laws of physics, and the smallish woofer still needs to produce four times the excursion for each halving of frequency-if it has to travel a quarter-inch to reproduce a 50 Hz tone, for example, it'll have to travel 1 inch to reproduce a 25 Hz tone.

As a fix, the M2 uses a proprietary, adjustable "concealment" circuit to protect the S10E-C speaker. This circuit "anticipates" signals that'll drive the speaker into overload and either raises the cutoff frequency, paring super-low frequencies from the input signal, or reduces overall signal level. Both measures have the same result: They limit distortion and overload. In other words, you can pretty much crank this sucker up all you want and you won't damage the speaker. The best part, perhaps, is that the system will continue to play the "safe" portion of the signal content, at full output, while the dangerous stuff is limited.

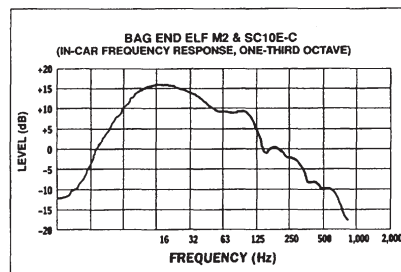
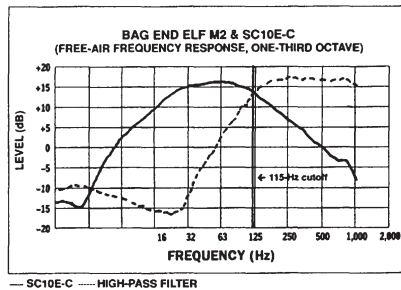
The key is that Bag End knows the capabilities of their 10-inch speaker-both as a raw driver and as part of the speaker-in-a-box S10E-C. This enabled them to configure the action of the concealment circuit to an exacting degree. It also explains why you can't use the M2 with a subwoofer system from another manufacturer. The M2 only "knows" the S10E-C; another woofer or woofer/box system will have entirely different capabilities.

The concealment circuit can be adjusted over a plus or minus 10 dB range from the nominal center position. A screwdriver-type of threshold control is on hand to do the adjusting; a companion red threshold LED flashes when peak music levels are encountered. When the control is set to its minimum position (for maximum concealment), the LED shines brightly all the time. The M2's owner's manual lists techniques for setting levels.

As mentioned, the M2 also incorporates a 90 Hz low/high-pass filter with adjustable levels (plus or minus 10 dB)

for both the low and high-pass functions; slopes are 12 dB per octave. The processor can be used as a single-channel three-way device or as a stereo two-way device with a high-pass crossover and a summed-mono low-pass filter.

Because cranking the volume knob too far can also damage midranges and tweeters, the M2 offers the CVR "continuously variable recovery" high-pass lim-



iter, which reduces the level of the signal going to your high-frequency speakers. It's not as sophisticated as the concealment circuit, since the limiter doesn't know the exact capabilities of your drivers (or any others, for that matter), but it's a nice, helpful touch nonetheless.

The limiter threshold works something like the concealment control. The front panel control has a range of plus or minus 10 dB, and the threshold is set by turning the control to the point where extremely loud music passages produce occasional LED flashes.

The M2 measures 1 3/4 x 19 x 5 1/4 inches (h/w/d) including its rack-mount "ears." It has XLR-type balanced inputs and outputs; connections with a standard, unbalanced RCA-type component can be made using a relatively inexpensive adapter (not supplied). The M2 will accept input levels of up to 3 volts; maximum output is also 3 volts.

The diminutive S10E-C stands 14 1/2 x 13 1/2 x 12 inches (h/w/d). The 10-inch

long-throw woofer has a paper cone and a foam surround, and it's protected by a sturdy metal grille. The box has a really neat (and convenient) folding handle on top, and you have a choice of parallel Neutrik NL-4MP or dual banana-jack speaker connectors; the Neutriks are pro-style jobs resembling XLRs. The banana jacks only accept banana plugs, not stripped leads nor spade lugs-a good idea, in my opinion, since that should lead to solid connections.

You also have a choice of finishes with the S10E-C: black paint or black carpet. Both options are finished with tough corner protectors. The M2 is protected by a 2-year limited warranty; the S10E-C is covered by a 6-year limited warranty. Prices: M2, \$998; S10E-C, \$348 apiece painted, \$378 apiece carpeted. Bag End, Dept CSR, 22272 Pepper Rd., Barrington, IL 60010.

BY THE NUMBERS

The S10E-C had a system resonance of 67.4 Hz. Minimum impedance was 6.4 ohms at 179 Hz. The accompanying graph shows the acoustic response of the woofer as well as the electrical response of the M2's high-pass filter; notice how the acoustic response resembles the tight control of an electronic device. Response was 3 dB down at 25 Hz in the lab. The crossover point hovered in the vicinity of 115 Hz with a gain setting of 0 dB; the cutoff varied somewhat as the gain setting was varied. When set for maximum processing, the concealment circuit began its limiting action at 60 Hz, cutting drive by 5 dB at 40 Hz and by 10 dB at 22 Hz.

THE INSTALL

Wiring the M2 wasn't any different than installing an equalizer or active crossover, though I did need to get adapters to link my unbalanced head unit and amplifiers with the balanced M2. (Bag End really should consider supplying the balanced/unbalanced adapters, since balanced connections-though superior-are still very rare in the 12-volt arena.) There are also two power leads, but there's no remote-turn-on relay, so you have to wire the unit to turn off when you shut off your ignition switch. Inputs came from my head unit, and outputs ran

to the amplifiers I'd designated for high and low frequency duty.

Installing the S10E-C speakers (Bag End supplied me with a pair) was as simple as tossing them in my car's hatch and plugging my speaker wires into the boxes' banana jacks.

Tune-up involved setting levels and adjusting the concealment and limiter circuits. I set both to activate at about 2 dB below the level of amplifier clipping or speaker overload, whichever occurred first. The M2's owner's manual was very helpful, and most folks shouldn't have any difficulty here.

ON THE ROAD

Bag End's system delivered the goods. Frequency response in the car was stunningly clean. Response was 3 dB down at 12 Hz and ran incredibly smooth out to the 115 Hz cutoff, above which output fell like a rock. The system also delivered a resounding 127 dB SPL with the Telarc cannons-all from a pair of boxes that, taken singly, measure up at only a hair larger than 1 cubic foot.

The Bag End system also had a spectacular sonic character. It was tight, hard, cool, and controlled-but it was also butt-kickin'! Somehow, it was both muscular and smooth at the same time: Electric bass was fat and warm. Acoustic bass was lean, cool, and articulate. Rap pounded. Lightning and thunder from my Telarc special-effects disc cracked and churned. Organ swirled thrillingly. It was all beautifully deep and resonant-and always within the context of the music and out concept of a high-quality system.

The system's image stayed up front, too. And the system never sounded hard or stressed, either-no distortion, no banging, no clanging, and no worrying about the volume control. I was never able to trick the concealment circuit into announcing itself. And I tried. Hard.

This is one hell of a bass system. Bag End has built a rig that's ideally suited to the automotive environment. It delivers big, high-quality bass and should continue to do so infinitely thanks to its dynamic protection circuitry. Because the speaker, crossovers, and electronics have been designed to work together, it'd be very difficult to make this system sound bad in a car.

It's not an inexpensive system, of

course, but this definitely is a case of "you get what you pay for." If you're looking for an almost foolproof means to serious, high-end bass, or if you're just a car audiophile who hasn't really been impressed by a product for a while, check out the ELF-M2/S10E-C combo. I think you'll love it.

- Tom Nousaine