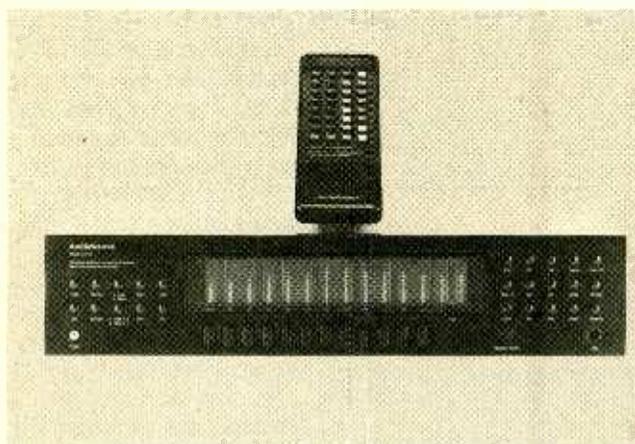


PRODUCT TEST REPORTS

By Len Feldman

AudioSource EQ Ten Graphic Equalizer/ Spectrum Analyzer

Anyone familiar with home-audio installations knows that, more often than not, some tonal equalization is needed to make the system sound right. Of course, the simplest type of equalization involves the use of ordinary bass, treble, and, on some amplifiers, mid-range tone controls. But the action of such tone controls is usually too broad to do a proper job of equalization. To solve that problem, many manufacturers offer graphic equalizers, which are really nothing more than sophisticated tone controls that divide the audio spectrum into several increments,



The AudioSource EQ Ten graphic equalizer/spectrum analyzer.

each of which is individually controlled by a button, slider, or knob. Dividing the spectrum in this way makes it possible to make very detailed corrections in frequency response where it is needed.

The problem with most equalizers of this type is that the user is left to his or her own devices when attempting to correct the

overall frequency response of a system. That's where the AudioSource EQ Ten stands out among graphic equalizers. It is a fully electronic, 12-band unit with soft-touch controls, a built-in pink noise generator, and a calibrated electret microphone that will enable you to automatically adjust each band while results are displayed on its spectrum analyzer. The EQ Ten's on-board computer actually analyzes the acoustics of the listening environment and then sets precise equalization settings for optimum sound reproduction.

Alternatively, you can adjust each of the twelve bands manually to suit your personal preference. Favorite equalization curves can be stored in four separate memories and recalled at the touch of a button. Tape-to-tape dubbing and tape equalization are also possible with the EQ Ten. Once properly installed, the EQ Ten can be operated from your listening position using the supplied thirty-two function remote control.

CONTROLS

Above the small power button, at the lower left of the all-black front panel, are eight soft-touch button controls. They activate the pink-noise generator, select tape monitoring, select line or tape input, adjust spectrum-display sensitivity, adjust volume levels, insert equalization when making a tape recording, select dubbing mode (Tape 1 to Tape 2, or Tape 2 to Tape 1), and activate the micro-

phone when using it to analyze the pink noise signal on the spectrum display.

The entire center section of the front panel is dedicated to the graphic/spectrum display. As a graphic indicator, it shows the cut or boost of each individual frequency band; the bands range from 25 Hz to 16 kHz. As a spectrum indicator, it shows the fluctuating output signal in each of the 12 frequency bands as sound passes through the equalizer. Below the display are equalization-level up/down controls. Each of these switches controls one frequency band, allowing the cut or boost to be manually varied by a total of ± 12 dB.

To the right of the display are pushbutton controls for storing up to four equalization curves, selecting left or right channel equalization (each channel can be equalized independently with this unit), initiating automatic equalization, instantly restoring flat response, dimming the display, reversing the EQ (equalization) curve (useful if you want to play back an equalized tape recording to hear it with flat response), muting sound, and sequentially altering the display mode from holding highest levels on the display, to freezing the display, to operating continuously while in the spectrum-display mode. A microphone input jack is found at the lower right corner of the front panel.

The supplied remote control duplicates virtually all of the front-panel controls'

functions. However, to operate the equalization-level controls using the remote, you must first activate the band you want by pressing a special Frequency button and then altering the level using the EQ+ or EQ- buttons. The remote control is powered by two "AA"-size batteries.

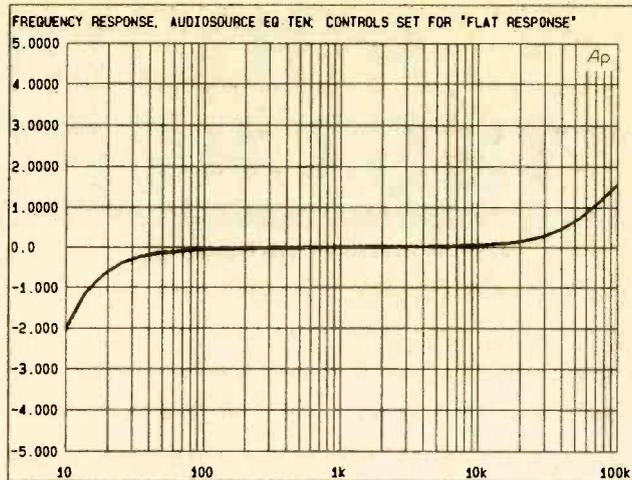
TEST RESULTS

We first looked at the overall frequency response of the EQ Ten when all controls were set for flat response. Deviation from a perfectly flat response under those conditions was no more than +0.2 dB and -0.6 dB over the range from 20 Hz to 20 kHz, though somewhat greater deviation was noted below and above the useful audio range.

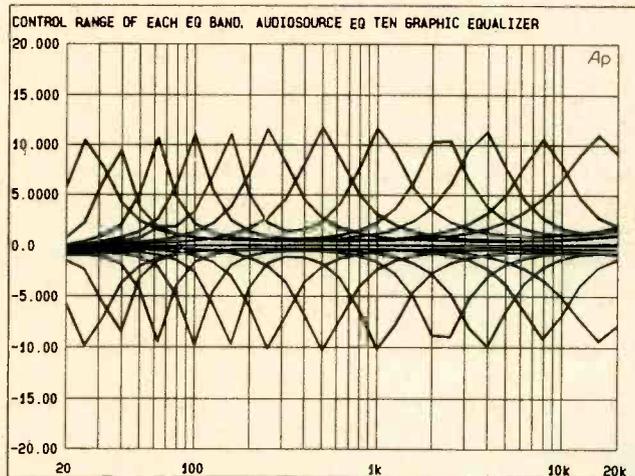
We next applied a series of 24 separate sweeps, superimposing one over the other while adjusting each of the EQ band controls to its maximum boost and maximum cut settings. Center frequencies of each band corresponded very closely to the control center points specified by AudioSource in their table of specifications. Control range was a bit less than the ± 12 dB specified, but was certainly deemed adequate for the applications to which such an equalizer would be applied.

Another specification that deviated from the published specification was the unit's total-harmonic-distortion-plus-noise versus frequency. Using an output level of 1 volt, and with all EQ controls once again set to their flat positions, the THD plus noise remained fairly constant at 0.1% over the 20 Hz to 20 kHz test-frequency range. While that is considerably higher than the .008% specified by AudioSource, it is certainly acceptable.

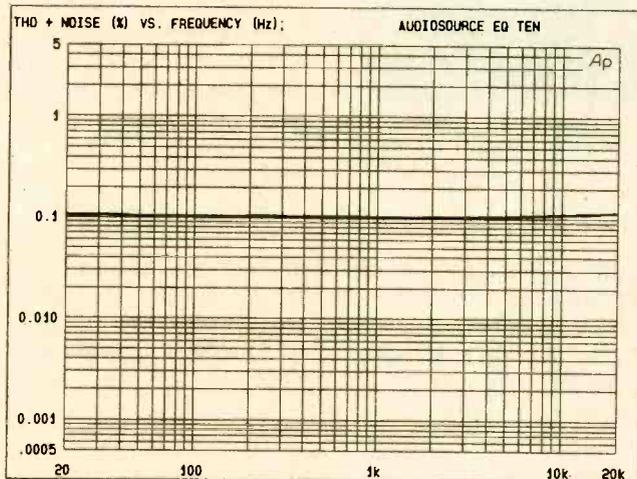
Nevertheless, in order to



Here's the overall frequency response of the AudioSource EQ Ten Graphic Equalizer/Spectrum Analyzer. For this test all of the equalization controls were set for flat response.



Successive sweeps were used to plot the boost and cut range of each of the EQ Ten's 12 bands. The center frequencies of each band corresponded very closely to the control center points specified.



This plot of harmonic distortion plus noise versus frequency showed that the THD plus noise remained virtually constant throughout the test-frequency range. At 0.1% it was certainly acceptable, although considerably higher than the .008% claimed by the manufacturer.

determine whether the readings obtained were the result of noise contributions rather than actual harmonic distortion, we conducted another test, using the Fast Fourier Transform (FFT) capability of our Audio Precision System One test equipment. Feeding a constant 1-volt, 1-kHz signal into the EQ Ten (with its EQ controls set for flat response), we did a spectrum analysis of the output. By allowing the test equipment to acquire the results in 16 passes, random noise is essentially canceled out, while actual harmonic components stand out in the resulting display. That display showed that the most prominent harmonic, at 2 kHz, was indeed at -60 dB relative to the fundamental 0-dB reference level. Since that corresponds to a distortion level of 0.1%, this test confirms the fact that the earlier readings were actually harmonic distortion and not contributions of random noise.

Further confirmation of the distortion level was obtained when we looked at distortion versus input/output levels. Clipping levels for 1 kHz and 20 kHz occurred at just about 4 volts, the maximum levels claimed for the EQ Ten by AudioSource. A 20-Hz signal, however, caused clipping to occur at around 3.6 volts.

We next looked at the residual noise of the product versus frequency, using a 1/3-octave tracking filter. Random noise was so low as to be totally inaudible under the conditions in which the product is likely to be used. Even the contribution of noise introduced from the power supply (at 60 Hz, 180 Hz, and 300 Hz) was more than 100 dB below the 1-volt reference level used in making the measurement. These results are actually somewhat bet-

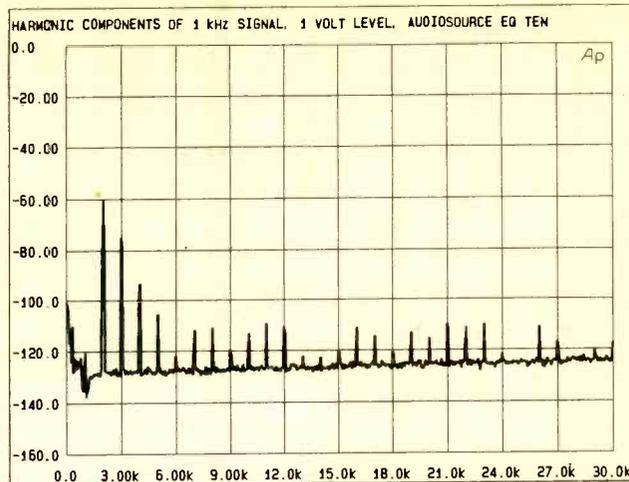
ter than the -99.7 dB signal-to-noise level claimed by AudioSource. An overall, A-weighted measurement of S/N yielded a reading of -100.8 dB. A summary of these and other test results is shown elsewhere.

HANDS-ON TESTS

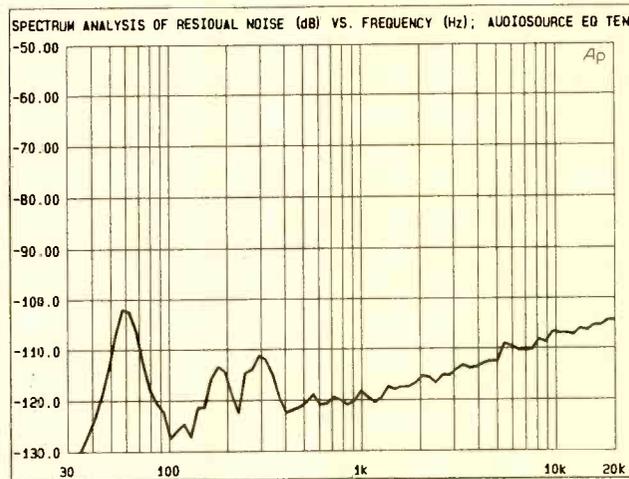
Setting up the AudioSource EQ Ten was relatively easy. We had used many graphic equalizers in the past and the easiest way to insert this one in the signal path of our system was via the tape-out/tape-in jacks on our reference integrated amplifier. Since the EQ Ten itself is equipped with a couple of tape monitor in/out loops, this method of connection did not deprive us of the use of tape monitoring facilities for our two analog tape decks in the system.

We were prepared for a somewhat tedious procedure when it came time to equalize our system/room acoustics, but were pleasantly surprised at how quickly and easily the automatic equalization was performed. Once the microphone was plugged in and the pink-noise generator was turned on, a push of the Auto EQ switch caused the built-in microprocessor to equalize the entire system in a couple of seconds! We allowed the EQ Ten to equalize each channel separately, as recommended by AudioSource and, not surprisingly, since the two speakers in our reference system were positioned some ten feet apart, the setting chosen by the EQ Ten for the left channel differed substantially from those chosen for the right channel.

The equalized settings were stored in the unit's "memory" with the touch of two buttons. Both left- and



This spectrum analysis of the harmonics of the 1-kHz, 1-volt test signal showed that the most prominent harmonic, at 2 kHz, is at -60 dB relative to the fundamental 0-dB reference level, corresponding to a distortion level of 0.1%. Note that the 1-kHz fundamental was notched out for this test.



This spectrum analysis of residual noise shows that noise levels are so low as to be inaudible under normal use.

TEST RESULTS—AUDIO SOURCE EQ TEN GRAPHIC EQUALIZER/SPECTRUM ANALYZER

Specification	Mfr's Claim	PE Measured
Frequency response	5 Hz to 120 kHz, ± 1 dB	± 2 dB
Gain (flat position)	Unity, ± 1 dB	Confirmed
Distortion @1 V output	0.008%	0.1%
Hum & noise re: 1 volt	-99.7 dB	-100.8 dB
Maximum input/output	4.0 volts	(See text)
Input impedance	47K ohms	Confirmed
Output impedance	600 ohms	Confirmed
Control center frequencies	25, 40, 63, 100, 160, 250, 500 Hz; 1, 2, 4, 8, 16 kHz	Confirmed
Control range	± 12 dB	+11, -10 dB
Pink noise output level	150 mV	Confirmed
Pink noise response	20 Hz to 16 kHz	Confirmed
Dimensions (W x H x D, inches)	16.5 x 3.5 x 8.75	Confirmed
Weight	7 lbs. 11 oz.	Confirmed
Price:	\$429.95	

right-channel settings were stored in a single memory location and were therefore recalled together whenever we wanted those settings. We found that the microphone position was quite critical during this operation, which made it important to use the remote control rather than the front panel controls to do the equalization procedure. We kept the microphone as close to our listening position as possible.

Of course, we experimented with the product by manually adjusting the EQ settings over a wide range. During these experiments we confirmed the advice given by AudioSource regarding over use of the extreme bass or high treble EQ controls. Using these controls for excessive boost can easily overload the capacity of your speakers or amplifier. Remember, a boost of 10 dB (easily within the capability of the EQ Ten) represents a power increase of 10-to-1, so go easy on the controls if you incorporate this or any other graphic equalizer in a home or professional sound system. And if you do use an equalizer such as this one, it's a good idea to keep other tone controls in your system in their flat position or, if possible, bypass or defeat them.

The AudioSource EQ Ten can take the drudgery (and inaccuracy) out of attempting to equalize a sound system. The product takes full advantage of the capability of modern microprocessors and turns a process that used to take as long as several hours into an accurate job that takes only a few seconds. For more information on the EQ Ten, contact AudioSource (1327 N. Carolan Ave., Burlingame, CA 94010) directly, or circle no. 120 on the Free Information Card. ■