

Dynaco Model SE-10 Equalizer



MANUFACTURER'S SPECIFICATIONS

Nominal Rated Output: 2.0 volts.

Maximum Output: 8.0 volts.

Equalizer Range: ± 12 dB at octave intervals, 30 Hz to 15 kHz.

Total Harmonic Distortion: 0.04 per cent.

Intermodulation Distortion: 0.02 per cent.

Frequency Response: 10 Hz to 35 kHz, ± 1 dB.

Gain: -12 dB to $+6$ dB (adjustable).

Signal-to-Noise Ratio: 85 dB below 2 volts output.

Output Impedance: 600 ohms.

Input Impedance: 50 kilohms.

Dimensions: 13 1/2 in. (34.3 cm) W x 4 1/4 in. (10.8 cm) H x 11 in. (27.9 cm) D.

Weight: 10 lbs. (4.536 kg).

Price: \$349.00 (249.00 in kit form).

The graphic or octave equalizer seems destined to become as important a high fidelity component as bass and treble controls or high and low cut filters. One would have thought that every facet of the audio equalizer had been explored by now, but, surprisingly, Dynaco has come up with a 10-octave equalizer that boasts a few features not normally found on similar products. Like so many other Dynaco products, the SE-10 is available either in kit form or fully wired, and, judging by the finished product we tested and evaluated, the \$100.00 incremental difference between the wired and unwired versions does not seem out of line. Furthermore, as is true of just about every Dynaco product we have examined in the past, if you elect to wire the unit yourself from a kit, your chances of coming up with a working unit that meets or exceeds specifications are very good indeed. Wiring and assembly instructions are excellently written, and the now well-established step-by-step kit building techniques which Dynaco and Heath have developed over the years can be followed by just about anyone who can wield a pencil-tip soldering iron.

As for the finished product itself, it resembles a great many other equalizers, in that the most outstanding elements on the front panel are the 20 slide controls (10 for each stereo channel) spread across the face of the panel. Nominal center frequencies listed atop each slide control are 30 Hz, 60 Hz, 120 Hz, 240 Hz, 480 Hz, 960 Hz, 1.9 kHz, 3.8 kHz, 7.7 kHz, and 15 kHz. The slide controls are smooth-operating, and each slider pair is separately calibrated from -12 to $+12$ with "0" corresponding to the flat response position of that control. Click-stop center positions for each slider are not provided, making it a bit difficult to establish exact center of motion unless you face the control head-on.

Beneath each bank of 10 controls is a horizontally mounted overall gain control for that channel which varies gain of the system from -12 dB (with respect to input level) to $+6$ dB. A "0" notation near the center of each gain control's range indicated the setting for unity gain. Three push-buttons located at the lower center of the panel handle tape/source selection (equivalent to having an additional tape monitor position in your system), equalization/defeat (whereby equalized reproduction can be instantly compared with unequalized program source sounds), and *Line 1/Line 2* selection. With this last switch set to the *Line 1* setting, normal operation of the equalizer takes place. But, in addition, an independent line 2 input/output stereo pair is available for equalizing a second program. Thus, without plugging and unplugging cables, you can switch either of two sources through the equalizer and one of them can be equalized *prior* to recording onto your tape deck.

A power *On/Off* switch and an a.c. power-on indicator lamp are located at the lower right corner of the front panel.

The rear panel of the Dynaco equalizer contains six pairs of input and output jacks. The three input pairs include tape in, line 1 in and line 2 in, while output pairs include tape out, line 2 out and line 1 out. Two a.c. outlets (one switched, the other unswitched) are also located on the rear panel.

Internal Construction and Circuitry

All of the audio components and power supply components, with the exception of the power transformer, are contained on a single large p.c. board. A total of eight integrated circuits, plus four transistors provide an IC-regulated power supply, independent channel gain control over an 18

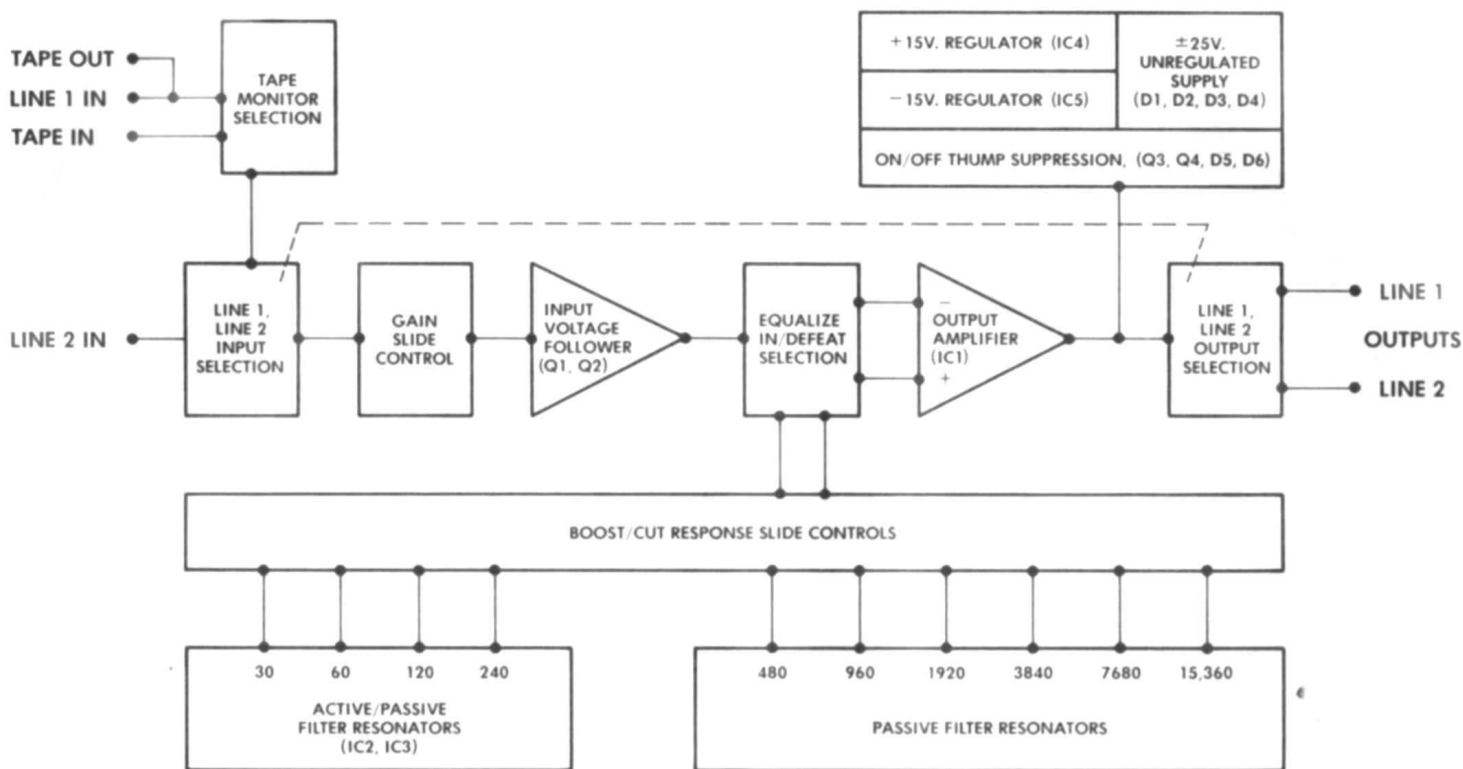


Fig. 1—Functional block diagram.

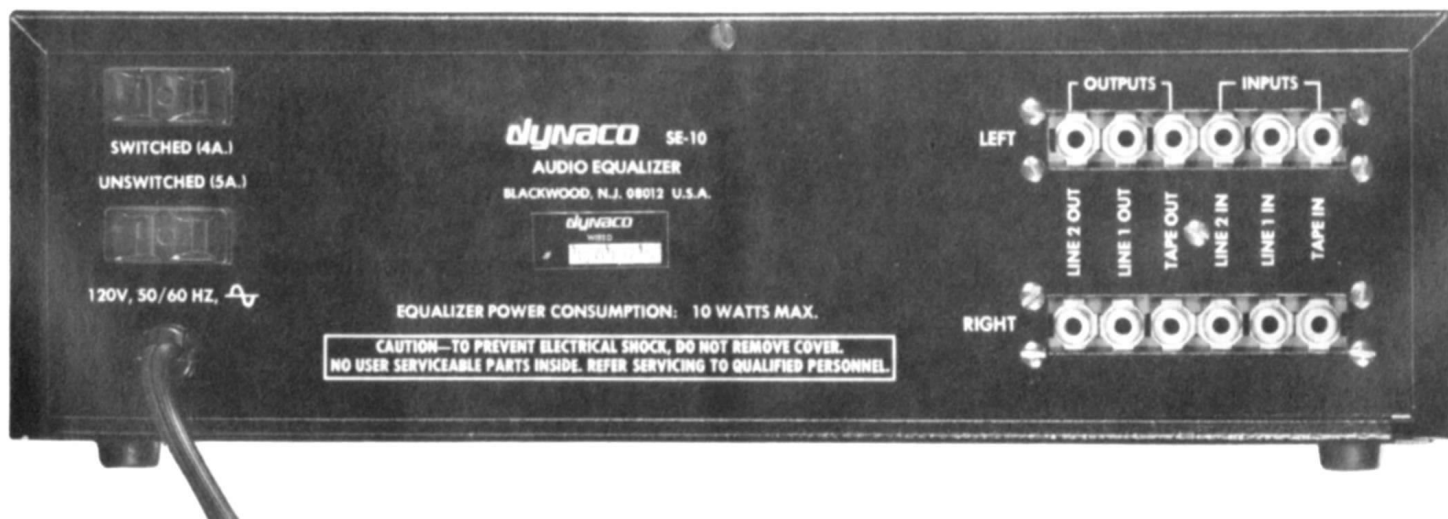
dB range, low impedance output and 16 operational amplifiers in the four low frequency sliders of both channels. Simulated IC "gyrator" inductors are coupled with polyester capacitors for the lower octaves to eliminate inductor saturation (and the need for overly large inductors) and related possible rise in distortion. Above the 300 Hz octave range, non-saturating gapped-pot core inductors are used for the filter/resonant circuits. A functional block diagram of the equalizer is shown in Fig. 1. Audio signals are first applied to a voltage follower containing a PNP-NPN direct coupled transistor pair, Q1 and Q2. This stage has a high input impedance and a fixed, low impedance output. It generates a fixed source impedance for the subsequent equalizer circuitry, regardless of the source impedance of the input signals. This stage has unity gain.

The Boost/Cut response controls connect individual filter resonators to either the inverting or the non-inverting in-

puts of IC-1. Boost action occurs when the slide control's wiper is moved toward the amplifier's summing point; cut action takes place when the wiper is shifted toward a non-inverting point. Other elements of the block diagram are self-explanatory.

Laboratory Measurements

Relatively few performance measurements are required to define the quality of an equalizer, at least insofar as its operation as a unity-gain amplifier is concerned. For these measurements, we used an input level of 2.0 volts and adjusted all sliders to their mid positions. Actually, the levels likely to be fed into the unit (unless it is connected between a separate preamplifier and power amplifier) will be far lower than 2.0 volts so that if anything, distortion readings would probably be better than the results we obtained. Our choice of a 2 volt level was governed strictly by Dynaco's



own published specifications which are based upon that rather high reference level.

In any event, we measured a harmonic distortion content of only 0.022 per cent under these test conditions, for both mid-range frequencies and at the audio frequency extremes. Intermodulation distortion measured much lower than that, with readings of 0.004 per cent. Frequency response, with all controls set to flat, was uniform within 1 dB from 8 Hz to 46 kHz. Hum and noise, referred once more to a 2 volt input or output level, measured a shade better than claimed, with readings of 86 dB. Readings were duplicated with the slide controls set to maximum and input level readjusted downward to maintain the nominal 2.0 volts output and did not differ substantially from the earlier readings of THD and IM obtained.

Figure 2 is a scope photo of many composite sweeps of the built-in audio oscillator contained in our spectrum analyzer and is designed to show the range of control (and bandwidth) afforded by each of the 10 octave controls of the Dynaco SE-10. Since the sweep is logarithmic (both in frequency and amplitude), the almost perfectly equal spacing between the peaks and dips in the photo confirms the accuracy of the positioning of the center frequencies of the filter circuits of equalizer. Figure 3 illustrates the effect of intermediate settings of a single equalizer slider control. Only intermediate boost positions are shown, but in our tests we confirmed that equivalent settings in the downward, or cut position, would result in a mirror-image inversion of the response curves shown.

Use and Listening Tests

Readers of *Audio Magazine* are, no doubt, sufficiently familiar with the functions and usefulness of an octave equalizer at this point, so that we need not go into the specific applications for which this device is intended. Suffice it to say that the Dynaco SE-10 equalizer introduced no audible distortion when installed in our reference listening system and, with controls set flat, we could detect no signs of sonic coloration because of its presence. Apart from the fact that its slide controls did exactly what they were intended to do, there is not much more than one could ask of a high quality graphic equalizer. The Dynaco SE-10's price and performance make it a very attractive component for serious audio enthusiasts to consider as a worthwhile addition to their hi-fi component systems.

Leonard Feldman

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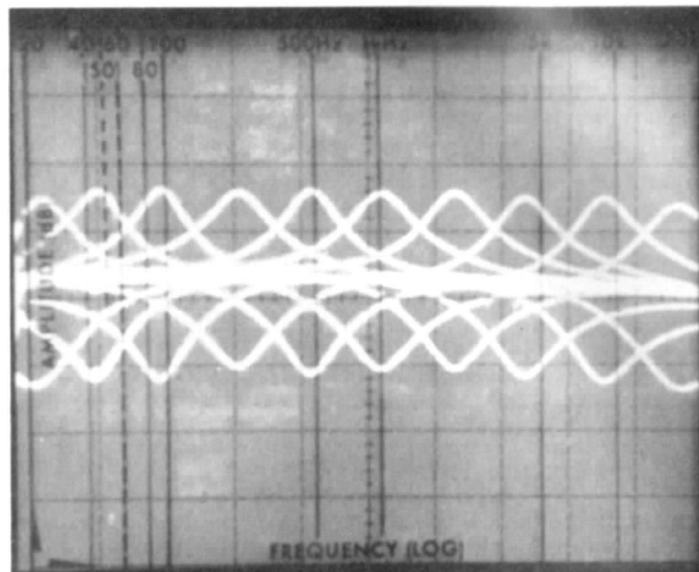


Fig. 2—Composite range of responses of the 10 octave controls.

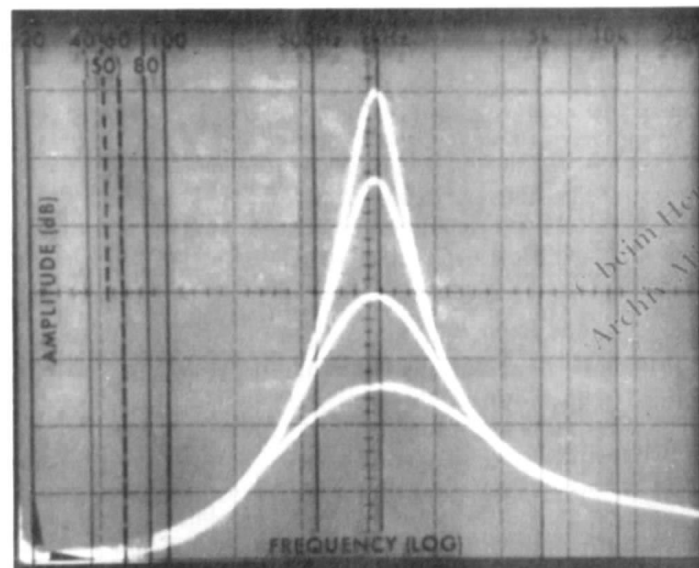


Fig. 3—Response of the 960 Hz slider control at various boost settings.

