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DBX 10/20 COMPUTERIZED EQUALIZER/ ANALYZER

Manufacturer's Specifications

Equalizer Section

Center Frequencies: 31.5, 63, 125, 250, and 500 Hz and 1, 2, 4, 8, and 16 kHz, ±9%.
Adjustment Range: ±12 dB, with ±1.4-dB tolerance.
Adjustment Accuracy: ±0.4 dB/step.
Frequency Response: 20 Hz to 20 kHz, ±0.5 dB; with low-cut filter, −3 dB at 12 Hz and −20 dB at 5 Hz.
Distortion: Less than 0.03%.
Dynamic Range: 112 dB.
Maximum Input/Output Level: 5 volts.

Analyzer Section

Accuracy: Relative, ±1 dB; absolute, ±3 dB.
SPL Range: 50 to 110 dB.
Line-Input Calibration: 100 dB equals 1 volt.
Dynamic Range: 25 dB shown on screen, reference selectable in 10-dB steps from 60 to 100 dB.

Pink-Noise Generator

Accuracy: ±0.5 dB.
Level: 1 to 300 mV, adjustable with slider.

Microphone

Frequency Response: 20 Hz to 20 kHz, ±1 dB, after input equalization.

Computer

Automatic Equalization: 15 iterations in all 10 bands within 40 S.
Memory: 10 EQ-curve memories, with battery backup.
Averaging: Multiple EQ curves can be averaged, and stored if desired.

General Specifications

Input Impedance: 50 kilohms.
Output Impedance: 620 ohms.
Dimensions: 17⅛ in. (435 mm) W × 3½ in. (89 mm) H × 11⅞ in. (302 mm) D.
Weight: 11.9 lbs. (5.4 kg).
Price: $1,200.00.
Company Address: 71 Chapel St., Newton, Mass. 02195.
For literature, circle No. 92

The dbx 10/20 replaces the earlier 20/20 (*Audio*, January 1982), which was probably the first home equalizer/analyzer combination with totally automatic, computer control. The specifications above, even though somewhat abbreviated, indicate the complexity of this unit. The automatic equalization process requires a pink-noise source (built-in) and an accurate measuring microphone (supplied). Another attractive and important feature is the memory, which can store up to 10 separate EQ curves (both left and right), any of which can be recalled with the simple push of a button. In addition, any combination of the stored curves can be averaged, and that average can be put in memory for future use.

The black front panel has white designations that are easy to read under any normal room lighting. The "Memory" pushbutton keypad is at the left end, above the power switch. There are three columns and four rows for memory-location buttons "1" to "10" and buttons for "Set Flat" and "Enter Memory." The "Set Flat" button erases the EQ currently in use, removing all boosts and cuts with a single push. It does not, however, erase or affect curves stored in the 10 memories. To erase a memory, you must store a new curve (even a flat one, if desired) in its place. This is done by pressing the "Enter Memory" button and then the button for the memory you wish to program, which automatically stores the current equalization. A red LED next to

each memory-location button shows which one has been selected.

Five buttons to the right provide even more flexibility in the handling of stored EQ curves. With "Enter" actuated, any number of EQ curves (up to 10) selected out of memory can be averaged, and *that* result can be stored. The LEDs help the user keep track of the selections made before pushing "Compute" to make the average. Any curve can be given more weight in the averaging by simply pushing its memory button more than once. The "L + R Average" button averages together the current left and right EQ curves, readjusting both curves accordingly. These matched curves can then be entered into memory if that is needed. The "HFR Curve" button (HFR stands for high-frequency roll-off) gives the user a one-push means of adding a smooth roll-off of the highest frequencies: −1 dB per octave above 1 kHz. This is a nice feature and a very convenient way to reduce the extra brightness that goes with flat response, the result more closely approximating concert-hall conditions.

"Auto EQ" is the last button in this group of five, but it accomplishes mighty things. One gentle push, and the computer-controlled system/room equalization process begins. First, there is automatic checking to make certain that the pink-noise source is turned on, flashing its LED if it isn't. A check is also made to ensure that the sound level picked up by the microphone is high enough for the auto-EQ. Then, each filter of the digitally controlled EQ is boosted or cut so that the compensating EQ makes the total response flat. The unit can be set to do left and right separately or together, another difference from the earlier Model 20/20. The 10/20 automatically keeps the system's average level after EQ close to its original, unequalized level, an important feature that helps prevent excessive boosts or cuts. Automatic equalizing stops when the measured response is within ±1 dB or after 15 iterations of adjusting all 10 bands, with a maximum time of 40 S. This is an excellent application of microprocessor/computer technology because it is both faster and better than what most users could do.

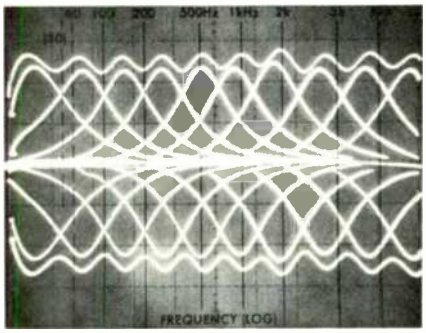

Fig. 1—Swept-frequency responses of each filter section at maximum boost and maximum cut, and with all sections at maximum boost and maximum cut.

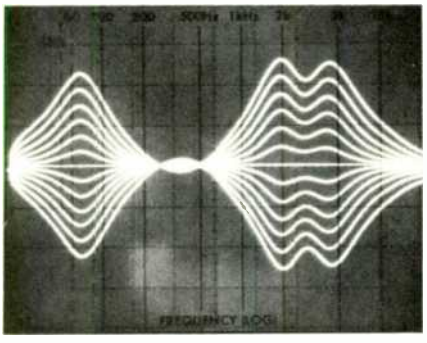

Fig. 2—Swept-frequency responses with 63-Hz, 2-kHz, and 4-kHz filters set successively for 2-dB steps from −12 to +12 dB. Small overshoot around 300 to 600 Hz (see text) has no significant audible effect.

A group of six pushbuttons just to the left of the display selects tape "EQ" ("Pre" or "Post"), "Monitor" ("Source" or "Tape") and "Pink Noise" ("On" or "Off"). All choices have indicating LEDs, with the exception of pink-noise off. I'm glad to see the inclusion of EQ for recording or playback, and it is a worthwhile addition to the previous 20/20 unit. A convenient horizontal, pink-noise level-control slider is below this group of buttons.

A large, horizontal-LED bar display dominates the center of the front panel. Each of the 10 frequency bands has 25 LEDs in a vertical column, which illuminate one at a time to show response or level from −12 to +12 dB, in 1-dB steps. The display, when in EQ mode, shows what EQ is being applied in the 10 bands. Each LED step is labelled, so boosts and cuts in dB can be read. Below the display, at the bottom of each column, are spring-loaded toggle switches which step the equalization up or down in 1-dB steps or, if held in for about a second, ramp up to a quick rate.

At the right, the display shows whether the EQ (selectable) is "L," "R," or "L + R." There is also a helpful indicator which is marked "L = R" that shows when the left and right EQs are the same, even if just one has been selected. A "0" appears at the center reference level in EQ mode, but this changes to SPL reference numbers in RTA mode (more on this later). At the very right in the display is an LED column for "dB SPL" from "64" to "110" in 2-dB steps.

At the upper right of the front panel are two buttons for EQ selection ("L" and "R") and eight for RTA control: Mode ("Peak Hold" or "Avg"), sensitivity ("Auto" or "Fixed"), fixed-sensitivity adjust (up or down), and source ("Line" or "Mic"). Simultaneous left and right EQ is obtained by pushing "L" and "R" at the same time. The fixed-sensitivity reference can be set anywhere from 60 to 100 dB, in 10-dB steps. In "Auto" the display is automatically shifted up and down over a range of 50 to 110 dB SPL. This centers the average of the levels in all of the bands, with 1-dB resolution. With a line input, 100 dB is equivalent to 1 V. Most of the time, the "Avg" RTA mode would be used, but peak holding is sometimes of interest for checking music levels. A push of "Peak Hold" automatically switches the display to its fixed-sensitivity mode.

The calibrated-microphone jack at the lower right is duplicated on the back panel, but the front-panel jack has precedence. The supplied cable is 20 feet long, which should be enough for most situations, but dbx makes the helpful note that the cable can be extended for up to 100 feet while main-

The dbx 10/20 can store ten automatically or manually set EQ curves, average those curves, and store the average in memory for later use.

taining performance. Also on the rear panel are the phono-jack stereo in/out pairs for connections to a preamp or receiver and a tape recorder. Thumbscrews on the battery-compartment door provide easy access to the two AA cells which save the EQs in memory when power is off.

I examined the interior with interest—and appreciation, as the two large p.c. boards, positioned one above the other, were made of high-quality glass epoxy; many recent products from other companies have used poorer quality material for the boards. The soldering was excellent, and interconnections were made with multi-pin cabling. There was one fuse in a clip, and the power transformer was just warm after use. The box-like chassis was fairly rugged, and it was even more rigid with the steel top and side cover back in place. Adaptors are supplied for 19-inch rack mounting.

Equalizer Measurements

With each of the filter bands set to zero, the frequency response was within 0.9 dB from 20 Hz to 20 kHz. The 3-dB down points were at 11.6 Hz and 38 kHz. The lower frequencies were rolled off by 22.5 dB at 5 Hz, which would give good rejection of disc-warp effects. Figure 1 shows the frequency responses of each of the filters at maximum and minimum settings and the results with all of the filters at maximum settings. The center frequencies were all within 5.5% of standard, and most were within 1.9%—very good indeed. The maximum boosts were 11.3 to 12.1 dB, and the maximum cuts were from 11.4 to 12.3 dB—all quite consistent. The boost for a bandwidth of one octave was 11 dB, while the boost for a Q of 1 was about 6 dB.

Figure 2 presents the swept responses obtained with the 63-Hz, 2-kHz, and 4-kHz filters set successively in 2-dB steps from −12 to +12 dB. The evenness of the steps is very apparent, a good aspect of the 10/20's performance. The small bulge between the large peaks shows that the highest settings cause a little overshoot in adjacent bands, but its effect is not important.

The maximum input/output levels were at least 5.6 V from 20 Hz to 20 kHz, even with a 10-kilohm load. As would be expected, boosting reduced the maximum input levels. The input impedance was very close to the specified 50 kilohms, varying slightly with frequency. The output impedance measured 670 ohms, which is plenty low enough for any normal use.

Even with the inclusion of noise, distortion measured 0.04% or less (usually half as much) from 20 Hz to 20 kHz. There was no slew-rate limiting observed, even at 2 V and 100 kHz. With all of the filters set to zero, the noise was about 101 dBA below 1 V. With some of the curves generated in testing, the noise level was higher, around −90 dBA—still excellent.

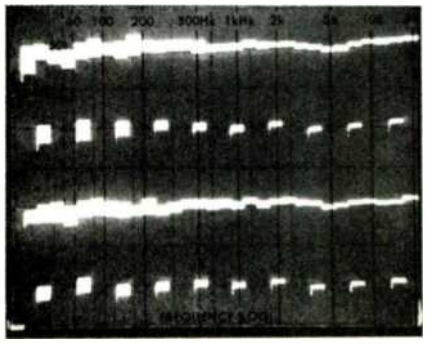

Fig. 3—Pink-noise spectra: Pink noise from dbx 10/20 (upper two traces) matches response of Ivie IE-20B generator (lower two traces) quite closely. Upper trace of each pair is third-octave response, lower trace is octave-band response (see text).

Analyzer Measurements

The filter centers for the RTA section were quite accurate; most were within 1.6% of standard. The peak responses for most bands were within ±1 dB of that for the 1-kHz band; 2 and 4 kHz were off just a bit more. The crossovers between adjacent bands for equal response were about 4 dB down, and the response in the center of the adjacent band was 9 dB down. For the intended purpose, I consider these filter shapes superior to many others that are very pointed in-band. With a pink-noise input getting zero level in all 10 bands, and a reference level of "70," the SPL LED column was correct with an indication of "80." (SPL equals band level plus 10 times the log of N, where N is the number of bands with equal level.)

The level thresholds from −11 to +12 dB were very accurate, measuring 0.96 dB/step on the average. As "−12" is always turned on, it cannot be considered useful as a level indicator. The SPL column thresholds (2 dB/step) averaged 1.94 dB apart, and most were within 0.1 dB.

The maximum pink-noise output was 195 mV, quite far below the specified 300 mV, but the measured level is high enough for substantially all testing situations. The level was easily controlled with the slider, all the way down to less than 0.1 mV. Figure 3 shows the noise spectrum as measured by an Ivie IE-30A, first in the ⅓-octave mode (top trace) and then in octave-band mode, to show how closely the 10/20's generator response would match up with its octave-band equalizer. For comparison, the next two traces show the ⅓-octave and octave-band spectra from an Ivie IE-20B noise source. Discrepancies between the two are very small, and dbx's generator appears to be flat within ±0.5 dB. The 10/20's display response time was about 1.5 S at the lower frequencies, dropping to about 150 mS by mid-frequencies.

It was not possible to get an exact calibration on the supplied microphone because of its nonstandard, 0.575-inch diameter. A number of sound level checks, however, made me feel confident that the dbx 10/20's SPL indications were within 1.5 dB of absolute—much better than many units tested. The line-input sensitivity for an indication of "100" was 1.06 V, substantially right on spec.

Use and Listening Tests

The owner's manual is one of the best that I have seen on any product, with considerable detail and good explanations of the many functions of the 10/20. There are lucid discussions of the RTA display and of equalizing and sound in rooms, which includes the very important comment that equalization cannot fix difficult acoustics or solve poor placement of loudspeakers.

For its high price, the 10/20 has little to fault and much to enjoy, and it's better and less expensive than its predecessor.

A block diagram would be a helpful addition for some.

I spent a little time watching the RTA display with a music input, and it was satisfactory, but the dynamics aren't of the peak-responding nature I prefer—and a bar-graph display is better for this purpose. Automatic equalization is the name of the 10/20's game, and that's what was rewarding and fascinating even though I had used dbx's earlier Model 20/20.

The display showed that the mike had the desired low directivity, with little sensitivity to exact pointing. Most RTA mikes are claimed by their manufacturers to be omnidirectional, but they peak at the high-frequency end when pointed at the speaker. I generated a number of EQ curves, including one for my favorite listening position, another for my second-choice spot and a third by averaging a set of curves for the general area. I used the "HFR" slope on all three, then manually added some slight boost (about +1 dB at 4 kHz and +2 dB at 8 kHz) to brighten the general-area sound. Everything worked exactly as it should have, and the results were very satisfying. I generated a few more curves to better match my preferences with certain types of music. Then, a simple push of one button recalled a sound balance I'd have had to work out again with other equalizers.

The dbx 10/20 can insert EQ before or after a connected tape recorder, and that is good. I do wish that the unit had the switching required to feed the built-in pink noise to the recorder, with EQ before or after, and with the playback fed to the RTA. This would facilitate recorder checks and response trimming when needed. Well, maybe next time.

As it stands, the dbx 10/20 delivers excellent system/room equalization that is close to complete automation. The flexible memory scheme enhances the usefulness of the device with a good means of compensating for differences from one point to the other. For its high price, the 10/20 has little to fault and much to increase enjoyment. Finally, it is no small achievement that dbx has not only improved on the earlier 20/20 unit, but has reduced the price 20% at the same time.

Howard A. Roberson