dbx

Model 14/10

Computerized Equalizer/Analyzer

Instruction Manual

INSPECTION and INSTALLATION

Your unit was carefully packed at the factory in a protective carton. Nevertheless, be sure to examine both carton and contents for any signs of damage that may have occurred during shipping. If there is such evidence, don't destroy the carton or any of the packing material, and notify your dealer or distributor immediately.

In any case it is a good idea to save the carton and packing materials should you ever need to ship your unit in the future.

In addition to a 14/10 and this instruction manual, the carton should contain hookup cables with phono, or pin, plugs, a microphone calibrated for the unit, a warranty/registration card and a pair of brackets for mounting the unit into a standard audio-equipment rack.

No special cooling or ventilation is required in any installation; other components may be stacked above or below the 14/10 provided that they don't generate excessive heat.

WARNING

TO PREVENT FIRE OR SHOCK HAZARD,
DO NOT EXPOSE THIS COMPONENT
TO RAIN OR MOISTURE.

This triangle, which appears on your component, alerts you to the presence of uninsulated dangerous voltage inside the enclosure -- voltage that may be sufficient to constitute a risk of shock.

This triangle also appears on your component, and it alerts you to important operating and maintenance instructions in this accompanying literature.

CAUTION
To Reduce Further the Risk of Shock, Do Not Remove the Cover or Back. There Are No User-Serviceable Parts Inside; Refer All Servicing to Qualified Personnel.

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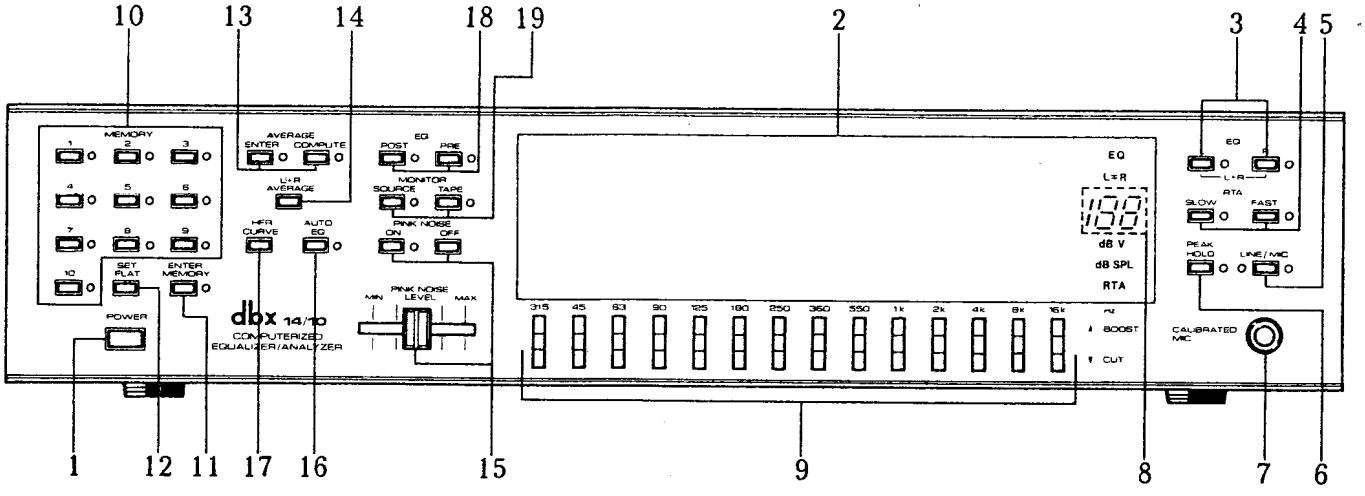
FRONT PANEL



1 POWER button. This turns the 14/10 on and off. Although the unit is briefly muted at these times, we recommend that you not turn it on or off with your amplifier's volume way up, so as to avoid sending any loud bursts to your speakers.

2 LED display. A fluorescent display consisting of 1-dB bar indicators.

3 EQ buttons. If you push EQ:L, the 14 LED columns at the left of the display, consisting of bar indicators numbered in 1-dB steps, show the equalization curve applied to the left channel (the "EQ" LED, in the upper-right corner of the display and the indicator beside the button, also light). If you push R, it's the right EQ and the indicators. Pushing the buttons at the same time shows the average of the two curves but doesn't affect the actual EQ.

4 RTA buttons and LEDs. If you push either of the RTA buttons (:SLOW or :FAST), the display is a "real-time analysis" of the spectral content of the program signal (the traditional frequency vs. amplitude graph). The "RTA" LED, in the lower-right corner of the display, lights up. Note that this is a mono display.

5 LINE/MIC buttons and LEDs. Press this button to light the LINE LED (to the left) to analyze the LINE input signal; press to light the MIC LED (to the right) to analyze the signal from the microphone. For the LINE input dBV (0 dBV=1 volt) is displayed at the right of the display; dB SPL is for the MIC input.

+15 dBV = 5.6 V	-20 dBV = 100 mV
+10 dBV = 3.16 V	-30 dBV = 32 mV
0 dBV = 1 V	-40 dBV = 10 mV
-10 dBV = 316 mV (millivolts)	

6 PEAK HOLD and LED. This button causes the display to show and hold the highest average level in each octave. When three bars ("- - -") are displayed in the level indicator, peak-holding is not performed because of an over- or underrange condition. Push the button again to recenter the display if the signal levels go too high or too low.

7 CALIBRATED MIC jack. The microphone supplied with the same serial number as the main unit plugs into either this jack or a similar one on the rear panel. This one overrides the rear one. Do not plug any other mike into these inputs, or a headphone; since the 14/10 supplies power to its own mike, using another may short out this supply and damage your mike as well. The supplied cable is 20 feet long and may be lengthened to around 100 feet. Use any good-quality single-conductor shielded low-capacitance (less than 30 pF/ft.) cable.

8 Level indicator. This shows the sound-pressure level (SPL) being measured at the microphone in dB SPL when the LINE/MIC is :MIC, or it shows the output voltage in dBV (0 dBV=1 volt) when it's :LINE. In either case the reading of the total rms energy of all frequency bands from below 20Hz to above 20kHz.

9 EQUALIZATION:BOOST and :CUT. Each of these spring-loaded toggle switches increases or decreases the amplitude of its frequency band ±12dB in 1-dB steps. When the LED beside the EQ:L button or EQ:R is on they affect only that channel. When both are on they affect both channels. When the EQ curves ,for left and right channel coincide, the "L=R" LED lights up in the upper-right corner of the display. EQ adjustment can be made during the RTA mode as well.

10 MEMORY:buttons and LEDs 1-10. Each button stores and recalls a pair of EQ curves (one for each channel). The curves may or may not be identical (as explained later). They can be ones calculated by the 14/10 or ones specified by the user.

11 ENTER MEMORY button and LED. This allows any displayed curve to be stored. Once the desired curve is produced (either manually or automatically), push ENTER MEMORY and then the memory button (1-10) where you want the curve stored. To cancel entering, press the button again (the LED extinguishes). Any previous curve stored in that location will be erased, of course.

12 SET FLAT button. This resets the 14 bands to their center ("0 dB") positions, so that signal passes through unequalized. Pressing it doesn't affect any EQ curves actually stored in the 1-10 memories; it does erase the EQ in current use, naturally.

13 :ENTER and :COMPUTE buttons and LEDs for AVERAGE. These buttons let you average EQ curves in MEMORY. Press :ENTER, then the memory buttons for the EQs to be averaged (to cancel, press the :ENTER button twice), and then :COMPUTE. Left channels are averaged with lefts and rights with rights. What channel is selected, however, is L alone, R alone, or L+R, depending on what EQ button(s) you push. If you want to weight an average (favor one curve over the others), push that memory button more than once during the ENTER procedure. Of course, this new pair of curves can be stored as usual.

Note that if the memory space for curves is exceeded (which depends both on the number of curves you're trying to store and on their amount of EQ boost and cut in each), the 14/10 won't accept new curves -- no new memory LEDs will light. However, the amount of memory is ample for most applications.

14 L+R AVERAGE. Pressing this button will average (and will display the average of) the current left-channel curve with the current right-channel curve, and will apply this new L+R-average EQ curve to both channels. The L=R indicator lights consequently. This curve can then be stored, too.

15 PINK NOISE:ON and :OFF buttons and LED, and :LEVEL:MIN to :MAX slider. Pink noise, which sounds like a waterfall, is defined as equal energy per octave from 20Hz-20kHz. To turn on the 14/10's pink-noise generator, set the PINK NOISE LEVEL slider to MINimum (for safety's sake -- pink noise is potent stuff for home speakers to be asked to reproduce). Then press the PINK NOISE:ON button, and slowly move the slider until the noise is louder than any background sounds and approximates a typical healthy listening level. We advise also leaving the slider at MIN when the pink noise is OFF (in case it gets turned on inadvertently). If you turn your system's volume control up at any time during your pink-noise listening, be sure to turn it back down before pushing PINK NOISE: OFF, so that the music doesn't suddenly come back in at a high level.

To obtain constant pink-noise output (approx. 300mV) from the PINK NOISE OUT jacks, press the PINK NOISE:ON and :OFF buttons at the same time. Pink noise is fed from the PINK NOISE OUT jacks (and <u>not</u> through the 14/10 line outputs) but the PINK NOISE LED doesn't light up. Note that output level cannot be controlled by PINK NOISE LEVEL.

16 AUTO EQ button and LED. First, plug in the microphone and place it at a typical listening position. Then turn on the pink noise and raise it to a healthy level. Push AUTO EQ. If the level isn't loud enough, the AUTO EQ LED will flash. If this happens, increase the system volume on your receiver or preamp if the slider is all the way up, but be careful not to turn it up to a huge roar. Then push AUTO EQ again.

If L or R channel alone is selected, the 14/10 will feed pink noise to and equalize the selected channel only; this takes a little over 20 seconds at most, usually less. If EQ:L and :R are lit or the 14/10 is in RTA display mode, both channels will be equalized. See "Details of Operation" for the pros and cons of simultaneous (speakers together) and sequential (speakers separately) equalization. The derived curves can be stored naturally. AUTO EQ can be made during the RTA mode.

It is also possible to equalize equipment that has a non-flat response. Feed pink noise from the labeled output of the 14/10 to the equipment you wish compensated, and then connect its output to the 14/10's LINE:IN jacks. When you push the PINK NOISE:ON and :OFF buttons at the same time, then push the AUTO EQ. The automatic EQ will begin, using the signal at the LINE:IN jacks instead of the mike input.

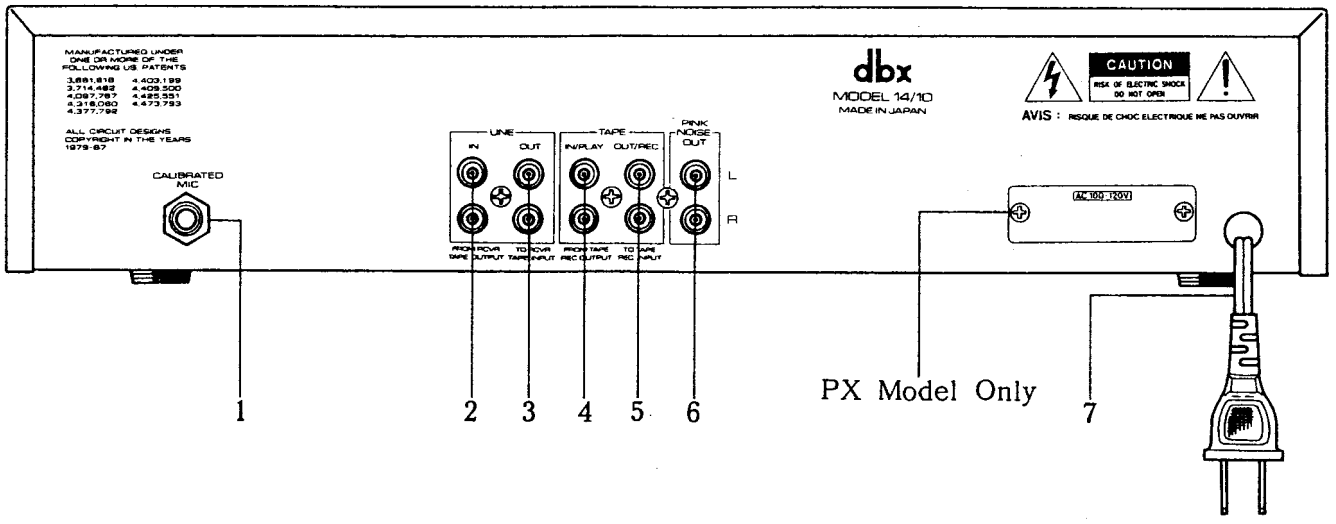
17 HFR CURVE. Pushing HFR, which stands for "high-frequency rolloff," turns down the treble by 1 dB/octave starting with 2 kHz. Since the 14/10 equalizes for flat power response (not just flat frequency response), with most speakers, rooms, and modern recordings, the resultant sound is too bright, and HFR makes it considerably more palatable.

This setting is also useful for smoothing the raw sound of too closely microphoned CDs. The setting sometimes is better, too, for classical music in general and/or for bright (nonabsorbent) rooms. In concert halls, the farther you get from the stage the more the highs are rolled off; our HFR curve (as you will see on the display) approaches this condition.

18 EQ:PRE and :POST. The 14/10 is not just a room/speaker equalizer; you can use it to change balances in the music, too. Pushing :PRE lets you equalize the signal before it goes to your tape deck. Pushing :POST, the more common setting, equalizes the sound on playback only. Be sure not to push these buttons carelessly during recording. Also, be careful about equalizing too vigorously the program to be recorded, because you will easily overload your tape recorder (especially cassette decks).

19 MONITOR:SOURCE and TAPE buttons and LEDs. This tape loop replaces the one the 14/10 occupies in your system. Push Tape to listen to tapes and Source to listen to everything else (CDs, records, radio, video, etc.).

REAR JACKS



1 CALIBRATED MIC. This jack, too, accepts the microphone supplied with the 14/10, in case you want to leave it plugged in and not have the cable show in front. The front jack overrides this one.

2 LINE:IN (FROM RCVR TAPE OUTPUT). These jacks receive the signal from your preamp/receiver, from its tape-output jacks marked "To Tape."*

3 LINE:OUT (TO RCVR TAPE INPUT). Connect these jacks to tape-monitor jacks on your receiver marked "From Tape."**

4 TAPE:IN/PLAY (FROM TAPE REC OUTPUT). Connect these jacks to the jacks on your tape deck marked "Out" or "Play."

5 TAPE:OUT/REC (TO TAPE REC INPUT). Connect these jacks to the jacks on your tape deck marked "In" or "Rec(ord)."

6 PINK NOISE OUT. Through these jacks the 14/10 feeds pink noise to other equipment. Pink noise from these jacks is not affected by the internal equalizer or the pink-noise-level control.

7 POWER CORD. Connect this cable to the appropriate power source. If another piece of equipment has a switched outlet (your preamp, for instance), that's one good place to plug in.

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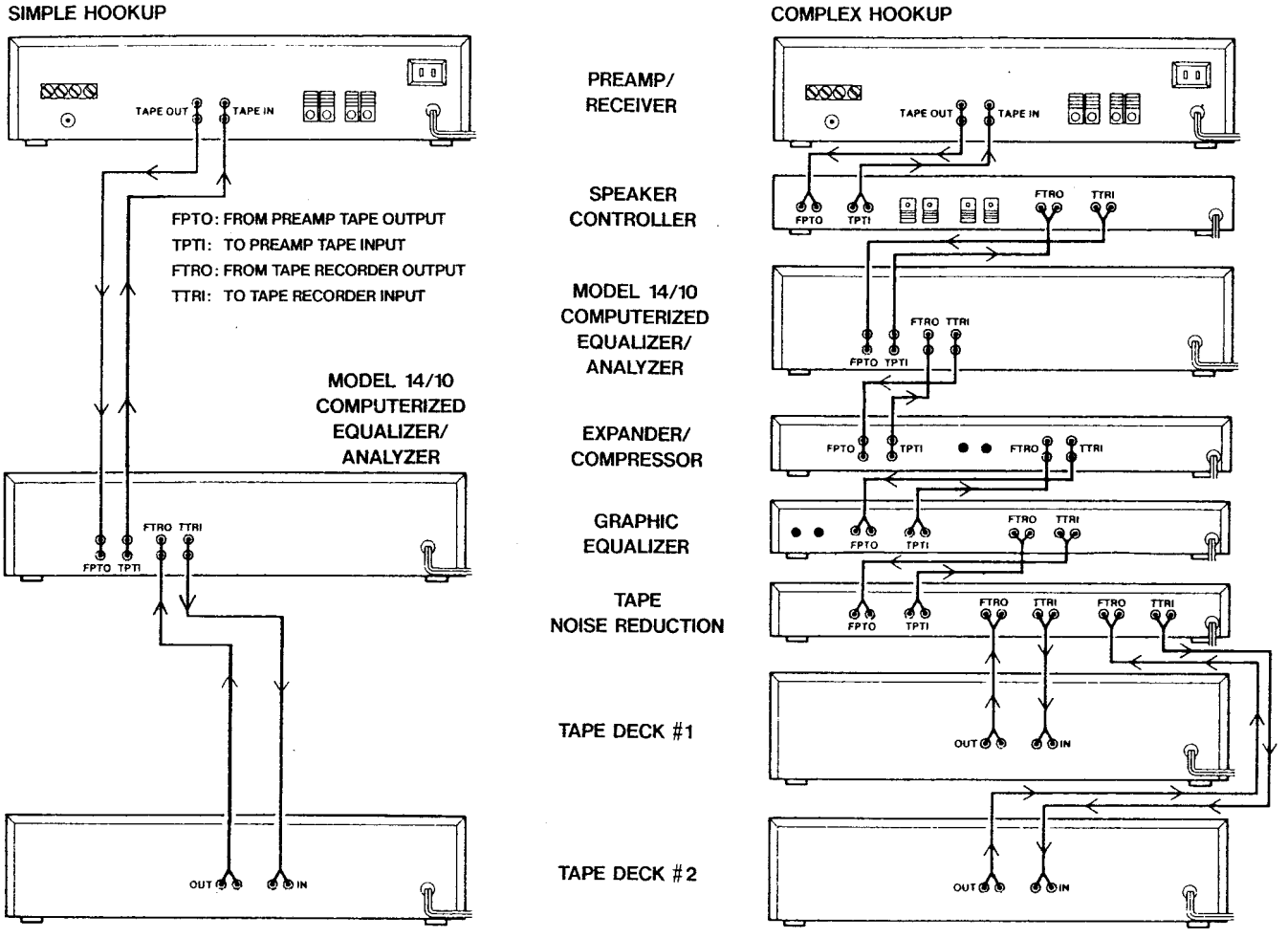
*Also called Tape Rec, Rec(Out), To Tape Rec, To Tape In(puts), (Out) To Tape, etc.

**Also called Play, Tape Play, Tape Monitor, Playback, (IN) From Tape, From Tape Out(puts), etc.

SOME TYPICAL HOOKUPS



The principle is to put the 14/10 in the receiver's tape-monitor (record/play) loop, and put everything else in the 14/10's tape loop, "chaining" it if necessary, as shown here. The only exception is the location of dedicated speaker equalizers, such as those made by dbx, Allison, Bose, Infinity, McIntosh, et al.: the 14/10 goes in its tape loop, and then proceed as usual. Let red plugs carry the right channel.

Those whose music systems approach or surpass this level of complexity should consider the dbx 200XG and 400XG Program-Route Selectors or the DAV-600G Audio/Video Program-Route Selector.

INTRODUCTION TO EQUALIZATION

The goal of a high-fidelity system is to reproduce sound accurately. It does this by changing movement (of a stylus, a microphone diaphragm) or digits into electrical current and back again (loudspeaker drivers). A system with so-called flat frequency response performs this task evenly -- maintaining and correctly putting out the levels of the information coming into it.

All components alter this ideal to some degree or other. Obviously, it is best when these alterations either are minuscule or are deliberate and controllable. Equalizers, which change the amplitude of specific parts of the audio band, can help "undo" anomalies in frequency response.

Sometimes trying to restore flatness is called for, but nearly as often the goal is changing the sound in a precise and repeatable way. The dbx 14/10 does these things and more. It is an unusually flexible graphic equalizer that includes a calibrated microphone, a pink-noise generator, a real-time analyzer (RTA) with a level indicator, and a microcomputer.

With all of these parts, the 14/10 is capable of equalizing sound in two channels (separately or together) to a flat response (on octave above 1 kHz, on half-octave below) anywhere in the sound field, of storing up to 10 different EQ curves for instant recall, and of averaging combinations of stored curves to obtain flat or rolled-off equalization over a larger listening area.

Sound in rooms

What we call sound is vibrations (usually in air) produced by objects. Music is that harmonious sound produced by strings, instrument shells or air columns, drum-heads, voice, etc., or produced by loudspeakers transmitting these sounds. Slow vibrations (in number of times per second) sound low; faster vibrations sound high. The ear of someone with unusually acute hearing can sense vibrations from below 20 times a second (Hz is the abbreviation) to about 20,000 times a second. In music, the frequencies above 4 kHz are mostly the harmonic overtones of instruments, not their fundamental sounds.

In a room the sound we hear, whether from a person, instrument, or loud-speakers, takes one direct path to our ears and numerous indirect paths. The indirect ones are reflections -- the bouncing of sound off room surfaces and furnishings. Depending on the size of the room and the distance of the source, the total sound heard may be predominantly reflected. Different wall and floor materials and different furnishings (and the presence of people) have a marked effect on sound, of course. Carpeting, curtains, heavily upholstered furniture, and archways and the like absorb some of the higher frequencies; too much absorption will make a room sound altogether dead (but a goodly amount of "deadness" is by no means a bad thing). Unrigid flat surfaces (walls that aren't stiff, for example) will flex with low-frequency sound, absorbing bass energy, letting it "leak out." Hard surfaces (glass, tile, etc.) can bounce back so much high-frequency sound that the result is the extreme reverberation of multiple echoes (bathrooms, gyms, etc.). Close, facing, hard surfaces (bare walls, for example) can make a room ring with "slaps" (as after a handclap).

The shape and size of the room affect the sound too, notably the bass. The more cubic (equal dimensions) the room, the more the low-frequency reflections meet at similar times and places, creating potentially large reinforcement points (most often near walls, intersections, corners) and cancelation points (most often away from intersections). The less cubic a room is, generally, the smoother the bass can be.

Ideally, of course, an acoustically promising room should have stiff walls, dimensions as different as possible (and no dimensions the simple multiple of another), facing surfaces not all parallel, and one dimension at least 25 feet or so (to make propagation of very low bass easier). The most venerable acoustic-dimension ratios are 1:1.25:1.6.

Similarly, the bumpiest bass response delivered by a loudspeaker into any room occurs when the center of the woofer (bass driver) is the same distance from the three nearest boundaries -- which again means that the low-frequency reflections meet at the same time and place. It might sound like the most bass (and may indeed be the most bass), and it might even go deep, but most likely it will be boomy, bassy, uneven with peaks and dips -- and hard to fix with any octave equalizer. The smoothest bass response usually occurs when the three boundary distances are maximally different. The same is true of listening positions: for the least-rough heard bass, the distances from your head to the three nearest boundaries should be as different as possible.*

The situation is not quite the same for treble. Treble reflections get readily absorbed, as noted, but when they're not, their peaks and dips are so closely spaced that the ear averages them smoothly (treble is shorter in wavelength to begin with).

The result of all of these acoustical properties is that room responses are seldom flat, and sound in them is altered accordingly. The 14/10 can help dramatically with such problems, increasing and/or reducing midrange and treble segments and smoothing bass for a number of listening positions. It is especially helpful in smoothing and flattening the bass ("drying it up") because its narrower-than-one-octave correction capability is so much better-suited to the low-frequency booms and resonances typical of speaker performance in real rooms. And by averaging the EQ curves of several locations, it thoroughly adjusts the sound over a wide area. This capacity for thoroughness, plus its accuracy of settings, is what sets it apart from all other octave equalizers.

Equalizers and frequency response

A 14-band graphic EQ, such as the one in the 14/10, covers the 10 audible octaves of the sound spectrum (from 20 Hz to 20 kHz) with boost/cut controls centered on 31.5, 45, 63, 90, 125, 180, 250, 360, 550, and 1, 2, 4, 8, and 16 kHz. These controls work on the entire band, not just the nominal center frequency: the center is where the response peaks but the accompanying frequencies are boosted or cut also.

Furthermore, adjacent bands are sometimes interactive, sometimes not. When two or more depart from flat, the actual changes made to the signal passing through the 14/10 may be different from what is shown on the LED display (this is true of all equalizers), or they may in fact be closer to it than most other EQs. For example, when two adjacent bands are at maximum (+12dB) boost, the octave between the nominal centers is boosted only a touch more -- 13dB. (The same holds for maximum cut.) But when one band is all the way up and the next is all the way down, the actual boost and cut are only about 7 dB each.

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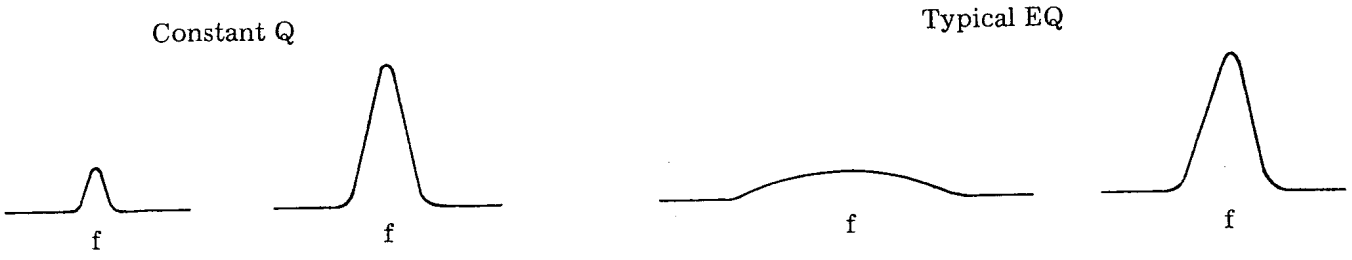
*The easy way to figure three maximally different distances is by satisfying the equation $B^2 = A \times C$ for distances A,B,C; and this holds for room dimensions, listening locations, and woofer centers.

Perhaps the most notable feature of the 14/10 as an equalizer -- apart from its automatic computer and memory capabilities -- is something called "constant Q." This is a technical term for the kind of filter shape each band has, and usually is characteristic only of pro-level units. It means that small as well as large equalization changes cover the same precise frequency area, as shown here. This, along with the fact that the 14/10 accurately "listens" to and carefully self-corrects during automatic-equalization routines, guarantees smooth-sounding interactions and precise results. Virtually all other consumer equalizers have a Q that changes with a broad rise or dip several octaves wide.



Displaying sound in real time

The 14/10's LED display also shows the level of the full range of audio frequencies, from bass to treble (low to high), changing over a range of 24 dB. The display is centered automatically -- "auto-ranging." To the right of the LED display is a level indicator that shows the overall wideband SPL (sound-pressure level) from 57 to 119 dB SPL or output signal voltage (L+R) from -47 to +15 dBV.

With such a real-time analyzer (RTA), it's helpful to have a source of pink noise to send through your various sound-producing components and also to observe it bouncing around the room. Pink noise has the same amount of energy in each audio octave, so it shows up on the RTA as a straight line, and departures from "straight" -- flat -- are readily observed. (Note that tones -- a sine-wave sweep -- will not read as flat because the bands are not all the same octave width and the detectors have been set to yield a flat display with pink nose only.) What will be perhaps most instructive as you begin to experiment with the 14/10 will be looking at pink noise as produced by your speakers and influenced by your room, then picked up by the calibrated mike to be displayed on the RTA. You will be able to see how small changes in mike position (simulating changes in listening position) affect the sound. Noticeable differences in measured frequency response result from mike shifts that would seem to be nearly inconsequential. Similar differences result from small changes in speaker placement, in the listening environment, or in both, as just discussed.

Therefore, because no equalizer can altogether fix a poor acoustical situation (speaker and/or placement and/or room), such changes are always a wise step to take before turning to the capabilities of the 14/10.

DETAILS OF OPERATION

First, cautions. The model 14/10 is a powerful tool, and improperly used it can damage your equipment, especially speakers. Never forget that 10 dB of boost takes 10 times as much amplifier power at any frequency, and so such a large increase, depending on where it comes, can quickly destroy tweeters and even sturdier, low-frequency drivers. Likewise, high levels of pink noise are potentially harmful: by definition, it is full-range sound. As was pointed out earlier, don't turn on the pink noise unless the slider is all the way left. Finally, during auto EQ, be certain that any signal processors after the 14/10 are in their "Bypass" ("Defeat," "Out") position.

Manual adjustments

The 14 spring-loaded toggles permit the individual adjustment of each octave. Pushing them up increases level; pushing them down decreases it. Their action accelerates as they are held up or down. Of course, more than one toggle may be pressed at a time. Be sure the 14/10 is in EQ mode, so you can correlate what you see with what you hear; you will want to experiment with the different toggles to remind your ear what the various frequencies actually sound like (but be careful with the volume). You can become a better-educated listener and judge of loudspeakers. Where is most so-called low bass? (Around 45-60 Hz -- adds oomph. Boosting 30 Hz seldom does much.) "Thickness"? (125 and 180-250 Hz -- boomy, too. The 180-250 area correlates also with "colored," "hollow" -- but with a thump.) "Honkiness," "nasality"? (360/550/1-2 kHz. The general sound is of congestion, but as you go higher, the sound assumes a "telephony" quality, too.) "Brightness"? (4 kHz. Don't forget that the ear is most sensitive in the 2-4 kHz area.) "Air"? (8 kHz -- also scratchy, sometimes spitty.) The 16 kHz band fully increased can add sparkle, and fully decreased makes a strong and effective scratch/hiss filter for some sources. SET FLAT returns any new setting to flat, for comparison.

Real-time analysis

Push RTA:SLOW and :FAST. To look at the spectrum of the program coming off the mixer or tape, set LINE/MIC to :LINE; to see what the speakers are putting out, push MIC (the microphone has to be plugged in, naturally). EQ adjustments of the signal may now be both seen and heard in the room. Aim the MIC between the speakers, unless you wish to check individual driver performance up close or an entire speaker you suspect of having a problem. Turn the sound up to a comfortably loud listening level. Actual dB SPL is shown, unweighted.

Obviously, the calibrated MIC will show sound in the room other than pink noise coming from the speakers and reverberantly. Try speaking, clapping, or walking around, to observe their frequency spectra. See how quiet (or noisy) your room is, too, especially low frequencies (traffic, appliance compressors, ac hum, footfalls, HVAC [heating/ventilating/air conditioning] systems, etc.).

Note that all of the LEDs in the display are numbered. This makes the addition and subtraction of levels in each octave or overall a matter of simple arithmetic, enabling the ready notation on paper of experiments and solutions. But also note that pressing PEAK HOLD in RTA mode shows and freezes the loudest average levels of a program until PEAK HOLD is re-pressed. (Peak-holding is possible while the level indicator indicates actual numbers.) Whether "peak" or average, this function is highly educational to watch during musical programs -- you can learn where sibilance lies in voices, how little loud high treble there is usually (almost none in acoustic music), how "high" a lot of bass actually is (and how rare really low bass is, how hard it is to hear it, and what it sounds like). Using PEAK HOLD, observe that virtually all music has its loudest points at 125 Hz-2 kHz and rolls off above 2-4 kHz -- even cymbals, harpsichords, triangles, and hard rock. Note also how even the widest, brightest pianos produce very little in the last two or three octaves.

Automatic equalizing

Push RTA:SLOW or :FAST, set LINE/MIC to MIC, slide the PINK NOISE LEVEL to MIN, and plug the calibrated MIC into either the front or rear jack. Note that AUTO EQ can be performed while the 14/10 is in EQ mode; in fact, it's necessary for separate-channel (one speaker at a time) equalizing. If the level indicator shows low enough level (say, at 60 or 70 dB SPL), ambient noises will be shown of the LED display, usually at the lower frequencies. It may be surprising how relatively loud these low frequency sounds actually are.

Place the mike 7-10 feet from the speakers, press PINK NOISE:ON, and slowly push the PINK NOISE LEVEL slider to the right until the sound is at a healthy level, say around 80 dB SPL. If necessary, increase your system's gain (the volume control that normally changes the loudness of the speakers). If the level isn't loud enough, the AUTO EQ LED will flash and auto EQ is terminated. (Two other notes are pertinent here: the pink-noise level must be at least 10 dB greater than the ambient reading for the auto EQ to be accurate, but too high levels -- above 95-100 dB SPL -- can damage even sturdy speakers.)

Push AUTO EQ. Several things begin to happen. First, if the 14/10 is in RTA, you will see it check that the MIC input is high enough (that the pink noise is loud enough), then look at internal pink noise (which shows up as flat, of course) to get a reference to EQ to, and then begin to adjust the settings of the filters, such that the frequency response in the room as heard at the microphone becomes flatter on octave.

If the level was high enough, you will begin to hear and see the 14/10 work, "thinking" about what it is hearing and trying to get what it hears flat. After about 25 seconds at most, the auto EQ is complete, and the RTA display becomes active again (unless you switched over to EQ mode), showing the new frequency response of the speakers producing pink noise. It will be quite close to a straight line. Repeat several times for slightly different microphone positions. Then fine-tune the averaged result by blending in a few readings from your listening position.

Push the PINK NOISE LEVEL slider to MIN, reduce the volume control to its typical setting, if necessary, and push PINK NOISE:OFF.

As mentioned, equipment may be equalized by the 14/10 as well. Connect the component output to the LINE IN of the 14/10 and the pink-noise output of the 14/10 to the component input. Push the PINK NOISE:ON and :OFF buttons at the same time, then AUTO EQ. The procedure of the automatic EQ will begin. If the input level is too low (under -31 dBV), the AUTO EQ LED will flash and auto EQ is terminated.

The EQ curve(s), however they are produced, will not be saved unless you store them in the 14/10 memory.

It is these capabilities of averaging, and storing and displaying the composite curves, that make the 14/10 such an unusually useful equalizer.

A caveat about flat equalization: it can sound bright. Sound in a room is a combination of direct and reflected, the latter usually having far less treble than the former (for a variety of reasons). The ear readily distinguishes between direct sound and reflected sound, but the 14/10 will equalize the pink noise its microphone hears to produce flat direct plus reflected sound -- which will seem too much to many people. With speakers that are directional at high frequencies -- which is to say, virtually all speakers except dbx Soundfield Imaging ones -- the direct sound will become quite bright, since the highs will have been boosted to make the power response (the total sound, reflections and all) flat. Closely microphoned and/or multi-microphoned recordings often become nearly intolerable when so reproduced.

In any case, if the system equalization is set for flat response as the starting point, then the highs may be reduced as necessary in a broad, smooth manner with the HFR button and/or treble tone controls.

Separate channel equalization vs. simultaneous channel equalization

Studies show that it is this total power response, reflections included, which is influential in our perception of spectral (tonal) balance. However, localization is determined primarily by direct sound. EQing two channels of a stereo system differently, therefore, can adversely affect stereo imaging. So for most cases where speakers are similarly loaded into the room (symmetrical environments etc.), we recommend using the 14/10 to apply the same curve to both speakers, by pressing the LEFT/RIGHT buttons at the same time (lighting their adjacent LEDs) and by beginning an auto EQ. Since localization is not important at low frequencies, a good compromise may be to do auto EQs separately (channels successively) below 250 Hz, identically (channels together) above it, and then combine the two.

Entering curves into memory

Once you have a desired curve, whether manually derived or automatically computed to flat, push ENTER MEMORY and the MEMORY button, 1-10, where you want the curve to be located. Whichever MEMORY you choose for the new curve will have its old curve erased, of course. To recall a memorized curve you push the corresponding memory button. Comparisons among curves or between a curve and no equalization (SET FLAT) are simple and instantaneous.
Battery provides for memory backup; replacement is recommended every 3 years.

Averaging EQ curves

After you have placed in the memories the curves (however derived) that you want to average, push AVERAGE:ENTER and then the appropriate MEMORY buttons of the curves. As each is selected, its LED lights up to show that it's been accepted for averaging. Then press COMPUTE, and you have the perfect average of those curves, to give flatter sound over a wider listening area.

There are several ways to obtain weighted averages. The simplest is to press the same MEMORY button twice. You probably would not be able to enter too many more than a dozen curves, however. You could press 1,2,3,2,4,2,5,2 and 6, or 1,2,2,2,2,3,4,5,6, to get a curve with about half the strength of the no. 2 curve in it, or you could enter curves 1 through 8 and then hit no. 2 again to make its presence felt more strongly. But after selecting more than perhaps 2 or 3 more -- depending on the amplitude of the boosts and cuts in any one octave -- it's probable that at some point following a selection, the corresponding LED will not light up, signifying that the computer is full. Note that once lit, the LED will not go out even if a re-entry of the same curve (for weighting) causes overflow.

Another way is to place a given curve into more than one memory, if they're not all being used. When this curve is stored in MEMORY nos. 1 and 2 and you average 1,2, and 3 (which has its own, different curve), the result obviously is weighted in favor of 1-2. You also could select and then average 1 through 7, store this average in 8, and then average 8 and 9, thereby favoring 9 fully 50 percent with the 1-7 average. And so on. With a little experience you will be able to figure out how to favor a given curve into any arithmetic weighting you desire. It helps that the curves are displayed; after the average is computed, its plot points fall into the middle of where all the other curves were.

SPECIFICATIONS

EQ section

Number and width of bands	14, 1/2-octave (360 Hz and below) 3/4-octave (550 Hz) 1-octave (1 kHz and above)
Center frequencies (ISO)	31.5,45,63,90,125,180,250,360, 550,1k,2k,4k,8k,16k Hz
Filter	Constant Q, fixed-frequency, two-pole, symmetrical "peaker-dipper," digitally controlled
Equalization range	±12 dB, one band at maximum or minimum, others centered
Accuracy of settings	±0.5 dB maximum for any band with others centered, typically much less
Set-flat frequency response, all inputs	±0.5 dB 20 Hz-20 kHz (fixed 18-dB/octave infrasonic [low-cut] filter -0.5 dB at 20 Hz, -3 at 12 Hz, more than -20 dB at 5 Hz)
Total harmonic distortion (THD), any control setting	Less than 0.03% (20Hz-20kHz)
Intermodulation distortion (IMD), SMPTE, any control setting	Less than 0.03%
The same, IHF	Less than 0.01%
Equivalent input noise	-103 dBV (below 1 volt)
Dynamic range (maximum signal to A-weighted noise)	Greater than 119 dB
Gain	0 dB (unity) ±0.5 dB (filters flat)
Maximum input and output levels	6.5 V

RTA section

Number of bands	14
Filter type	Fixed-frequency, two-pole, Q=1.4-2.8
Center frequencies	Same as EQ section
Readout	25 LEDs x 14-band display, 1 LED illuminated per band
"Peak" hold	Freezes the highest average reading encountered; released manually
Dynamic range	25 dB shown on screen
Detector	Average-responding
Inputs	Line, microphone

SPL meter

Bandwidth	20 Hz-20 kHz at 90-dB SPL
SPL range	57-119 dB SPL, -47 to +15 dBV
Relative accuracy	±1 dB
Absolute accuracy	±3 dB
Readout	7-segment LEDs
Detector	Rms

Pink-noise generator

Type	Left/right uncorrelated digital pseudo-random white-noise sources with analog filtering for -3 dB/octave rolloff
Accuracy	±0.5 dB

Output level	1-300 mV, depending on front-panel-slider position
at pink noise output jacks	300mV±3dB, fixed
Output impedance	470 ohms
Microphone	
Type	Omnidirectional electret condenser
Power	Phantom, supplied by 14/10
Frequency response	20 Hz-20 kHz ±1 dB as measured and equalized by analyzer network
Cable length	20 feet; may be extended up to 100 feet with low-capacitance (less than 30pF/ft.) single-conductor shielded cable
Connector	1/4" phone plug
Mounting	Clip supplied
Computer	
Automatic equalization	Analyzes frequency response of mike signal as it responds to pink noise sent to speakers; equalizes pink noise to obtain flat response over all 14 bands as measured by microphone; stops when ±1 dB response is reached; maximum time 25 seconds
High-frequency rolloff	Rolls off EQ curve -1 dB/octave above 1 kHz (-4 dB at 16 kHz)
Memory	10 locations for storage; any EQ curve shown on display is storable; storage erases previous contents; duration of memory is indefinite (a lithium battery provides power backup); SET FLAT returns equalizer to no-EQ condition with accuracy of ±0.5 dB 20 Hz-20 kHz
Averaging	Multiple EQ curves may be averaged; weighted averages are possible
General	
Input impedance	51 k-ohms
Output impedance	470 ohms
Connectors	Preamp and tape-deck connections are phono (pin); MIC has phone jacks
Power requirements and fusing	See rear of unit
Dimensions	3-1/2"h x 17-1/8"w x 11-7/8"d (8.8 x 43.5 x 30.2 cm)
Weight (shipping, approximate)	11.2 lbs. (4.9 kgs)

NOTES

1) Specifications are subject to change.
2) All data are for 20 Hz-20 kHz unless otherwise specified; line inputs are driven by a source impedance of 1 k-ohms and outputs are loaded by 10 k-ohms in parallel with 1000 pF; all voltages are rms (root-mean-square).
3) All noise figures are A-weighted.
4) Frequency-response figures are for pink noise.
5) SMPTE IMD is measured with 60 Hz and 7 kHz mixed 4:1; IHF (difference-tone) IMD is measured with 19 kHz and 20 kHz mixed 1:1; output 1V.
6) Inputs and outputs have identical polarity.
7) All dbx home products are designed to be used with components whose output impedance is 5 k-ohms or less. All units are designed to drive loads of at least 5 k-ohms in parallel with 1000 pF or less.

WARRANTY and FACTORY SERVICE

All dbx products are covered by a limited warranty (warranties for products purchased outside the USA are valid only in the country of purchase and the USA). For details, consult your warranty card or your dealer/distributor.

The dbx Customer Service Dept. will help you use this product. For answers to questions and information on problems, write to:

dbx
71 Chapel St.
Newton, Mass. 02195 USA
Attn: Customer Service

You also may call (617) 964-3210 during business hours (USA Eastern time). The telex is 92-2522.

Should problems arise, consult your dealer or distributor. If it becomes necessary to have your equipment serviced at the factory, repack the unit, including a note with a description of the problem and date of purchase, and send the unit freight prepaid to the above address, marking it Attn: Repairs.

FOR USERS IN THE UNITED KINGDOM

Important

The wires in the unit's main lead are coloured in accordance with the following code:

Blue: Neutral
Brown: Live.

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The blue wire be connected to the terminal that is marked with the letter N or coloured black;

The brown wire must be connected to the terminal that is marked with the letter L or coloured red.

Ensure that all terminals are securely tightened and that there are no loose strands of wire.

Warning

This unit must be protected by a 3-amp fuse, preferably using a fused plug.

Also, do not remove the cover without first disconnecting the unit from the mains supply.

dbx

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