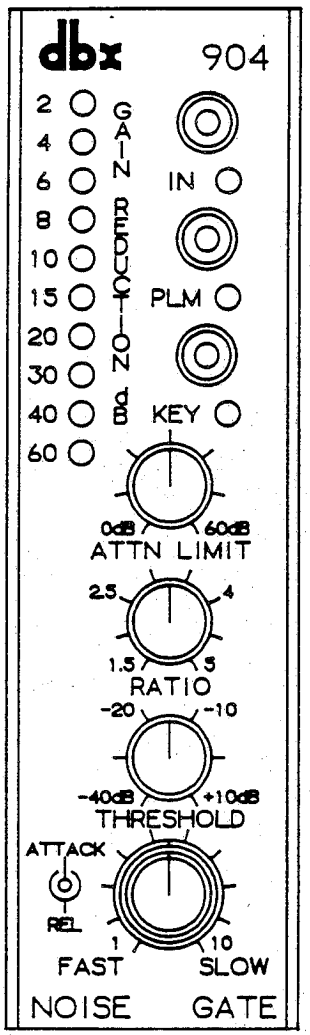
Dbx 904
Instruction Manual

The illustrations at mid-page, which are repeated in the Applications section, show the action (and interaction) of the following three controls.



E

F

G

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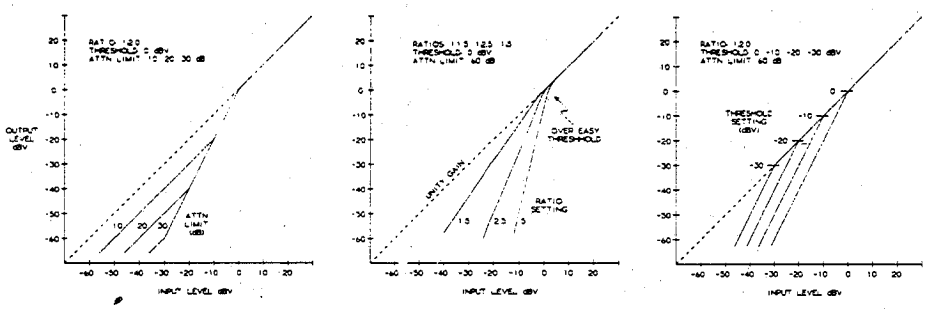
E ATTN LIMIT. Turn this knob to set a limit on the maximum attenuation performed by the 904. At "60 dB" the attenuation is greatest, being at least 60 dB (typically it is somewhat more, owing to the design of the circuit; it is limited essentially by the noise of the input signal). At "0 dB" there is no attenuation and the 904 is effectively bypassed.

F RATIO. This knob, too, controls the amount of attenuation of signals below threshold, except that it does so according to the amount they are below it. The control varies from 1.5 to 5 the ratio of output level (attenuated) to input level below threshold; if the signal is 5 dB below threshold and the knob is turned to 3, it gets expanded downward to -15 dB (3 x 5). Its action is most audible for signals just under threshold; attenuating a -35-dB signal to -70 dB (RATIO setting of 2) is not as noticeable as attenuating a signal 10 dB below threshold to -20 dB (also a setting of 2). Naturally, settings around 1.5 sound relatively mild and settings up toward 5 sound relatively dramatic.

G THRESHOLD. This knob sets the level below which a signal is attenuated or expanded downward. With a range from -40 to +10 dB, this control determines when and how often the 904 will work. Ideally, for noise-gating it should be set such that only wanted signal is above the threshold, and below it is only unwanted signal or noise.



H ATTACK and RELease knobs, FAST to SLOW. These control, respectively, the speed at which the 904 comes out of attenuation ("unattenuates") and the speed at which it attenuates in the first place.

ATTACK, in other words, is audio attack, and applies to the signal you hear as the 904 comes out of its noise-gating mode. Since it determines how quickly the signal returns as the 904 comes out of attenuation, it enables you to control the opening sound of an instrument. RELease is the opposite, governing the audio release as the 904 goes into the noise-gating mode, making the signal die away. With it you control how quickly (or slowly) the 904 attenuates, and how dry (for example) the reverberant tail of the sound is.

Experiment with these knobs. Faster settings may sound annoyingly sudden in some situations, but too slow can sometimes be too smooth. As always, it depends on your goals.

HOOKUP (see facing page)

AUDIO (A+,A-)/KEY (C+,C-) INPUT

Terminating resistors generally are not needed in the 904's audio input for proper operation, but they may be required if the input is fed from devices (e.g., passive equalizers) designed for a specified load. The 904 has an input impedance of 25 k-ohms balanced or 18.5 k-ohms unbalanced for Audio and 250 k-ohms balanced or 185 k-ohms unbalanced for Key. These make it suitable for use with virtually any nominal source impedance, low or high.

Balanced Lines. Connect the signal leads to the A+ and A- (PC fingers 12 and 13) or the C+ and C- (fingers 8 and 7) terminals of the 900 series mainframe. If hum develops, try attaching the shield to the ⏚ connection at the 904 input.

Unbalanced lines. Wire the hot lead to the A+ or C+ terminal and the shield to the A- or C- terminal. If hum develops, try connecting a jumper between the A-/C- and the 904's input ground.

Reversing the input wires to the + and - terminals will, of course, result in the 904 output signal's being out of phase (180°) with the input.

For maximum hum rejection, avoid common grounding through cable shields at the 904's input and output. The best starting point is to ground the input-cable shield at the source unit (leave it unconnected to the 904) and then ground the output-cable shield to the ground terminal of the 904 (leave it unconnected at the receiving unit). One shield end must be connected to something, in other words. Additionally, each unit should be individually grounded to the studio common system ground. (In the case of the dbx 900 series, just ground the mainframe.)

AUDIO OUTPUT (B+,B-)

The output of the 904 is designed to feed balanced or unbalanced loads greater than or equal to 600 ohms. The stage is single-ended; in normal operation the B- terminal (PC finger 15) is connected internally to ground (finger 11). When the unit is bypassed, the signal inputs are connected directly to the signal outputs, A+ to B+ and A- to B-, and the internal jumper between B- and ⏚ is removed.

Note that switching the 904 IN and Out ought to make no noise in the signal path, although, depending on the amount of program attenuation, going back and forth between processed and unprocessed signal may reveal a difference in level. If a pop is heard, there probably is a grounding problem in the signal-processing system, and you should implement some of the suggestions given in this section. (To be sure, there's a chance you have dc-offset problems from other gear, which won't be helped by proper grounding.) If the noise persists, try connecting a jumper between B- and ⏚. This should cure the popping -- but the signal will now be unbalanced in the Out (bypass) mode.

CONTROL-VOLTAGE INPUT (D-)

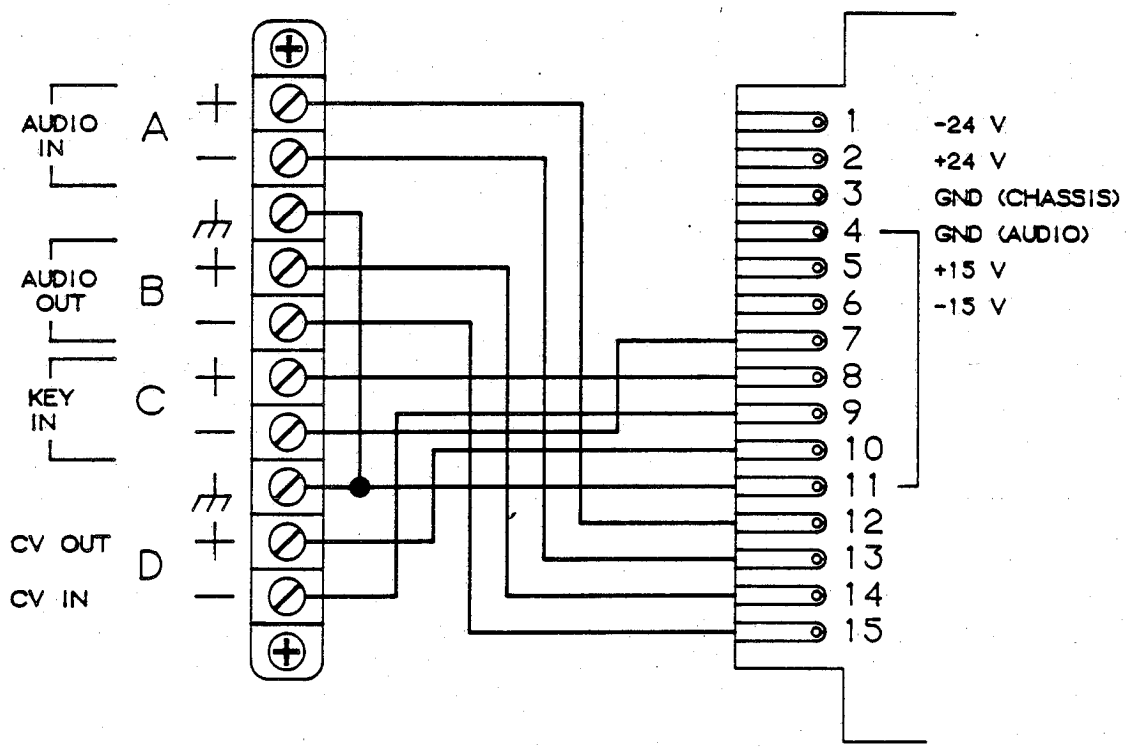
The CV input and output connections come jumpered together (normal operation), so to use the CV input, the jumper (Y1, white) must be removed. It lies next to the upper-right-hand corner of the silver

VCA module on the 904's main PCB, two inches in from the card-edge connector's finger 2. The CV input provides direct access to the port of the Blackmer VCA that controls 904 gain, which means the user has a variety of dc-control options.

The control characteristic of the VCA is a convenient -50 mV/dB (-20 dB/V). The VCA provides linear-gain tracking in dB from -100 to +40 with 1% accuracy (i.e., a maximum of 1 dB of deviation per 100 dB of gain change). An input of 0 V produces no (0 dB) gain through the VCA; for example, +500 mV causes -10 dB and -500 mV causes +10 dB. The input impedance of the control port is 650 ohms, and it should be driven by an op amp or other low-impedance source. Rarely, a bypass capacitor may be required between the CV input (PC finger 9) and ground, to prevent the audio signal from leaking into the control port and causing modulation distortion. It should be unnecessary if the source is low-impedance.

CONTROL-VOLTAGE OUTPUT (D+)

The voltage at this pin (CV) changes in proportion to the gain change the 904 produces. The relationship can be expressed as CV = -50 mV/dB gain change. The CV output (PC finger 10) is low-impedance and capable of driving bridging loads of more than 10 k-ohms and less than 0.01 µF.



In custom installations, these edge connectors may be used:

SAC 155/2-2 (Stanford Applied Engineering, 340 Main Ave., Santa Clara, CA 95050);

Jones 50-15EE-10 (Cinch Connectors, 1501 Morse Ave., Elk Grove Village, IL 60007);

or Amphenol 143-015-07 (Bunker-Ramo, Amphenol Sales Division, 2875 S. 25th Ave., Broadview, IL 60153).

APPLICATIONS and USAGE NOTES (also see FRONT PANEL)

Noise reduction and the like

The basic purpose of a unit like the dbx 904 is to remove unwanted background sounds in the spaces between desired foreground sounds. Note that there has to be some real level distance between the unwanted and wanted material — at least a few dB — in order for the 904 to "get its foot in the door." If levels are too much the same (because of compression, for example), the downward-expansion efforts of the unit will go for naught. Therefore, use the 904 before any compressors.

For example, a 904 can be used to prevent or reduce leakage among microphones in live-sound reinforcement and during panel discussions. Placing a unit on each mike and setting its THRESHOLD below the level of the music or speech will achieve this. Similarly, broadcasters can employ 904s to tighten land-line feeds or noisy ENG audio, gating out low-level trash on the lines by having a unit set as just discussed on the output from the feed or ENG equipment.

Or let's suppose that during a remote interview, wind or air conditioning is creating noise. It's audible if you concentrate, but, because of the ear's ability to select and/or ignore certain sounds -- to act as a gate, in a sense -- it's not noticeable otherwise. Moderate 904 attenuation will keep the noise during pauses from being either loud or absent (loud would be obtrusive, the noise suddenly calling attention to itself; absent would sound peculiar, the noise having suddenly disappeared).

The possibilities in a recording studio are myriad. Sound engineers can clean up a buzzy drum kit, or keep a closely miked piano track from being "contaminated" by leakage from a second instrument (e.g., a drum). This potential reduction of leakage applies as well to each drum in the kit. Even the best miking technique allows some bass-drum pickup by the snare mike, and so on. By gating out such leakage, a 904 on each mike will help make it pick up only direct sound. The result is tight, close-up sound from each individual drum.

Changing sound quality

In the studio there is more to be done with 904s, of course, than just keeping out unwanted backgrounds. A second basic use for a 904 is to change sonic character. For example, if each drum has its own mike and each mike its own 904 (a not uncommon situation), by playing with the ATTACK and RELease settings you will be able to set the individual "feel" of each drum and thus of the kit as a whole.

Beyond this, the 904 can be employed generally to reduce or otherwise alter the quality of instrumental ambience, reverberation, and/or attack. As the sound decays after an instrument stops playing, the amplitude of its reverberation passes through the 904's THRESHOLD setting, below which it may be made to die out more quickly or less quickly (in any case faster than the original). You most likely will want to leave some tail to the sound; to determine how much, experiment.

If you set the 904 to expand downward both fast and by a large amount such that it acts while the note is still actually sounding (fading, perhaps), the latter part of the note may sound choppy. This is inevitable with gates; it depends on the THRESHOLD setting. If such a THRESHOLD setting is needed, try slowing the release rate and reducing the RATIO setting.

Generally, when the dryness of gating is called for, use the fastest RELease tolerable short of producing a funny sound. Similarly for ATTACK settings, especially with instruments that themselves have fast attacks (such as percussion): use the fastest that sounds okay -- or be content with altering the opening crispness. Note that too fast an attack can create clicks (as on a bass-drum track). Sometimes these may be desirable, but when they're not, try a slower setting. (One's tendency is the opposite.)

After a little practice with the RATIO control, you'll be able to tighten up in a judicious and pleasing way the ambience of virtually any instrument in a multi-miked situation. It helps that the downward expansion is governed by the dbx Over Easy circuit, ensuring the smoothest possible transitions.

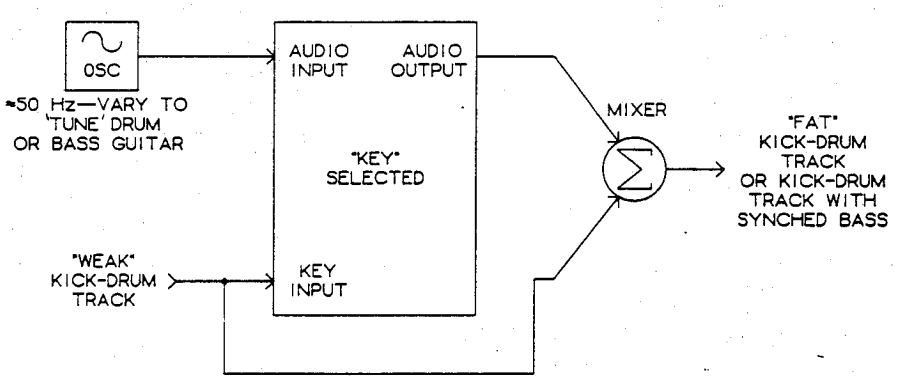
Quick setup procedure

An initial run-through might go as follows: 1) set RATIO and ATTN to maximum and ATTACK and RELease to their fastest; 2) play the track; 3) set THRESHOLD for the proper cutoff point (don't worry if the track sounds choppy now); 4) use RATIO to achieve the desired rate of signal "drop-away" (this should reduce any choppiness); 5) use ATTACK and RELease to establish the desired envelope of the signal (this also sets the amount of choppiness that's audible); 6) use ATTN to set the desired amount of noise suppression.

Now that we've tried to start you thinking about your own specific uses, let's take a repeat look at the front panel.

PLM. This is useful for squelching noise (e.g., a guitarist's tuneup, or coughing) until some desired event occurs (e.g., the guitar solo starts), at which time the gate opens up (unlatches) and stays open (even through pauses in the solo). Studios without automation clearly will find this attractive, for it can eliminate the need for shoving faders up and down or unmuting channels during mixdown. Just set the correct channel level and the 904 will keep it muted until the solo begins.

KEY. Among other things, this allows you to control the gating of one signal by another (the KEY one), permitting perfectly in-synch playing and overdubbing among individual instruments or precise sonic augmentation ("fattening") of a weak solo. An example of the former would be synchronizing bass guitar and drum; an example of the latter would be using the drum signal to key an oscillator which is set at an appropriate frequency to "tune" and "punch up" the drum sound. (See below.) As noted, in all cases the ATTACK and RELease controls are very helpful for determining the sound of the final product.



For conventional gating, the PLM and KEY buttons are out.

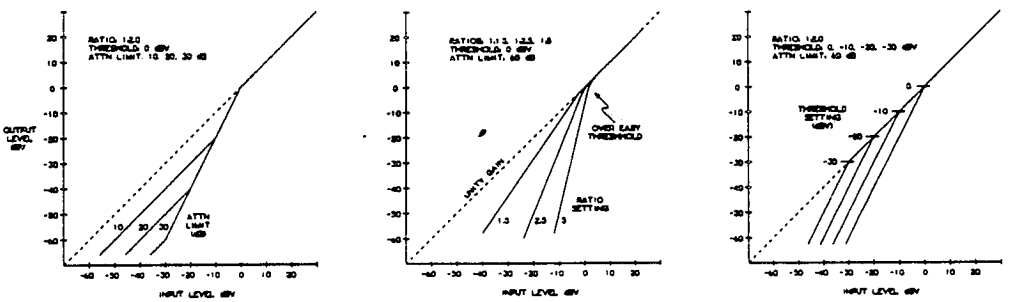
ATTN LIMIT. This is useful if you don't have total control over the signal and the input level and/or you don't want to attenuate the signal severely and make it sound unnatural or dead. It permits much gentler effects to be achieved. As suggested, try damping the reverb of a note or chord in various amounts so you can sense the effect; fine-tune the sonic tail down perhaps 6-8 dB and see how it suits you. Full gating (greater than 60 dB of attenuation) often sounds too dry to be believable. This control is especially useful in damping a particular track's reverberance/ambience.

The ATTN LIMIT knob, by the way, is the last circuit element in the CV-processing path (see the block diagram). It is therefore best set after everything else is adjusted. If you start with the limit at maximum (60 dB nominal), it is easier to hear the effects of the other controls.

As noted, the actual amount that the signal is attenuated is a function of both the THRESHOLD setting and the RATIO control. The amount of attenuation can be readily calculated by determining how far the signal is below the threshold and what the actual ratio is: for example, if the signal is 10 dB below THRESHOLD setting and the ratio is 5, then the signal will be attenuated 50 dB (unless the attenuation has been limited).

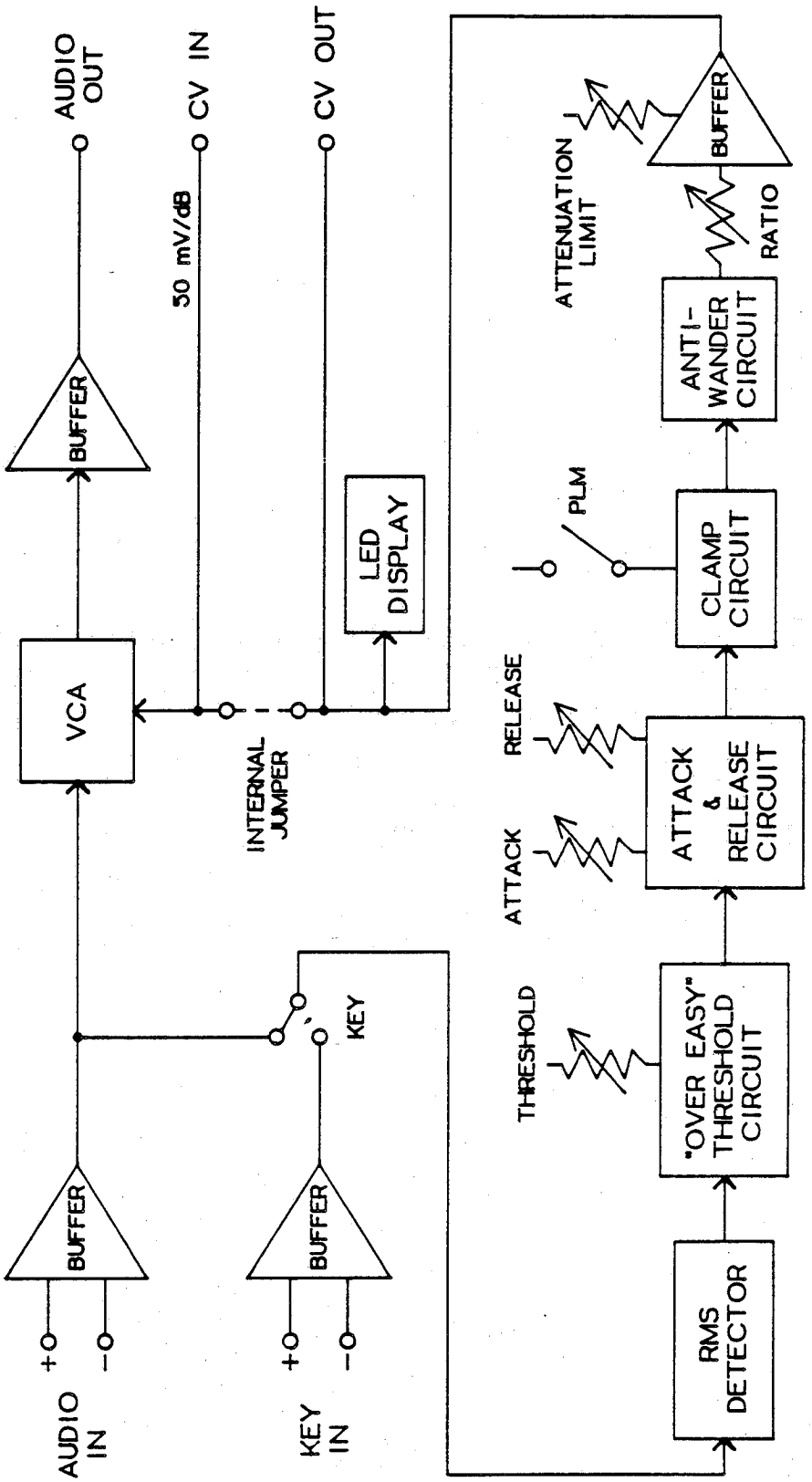
RATIO. To repeat, a mild setting (low ratios) typically will do for reverb control and general dynamic-range expansion — subtle effects, to be achieved by altering a signal's dynamics through downward expansion. Low ratios also are good when the distance between the signal and the noise is little and you don't want the signal "torn up" as it crosses the threshold. When the signal ends sharply or there is a lot of S/N distance, high ratios are possible without harming (tearing up) the sound. Again, particularly when combined with high attenuation, high ratios are appropriate for tightening percussion sound (for example) and eliminating background noise. This essentially turns off all signal during quiet parts.

These figures are duplicated here to help clarify the variables governed by the three controls.

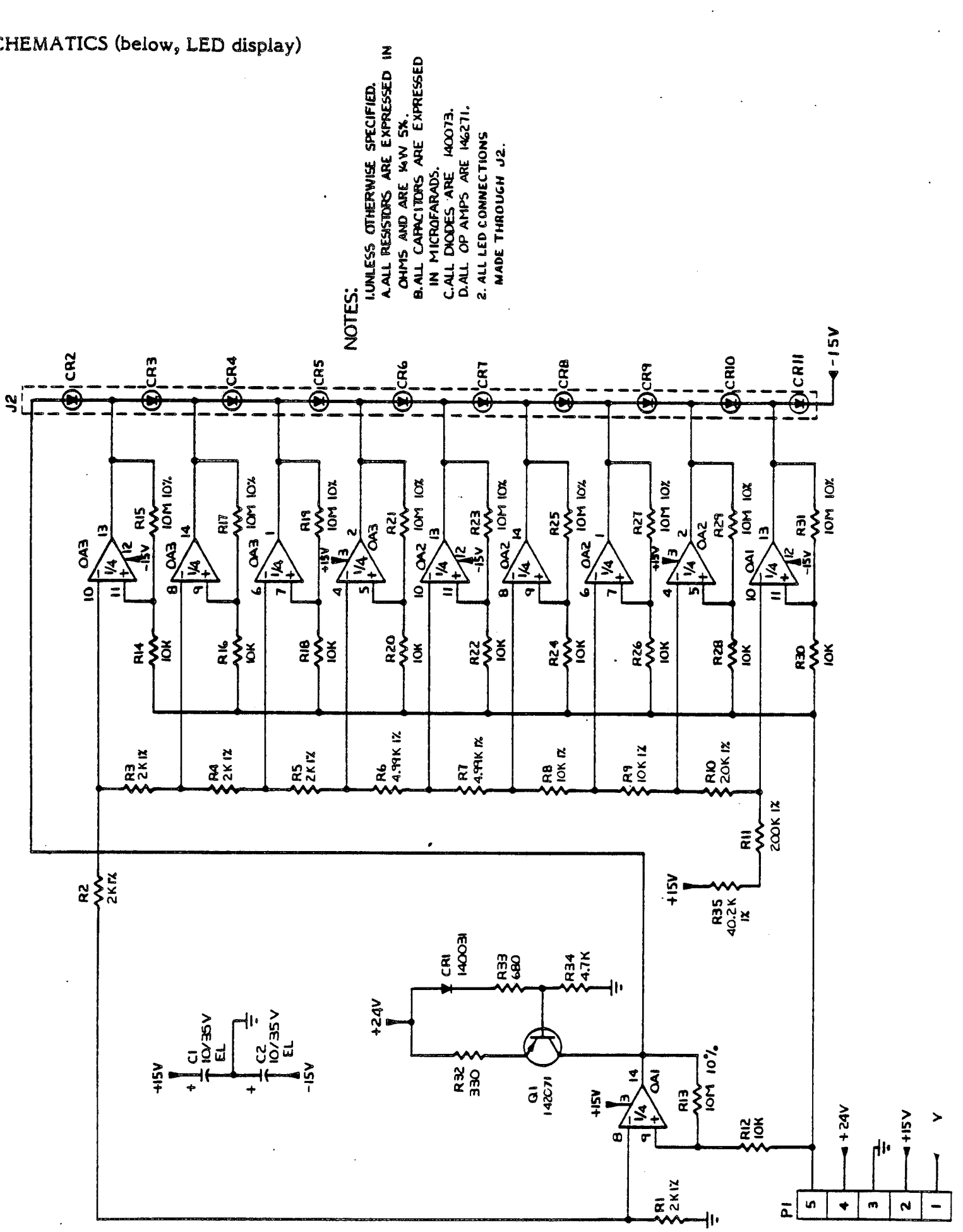


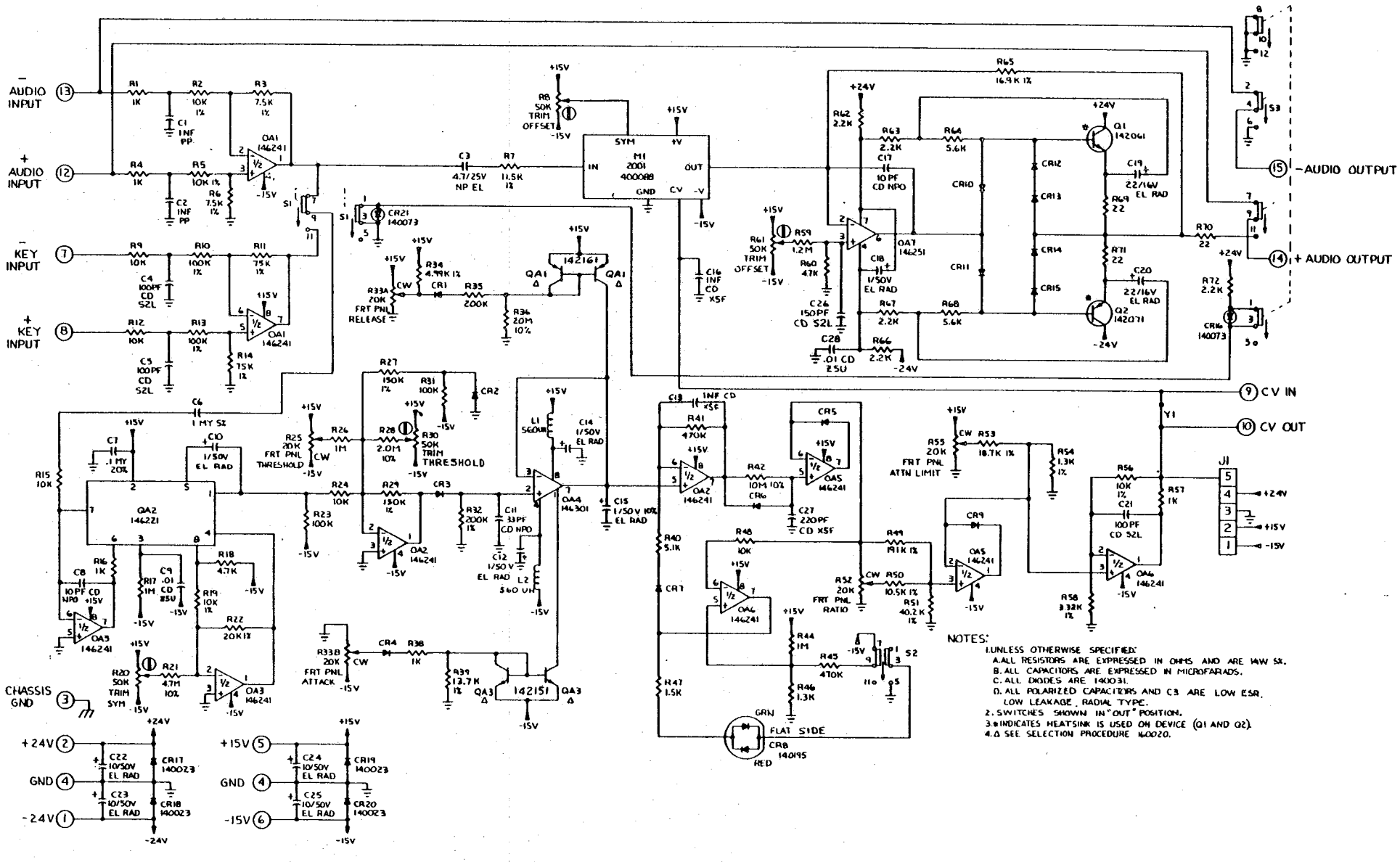
ATTACK. Since this determines the speed at which a signal returns to normal after being attenuated, a fast setting lets the natural attack of virtually any signal pass through unaltered, and slower ones control the initial transient for those applications where smoothness is called for. Likewise RELease, which determines the speed of the 904's attenuation: faster settings on percussive (or similar) sounds gate out background noises, and slower settings provide smoother transitions for signals with long decay.

BLOCK DIAGRAM



SCHEMATICS (below, LED display)





Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,789,143; 4,101,849; 4,097,767. Other patents pending.

WARRANTY and FACTORY SERVICE

All dbx products are covered by a limited warranty; for details, consult your warranty/registration card or your dealer.

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

dbx Inc.
71 Chapel St.
Box 100C
Newton, Mass. 02195 USA

Attn: Customer Service

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

Should it become necessary to have your equipment serviced at the factory:

1) Repack the unit, including a note with a description of the problem and the date of purchase.

2) Send the unit freight prepaid to:

CARILLON TECHNOLOGY INC.
136 WOLFE RD.
SUNNYVALE, CA. 94086

Attn: Repairs

(Continue to send inquiries to the Customer Service Dept., however.)

3) We strongly recommend that you insure the package and send it by United Parcel Service.

If you live outside the USA, contact the nearest dbx dealer for the address of the nearest authorized repair center.