dbx

Model 163X

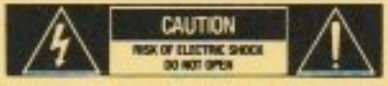
OverEasy
Compressor/Limiter

Instruction Manual

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.

INSPECTION and INSTALLATION

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

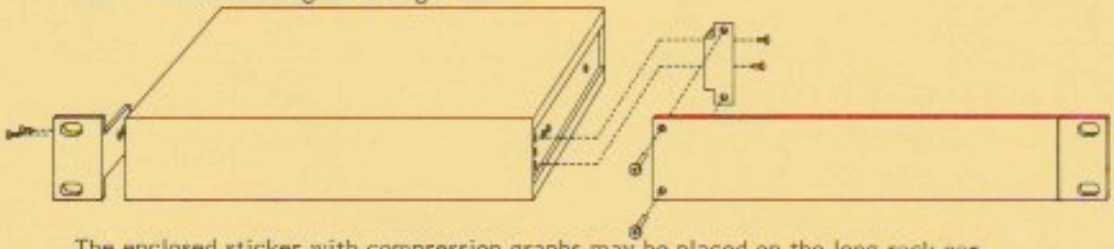
It's a good idea in any case to save the carton and packing should you ever need to ship the unit.

In the event of initial problems, contact your dealer first; your unit was thoroughly inspected and tested at the factory.

The carton should contain this owner's manual, a 163X, of course, and a warranty/registration card. Please fill the card out and send it to us. The carton also should contain hardware for rack-mounting both a single unit (screws, a long [half-rack-width] ear, a small L-bracket, and a short rack ear) and two units together (side plates along with a screwdriven joiner). See below.

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

Here's rack-mounting for a single unit:

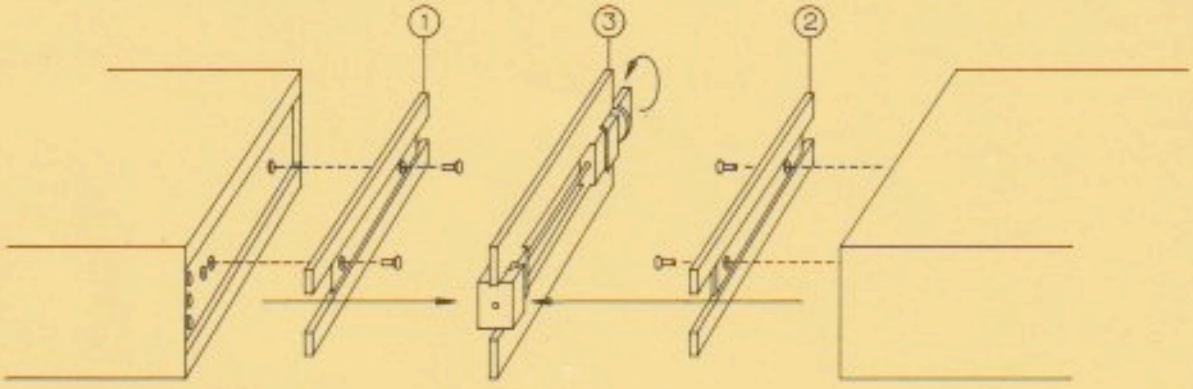


The enclosed sticker with compression graphs may be placed on the long rack ear.

Here's rack-mounting for a pair of 163Xes:

1 & 2) Attach side panels;

3) Bring units together, lining up the side panels with the screw-joiner catches, and then gently tighten the screw to close the catches.



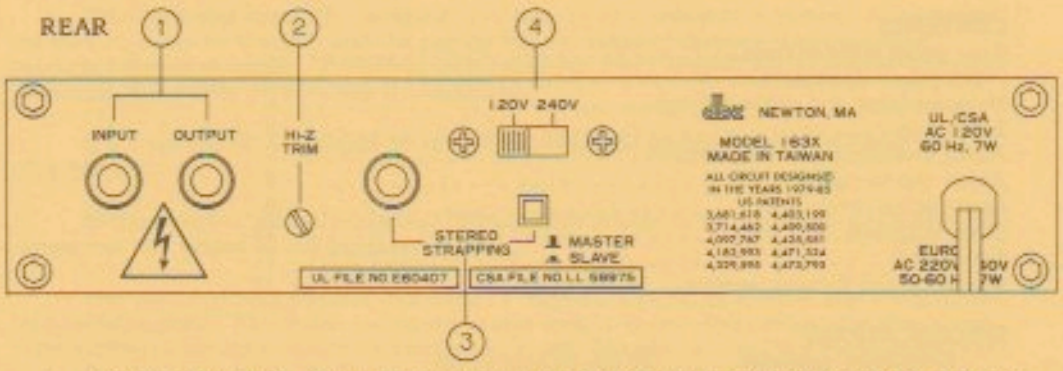
CONTENTS

SPECIFICATIONS

Frequency response	20 Hz-20 kHz ±1 dB
THD	0.2%
Equivalent input noise	-85 dBv unweighted
Maximum input	18 dBv to soft clipping
Maximum output	18 dBv into 600 ohms
Input impedance	391 k-ohms, single-ended
Output impedance	22 ohms, single-ended (designed to drive 600 ohms or greater)
Operating level	-30 to +10 dBv
Threshold range	Same
Gain	0 to 30 dB, automatic, depending on control settings; additional 0 to 20 dB, adjustable, instrument input
Maximum compression	Greater than 50 dB
Attack times	Program-dependent: 15 ms for 10 dB, 5 ms for 20 dB, 3 ms for 30 dB
Release times	Program-dependent: 0-400 ms

Notes

1) Specifications are subject to change.
2) All voltages are rms (root-mean-square).
3) 0 dBv is defined as 0.775 V regardless of load impedance. Subtract 2.2 from the dBv figure to convert to dBV (i.e., referred to 1 V). When the load impedance is 600 ohms, this particular dBv is also known as "dBm."
4) Noise figures are for 20 Hz-20 kHz.
5) Measured in the infinite-compression region of the dbx OverEasy curve, attack time is the time required to reduce the signal by 63% of the level increase above threshold, while release time is the time required to restore gain to 90% of the level decrease below threshold.



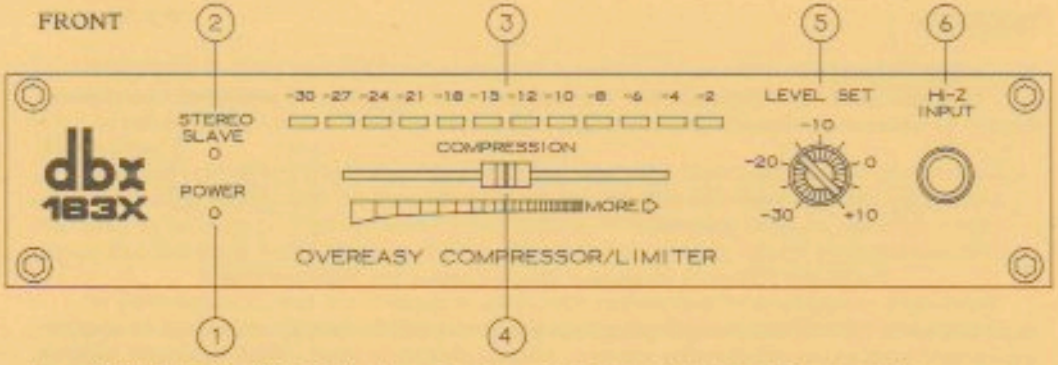
1 INPUT, OUTPUT. These jacks are for a line-level input and ouput and are the standard 2-circuit ("mono") 1/4" phone type, where the tip carries the signal and the sleeve carries the ground.

2 Hi-Z trim. This screwdriver control sets the gain of the preamp for the Hi-Z input only (see front panel). The gain is set at the factory at +20 dB (all the way right, or clockwise) and shouldn't be changed unless your instrument's output is very hot. All the way left (ccw) is unity (0 dB) gain.

3 STEREO STRAPPING jack and button. Connect this jack to the same jack on another 163X and you have a true rms-detecting stereo compressor/limiter. See pp. 6 and 9. This jack is a 1/4" 3-circuit ("stereo") phone type (tip, ring, sleeve). Use 3-circuit plugs and cables only; anything else won't work. Disconnect for independent (dual-mono) operation.

The Master/Slave button selects which unit controls the other. Note that you must leave it out, at Master, for normal (non-stereo) operation as well as for stereo operation as a Master. Pushing it in, to Slave (the front-panel LED will light), deactivates the controls and forces the unit to obey the Master's settings when a second 163X is properly connected and switched. (If you push it in when no Master is connected, it's a bypass switch for the compressor only; the preamp still works.)

4 VOLTAGE SWITCH. This must be properly set for your ac voltage; be sure to check before plugging in and powering up. For 220 V operation you will need a suitable adaptor plug.



1 POWER LED. This indicates when the unit is connected to a live ac outlet.

2 STEREO SLAVE LED. See previous page; this indicates that the unit has been set by its rear switch to be the Slave in a connected pair of 163Xes.

3 GAIN REDUCTION LEDs. These 12 LEDs show in dB how much the signal is being compressed.

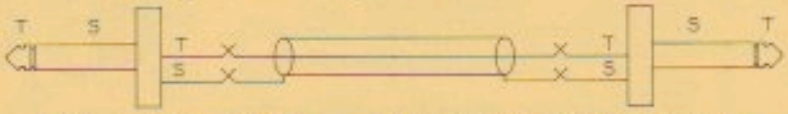
4 COMPRESSION slider. Moving this to the right (MORE) increases the amount of compression -- compressing more of the signal sent to it (the compression "reaches down" to lower levels) as well as compressing the signals more (the compression ratio for any given signal level gets higher). We'll discuss this in detail presently.

5 LEVEL SET. This thumb knob sets the operating (output) level that the 163X will always "aim toward" as compression is increased; the circuit automatically adjusts the gain to maintain a constant output.

6 Hi-Z input jack. This connects to the 163X's low-noise FET preamp. The gain is such that virtually all low-level instruments can be plugged in directly -- guitars, basses, keyboards, even some high-impedance mikes. As explained, there's a gain trim on the rear for very hot instruments (likely to be useful with some synthesizers, etc.). Note that this jack overrides the rear line-level input.

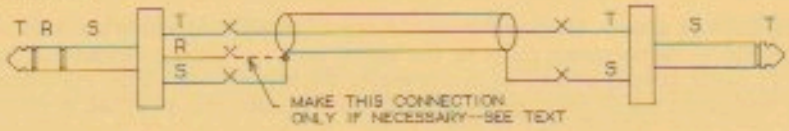
Inputs and Outputs

The line-level inputs and outputs are single-ended (unbalanced) and should be connected to other such equipment with single-conductor shielded cable, as shown here.



2-Circuit ("Mono") Plugs and Single-Conductor Shielded Cable

This will work fine for balanced inputs, too, but if the 163X input is connected to source equipment with balanced outputs, the next hookup should be used. Most balanced sources will work without the dotted connection between the ring (-) output and the sleeve (the ground — this is true for "active-balanced" and "ground-referenced" outputs). This floating condition unbalances a balanced source, which is usually okay. However, some sources require the dotted connection, e.g., "transformer-isolated" balanced outputs. We recommend making the connection only if necessary for your installation, because some active balanced and ground-referenced outputs may be damaged by doing so. Consult the owner's manual.



Balanced Outputs and the 163X Line Inputs

The Hi-Z (instrument) input is single-ended (unbalanced) also and should be connected to instrument outputs with single-conductor shielded cable as shown at the top of the page for line-level jacks.

SETTING UP

The 163X is dbx's simplest and easiest-to-operate compressor. For most applications, one slider does everything. But there's more to the unit than this, of course.

Which Input?

Use the rear-panel (line) input in recording when the instrument to be compressed is already preamplified, such as through a direct box or console. Synthesizers sometimes can plug in here, too. And of course when mixing or submixing (e.g., to open up track space in a crowded tape), the signal from the deck (or console/mixer) goes here as well.

In performance, this input again is useful for connection to synthesizer high-level outputs or line-level outputs of guitar and bass preamps (before the feed to the power amp).

Use the front-panel Hi-Z input in the studio for adding quick (direct-input) overdubs and for the convenience of carrying the guitar or bass into the control room (no hassle of lugging an amp). In performance, any instrument can plug directly into this input (synths included), as well as many high-impedance microphones.

Setup: the LEVEL SET control

For best operation, the 163X should be reset for your application each time it's used in a different studio or with a different set of performance gear. "Setting it up" consists of adjusting the LEVEL SET thumb knob to the level that suits the gear around it. This lets the 163X figure out how much gain to add to your sound.

1) Play your instrument (or the track to be compressed) at a typical, moderate level through the 163X with the slider all the way left. Concentrate on how loud it sounds.

2) Move the slider all the way right and play the same way again (or play the same passage from the tape). Again, listen to how loud it sounds.

3) Now adjust the level by turning the LEVEL SET knob so the volume with the slider right is the same as with it left.

4) When properly adjusted, there will be little difference in level as you move the slider, but to the right, the sound will be fatter, with more sustain, evenness, and bite to the attacks.

Setup cont'd: the slider

This is the heart of the 163X. Move it to the right and more of the input signal is compressed, the compression ratio is increased, and more gain is added. That's why it's labeled MORE -- you get more effect.

In actual use, start by playing music through the 163X with the slider at the left, then gradually move it right until you hear enough compression. Remember that dbx's OverEasy compression curve keeps the music sounding natural even under extreme amounts of compression, so listen carefully to gauge the right amount.

The Hi-Z trim

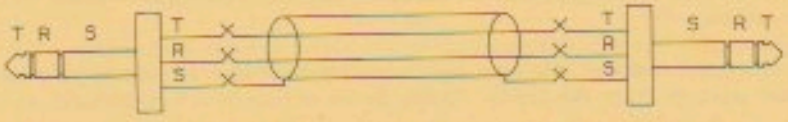
This screwdriver trim is rarely necessary in practical applications. Most of the time, then, it won't need to be adjusted. It should be reset ONLY if you hear distortion (overdriving) while using the Hi-Z input even when the slider is all the way to the right. The instrument is probably overdriving the Hi-Z input and the gain must be changed (by means of the trim).

To adjust it, play your instrument through the 163X with the slider to the far right. Listen to the output of the 163X. Turn the Hi-Z trim down (ccw) until the distortion disappears. If distortion is still audible with the trim all the way down, the problem is not in the 163X.

Stereo

True stereo compression -- as opposed to dual-mono compression, which you can achieve with two independent compressor/limiters -- is important when a stereo signal is to be compressed and its channel balance and imaging preserved. Dual-mono compression can't do this; instruments and their overtones wander or, worse, jump around, because the two channels can have different gains at different times (imagine someone fiddling with the balance control while you're listening!). As mentioned, two 163Xes properly connected will give you true rms stereo-tracking compression; your sound and your mixes will readily show the benefits. Also see p. 9.

Use this mode whenever imaging must remain stable. A cable as shown below is what's needed to link two 163Xes. It is 2-conductor shielded (3-wire) with standard 1/4" tip/ring/sleeve phone plugs at the ends. Shielding is essential, and keep the cable short, too, to minimize hum pickup. Don't use mono cable or plugs (tip/sleeve) lest you damage the rms detectors.



3-Circuit ("Stereo") Plugs and Dual-Conductor Shielded Cable

Don't fail to disconnect the units from ac power when hooking up a stereo pair of 163Xes; you'll avoid a potentially loud (and damaging) pop.

Also see the assembly drawing at the bottom of the inside front cover.

After you've decided which unit is the Slave by pressing in the rear button, the yellow LED on the front will light. As explained in the section on the rear panel, the Slave controls will have no effect and the LED bar graph will be blank since the amount of compression is exactly the same for both Master and Slave. When you want to have two independent compressors, you have to remove the strapping cable and leave both Master buttons out.

ABOUT COMPRESSION

General

The primary purpose of a compressor is to reduce the dynamic range of a program and give you control over its dynamics, from gentle taming of overall levels to limiting of peaks to squashing all dynamics. Control is the key idea.

Another major use for compressors is to add punch to flabby, loose sounds. A compressor can do this by making the level of an instrument or a sound more consistent, or by reducing the volume of the body of a note, which comparatively accentuates the leading edge (the transient attack).

Still another use is to increase the "sustain" of instruments, especially bass guitars, by raising the volume of low-level trailing edges of notes, which gives a more solid presence to the instrument. It also makes the note-by-note volume more even.

A compressor does all this by changing its gain in response to the signal. When the input is low in level, the compressor gain remains fixed, usually at 0 dB (unity gain) or greater. When the input increases above the threshold of compression, the gain begins to decrease. For very large inputs, the gain can decrease considerably.

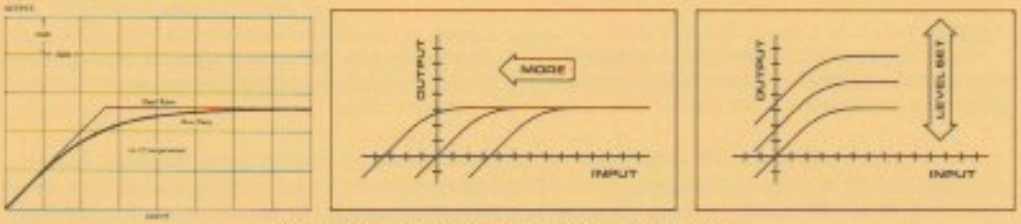
In the 163X, the gain of low-level signals can be as great as 60 dB, depending on the settings of the MORE and LEVEL SET controls. As signals get larger, the gain will decrease; at least 40 dB of range is available for this gain decrease.

The slider allows you to determine how much of the signal you want to compress. Severe compression will result at the far-right settings; gentle (or no) compression will be produced by leftward settings. Experiment to familiarize yourself with the different sounds available. Educate your ear -- and then use it to guide you.

Here are some slider examples for getting started:

> Leftward settings, which gently reduce the overall dynamic range of a program, are useful for compression of overall mixes and to provide a safety net for PA systems, since high compression ratios will be triggered only if signals get really high.
>
> Moderate settings, which affect overall dynamics, are often good for smoothing out bass guitar and vocals. Typically they're used during mixdowns.
>
> Higher settings will provide leveling for instruments and vocals. These are most useful for this effect, and will fatten kick drums, increase sustain, and generally squash the program. High settings can sound unnatural, so be sure to listen closely. Fortunately, the 163X's OverEasy circuit prevents extreme compression from sounding too unnatural; the ratio changes gradually from 1:1 (no compression) to Infinity:1 (full compression). See the next page.

ABOUT THE CIRCUIT



Compression and Control Characteristics

The 163X is a special type of compressor: it combines several features into a versatile, easy-to-use unit that's helpful for a wide variety of situations but is quick to adjust and set up. We made it sophisticated on the inside so it could be friendly and simple on the outside. The first figure above shows the OverEasy compression curve compared with the so-called hard-knee behavior of other compressors, ranging from none (the leftward side of the graph, where input and output are the same) to infinite compression (the right side, where output is the same no matter what the input). This incredible range means that as signal levels increase the output level increases toward a certain maximum but (except for short transients) will NEVER go above it no matter how much signal is put in.

With dbx's OverEasy characteristic, every possible ratio* is available, from 1:1 to Infinity:1, selected by the signal level itself.

To allow user control over the amount of compression, the OverEasy curve may be moved to the left and right by the slider. When the control is moved to the right, the curve moves left (see the center graph) and more of the input signal is compressed. Consider any specific input level: when the curve moves to the left, the input lies closer to the (right-hand) flat part of the OverEasy curve, where the compression ratio is the highest.

Actually, the slider varies the threshold of compression, the point above which signals begin to be compressed. More compression results from lower threshold settings. The 163X is especially useful because the OverEasy characteristic simultaneously provides every compression ratio, so varying the threshold causes the ratio to vary automatically -- in just the way you'd want.

You may have noticed that as the slider is moved, the part of the center figure showing 1:1 compression (the part to the left) moves, too. The slope (steepness) of the line doesn't change, but the movement indicates that as more compression is set, more gain is dialed in as well. The LEVEL SET knob is used to set the amount of this extra gain, as shown in the third graph.

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*For the technically minded, compression ratio is the change in input level divided by the change that will result in output. When the output change equals the input change, the compression ratio is 1:1; when the output changes 1 dB for every 2 dB of input change, the ratio is 2:1; and when the output remains constant irrespective of the change in input, the ratio is Infinity:1. In other words, it's the change in input level required to produce a 1-dB change in output level.

APPLICATIONS

Here are some of our favorite applications. Don't be afraid to experiment, though; you'll probably find lots more uses as you become familiar with the unit.

Smoothing out bass guitar

Bass lines often are inconsistent in level and lack the sustain needed to give a solid bottom end. Set the MORE slider so that peaks cause 10-12 dB compression. Use more for increased sustain and for more percussive attack on the transients.

Fattening kick drums

Weak, flabby kick drums often have too much boom and not enough slap. Tighten them up by setting the slider for 15 dB of compression on the peak of the kick. Because the 163X takes some time to react, this will emphasize the slap at the beginning of the note and reduce the boominess of its body.

Variations in mike levels

As the distance between vocalist and microphone changes, signal levels change. Set the slider so that average levels cause 6-8 dB compression, as indicated on the front meter. Use more for less-experienced vocalists. Ask him or her to help out by backing off on the mike a bit when going for especially loud notes.

Variations in instrument levels

To smooth out instrument levels, set the slider so that 8 or more dB compression occurs on all peaks. Be careful, however: large amounts of compression used on a mixed stereo program can become quite audible. Compression is much less noticeable if the separate tracks are compressed before mixing.

Raising the signal out of a mix

Since reducing dynamic range can increase the average signal level and meter readings, a single track can be brought up out of a mix by boosting its level slightly and applying compression. Set the slider for 4-6 dB.

Preventing PA overload

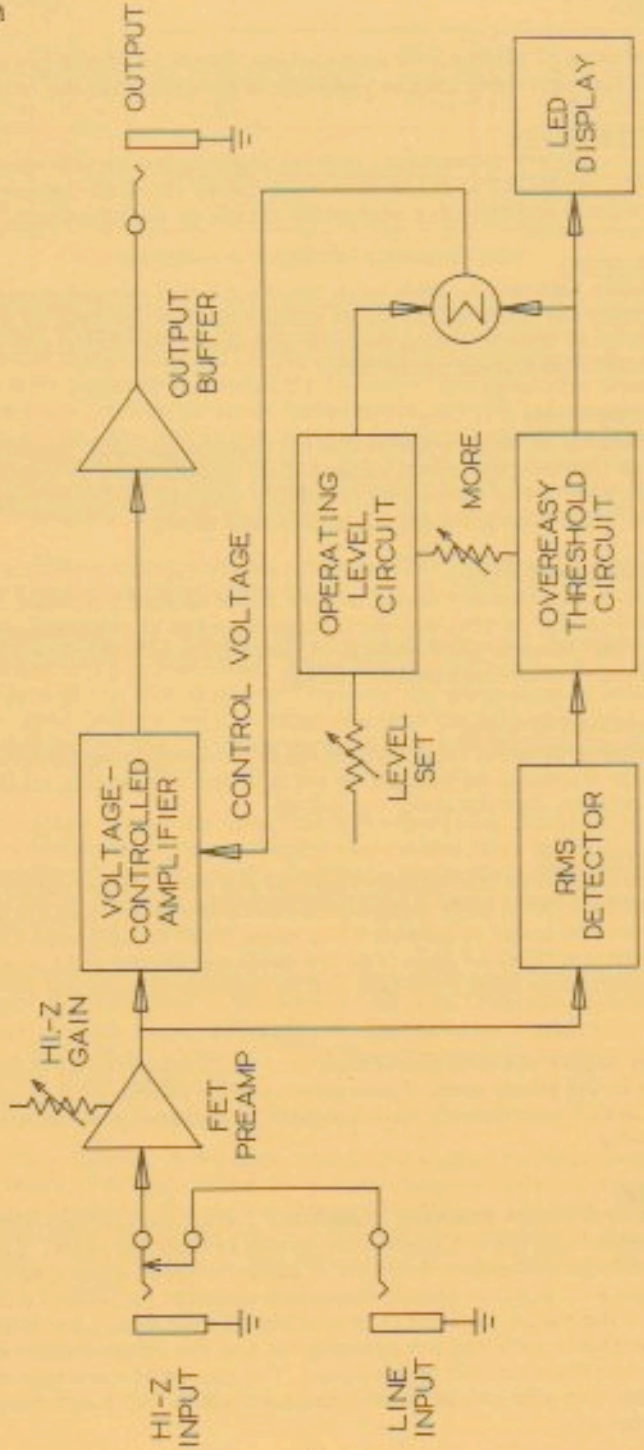
To get the benefit of the Infinity:1 part of the compression curve to prevent PA-system overload (whether you're doing auditorium disco or are just a mobile deejay for small dances), set the slider to provide 15 or more dB of compression just a few dB below the loudest levels your PA can play. For low-level signals the 163X won't change gain, but if large signals come along, the gain will be reduced to keep the PA right under its maximum.

As a rule, to give the best protection, your 163X should be as close as possible in the signal path to the power amp. For maximum SPLs (watch your ears), large sound-reinforcement systems frequently have a separate compressor on each output of the electronic crossover(s).

Stereo Strapping

As mentioned, stereo strapping is essential for all applications where two channels must be compressed and the left/right perspective remain the same. Examples include the L and R overhead mikes on a drum kit or piano, a stereo submix of a vocal ensemble, the feed from an X-Y or other pair of mikes in a classical recording, a complete stereo mix, etc. All of the earlier comments about compression apply; the difference is that when the Master/Slave switches are properly set and the stereo cable connected, the gain changes in the two channels will be identical. The signals at each rms detector are combined (so the true rms sum can be sensed) and controlled. All functions of the Master control both channels.

BLOCK DIAGRAM



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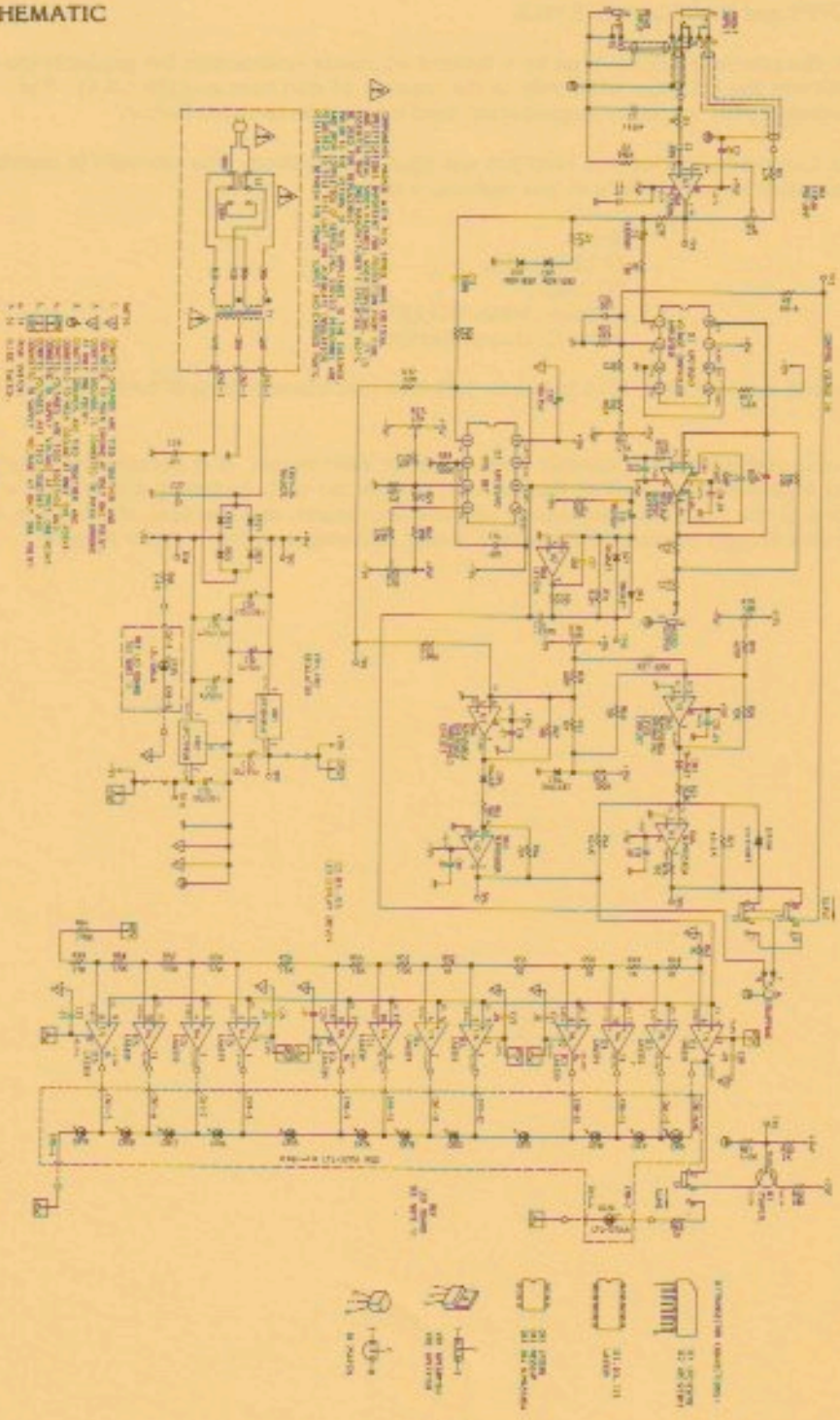

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