

# Preliminary Technical Service Manual

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## **MODEL 160/161/162**

Compressor/Limiters

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dbx Professional Products  
May 1, 1991

**dbx®**

Manufactured under one or more of the following U.S. patents: 3,377,792; 3,681,618; 3,714,462; 3,789,143; 4,097,767; 4,329,598; 4,403,199; 4,409,500; 4,425,551; 4,473,795. Other patents pending.

This dbx-branded product has been manufactured by AKG Acoustics, Inc.

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**dbx Professional Products**

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1525 Alvarado Street

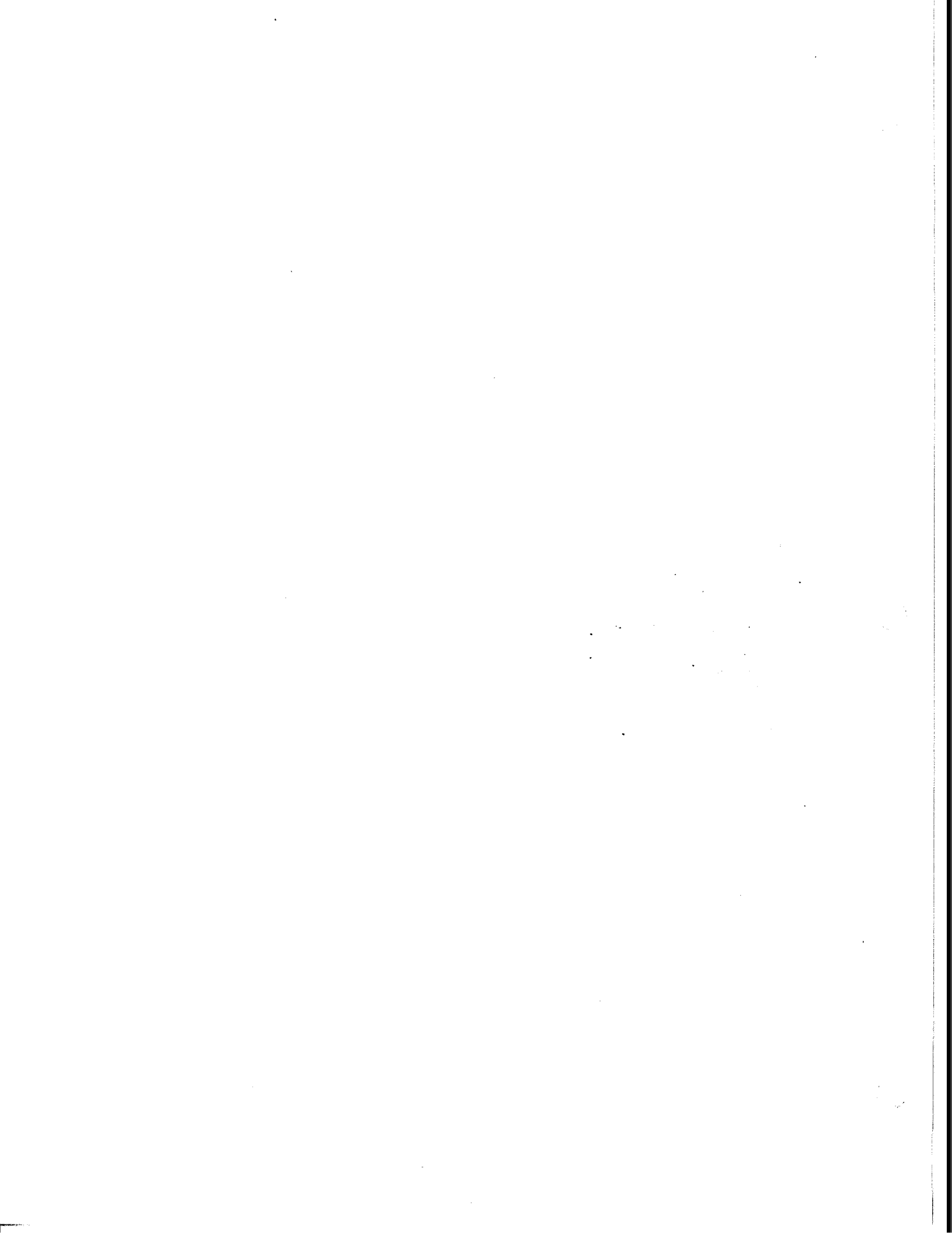
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# User/Operator Description

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# dbx 160 SERIES

compressor/limiters



## description

dbx 160 series compressor/limiters are a family of single channel devices using true rms level detection circuitry for signal sensing and highly sophisticated voltage controlled amplifiers as the control element.

While most available compressor/limiters use peak detection and fast response characteristics, their action is frequently displeasing to the ear, even at moderate compression ratios. This results from the psychoacoustic phenomenon that the ear responds not to the peaks, but to the rms value of the signal, defined as the sum of all the frequencies/energies present.

Accordingly, the dbx 160 series uses true rms sensing to most closely simulate human hearing response for the most listenable result in dynamic range signal processing.

The dbx 160 series uses feed forward control circuitry. This is markedly superior to conventional limiters which accomplish gain change through a level sensing feedback loop around a variable gain stage.

When progressively higher compression ratios are used with most limiters, the feedback loop gain increases along with a consequent increase in distortion until the point of instability (or even oscillation) is reached.

dbx 160 series limiters with feed forward circuitry eliminate noticeable distortion even at high compression ratios and are inherently stable even at infinite compression because the output signal is never "seen" at the input. The compression ratio is continuously variable from 1:1 to infinite compression.

The adjustable threshold is continuously variable from -38 dBm to +12 dBm and two LED indicator lamps show whether the unit is operating above or below threshold. The output level of the device is adjustable to 20 dB above or below standard studio line level.

The panel meter is switchable to read input level, output level or gain change over a 60 dB range. A rear panel control provides zero set at any line level between -10 dBm and +10 dBm.

The dbx 160 series offers plenty of headroom with a

maximum output of +26 dBm for Model 160 and +18 dBm for Model 161 into 10k ohm loads.

Model 160 is a professional studio product with balanced, high impedance differential input stage and balanced 25 ohm output, Jones barrier strip terminations, automatic ground loop compensation (any ground loop at the output is electronically sensed and attenuated at least 40 dB), plus built in thump and pop protection to prevent turn-on and turn-off transients from appearing at the output.

Model 161 is lower priced unit for the smaller studio or semi-professional recordist. It has unbalanced input and output, terminated in RCA type phono jacks, and lacks turn-on and turn-off transient protection.

Two Model 160 or 161 compressor/limiters may be ganged for rack mount in a 3½" panel space with addition of a Model RM-150 rack mounting kit available as an accessory. The units are electrically independent and are not strappable for stereo tracking operation.

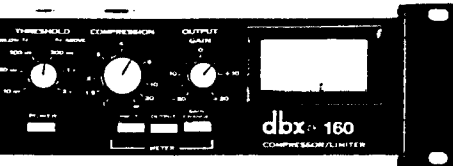
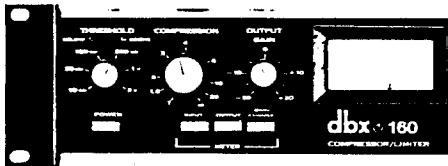
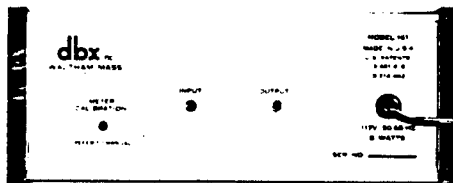
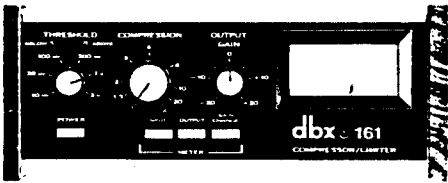
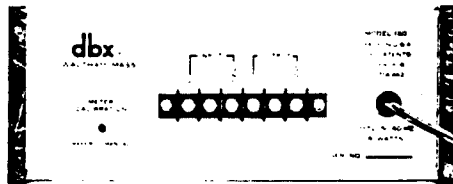
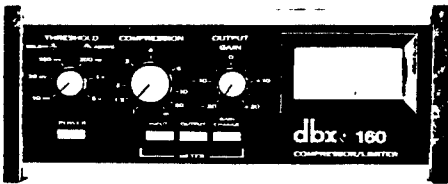
## application

The dbx Model 160 compressor/limiter offers the professional studio, broadcaster or sound reinforcement operator full signal processing capability in a small, easy to use package at a reasonable price. The dbx Model 161 makes the same professional quality and versatility available to the small studio or semi-pro recordist in a configuration designed to interface with other semi-pro or audiophile components.

In addition to compressor/limiter service, these units may also be used as metered, calibrated line amplifiers.

## features

- True rms level detection
- Compression ratio variable from 1:1 to infinity
- Threshold variable from 10 mV to 3 V
- LED above/below threshold indicators
- Low distortion at high compression ratios
- 60 dB meter range
- Wide dynamic range and low noise
- Ground loop compensated and transient protected
- Pairs can be ganged for rack mount
- Small, easily portable package



## specifications

### compression ratio

variable from 1:1 to infinite compression

### threshold

variable from 10 mV to 3 V (-38 dBm to +12 dBm)

### input impedance

Model 160 50 k ohms, balanced  
25 k ohms, unbalanced  
Model 161 25 k ohms, unbalanced

### input level

Model 160 +21 dBm max  
Model 161 +17 dBm max

### equivalent input noise

-78 dBm typical unweighted

### output impedance

Model 160 25 ohms  
Model 161 100 ohms

### output level

Model 160 +24 dBm into 600 ohms  
+26 dBm into 10k ohms  
Model 161 +16 dBm into 600 ohms  
+18 dBm into 10k ohms

### frequency response

+1 dB 30 to 20,000 Hz

### distortion

.075% 2nd harmonic at 120:1 compression and +4 dBm output  
0.5% 3rd harmonic typical at infinite compression ratio

### attack time

100 microseconds for fast signals  
5 milliseconds for slow signal changes

### release time

120 dB per second

### meter zero set

-10 dBm to +10 dBm

### controls

threshold ● compression ● output gain ● meter function switch ● meter zero adjust

### connectors

Model 160 Jones barrier terminal strip  
Model 161 RCA type phono jacks

### case

solid walnut sides, balance aluminum

### dimensions

3 3/4" H x 9 1/4" W x 10 1/2" D

### weight

5 1/4 lbs.

### power line requirements

117 VAC +10%, 50-60 Hz

### power consumption

8 watts

### warranty

dbx products are fully warranted (parts and labor) for two years from date of original purchase.

## compression ratio: a review

Compression ratio can be defined as the ratio of input change to output change for a given signal processing device. For a 2 dB input change and a 1 dB output change, the unit would have a 2:1 compression ratio. For a 20 dB input change and a 1 dB output change, the unit would have a 20:1 compression ratio (see Fig. 1). The Model 160 and 161 compressor/limiters have an adjustable threshold, or rotation point. Below this point, the unit functions as a 1:1, or unity gain device. Above the set threshold, the unit functions at the input to output ratio as selected by the front panel COMPRESSION RATIO control. The higher the compression ratio, the more severe the effective alteration of the signal being processed will be.

A 2:1 compression ratio reduces the dynamic range by a factor of one-half (Fig. 2, Curve B). At a 20:1 ratio (Curve D), severe alteration of the signal waveform occurs, reducing the maximum peak output level to only 5% of the value of the original input signal. At this high a ratio, strong alteration of the overall harmonic structure of the signal will occur, changing the timbre, or tonal color of the original input signal. While higher compression ratios can often be extremely useful, extreme care and discretion are necessary to produce a pleasing, listenable result.

FIGURE 1

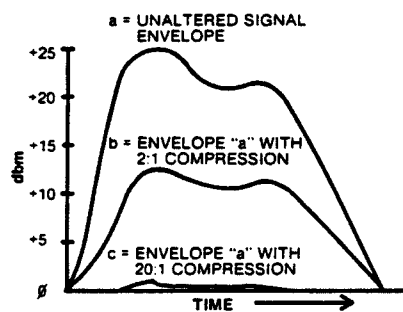
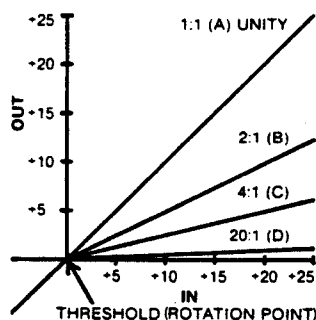


FIGURE 2





# dbx 160 single channel compressor/limiter



## description

dbx 160 series compressor/limiters are a family of single channel devices using true rms level detection circuitry for signal sensing and highly sophisticated voltage controlled amplifiers as the control element.

While most available compressor/limiters use peak detection and fast response characteristics, their action is frequently displeasing to the ear, even at moderate compression ratios. This results from the psychoacoustic phenomenon that the ear responds not to the peaks, but to the rms value of the signal, defined as the sum of all the frequencies/energies present.

Accordingly, the dbx 160 series uses true rms sensing to most closely simulate human hearing response for the most listenable result in dynamic range signal processing.

The dbx 160 series uses feed forward control circuitry. This is markedly superior to conventional limiters which accomplish gain change through a level sensing feedback loop around a variable gain stage.

When progressively higher compression ratios are used with most limiters, the feedback loop gain increases along with a consequent increase in distortion until the point of instability (or even oscillation) is reached.

dbx 160 series limiters with feed forward circuitry eliminate noticeable distortion even at high compression ratios and are inherently stable even at infinite compression because the output signal is never "seen" at the input. The compression ratio is continuously variable from 1:1 to infinite compression.

The adjustable threshold is continuously variable from -38 dBm to +12 dBm and two LED indicator lamps show whether the unit is operating above or below threshold. The output level of the device is adjustable to 20 dB above or below standard studio line level.

The panel meter is switchable to read input level, output level or gain change over a 60 dB range. A rear panel control provides zero set at any line level between -10 dBm and +10 dBm.

The dbx 160 series offers plenty of headroom with a maximum output of +26 dBm for Model 160 and +18 dBm for Model 161 into 10k ohm loads.

Model 160 is a professional studio product with balanced, high impedance differential input stage and unbalanced 25 ohm output. Jones barrier strip terminations, automatic ground loop compensation (any ground loop at the output is electronically sensed and attenuated at least 40 dB), plus built-in thump and pop protection to prevent turn-on and turn-off transients from appearing at the output.

Model 161 is a lower priced unit for the smaller studio or semi-professional recordist. It has unbalanced input and output, terminated in RCA type phono jacks, and lacks turn-on and turn-off transient protection.

Two Model 160 or 161 compressor/limiters may be ganged for rack mount in a 3½" panel space with addition of a Model RM-150 rack mounting kit available as an accessory. The units are electrically independent and are not strappable for stereo tracking operation. For applications requiring accurate tracking for two or more channels, the use of the dbx model 162 true stereo compressor/limiter is suggested.

## application

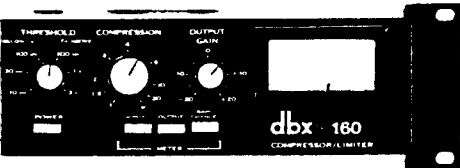
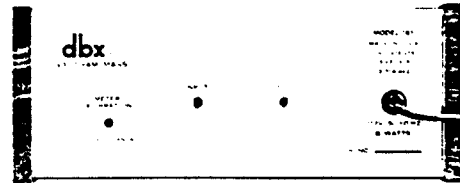
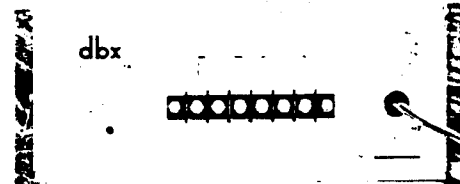
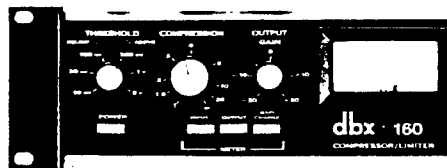
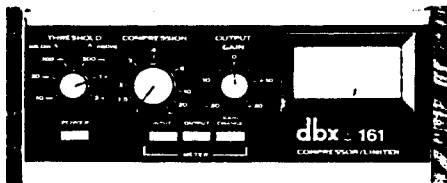
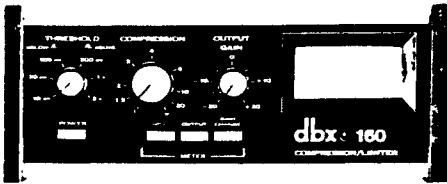
The dbx Model 160 compressor/limiter offers the professional studio, broadcaster or sound reinforcement operator full signal processing capability in a small, easy to use package at a reasonable price. The dbx Model 161 makes the same professional quality and versatility available to the small studio or semi-pro recordist in a configuration designed to interface with other semi-pro or audiophile components.

In addition to compressor/limiter service, these units may also be used as metered, calibrated line amplifiers.

## features

- True rms level detection
- Compression ratio variable from 1:1 to infinity
- Threshold variable from 10 mV to 3 V
- LED above/below threshold indicators
- Low distortion at high compression ratios
- 60 dB meter range
- Wide dynamic range and low noise
- Ground loop compensated and transient protected
- Pairs can be ganged for rack mount
- Small, easily portable package





## specifications

### compression ratio

variable from 1:1 to infinite compression

### threshold

variable from 10 mV to 3 V (-38 dBm to +12 dBm)

### input impedance

Model 160 50 k ohms, balanced  
25 k ohms, unbalanced  
Model 161 25 k ohms, unbalanced

### input level

Model 160 +21 dBm max  
Model 161 +17 dBm max

### equivalent input noise

-78 dBm typical unweighted

### output impedance

Model 160 25 ohms  
Model 161 100 ohms

### output level

Model 160 +24 dBm into 600 ohms  
+26 dBm into 10k ohms  
Model 161 +16 dBm into 600 ohms  
+18 dBm into 10k ohms

### frequency response

±1 dB 30 to 20,000 Hz

### distortion

0.075% 2nd harmonic at infinite compression at +4dBm output  
0.5% 3rd harmonic typical at infinite compression ratio

### attack time

15ms for 10dB level change above threshold  
5ms for 20dB level change  
3ms for 30dB level change (time to reduce signal by 63% of level change)

### release rate

120 dB per second

### meter zero set

-10 dBm to +10 dBm

### controls

threshold ● compression ● output gain ● meter function switch ● meter zero adjust

### connectors

Model 160 Cinch-Jones type barrier terminal strip  
Model 161 RCA type phono jacks

### case

solid walnut sides, balance aluminum

### dimensions

3 3/4" H x 9 1/4" W x 10 1/2" D  
(9.5cm x 23.5cm x 26.7cm)

### weight

5 1/4 lbs. (2.4kg)

### power line requirements

117 VAC ±10%, 50-60 Hz

### power consumption

8 watts

### warranty

dbx products are covered under a limited warranty (parts and labor) for two years from date of original purchase.

## compression ratio: a review

Compression ratio can be defined as the ratio of input change to output change for a given signal processing device. For a 2 dB input change and a 1 dB output change, the unit would have a 2:1 compression ratio. For a 20 dB input change and a 1 dB output change, the unit would have a 20:1 compression ratio (see Fig. 1). The Model 160 and 161 compressor/limiters have an adjustable threshold, or rotation point. Below this point, the unit functions as a 1:1, or unity gain device. Above the set threshold, the unit functions at the input to output ratio as selected by the front panel COMPRESSION RATIO control. The higher the compression ratio, the more severe the effective alteration of the signal being processed will be.

A 2:1 compression ratio reduces the dynamic range by a factor of one-half (Fig. 2, Curve B). At a 20:1 ratio (Curve D), severe alteration of the signal waveform occurs, reducing the maximum peak output level to only 5% of the value of the original input signal. At this high a ratio, strong alteration of the overall harmonic structure of the signal will occur, changing the timbre, or tonal color of the original input signal. While higher compression ratios can often be extremely useful, extreme care and discretion are necessary to produce a pleasing, listenable result.

FIGURE 1

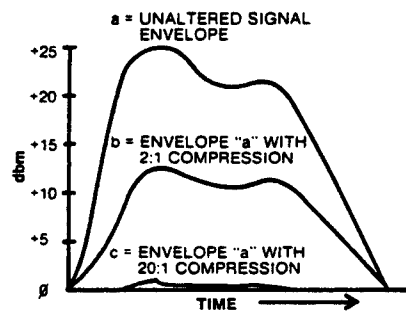
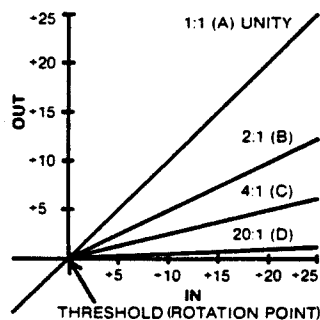
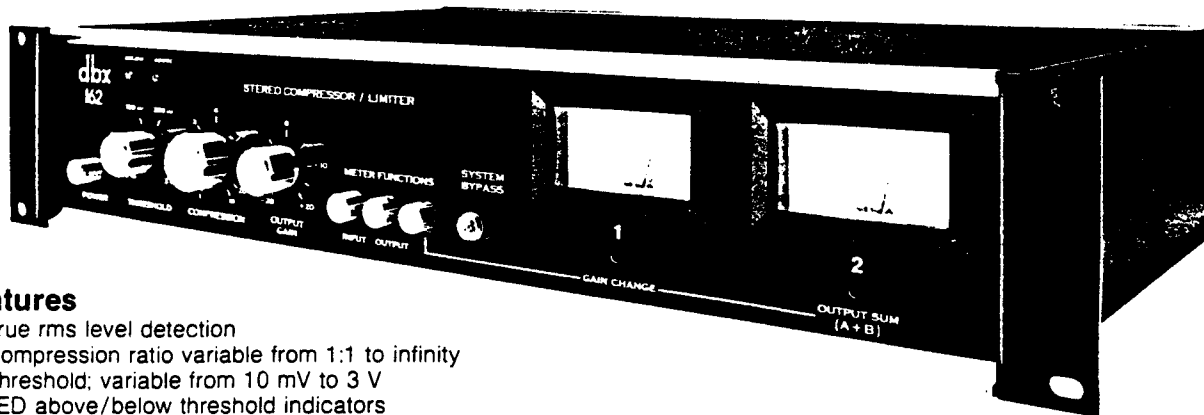


FIGURE 2



# dbx 162 true stereo compressor/limiter



## features

- True rms level detection
- Compression ratio variable from 1:1 to infinity
- Threshold; variable from 10 mV to 3 V
- LED above/below threshold indicators
- Low distortion even at high compression ratios
- 60 dB meter range
- Wide dynamic range and low noise
- Ground loop compensated and turn-on, turn-off transient protected
- Two units can be ganged for quad operation
- Small, easily mounted 3½" rack package

## description

The dbx 162 compressor/limiter is a stereo device using true rms level detection circuitry for signal sensing and sophisticated voltage controlled amplifiers as the gain control elements.

While most available compressor/limiters use peak detection and fast response characteristics, their action is frequently displeasing to the ear, even at moderate compression ratios. This results from the psychoacoustic phenomenon that the ear responds, not to the peaks, but to the rms value of the signal, defined as the sum of the energies of all frequency components present.

Accordingly, the dbx 162 uses true rms sensing to most closely simulate human hearing response for the most listenable result in dynamic range signal processing.

The dbx 162 uses feed forward control circuitry. This is markedly superior to conventional limiters which accomplish gain change through a level sensing feed-back loop around a variable gain stage.

dbx 162 limiters with feed-forward circuitry eliminate noticeable distortion even at high compression ratios and are inherently stable even at infinite compression because the output signal is never "seen" at the input. The compression ratio is continuously variable from 1:1 to infinite compression.

The adjustable threshold is continuously variable from -38 dBm to +12 dBm and LED indicator lamps show whether the unit is operating above or below threshold.

The panel meters are switchable to read input level or output level over a continuous 60 dB range. A rear

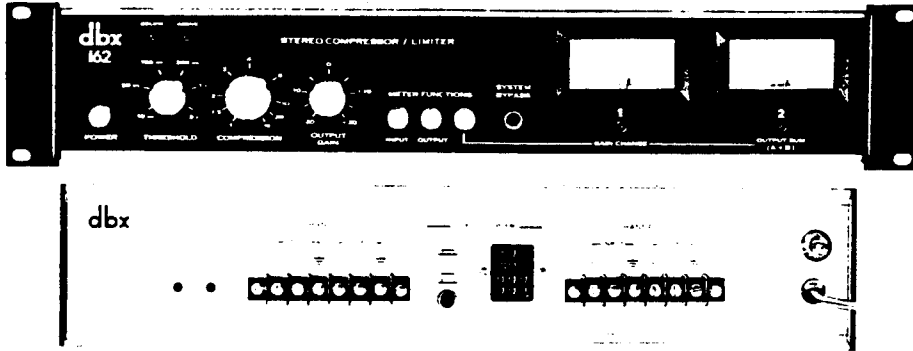
panel control for each channel permits zero dB to be set at any nominal line level between -10 dBm and +10 dBm. An additional switch position displays gain change on one meter while the other shows the sum (A+B) of the output levels of both channels.

The dbx 162 offers plenty of headroom with a maximum output of +26 dBm into 10 k ohm loads, and +24 dBm into 600 ohms.

Model 162 is a professional product with balanced, high impedance differential input stage and an unbalanced 25 ohm output, Jones barrier strip terminations, automatic ground loop compensation (any ground loop at the output is electronically sensed and attenuated at least 40 dB), plus built-in thump and pop protection to prevent turn-on and turn-off transients from appearing at the output.

The dbx 162 achieves precise stereo tracking by energy summing the outputs of two rms level detectors into a single control voltage. The control voltage commands gain change information to a voltage controlled amplifier in each channel. For four or more channel operation, a rear panel connector permits two or more model 162s to be coupled so that the single control voltage will represent the energy sum of any number of channels, which will gain track accurately over a wide dynamic range.

This results in true single-knob operation of the threshold, compression and output gain functions for all the ganged channels. This single control voltage operation provides far superior tracking accuracy to ganged single channel limiters whose threshold, compression and output gain controls must be set individually. In single channel strappable units, tracking accuracy is dependent on both operator error and component tolerances, thereby providing unpredictable tracking.



## application

The dbx 162 allows the professional recordist, broadcaster or sound reinforcement operator to compress the dynamic range of any stereo source by any desired amount variable from none to infinite compression. The point of compression is determined by the setting of the calibrated threshold

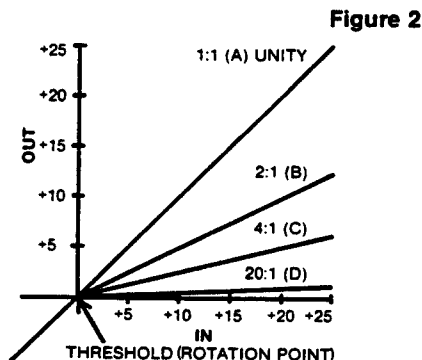
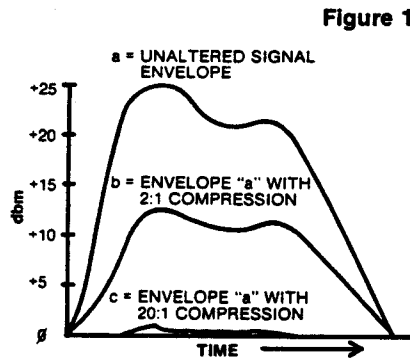
control which activates compression or limiting. Limiting is achieved by setting a high compression ratio up to infinity and the threshold for the desired maximum level.

A front panel system by-pass switch provides a hard-wired by-pass of all electronic circuitry.

## compression ratio: a review

Compression ratio can be defined as the ratio of input change to output change. For a 2 dB input change and a 1 dB output change, the unit would have a 2:1 compression ratio. For a 20 dB input change and a 1 dB output change the unit would have a 20:1 compression ratio (see Fig. 1). The Model 162 compressor/limiter has an adjustable threshold, or gain change point. Below this point, the unit does not compress the signal, and is a fixed gain device. Above the set threshold, the unit functions at the input to output ratio selected by the front panel COMPRESSION RATIO control. The higher the compression ratio, the more dynamic alteration of the signal will occur.

A 2:1 compression ratio reduces the dynamic range by a factor of one-half (Fig. 2, Curve B). At a 20:1 ratio (Curve D), dramatic alteration of the signal envelope occurs. Higher compression ratios can often be very useful, and the 162 can provide large amounts of compression with a very listenable result.



## specifications

### compression ratio

variable from 1:1 to infinity

### threshold

variable from 10 mV to 3 V  
(-38 dBm to +12 dBm)

### input impedance

50 k ohms, balanced  
25 k ohms, unbalanced

### input level

+26 dBm max

### equivalent input noise

-78 dBm typical (20 Hz to 20 kHz)

### output source impedance

25 ohms

### output level

+24 dBm into 600 ohms  
+26 dBm into 10 k ohms

### frequency response

±1dB 30 to 20,000 Hz

### distortion

0.075% 2nd harmonic at infinite compression at +4dBm output  
0.5% 3rd harmonic typical at infinite compression ratio

### attack time

15ms for 10dB level change above threshold  
5ms for 20dB level change  
3ms for 30dB level change (time to reduce signal by 63% of level change)

### release rate

120 dB per second

### meter zero set

-10 dBm to +10 dBm

### controls

threshold ● compression ● output gain ● meter function switch ● meter zero adjust ● by-pass switch ● power switch ● master/slave switch

### connectors

input, output: Cinch-Jones type barrier terminal strip  
multi-unit coupler: 12 pin Jones connector

### case

black painted steel sides; extruded aluminum front and rear panels; vinyl clad steel covers top and bottom

### dimensions

3½"H x 19"W x 10½"D (8.9 cm x 48.3 cm x 26.7 cm)

### weight

10 lbs. (4.5kg)

### power line requirements

117 VAC ±10%, 50-60 Hz

### power consumption

20 watts

### warranty

dbx products are covered under a limited warranty (parts and labor) for two years from date of original purchase.



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