MODEL 165A

Compressor/Limiter

dbx®

SERVICE MANUAL
(Preliminary)

CAUTION | **AVIS**
RISK OF ELECTRIC SHOCK DO NOT OPEN | RISQUE DE CHOC ELECTRIQUE NE PAS OUVRIR

DO NOT EXPOSE TO RAIN OR MOISTURE

CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure — voltage that may be sufficient to constitute a risk of shock.

This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Read the manual.

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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BRIEF OPERATING INSTRUCTIONS

Fig. 1 — Front Panel

Threshold Indicators There are three LED's which indicate the relationship of the input signal level to the threshold of compression. The green LED is ON when the signal is below threshold, the red LED is ON when the signal is above threshold, and the amber LED is ON when the signal is in the Over Easy threshold range.* (Refer to Figure 4.) Since the LED's indicate the contents of the gain control signal, their response time will be affected by the selection of automatic or manual operation, and by the attack/release rates selected in manual operation.

NOTE: Even though no input signal is applied, it is normal for the Above Threshold and Over Easy™ LED indicators to flicker ON when the power is turned ON or OFF.

Power ON/OFF Switch Engage this switch to apply AC power to the unit. The LED (Light Emitting Diode) indicator above will be illuminated when the power is ON. No signal flows when the power is OFF, unless the System Bypass button is engaged.

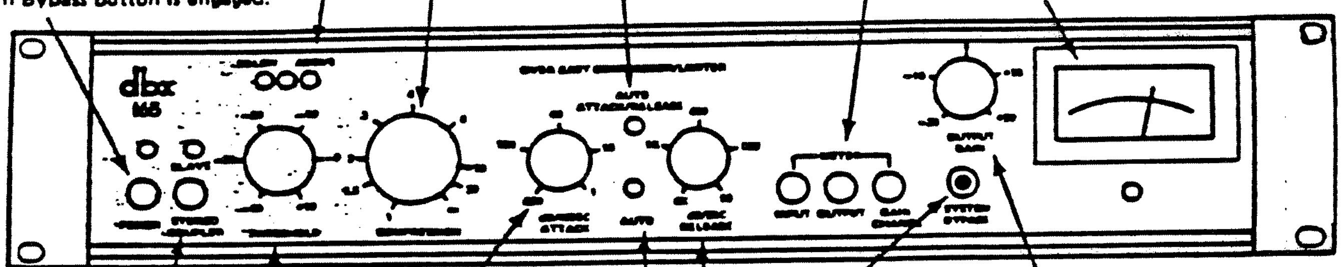
Meter Function Switches These three interlocking pushbuttons determine whether the meter displays Input level, Output level or the amount of Gain Change. Input level metering is useful in deciding how much compression may be needed. Output level metering is useful as a check to ensure that the levels are not exceeding the desired maximum and the over-all gain of the 165 is set properly. Input and output levels are displayed on an RMS basis, with fixed time constants which are unaffected by the front panel attack and release controls. Gain change metering provides a more precise indication of how much of the program is being compressed than can be determined from the Threshold Indicator LED's. The meter, when displaying gain change, indicates the contents of the gain control signal, so its response time will be affected by the setting of the front panel manual/automatic switch and, in manual mode, by the attack and release rate controls. (Fixed gain changes commanded by the output gain control are not displayed by the meter's gain change function.)

Compression Control Clockwise rotation of this control increases the maximum amount of compression from 1:1 (unity gain) up to infinity. The unit can be considered to be a limiter at compression settings of 10:1 or higher, especially with a fast attack rate (above 100 dB/mS).

Auto Attack/Release Indicator This LED is illuminated when the 165 is in Auto Attack/Release mode.

Meter The meter is factory set so that 0 VU is equivalent to + 4 dB input or output level, as selected with the Meter Function switch. The nominal 0 VU level may be changed to anywhere from −10 dB to +10 dB by adjusting the rear panel Meter Calibration trimmer. In Gain Change mode, the meter pointer moves down scale from 0 VU to indicate how many dB of compression the 165 is providing.

NOTE: The screw beneath the meter face is a zero-set adjustment to assure the needle rests at 0 VU when the unit is OFF; it is not intended for calibration. See page 8 for meter recalibration instructions.



Stereo Coupler For single-channel (monaural) operation, this switch determines whether the unit will be the master (controlling unit) or the slave. The unit becomes a slave when the button is pressed IN, and the LED above the button turns ON to indicate the slave status. In stereo operation, all gain, attack/release, compression and threshold adjustments are made with the Master unit's controls. The Slave follows the Master's commands with the exceptions of Meter switching, System Bypass switching and Power switching which remain independent and must be done on both units.

Attack Rate Control Clockwise rotation of this control adjusts the maximum attack rate from 400 dB per millisecond to 1 dB per millisecond. The control setting only affects the 165's operation when the unit is in manual mode; it has no effect when the 165 is in Auto Attack/Release mode.

Auto Switch Engage this switch to place the 165 in the Auto Attack/Release mode. The compressor's attack rate and release rate then automatically vary to suit the volume envelope of the input signal. The attack and release characteristics may be set manually with the adjacent front panel controls when the switch is not engaged.

Threshold Control Adjust this knob to set the threshold of compression from −40 dB (7.8 mV) to +10 dB (2.45 V).** The threshold of compression is defined as the approximate middle of the Over Easy™ region.

Release Rate Control Clockwise rotation of this control adjusts the maximum release rate from 4,000 dB per second to 10 dB per second. The control setting only affects the 165's operation when the unit is in manual mode; it has no effect when the 165 is in Auto Attack/Release mode.

Output Gain Control This control adjusts the amount of gain in the 165's output amplifier stage. The signal can be attenuated or boosted by a full 20 dB relative to a "0" center setting (unity gain). This control is independent of the threshold of compression.

Because 20 dB of gain can be added at the 165 output, it is possible to cause clipping even when the input level is within the specified range. Especially when the COMPRESSION RATIO is set at a low number (a low "factor"), extreme clockwise rotation of the OUTPUT GAIN may cause the 165 output stage to clip program peaks. Therefore, for normal operation we suggest setting OUTPUT GAIN at "0 dB" (12 o'clock position). Where the circuit fed by the 165 has a high input sensitivity, lowering the 165's OUTPUT GAIN setting can avoid the need for an attenuation pad.

System Bypass Switch Engaging this button creates a hard-wired bypass of the 165's circuitry by connecting the input directly to the output. The Bypass is useful for A-B comparisons of the compressed and the "straight" program, or for rapid restoration of signal flow in the event of a 165 circuit problem.

NOTE: Since the system output is normally single-ended, in normal operation the (+) output carries the signal, while the (−) output is connected to ground. In the System Bypass mode, the (+) signal input is directly connected to the (+) signal output, and the (−) signal input is directly connected to the (−) system output. Thus, in Bypass mode, the output is single-ended when the input is single-ended, and balanced when the input connection is balanced.

**"Threshold" is defined as the point of 6 dB gain reduction when the unit is set for a maximum (infinite) compression ratio.*

***0 dB is referenced to 0.775 V RMS.*

Fig. 2 — Rear Panel

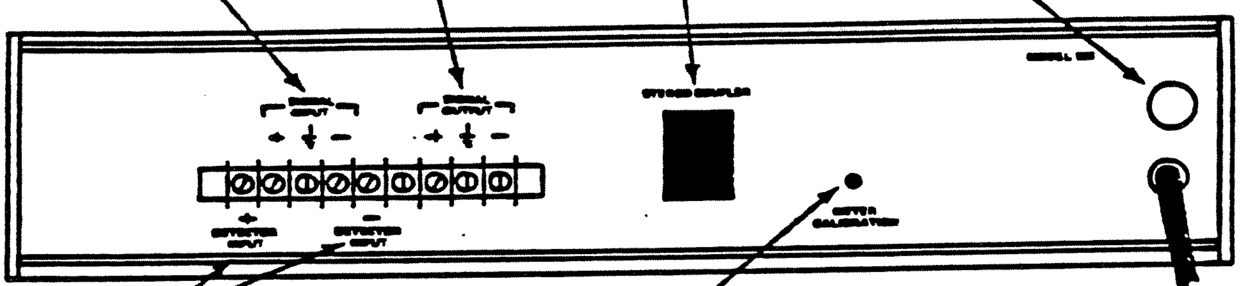
Stereo Coupler When a suitable cable joins this connector to the Stereo Coupler connector on another Model 165, and when one of the units is switched to "slave" mode, the two units may then be utilized for processing a stereo program. A multi-pin male connector is supplied with each 165 so the coupler cable can be assembled using the wiring diagram in Figure 7.

NOTE: Only two Model 165's can be coupled together. Four units cannot be coupled together for quad (4-channel) operation. For this purpose we recommend the use of two dbx Model 162 stereo compressor/limiters.

Signal Output These terminals feed the program processed by the 165 to the next device in the audio path.*

Fuse For Models sold in the U.S.A., this 1/4 amp, 250 volt AGC type fuse protects the primary side of the unit's 117V AC power supply. Be sure to replace a blown fuse with one of the same size and type. If the fuse blows consistently, contact the dbx factory or your dbx dealer.

Signal Input These terminals accept the incoming audio program for processing by the Model 165.*



Detector Input The 165 comes from the factory with these terminals strapped to the adjacent Signal Input (+) and (−) terminals. If you wish to gain access to the 165's Detector Input for insertion of an auxiliary device, you may do so by removing the strapping, wiring the auxiliary device's output to the 165's Detector Input terminals, and feeding the auxiliary device's input with the same signal fed to the 165's Signal Input. In certain situations, the signal processor (auxiliary device) may need to be inserted in the signal path, not in the detector path. (This would be the case when a delay line is used to achieve a "preview" of the signal.) In such cases, signal is fed to the input of the auxiliary device, and also to the detector input, and the auxiliary device's output is fed to the 165 signal input.

Unless the installation is permanent, the connections described above can be awkward. Therefore we recommend wiring a few Tip/Ring Sleeve phone jacks to the 165 instead, "normalling" the jacks so that the Signal Input-to-Detector Input link is normally established via the jacks, but is automatically disconnected whenever a plug is inserted in the Detector Input jack. A similar jack may be used for the 165 output. (See Figure 6 for information on wiring of these jacks.)

Meter Calibration Control This recessed, screwdriver-adjustable trimmer may be used to precisely calibrate the meter so 0 VU Input or Output level is equivalent to anywhere from −10 dB (245 mV) to +10 dB (2.45 V).

AC Power Cable Connect this cable to a 117 VAC, 50 or 60 Hz AC power source only. Models for use with other power sources outside the United States are available. Contact the dbx factory for information. The Model 165 requires a maximum of 15 watts AC power.

**Audio High (+), chassis ground (⏚), and Audio Low (−) terminals are provided for connection of the 165 Input and Output to balanced or floating lines (i.e., two conductor shielded audio cables). For use with an unbalanced line (i.e., a single conductor shielded cable), it is necessary to connect a jumper between the (−) and (⏚) input terminals. No jumpers are necessary for the output terminals when input jumpers are used. The Detector Input has only audio high (+) and low (−) terminals, and it shares the chassis terminal with the Signal Input.*

The dbx Model 165 is a professional single channel compressor/limiter that features the new dbx Over Easy compression curve. The dbx Over Easy compression curve permits extremely smooth, almost inaudible compression due to the gradual change of compression ratio around the threshold, instead of the customary sharp threshold. This curve, plus dbx's true RMS level detector coupled to a wide-range voltage controlled amplifier in a feed-forward circuit, makes it possible to achieve larger amounts of compression without adverse audible side effects.

The RMS level detector is separately accessible, allowing various signal conditioners — equalizers, filters, delay lines, etc. — to be inserted in either the level detector or signal path independently. This feature aids in the compression of certain difficult types of material, as well as in the creation of special effects. In addition to dbx's automatically variable attack and release time circuitry (as on the Models 160, 161, 162, 163 and 164), a front panel switch and controls provide for manually adjustable attack and release rates over a very wide range.

The Model 165 also features stereo coupling for two 165's (at the touch of a front panel button), LED indicators showing whether the signal is at, above or below the threshold of compression, a 30 dB dynamic range meter (indicating input, output and gain change levels), and a rear panel zero VU calibration adjustment. A hard-wired bypass switch, also located on the front panel, is convenient for checking the effect of the compression, and assures failsafe flow of audio through the unit. The maximum input level is +24 dB (12.3 V RMS) and maximum output level is +23 dBm. The output amplifiers have a source impedance of 47 ohms and will drive input loads of 600 ohms or greater impedance. Output gain is also adjustable over a very wide range (± 20 dB), so the Model 165 is compatible with virtually all professional sound and creative audio equipment.

Perhaps the most flexible and useful compressor/limiter ever offered, the dbx Model 165 is well suited to a wide range of applications including: tape recording, disc mastering, radio and TV production and broadcast, live concert sound reinforcement, and theatrical production.

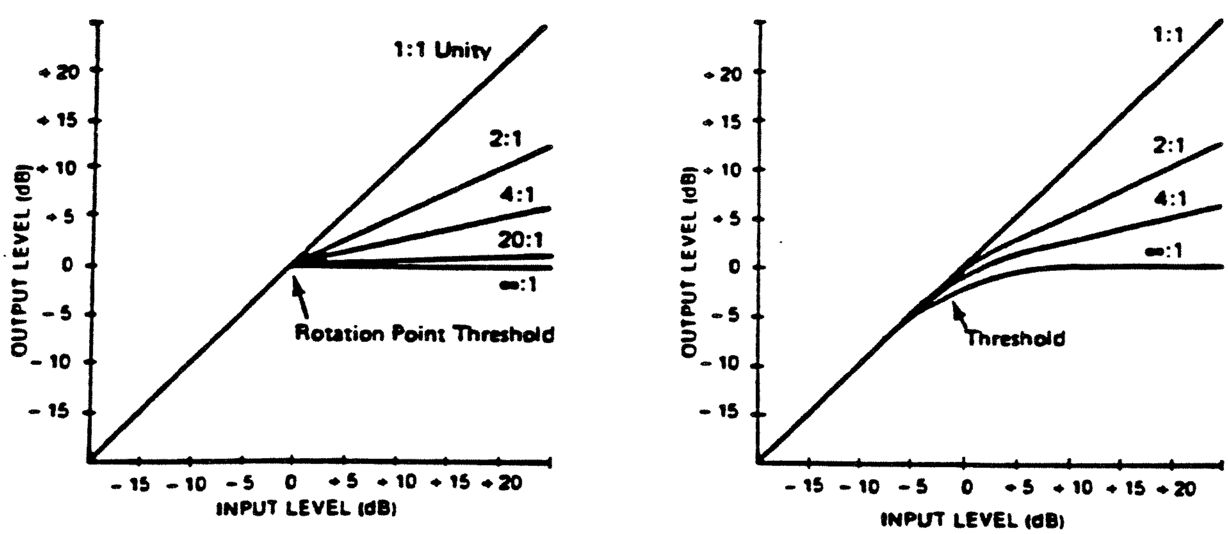
More About Separate Level Detector Access

Because auxiliary sound equipment can be used to process the level detector signal but not the main audio input signal (or vice-versa), the 165 offers the user an opportunity to create many unusual effects. By connecting it to additional signal processors, such as a parametric equalizer, the Model 165 can be converted to a de-esser, a vocal stresser or a level-sensitive filter. Certain musical or vocal elements in a program can be suppressed without affecting others. In addition to these signal conditioning functions, many creative special effects are possible.

More About Over Easy Compression

Conventional compressor/limiters have a sharp knee at the threshold point (see Figure 3A). That is, when the input signal is below the threshold, the gain remains fixed (1:1 ratio or no compression), but when the input signal goes above the threshold, the gain abruptly decreases according to the compression ratio for which the unit is adjusted (several fixed compression ratios are shown in Figure 3A). This abrupt change in gain in a conventional compressor/limiter is often audible and therefore undesirable to the user.

The dbx Over Easy approach utilizes a soft knee at the threshold of compression (see Figure 3B). The Over Easy compressor/limiter gradually increases its compression ratio from 1:1 towards the set compression ratio as the input signal rises through the threshold region. Thus an age old dream can be realized . . . dynamic range restriction without audible, abrupt gain changes. When properly operated, the Model 165 is a highly effective compressor/limiter that you don't hear working.



3A — Conventional Compressor/Limiter

3B — Over Easy Compressor/Limiter

Fig. 3 — Over Easy Versus Conventional Compression

Since dbx Over Easy compressor/limiters have no distinct point at which the gain changes, the threshold on such units is defined differently from conventional units. We define the threshold to occur approximately mid way between the fixed gain portion of the curve and the point where the curve "levels off" at the selected compression ratio. At an infinite compression setting, threshold is defined as the level at which 6 dB gain reduction is realized. At this setting, the maximum permissible output level is 5 dB above the threshold. At lower compression settings, the threshold represents somewhat less gain reduction. (In contrast, a conventional compressor/limiter yields 0 dB of gain reduction at the threshold; gain reduction begins just above the threshold.) To see how the 165's Threshold indicator LEDs correlate with the compression curves, refer to Figure 4.

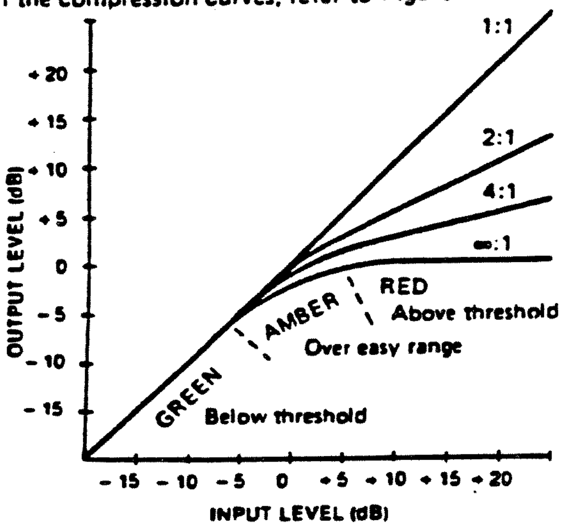


Fig. 4 — How The 165 Threshold Indicator LED's Correlate With The Compression Curve

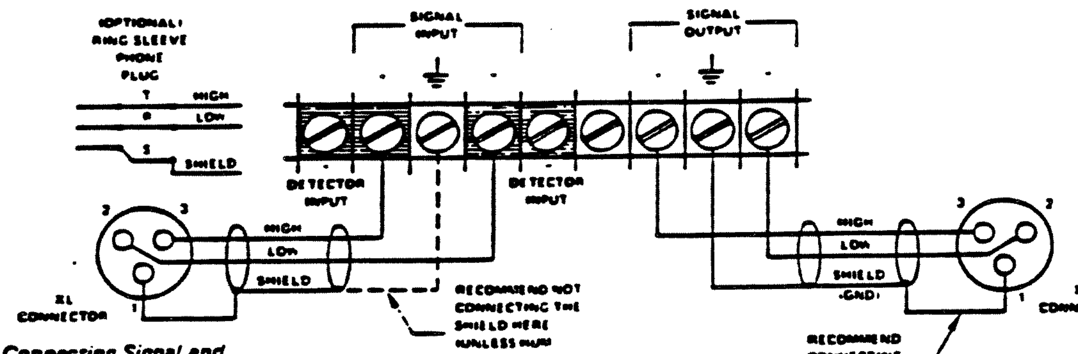
Make input and output connections to the barrier strip on the rear panel (Figures 5 and 6).

Input Connection

For balanced or floating lines, connect the signal leads to the (+) and (—) terminals, and the shield to the chassis ground (⏚) terminal. For unbalanced lines, connect the signal high lead to the (+) terminal, and jumper the (—) and chassis ground (⏚) together for connection of the shield. When using an unbalanced connection, reversing the (+) and (—) input terminals will cause the output signal to be 180° out of phase (reverse polarity) relative to the input signal.

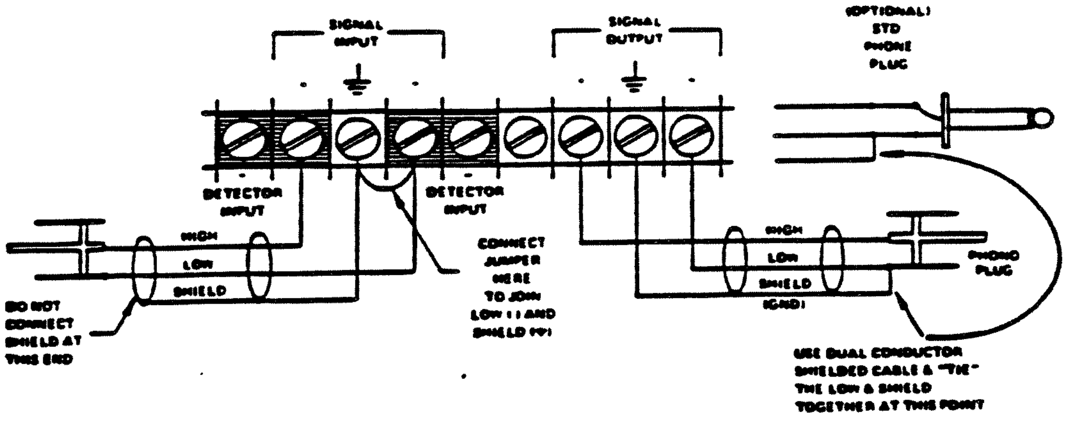
Level Detector Input Connection

For normal compressor operation, leave the factory-installed straps connected between the Detector (+) and the Input Signal (+) terminals and the Detector (—) and Input Signal (—) terminals. (Refer to Figure 5.) If you wish to gain access to the 165's Detector Input for insertion of an auxiliary device, you may do so by removing the strapping, wiring the auxiliary device's output to the 165's Detector Input terminals, and feeding the auxiliary device's input with the same signal fed to the 165's Signal Input. In certain situations, the auxiliary device may need to be inserted in the signal path, not in the detector path. In such cases, signal is fed to the input of that device, and also to the detector input, and the auxiliary device's output is fed to the 165 signal input. Unless the installation is permanent, this connection can be awkward. Therefore, we recommend wiring a few Tip/Ring/Sleeve phone jacks to the 165 instead, and using the jacks for Signal and Detector Inputs as well as for the Signal Output. Figure 6.)



NOTE: Straps Connecting Signal and Detector Inputs are shown in place.

5A — Balanced Configuration



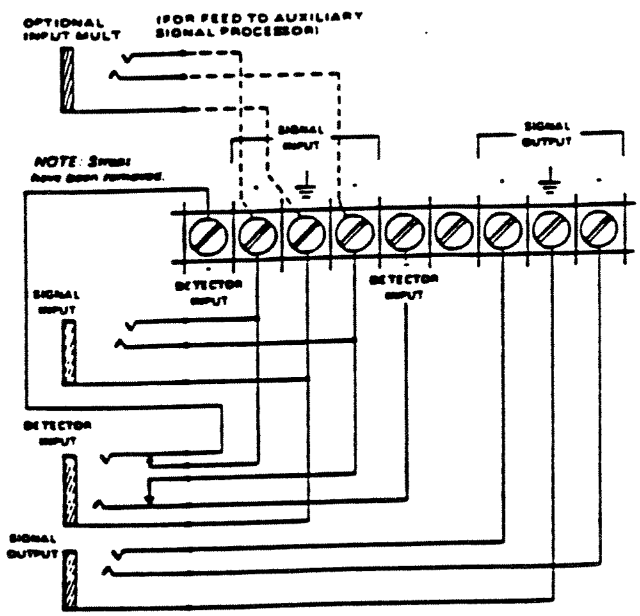


Fig. 6 — Signal Input & Output Jacks With A Normalling Jack For The Detector Input Dotted lines indicate location of optional mult jack (parallel wired) for feeding input of auxiliary device with same program as 165 Signal Input.

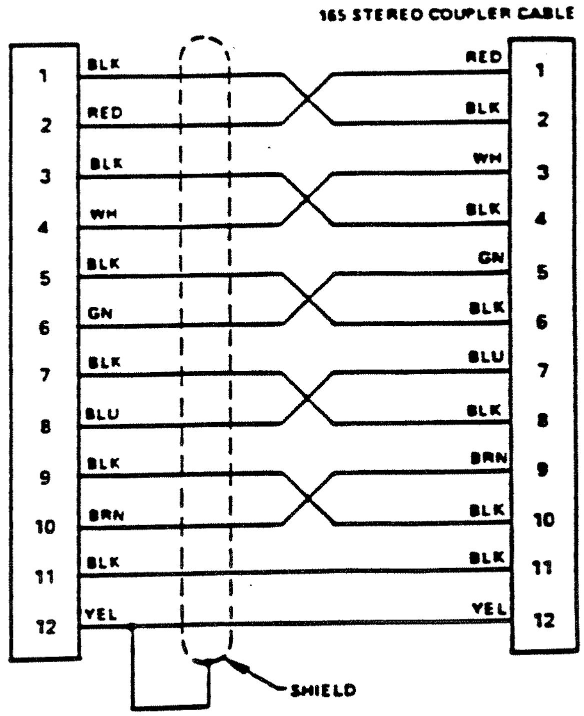


Fig. 7 — Stereo Coupler Cable
NOTE: The cable for the dbx Model 162 *is not compatible* with the Model 165.

Output Connection

The output of the dbx 165 is designed to feed balanced or unbalanced 600 ohm or greater loads. The output stage is single ended, so that in normal operation, the (—) signal output terminal is internally connected to the (⏚) terminal. When the system bypass switch is engaged, the signal inputs are directly connected to the signal outputs (so a balanced input would produce a balanced output).

Grounding

For maximum hum rejection, avoid common grounding at the input and output (i.e., double grounding). One method that usually works is to ground the shield at the 165's output Ground (⏚) terminal and also ground it at the input of the following device. Do not connect the shield at the 165's input Ground terminal; leave the input shield connected only to the output of the device feeding the 165.

Stereo Coupler Cable

When you wish to link two Model 165's for processing a stereo program, a cable must be constructed to join the Stereo Coupler connectors on the two units. Use the mating connectors supplied with each Model 165, and wire the cable according to Figure 7. Use connectors supplied with units, or equivalent (Cinch-Jones P-312—CCT). The cable should be 6-pair, twisted 24 ga. wire with shield (Belden 9506).

Once the cable is connected to the two 165's, it may be left in place at all times. When both units' Stereo Coupler switches are placed in "master" mode (button OUT), the 165's operate completely independently; stereo operation is achieved simply by switching one of the two units to "slave" mode (button IN, Slave LED ON).

Input Impedance & Terminations

There is sometimes a misunderstanding regarding the nature of matching and bridging inputs, the use of terminating resistors, and the relationship between actual input impedance and nominal source impedance. Most electronic outputs work well when "terminated" by an input (connected to an input) having the same or a higher actual impedance. Outputs are usually overloaded when terminated by an impedance that is lower than the source impedance. When the input impedance is nearly the same impedance as the source, it is known as a "matching" input. When an input is 10 times the source impedance, or more, the input is considered to be a "bridging" input.

The dbx Model 165 signal input has an actual impedance of 22,000 ohms in balanced configuration or 11,000 ohms in unbalanced (it has a high-Z* input). This makes the 165 signal input suitable for use with virtually any nominal source impedance, low or high. The dbx signal input will bridge 150-ohm or 600-ohm (low-Z) lines.

The dbx 165 detector input has an actual impedance of 600,000 ohms in balanced configuration or 300,000 ohms unbalanced. This very high impedance means the level detector will bridge virtually any nominal source impedance. It also means that when the jumper connectors link the detector and signal inputs, the detector has a negligible effect on the 165's input impedance as "seen" by the source device. The very high impedance of the detector does suggest, however, that cables from an external processor to the detector input be kept as short as practical to reduce susceptibility to hum and RFI.

Terminating resistors are not needed for the dbx 165 signal or detector inputs to operate correctly, but may be required at these inputs when they are fed from devices (such as passive equalizers) designed for a specified load impedance.

The dbx 165 output is capable of driving loads of 600 ohms or greater. While it may be terminated by a low impedance, such termination is not required.

"Z" is an abbreviation for "impedance."

OPERATION & APPLICATIONS
Additional Information on the Setting and Function of Certain Controls.

Compression Control

This control is continuously adjustable from a compression ratio of 1:1 to infinite compression (that is, no change in output level regardless of changes in input level above the set threshold). High compression (settings greater than 6) significantly level out program materials. Infinite compression virtually stops music levels from exceeding the threshold setting. Lower compression settings (below 4) still permit dynamic range to exist. They are used to tighten up the sound of a bass guitar, lead guitar, snare drum, kick drum and vocals. Moderate overall compression is typically used during stereo mixdowns. Here a variety of settings could be used.

While any compression ratio can be set with this control, remember that the Over Easy curve causes that ratio to be approached gradually as the input signal level rises through the threshold. Only when the input signal is considerably above the threshold does the 165 closely approach the set ratio of compression. (See Figure 3.)

Threshold Adjustment & LED Indicators

The Threshold control sets the level at which the 165 begins to compress the signal (i.e., it sets the point where the Over Easy compression curve intersects the input signal). The control has a wide range so that the desired results can be obtained with any line level input signal. When the Threshold control is set too low, the 165 will compress most if not all of the input signal (red LED ON most of the time). At low compression ratios, the very low threshold setting can be used to gently reduce the overall dynamic range of the program. Low threshold settings (−20 to −40) are used when program materials are to be compressed. Low settings, with high input levels, cause the 165 to "work" all or more of the time than with lower input levels. The major portion of program material *is processed* with a low threshold setting. Normal compression and "leveling" of vocals and instruments typically use lower settings. Compression of the whole program, however, may not sound natural, especially at compression ratios of 10:1 or greater. High threshold settings (−10 to +10) are used for limiting program levels or where only peaks are to be compressed. The major portion of the program material *is not processed* with a high threshold setting. Speaker protection and peak overload prevention are just two applications.

NOTE: Whenever threshold level and compression ratio settings are made, it is important to watch the LED's and meter for reference and confirmation. Remember that a compressor/limiter is a tool that can provide desirable effects when used properly. When used to excess, the results can sound unusual, and may be of value only for special effects.

With the Compression control set for the desired maximum compression ratio (or an approximation thereof), rotate the Threshold control counterclockwise until the desired sound, special effect, or amount of gain reduction is achieved.

Auto Switch & Auto Attack/Release LED Indicator

When the Auto switch is IN (Auto Mode), the LED indicator will be illuminated and the Model 165 will automatically adjust its attack rate and release time to suit the program envelope. (This Auto Model sets the Model 165 for the same attack and release characteristics as dbx Models 160, 161, 162, 163 and 164 compressor/limiters.) When the Auto switch is OUT (manual mode), the LED indicator above it turns OFF, and the front panel Attack and Release rate controls determine the maximum rate of gain change and the behavior of the level detector circuitry (see below).

Attack Rate & Release Rate Controls

The Model 165 is the first dbx compressor/limiter to offer a choice of automatic or user adjustable attack and release characteristics. In Auto Mode, the 165 utilizes the patented dbx RMS level detector with its program dependent attack/release characteristics to obtain natural-sounding compression or limiting. For special effects and certain signal situations, however, it is often desirable to set fixed attack and release characteristics. Manual mode affords this capability. The Auto Mode is recommended for vocals as well as instruments. When determining separate attack and release rate control settings, it provides a good starting point. Because the Auto Mode has a variable attack rate, the 165 may compress or limit some program materials smoother than in the manual mode which has a fixed rate of attack. This is especially true on vocals.

Where To Set Attack & Release Controls

There is no "right" way to set the Attack and Release controls. Generally, one would want a slow enough Release to avoid "pumping" or "breathing" sounds caused when background sounds are audibly modulated by the dominant signal energy, yet the release must be fast enough to avoid suppression of the desired signal after a sudden transient or a loud note has decayed. Depending on the desired effect, one might want a very slow Attack so that percussive or transient sounds are not restricted, but average volume levels are held within the desired range.

A very fast attack setting (control maximum counterclockwise) will cause the 165 to act like a peak limiter even though RMS detection circuitry is used. Slower attack settings cause the 165 to act like an RMS or averaging detecting compressor/limiter. Don't forget, attack and release controls operate together and with the compression ratio control. Changing any one control may necessitate changing the other settings.

Meter Calibration & Use

The meter in the 165 is factory calibrated to indicate "0" when the signal level is +4 dB (1.23 V) at either the input or output of the 165, depending on the meter function switch position. (When the meter is in Gain Change mode, "0" indicates no gain change; the meter calibration control does not affect this mode.)

To recalibrate the meter, engage the Input meter function switch and feed a 1 kHz signal at the selected nominal operating level (the level desired for a "0 VU" meter indication) to the 165's signal input. Then adjust the rear panel METER CALIBRATION control until the meter indicates "0 dB".

Use of an Equalizer in the Level Detector Circuit for Frequency Weighted Compression, De-essing, or Increasing Sustain

It is possible to "separate" certain instruments from a mix by frequency weighted compression. This function is created by inserting an equalizer ahead of the Model 165's level detector input, but not in the main signal input path. Peaking the equalizer in a certain frequency range will tend to suppress any frequencies (notes) in that register. A relatively high threshold setting can allow normal sounds to be unaffected while solo or very loud sounds are held back. Of course, when compression does occur, the level of the entire program is affected. For this reason, it may be more useful to reserve this combined EQ/compression technique for isolated sound sources, such as a single channel of vocal or a single instrument in a multi-track program. Unlike overall program equalization, EQ of the level detector will take effect only when signals are above threshold (or when those frequencies affected fall above the set threshold). Depending on the threshold setting, lower-level fundamentals or harmonics will not cause compression, and the program is not subject to the phase shift normally caused by program equalization.

For example, consider a single channel carrying the preamplified signal from a microphone placed near a cymbal and a tom-tom. Set up the 165 with an equalizer in the level detector path, as depicted in Figure 8. The equalizer can be adjusted for boost with a peak at about 5 kHz, causing the cymbal to be compressed on a very loud crash, preventing tape saturation at high frequencies where there is less headroom. However, gentle tapping of a drumstick or brushing of the cymbal will not be held back. Assuming the tom-tom is a lower frequency instrument, and can be better tolerated by the tape, there is less need for compression on it. The equalization in the detector circuit means that the compressor will not be triggered as readily by a loud tom beat as by an equally loud cymbal crash.

Another application for this type of EQ boost in the level detector is for increasing the sustain of a guitar, bass, etc; this requires EQ boost in the dominant frequency range of the instrument, along with a fairly low threshold and a moderate compression ratio.

Still another related application involves de-essing of vocals (reduction of sibilance). Use a parametric equalizer in the level detector circuit and set it for high frequency boost in the specific frequency range where the vocal "hiss" or lisp occurs. This pre-emphasizes the already "hissy" vocal input to the detector. Used in conjunction with a moderate to high threshold and compression ratio, this arrangement greatly attenuates the "essing" without affecting the basic sound quality or balance of the voice. While it is true that all frequencies are lowered in level when the compressor is triggered, generally the "sss" sound occurs alone, before or after the dominant tone in the voice. (If this seems unlikely, just try to hum and hiss at the same time.)

The converse of the above EQ techniques may be used; dipping the equalizer will cause any sound in the affected register to pull the level up because it will seem to require less compression than the other frequencies.

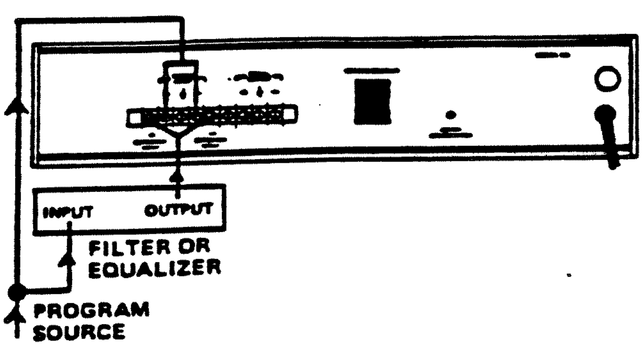


Fig. 8 — Equalizer or Filter Used with the Level Detector Input

Use of a Filter in the Level Detector Circuit

The results of inserting a filter in the level detector circuit are basically the same as obtained with an equalizer, as previously described. Those frequencies passed by the filter are subject to compression (or at least they are subject to considerably more compression than those frequencies outside the passband). Because a passive filter can have insertion loss, it may be necessary to lower the 165's Threshold setting to maintain a given amount of gain reduction within the filter passband; this can be determined, as usual, by monitoring the 165's threshold indicator LEDs.

Use of a Time Delay Line in the Signal Path but not in the Level Detector Circuit for Zero or Negative Attack & Release Times

While the Model 165 can be set for incredibly fast attack times, there will always be some small transient that "gets past" the level detector. In some cases — such as maximum modulation broadcasting — it may be desirable to preserve the sonic quality obtained with a slower attack time, yet it may not be permissible for even the slightest overshoot to get past the compressor/limiter. A delay line (digital or analog) can be used in this instance. By feeding the program directly to the 165's detector input, but delaying the feed to the 165's signal input, the unit can "anticipate" the need for a gain change. (Refer to Figure 9.) With some experimentation, the effect can be that of "zero" attack time.

Additional signal delays beyond the "zero" time established above would then cause the compressor to finish changing gain before the leading edge of the loud passage enters the signal input, suppressing program which is not above threshold. Also, the 165 would begin to recover from compression (release) before the input signal has dropped back to the set threshold, causing the output to surge higher in level as the note or passage is decaying. This special effect obtained with the time delay might sound akin to reverse playback of a tape recording.

Access to the 165's level detector makes possible a whole range of effects not normally available. The more you think about it and experiment, the more useful this capability can become.

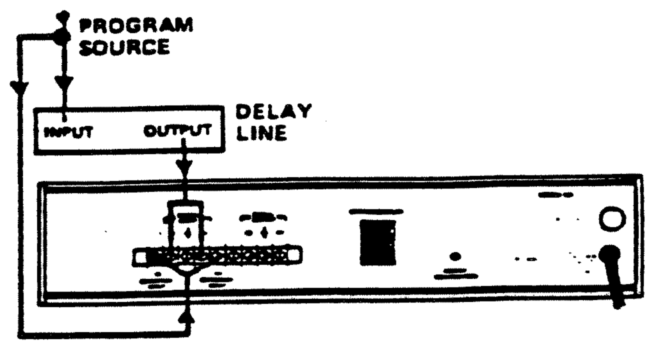


Fig. 9 — Delay Line Used With The Signal Input

The 165 As A Line Amplifier

To use the 165 as a line amplifier, adjust the COMPRESSION RATIO control to fully counterclockwise (1:1 position), THRESHOLD to full clockwise position (+10) and OUTPUT GAIN to whatever setting is required for the application. Remember that, as with any amplifier, excessive gain may lead to output clipping of high level signals. To add compression, adjust the COMPRESSION RATIO and the THRESHOLD controls to the desired settings.

SPECIFICATIONS

Input Characteristics

IMPEDANCE

Signal: 22 kohms, balanced; 11 kohms, unbalanced
Detector: 600 kohms, balanced; 300 kohms, unbalanced

LEVEL

Signal: >+24 dB (12.3 V) maximum
Detector: >+28 dB (18.6 V) maximum

Output Characteristics

IMPEDANCE

Less than 47 ohms (active low Z output)

LEVEL

>+23 dBm (11 V) into a 600 ohm or higher Z termination

Performance Characteristics

DISTORTION

2nd harmonic, 0.05%
3rd harmonic, 0.2% (Auto or Manual with Attack & Release Controls Centered)

NOTE: Distortion figures are typical at infinite compression, 1 kHz, 0 dBm (0.775 V) input and output. 2nd harmonic is relatively unaffected by compression ratio, time constants and frequency while 3rd harmonic decreases with slower time constants, higher frequency and lower compression ratio.

EQUIVALENT INPUT NOISE

Less than −90dBm, 20 Hz to 20 kHz

ATTACK RATE* (63% dB reduction in Signal Level)

Auto Mode: 15 mS for 10 dB level change, 5 mS for 20 dB level change, 3 mS for 30 dB level change

Manual Mode: Continuously variable from 1 to 400 dB per millisecond.

RELEASE RATE*

Auto Mode: 120 dB/second

Manual Mode: Continuously variable from 10 to 4000 dB per second.

FREQUENCY RESPONSE

+0, −1 dB from 20 Hz to 20 kHz

Controls

THRESHOLD

Continuously variable from −40 dB (7.8 mV) to + 10 dB (2.45 V)

COMPRESSION RATIO

Continuously variable from 1:1 to infinity:1

ATTACK RATE

Continuously variable from 400 dB per millisecond to 1 dB per millisecond

RELEASE RATE

Continuously variable from 4,000 dB per second to 10 dB per second

OUTPUT GAIN

Continuously variable from −20 dB to +20 dB

Metering

RANGE

30 dB (from −20 to +10 VU)

FUNCTION

Switchable for input level, output level or gain change

CALIBRATION

Factory preset at 0 VU = +4 dB (1.23 V); rear panel potentiometer sets 0 VU for any level from −10 dB (7.8 mV) to +10 dB (2.45 V).

Connectors

SIGNAL

Jones type barrier strip for signal input, signal output, and detector input.

STEREO COUPLER

12 pin Cinch-Jones J-312-CCT connector for strapping two 165's together to process a stereo program.

General

POWER REQUIREMENTS

117 V AC ±10%, 50 or 60 Hz; 234 V AC, 50 or 60 Hz available on special order for use outside the U.S.

DIMENSIONS

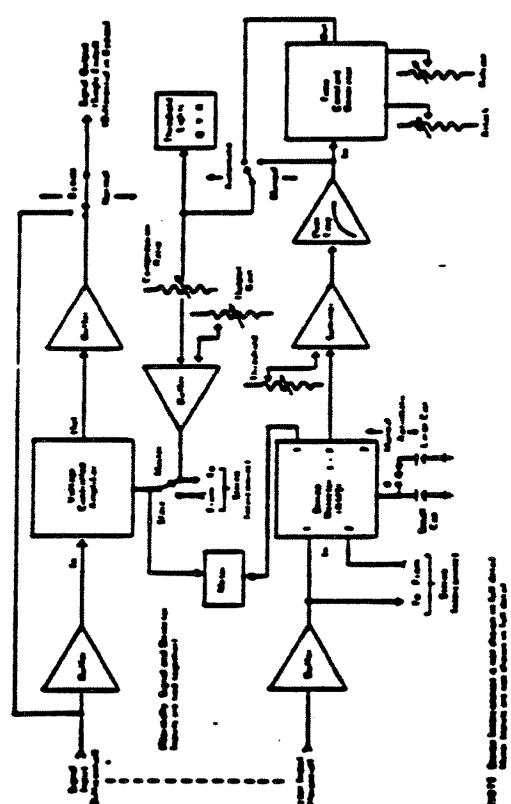
19" wide x 3-1/2" high x 10-1/8" deep
(48.3 cm x 8.9 cm x 25.7 cm); suitable for rack mounting

NET WEIGHT

8 Pounds (3.6 kg)

**Measured in the infinite compression region of the over easy curve.*

BLOCK DIAGRAM



dbx 165A Initial Test Procedure

1. Preliminary Setup
   1.1 Connect the dbx 165A under test to the 165A test box using the appropriate cables.
   1.2 Insure that the "THRESHOLD", "COMPRESSION", "db/MSEC ATTACK" and "db/SEC RELEASE" pots all have the correct travel. (E.G. Insure that each of these pots travels just as far past the most CCW calibration mark as they do past the most CW calibration mark.

2. Power Supplies
   2.1 Connect the dbx 165A to the proper AC power (120 or 240VRMS). Place the "POWER" switch to it's "IN" (ON) position. Note that the "POWER" LED lights.
   2.2 Measure the voltage on the left side of R14 with a DVM. Adjust R8 for a reading of +15.00±.01VDC.
   2.3 Measure the voltage on the far side of R15 with a DVM. This must read -15.00±.15VDC.
   2.4 Measure the voltage on the collector (metal can) of Q5. This must read +20.00±.2VDC.
   2.5 Measure the voltage on the collector (metal can) of Q12. This must read -20.00±.4VDC.

NOTE: The stop level pot must be fully CW for all tests except test 10.A.

3. RMS ADJUSTMENTS
   3.1 Place the "STEREO COUPLER" switch to it's "IN" (SLAVE) position. Note that the "SLAVE" LED is lit.
   3.2 Lift one side of Y20. (Between R39 and C17). Apply 100HZ at "0"dBV (1.00VRMS) to test box. Set the "INPUT" switch on the 165A test box to "J25 Pin 1".
   3.3 Place the "AUTO" switch to it's "OUT" (MANUAL) position. Note that the "AUTO" LED is lit. (NOTE: The "AUTO" LED should be lit when the "STEREO COUPLER" switch is in "SLAVE" regardless of the position of the "AUTO" switch).
   3.4 Observe the waveform on QA2 PIN 1. It should be a fullwave rectification pattern. Adjust R45 for equal positive alternations. These alternatations should have an amplitude of approximately 80MV.
   3.5 Place the "INPUT" switch on the 165A test box to "J25 PIN 2". Observe the waveform on QA2 PIN 1. It should be a full wave rectification pattern. Adjust R59 for equal positive alternations. These alternations should have an amplitude of approximately 80MV.
   3.6 Place the "AUTO" switch to it's "IN" (AUTO) position. The waveform at QA2 PIN 1 should now be a symmetrical sinewave with an amplitude of not more than 3MV P/P.
   3.7 Place the "INPUT" switch on the 165A test box to "J25 PIN 1" and repeat step 3.6.
   3.8 Apply 1KHZ at "0" DB and measure the DC voltage at QA2 PIN 1 (far side of R48). Note this reading.
   3.9 Place the "INPUT" switch on the 165A test box to "J25 PIN 2" and measure the DC voltage at QA2 PIN 1. Adjust R52 for the same voltage noted in step 3.8.
   3.10 Install the lifted end of Y20. Place the "INPUT" switch in the 165A test box to "NORMAL". Measure the DC voltage at QA2 PIN 1. This voltage should read: Add -38mvdc to the voltage measured in step 3.8. This is the voltage you should read for step 3.10 +/-6mvdc.

4. Threshold LED Indicators
   4.1 With the "STEREO COUPLER" switch still to it's "IN" (SLAVE) position, place the "REMOTE" switch on the 165A test box to "POSITION 4".
   4.2 Measure the DC voltage at the "DVM Banana Jacks" on the 165 test box and adjust the "OUTPUT GAIN" pot on the dbx 165A for .00VDC. Note that the "BELOW" (GREEN) LED is lit.
   4.3 While still pressing the "THRESHOLD TEST" switch, adjust the "OUTPUT GAIN" pot until the point where the "BELOW" LED has just gone "COMPLETELY" out and the "YELLOW" LED is lit brightly. The DVM must read +140±5MVDC.
   4.4 While still pressing the "THRESHOLD TEST" switch, adjust the "OUTPUT GAIN" pot until the point where the "YELLOW" LED has just gone "COMPLETELY" out and the "ABOVE" (RED) LED is lit brightly. The DVM must read +380±5MVDC.

5. Threshold Calibrate
   5.1 Place the "STEREO COUPLER" to it's "OUT" (master) position. Note that the slave LED is no longer lit.
   5.2 Place the "AUTO" switch to it's "OUT" (manual) position. Note that the "AUTO" LED is not lit, place the "AUTO" switch back to it's "IN" (AUTO) position.
   5.3 Apply 1KHZ at +10DB. Place the threshold pot fully CW. Adjust R65 until the red threshold LED is on and then back off on R65 until the yellow threshold LED just comes on.
   5.4 Apply 1KHZ at -40DB. Place the threshold pot fully CCW. The yellow threshold LED must be on.
   5.5 Place compressor knob to "4".
   5.6 Place R140 fully CW then CCW slightly.
   5.7 Apply 1KZ 0DB (1.00VRMS). Note: Reading on DB meter (adjust gain pot for reading).
   5.8 Apply 1KHZ +20DB (10.VRMS). Meter reading should increase 5DB. Adjust R140 until the requirements of 5.7 and 5.8 are met.
   5.9 Repeat steps 5.7 and 5.8 until no adjustment of R140 is necessary.
   5.10 Set the "COMPRESSION" pot fully CW. Apply 1KHZ at "0"DB and set the "OUTPUT GAIN" pot for a convenient reading on the external DB meter. (e.g. -20DB). Apply 1KHZ at +20DB. The reading on the external DB meter must not change more than ±.5DB.

6. System Bypass and Compression Test
   6.1 Apply 1KHZ at "0" DB and place the "SYSTEM BYPASS" switch to it's "IN" (SYSTEM BYPASS) position. The external DB meter should read "0"-.2DB. Note that the "OUTPUT GAIN" pot on the DBX 165A has no effect on this reading. Place the "SYSTEM BYPASS" switch to it's "OUT" position.

7. Meter Calibration - Input Mode
   7.1 Shut the power off and set the mechanical zero on the dbx 165A meter for "PRECISELY" "0". Set the power back on.
   7.2 Apply 1KHZ at "0"DB. Place the "THRESHOLD" pot fully CW. Place the "METER" switch on the dbx 165A to "INPUT". Insure that R125 (R.P.) will vary the reading on the dbx 165A meter from -11.5 to +10DB. Set R125 for "PRECISELY" "0". You might have to change R169 to a value between 1Mohm and 680K ohm to meet this spec.
   7.3 Apply 1KHZ at -20DB. The dbx 165A meter must read -20±1DB.

8. Meter Calibration - Output & Gain Change Mode
   8.1 Apply 1KHZX at "0"DB. Place the "METER" switch to "OUTPUT". Set the "COMPRESSION" pot fully CCW.
   8.2 Place the "REMOTE" switch on the 165A test box to "POSITION 7" and measure the DC voltage at the DVM Banana Jacks with a DVM. Install the knob on the "OUTPUT GAIN" pot so that when the slot in the knob is lined up "PRECISELY" with the "0" calibration mark, the DVM reads less than +.200vdc.
   8.3 With the "OUTPUT GAIN" pot set "PRECISELY" on "0".
   Adjust R77 for minimum 2nd harmonic distortion.
   Adjust R138 for "PRECISELY" "0" on the external DB meter.
   Adjust R172 for "PRECISELY" "0" on the dbx 165A meter.
   8.4 Place the "METER" switch to "GAIN CHANGE". The dbx 165A meter must read "0" +/-1dB.
   8.5 Place the "THRESHOLD" pot fully CCW. Vary the "COMPRESSION" pot until the external DB meter reads -10DB. The reading on the dbx 165A meter must be -10+1.5DB. Place the "METER" switch in "OUTPUT". The dbx 165A meter must read -10+1.5DB.
   8.6 Place the "THRESHOLD" pot fully CW and the "COMPRESSION" pot fully CCW. Insure that the "OUTPUT GAIN" pot will vary the reading on the external DB meter from approximately -19DB to approximately +19DB. Total swing must be not less than 38DB.

9. Noise
   9.1 With the "COMPRESSION" pot still fully CCW and the "OUTPUT GAIN" pot set to "0", short the input to the dbx 165A by placing all of the attenuator switches ont he K-H oscillator to their "OUT" positions. The noise reading on the external DB meter must be -78DB or better. (unweighted).

9A. Frequency Response
   9A.1 Apply 1KHZ at "0"DB and adjust the "OUTPUT GAIN" pot on the dbx 165A for "PRECISELY" "0"Db on the external DB meter. Sweep the K-H oscillator from 20HZ to 20KHZ. The output should not vary more than +.5DB or -1.0DB.

10. Peak Stop Adjust
   10.1 Set KH to 1KHZ at 1.00vrms
   10.2 Place the "SYSTEM BYPASS" switch to it's "IN" position. Note that the external DB meter reads "0" + .2DB.
   10.3 Adjust the "volts" pot on the K-H oscillator until the external DB meter reads -2.2DB (e.g. .775vrms).
   10.4 Place the "SYSTEM BYPASS" switch to it's "OUT" position.
   10.5 The front panel switches should be as follows:
   Threshold - Fully CW
   Compression - Fully CCW
   Stop Level - "0"
   Output Gain - "0"

10.6 Adjust R165 fully CW. Note the waveform on the scope. No clipping should be evident. The 2nd harmonic distortion should be less than .032%.
10.7 Adjust R165 CCW until the 2nd harmonic distortion reads .1%.
10.8 The peak stop LED should be on.
10.9 Increase the output of the K-H oscillator to +10DB. The external DB meter should read +3DB±1DB. Note that the waveform on the scope is "soft" clipped. (E.g., the corners of the waveforms are rounded).
10.10 Rotate the "Stop level" fully CW. The "peak stop" LED should be off. Rotate the "stop level" pot until the "peak stop" LED lights. This should occur when the "stop level" knob on the 165A reads 10±3.
10.11 No clipping should be observed on the scope.
10.12 Rotate the "Stop level" pot slightly CCW until "soft" clipping is observed on the scope. This should occur when the "stop level" knob reads 10±3DB.
10.13 Rotate the "stop level" pot fully CW.
10.14 Reset the KH oscillator to 1.00vrms.

11. Maximum Output - 600 Ohms
11.1 Apply 1KHZ at +20Db and place the "NORMAL/600 OHM" switch on the 165A test box to "600 OHMS". Adjust the "OUTPUT GAIN" pot until clipping is observed on the scope. Clipping must be symmetrical and must occur at not less than +23DB (11.00vrms). Return the "NORMAL/600 OHM" switch to "NORMAL".

12. Clamping Circuit
12.1 Apply 1KHZ at "0"DB. Set the "COMPRESSION" pot fully CCW. Set the "OUTPUT GAIN" pot to "0" on the front panel.
12.2 Observe the waveform on the scope. Place the "POWER" switch off and note that the waveform on the scope collapses without any DC shifts occuring above or below the P/P level of the sinewave.
12.3 Note that when the "POWER" switch is turned on, the waveform on the scope goes to an intermediate level for a short period of time, and then to it's final level.

13. Remote Test
13.1 Apply 1KHZ at "0" DB.
Place the "STEREO COUPLER" switch to "OUT" (MASTER).
"THRESHOLD" pot fully CCW.
"COMPRESSION" pot fully CCW.
"AUTO" switch to "IN" (AUTO).
"OUTPUT GAIN" pot fully CW.
"STOP LEVEL" pot fully CW.
13.2 Measure the voltage at the "DVM Banana Jacks" on the 165A test box. The voltages should read as follows:

Position of test box stereo coupler switch
1. Press "LED TEST" switch. Note LED is lit.
2. OVDC
3. Voltage reads +1.8VDC. Rotate the "THRESHOLD" pot fully CW. The voltage reads .1VDC.

4. 0VDC
5. Place the "COMPRESSION" pot fully CW. The voltage reads greater than -.09VDC (in a negative direction). Rotate the "THRESHOLD" pot fully CCW. The voltage now reads +.06VDC.
6. 0VDC.
7. >+_14VDC
8. 0VDC
9. >+14VDC
10. 0VDC
11. 0VDC
12. Press the "LED TEST" switch. Note LED is lit.

13.3 Place the "STEREO COUPLER" switch to it's "IN" (SLAVE) position. Position of test box stereo coupler switch.

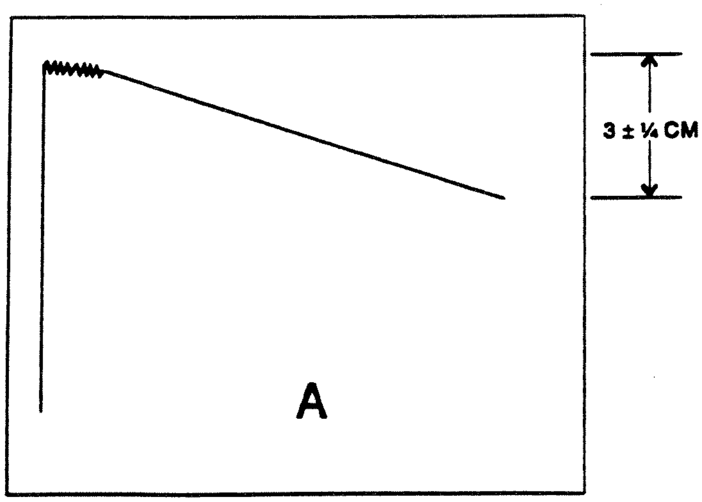
6. Place the "COMPRESSION" pot fully CCW. Place the "METER" switch to "GAIN CHANGE". Note the reading on the dbx 165A meter. Press the "THRESHOLD TEST" switch. Note that the reading decreases 2-4DB.
8. Note the reading of the dbx 165A meter. Press the "THRESHOLD TEST" switch. Note that the reading decreases .5-10DB.

14. Attack/Release Time Test

14.1 Set the "THRESHOLD" pot fully CCW.
Set the "COMPRESSION" pot fully CW.
Set the "db/MSEC RELEASE" pot to "40".
Set the "db/SEC RELEASE" pot fully CW.
Set the "AUTO" switch to it's "OUT" (MANUAL) position.
Set the "STEREO COUPLER" switch out.

14.2 Measure the DC voltage at the far side of R92 with DVM. Set R93 for a reading of approximately -3vdc.

14.3 Apply a 200HZ Toneburst signal. Set the scope vertical pot to ".1V/CM". Set the scope horizontal pot to "50MSec/CM". Observe the waveform at S3 PIN 9. Adjust R93 until a slew rate of -300MV per 1/2 second is obtained, as shown in figure A. The scope should be DC coupled. If the waveforms offset is too much for scope, see addendum 14.2A.



A. Add Test 14.2A as follows:

14.2A.. Connect the test lead from the "Bias" test jack on the 3BX test box to the junction of R48 and pin 1 of QA2 on the dbx 165 or dbx 165A under test.

B. The reason for adding test 14.2A is as follows:

In step 14.3, we are trying to monitor a signal that looks like that shown in figure #1 below, on the .1vDC scale (YA) of a Philips Scope.

To do this there must be enough range in the position pot of channel A to allow a 2.3vDC level to appear on the 8cm (high) screen of the scope. On some Philips Scopes this can be done, on some Philips scopes this cannot be done.

To enable this signal to be monitored on all Philips Scopes, a test lead has been added to the 3BX test box. This lead goes to the -5vDC supply in the 3BX test box, through a 22K resistor. During step 14 (in the 165/165A test procedure) this lead is connected to the junction of R48 and pin 1 of QA2. This voltage biases the output of the RMS chip (QA2) slightly negative, and changes the signal at pin 9 of S3 to look like that shown in figure #2 below (approximately). This signal can now be monitored on all Philips Scopes, on the .1vDC scale.

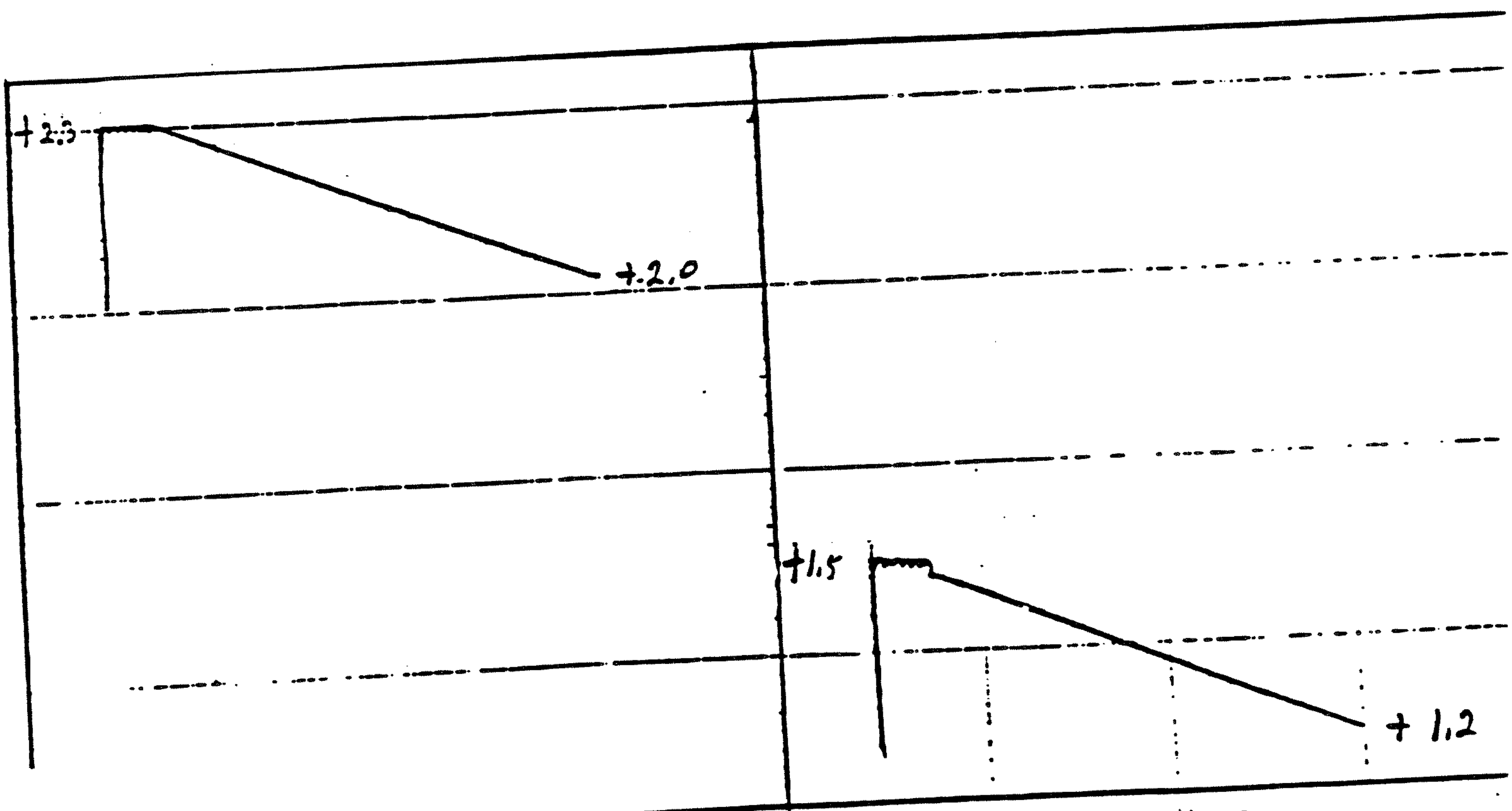
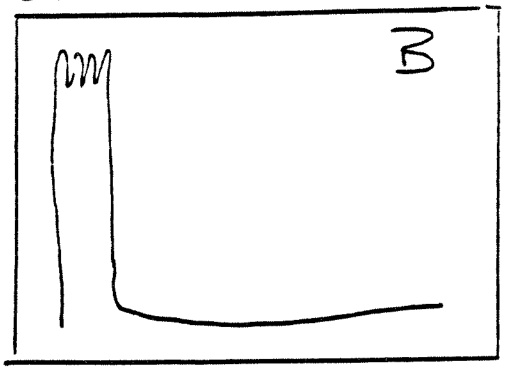
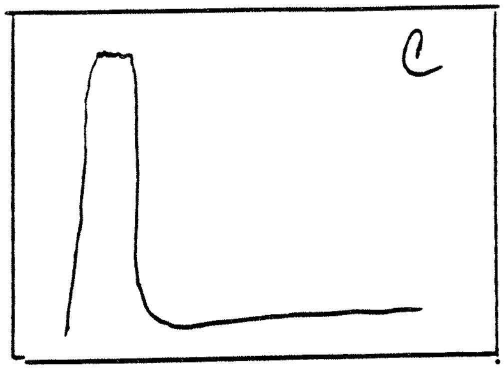


FIGURE # 1

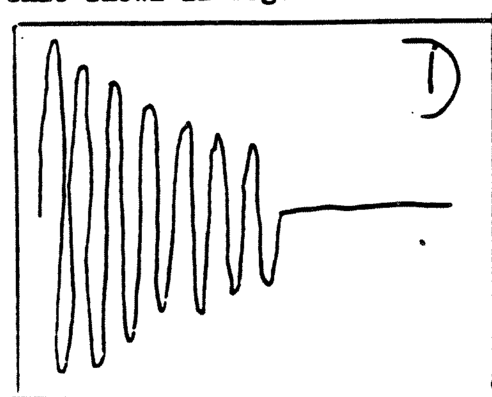
FIGURE # 2

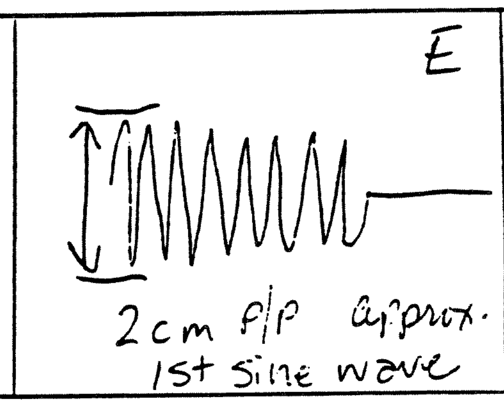
14.4 Set the scope vertical pot to ".5v/cm(DC)" and adjust the vertical position pot so that the bottom line is "0" VDC.
14.5 Set the "db/SEC RELEASE" pot fully CCW. The waveform on the scope should look like that shown in figure B.





14.6 Set the "db/MSEC ATTACK" pot fully CCW. The waveform should still look like that shown in the left diagram above. Set the "db/MSec ATTACK" pot fully CW. The waveform should look like that shown in figure C.
14.7 Apply a 3KHZ Toneburst signal and observe the output of the dbx 165A on the scope. Place the scope vertical pot to ".2V/CM" and set the scope horizontal pot to "5 MSEC/CM". Adjust the "OUTPUT GAIN" pot on the dbx 165A until the first cycle of the waveform covers approximately 8 vertical centimeters. The waveform should look like that shown in figure D.





14.8 Place the "AUTO" switch to it's "IN" (AUTO) position. The waveform should look like that shown in figure E.
14.9 Place the "AUTO" switch to it's "OUT" position.
14.10 Rotate the release pot "CW" until the P/P voltage of the first sine-wave of the toneburst waveform is approximately 2 cm.
14.11 The release pot knob should point to approximatly 100.

15. Detector Separation
15.1 With an ohmmeter, check between te detector and input and the signal and input on the rear terminal strip. This must measure more than 100K ohms. Measure between the detector - input and signal - input. This must also measure more than 100K ohms.

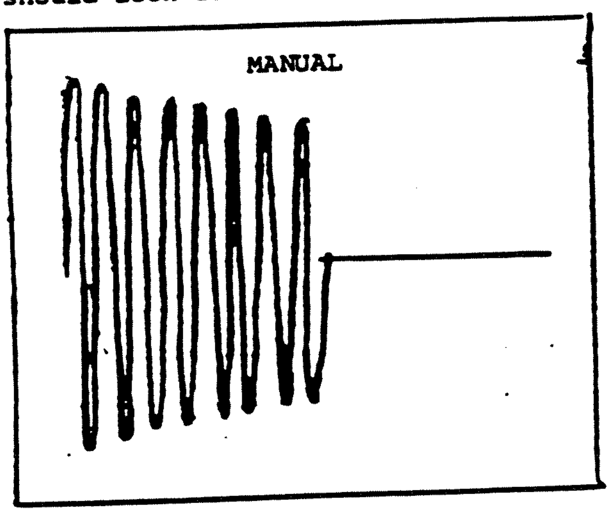
16. Apply 1kHz @ 0dB. Place the power switch to its OUT position while observing the action of the clamping circuit on the scope. Place the power switch to its IN position and observe the action of the clamping circuit on the scope. There should be no transients that exceed the final P/P amplitude of the sinewave, with power on.

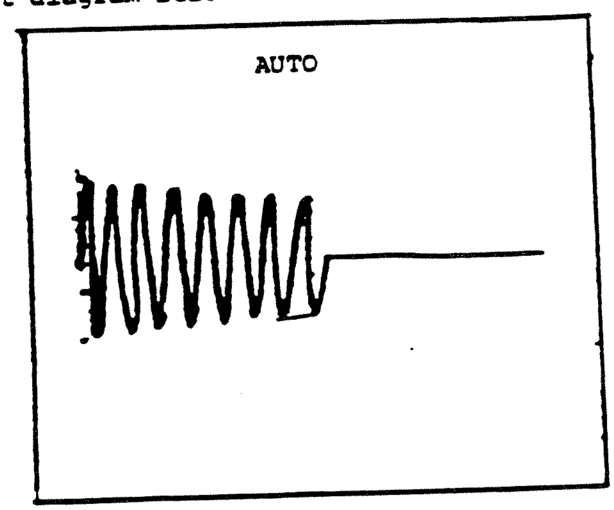
17. Rotate the STOP LEVEL pot CCW until the red STOP LED just lights. This should occur when the stop level pot reads +5 ± 2dB. At this time no clipping should be observed on the scope. Rotate the STOP LEVEL pot to 0. Observe that the waveform on the scope is clipped softly. Rotate the STOP LEVEL pot fully CW.

18. Apply 1kHz @ +20dB. Place the load switch on the 165A test box to ON. Rotate the OUTPUT GAIN pot on the 165A until clipping is observed on the scope. Clipping must be symmetrical and occur at an amplitude greater than +21dBv (+23DVM). Place the load switch on the 165A test box to off.

19. Apply 1kHz @ 0dB. Rotate the knob of the OUTPUT GAIN pot until it lines up mechanically with the 0 on the front panel. Observe that 2nd harmonic distortion is less than .05%.

20. Apply a 3kHz toneburst from the 3bx test box. Rotate the THRESHOLD pot fully CCW. Rotate the COMPRESSION pot fully CW. Rotate the ATTACK pot fully CW. Rotate the RELEASE pot fully CCW. Place the AUTO switch to its OUT position. Place the STEREO COUPLER switch to its OUT position.
Place the Scope Vertical pot to .2V/CM and set the scope Horizontal pot to .5MSEC/CM. Adjust the OUTPUT GAIN pot on the dbx 165 until the first cycle of the waveform covers approximately 8 vertical centimeters. The wave form should look like that shown in the left diagram below.





Place the AUTO switch to its IN (AUTO) position. The waveform should look like that shown in the above right diagram.

21. Place the AUTO switch to its OUT position. Rotate the release pot CW until the wave form on the scope measures 2cm P/P. The release pot should read approximately 100.

22. Apply 1kHz @ 0dB. Adjust the METER CALIBRATION pot on the rear panel until the 165A meter reads approximately -1.8dB.