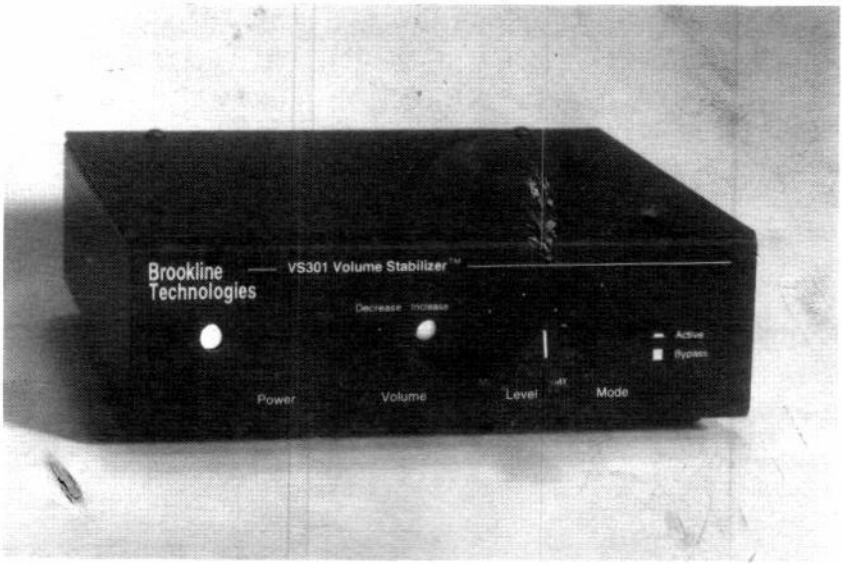
Brookline Technologies

VS301E Volume Stabilizer™

now with Enhanced Sound Circuitry

Instruction Manual



Limited Warranty

Brookline Technologies warrants this product against defects in material or workmanship for a period of 1 year from the original purchase. In this period Brookline Technologies will supply new or rebuilt parts and the labor to install them if returned to our factory service center. Simply ship the unit adequately insured with shipping costs prepaid. Return shipping costs will be paid by Brookline Technologies.

This warranty is only valid if the original serial number appears on the product.

This warranty does not cover cosmetic damage and damage due to acts of God, accident, misuse, abuse or negligence to the product

There are no express warranties except as listed above

BROOKLINE TECHNOLOGIES SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THE PRODUCT, OR ARISING OUT OF ANY BREACH OF THIS WARRANTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied warranty lasts, so the above limitations or exclusion may not apply to you.
This warranty gives your specific legal rights and you may also have other rights which vary from state to state.

Warning

- To prevent fire or electric shock hazard, do not expose the unit to rain or water.
- Use only with the supplied power transformer.
- Do not cycle power at high volume settings as this could possibly cause loud turn on/off surges.

Model VS301E

Serial Number _____

Date Purchased _____

Table of Contents

Introduction

Congratulations on purchasing the VS301E Volume Stabilizer with Enhanced Sound Circuitry from Brookline Technologies. It has been designed for easy installation and use.

Please read pages 5 to 11 for the proper hook up and operation of the VS301E before using the unit. If you want more technical information on how the unit operates, you can refer to the Technical Information Chapter starting on page 12.

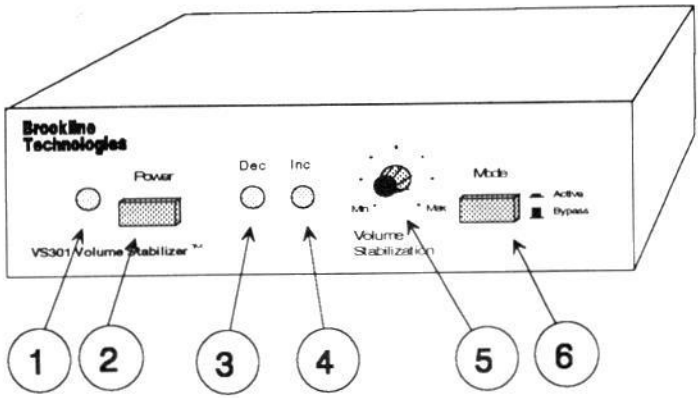
The VS301E is the ideal accessory for audiophiles who want to decrease the volume fluctuations between quiet and loud portions of music or audio but still want to maintain the dynamics of the music. The VS301E has been designed to work in your home stereo system, home theater system or with other devices like satellite receivers. It allows you to hear soft dialogue in movies without being blasted by loud sounds. In addition, any source can be optimally recorded onto cassette tapes, DAT, DCC and MD discs. These recordings are ideal for listening in cars, in airplanes, while riding exercise bikes, at the beach or other places with background noise that typically prevents you from hearing all of your music. Also it can be used while listening to music at normal levels. It is also great for background music at home or office because of a more stable volume between different songs or CDs (especially useful with a CD changer!). The music can always be heard, but not overwhelm your guests. With home theater systems, the VS301E eliminates the need for you to constantly adjust the volume between loud and quiet scenes because it maintains a more constant volume level.

When using the VS301E Volume Stabilizer, you will notice that it will increase the volume slowly as the music volume falls, just as you would do. However, when the music volume increases, the VS301E responds in less than a millisecond to turn the volume down to precisely the correct level...much faster than any human could do.

The VS301E Volume Stabilizer has been tested with a wide variety of music and videos and has been optimized for excellent sound reproduction without the "compressed" sound that you often hear from music on the radio and other over-compressed sources. And now with the new enhanced sound circuitry, the unit responds like the human ear for an even more natural sound.

Product Overview

Figure 1
Front Panel



1) **POWER LIGHT (green)** - This indicates when power is applied to the VS301E.

2) **POWER PUSH BUTTON** - Push this button in to turn power on the VS301E.

3) **DECREASE LIGHT (red)**- This indicates when the VS301E is decreasing the volume of the audio signal because the signal is louder than the threshold.

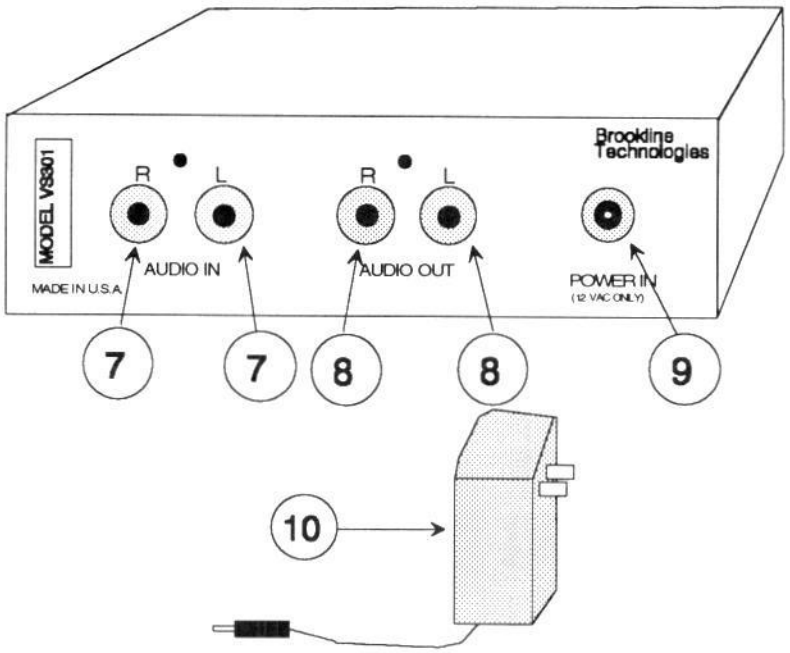
4) **INCREASE LIGHT (amber)** - This indicates when the VS301E is increasing the volume of the audio signal because the signal is softer than the threshold.

5) **VOLUME STABILIZATION CONTROL** - This adjusts the amount and the slope of the volume stabilization. Clockwise give the greatest amount of volume stabilization and counter-clockwise eliminates the volume stabilization effect .

6) **MODE SWITCH** - Push this button in to put the VS301E in the audio circuit. When this button is out, all of the electronics are bypassed.

Note: The DECREASE and INCREASE LIGHTS will not operate when this switch is in the out position.

Figure 2
Rear Panel



7) AUDIO IN - Inputs from a standard line level audio output.

8) AUDIO OUT - Outputs to go to the input of a cassette deck or receiver.

9) POWER IN - Low voltage 12 VAC input. Plug the power connector from the wall mounted transformer into this jack.

Note: Use only the supplied 12 VAC transformer.

10) WALL MOUNTED POWER TRANSFORMER - Supplies 12 VAC to the VS301E.

Installation

Power Connection

Plug the power plug from the AC WALL TRANSFORMER into the POWER IN connector on the VS301E and then plug the AC WALL TRANSFORMER into a standard 120 VAC wall plug.

Audio Connections

Inputs
The VS301E accepts standard RCA connectors with line level outputs from a VCR, laser disk player, satellite receiver, CD player or other similar signal source.

> ***Note:*** *Connect to the fixed level output of a device and not the variable level outputs. If it only has variable outputs, then set the volume on the device to maximum. This means that the VS301E should be before the volume control in the audio chain.*

Outputs
The output of the VS301E uses standard RCA connectors to go to the inputs of a cassette deck, receiver or other device.

> ***Warning****: Do not connect the VS301E between the output of a preamplifier and the input of a power amplifier. This could result in excessive volume levels as the VS301E will try to bring the volume up to full line level.*

The actual way you connect the Volume Stabilizer to your system will vary depending upon the equipment you have and how you want to use the Volume Stabilizer.

Refer to the diagrams on the next two pages for more connection information.

The easiest way to connect the Volume Stabilizer is shown in **figure 3**. Put it between the source you want to stabilize and your stereo receiver. If you have multiple devices (satellite receiver, laser disk player, VCR, etc.) then you could "daisy chain" the units. That is, feed the output of the first unit into the input of the second device and so on.

Figure 4 shows the Volume Stabilizer connected directly between a VCR, video disk player, satellite receiver or other source and the A/V jacks on a TV. Remember, you must select the A/V or auxiliary input on your TV for this to work.

Finally **figure 5** shows the best way to handle multiple devices connected to your stereo or home theater system. Connect the Volume Stabilizer in a external processor loop or a "tape loop". This "tricks" the receiver to think that the VS301E is a tape deck. You can select any input and then "monitor" the tape loop to hear the Volume Stabilizer. If you already have a tape deck connected to your receiver, connect the VS301E between the output of the receiver and the input of the tape deck. This will allow you to make tapes using the VS301E.

Figure 3

Connection between CD player, laser disk, VCR, satellite receiver or other source and receiver

Useful if you want the VS301E to affect just the output of one device.

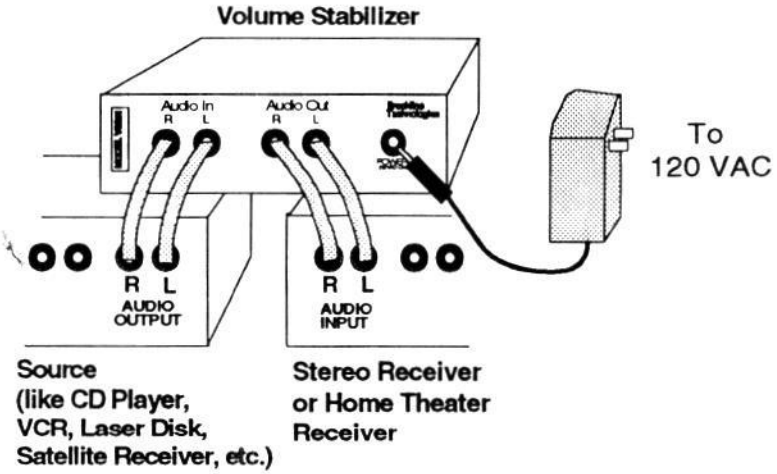


Figure 4
Connection between a satellite receiver, VCR or cable box and a TV with AV jacks

Useful if you want the VS301E to minimize sound changes from your satellite receiver or VCR on your TV

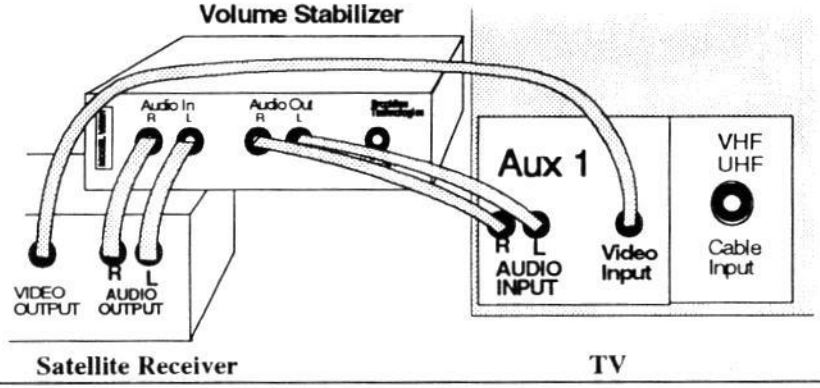
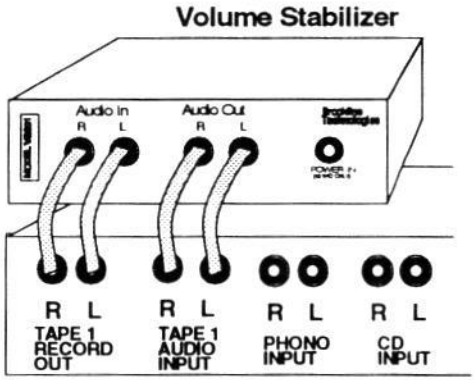


Figure 5
Connection in a Tape Loop

Useful if you want the VS301E to affect the output of any device connected to your receiver. Simply select the desired input and then monitor the "tape" to hear the VS301E.



Operation

Power

Press the POWER BUTTON. The green POWER LIGHT will light indicating power is on. For about 10 seconds, the red DECREASE light will be on and the unit will be in a reduced gain mode.

Note: Be sure the volume control on your receiver or preamp is turned down when power is turned on to the VS301E, or turn all components on together.

Bypass Mode

With the MODE SWITCH in the "OUT" (bypass position) position, no change to the audio signal occurs.

This is useful if you want to listen or record without any volume stabilization. The VS301E will work with power on or off in this mode. Likewise, adjustment of the VOLUME STABILIZATION control will not have any affect. Note that the INCREASE and DECREASE LIGHTS will go out in the bypass position. This makes it easy to tell when the unit is in the active or bypass mode.

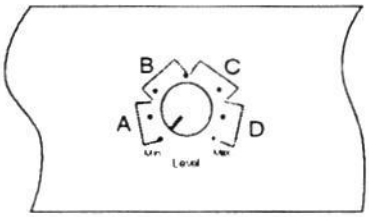
Active Mode

With the MODE SWITCH in the "IN" (active position) position, the VS301E Volume Stabilizer is in the signal path. The Volume Stabilization adjustment allows you to adjust from no volume stabilization (at the full counter-clockwise position) to maximum volume stabilization (at the full clockwise position). A special circuit minimizes any volume changes as you rotate the Volume Stabilization adjustment.

The MODE SWITCH can be pressed to hear the difference between with and without volume stabilization. Typically the volume will be slightly louder in the active position. This is because most audio is recorded below the maximum level so the peak sound levels do not saturate or clip.

The Volume Stabilizer has the biggest impact on music and movies on the softer passages. Here the volume and the sound quality will improve in the active mode. When the music is recorded "hot" (very loud) on the CD or movie, you will actually hear the volume decreased by the Volume Stabilizer. However, this is done automatically for you so you can just enjoy the movie or music.

Volume Stabilization Setting



The optimal setting of the Volume Stabilization level control depends upon how you intend to use the VS301E and your preferences. Here are some suggestions.

Volume Stabilization Setting	Zone	Audio Effect	Applications
Lowest settings	A	Increases only the very soft audio	At home listening To keep recorded music above cassette tape hiss
Mid-low position	B	Increases just the soft and medium audio	General purpose listening. Brings up just quiet dialogue
Mid-high position	C	Somewhat constant volume level	Tapes for quiet cars Reduces loud action scenes slightly in movies
Full clockwise (i.e. max)	D	Constant volume level	Tapes for automotive and airplane use Minimal volume changes for home theater and satellite

Indicator Lights

The INCREASE and DECREASE LIGHTS show how the VS301E is changing the volume. The INCREASE LIGHT indicates that the volume is being increased because the audio is soft or at a low level. With soft music or dialogue, the INCREASE LIGHT will be on full. As the volume increases the light will begin to dim. If the volume gets loud enough, the red DECREASE LIGHT will begin to light as the unit decreases or "turns down" the volume.

The actual operation of the lights will vary among different music sources, different CDs and even different songs on the same CD. Likewise, as the Volume Stabilization control is adjusted, the lights will reflect the operation of the VS301E. If the Volume Stabilization control is set to the Min position (full counter clockwise), both of the lights will be either very dim or off independent of the incoming audio.

Note: It is common that with some equipment, the amber increase light is on most of the time, although some blinking of the light should occur on louder audio. You should not use the lights to set the Volume Stabilization Setting. See the chart above for proper setting.

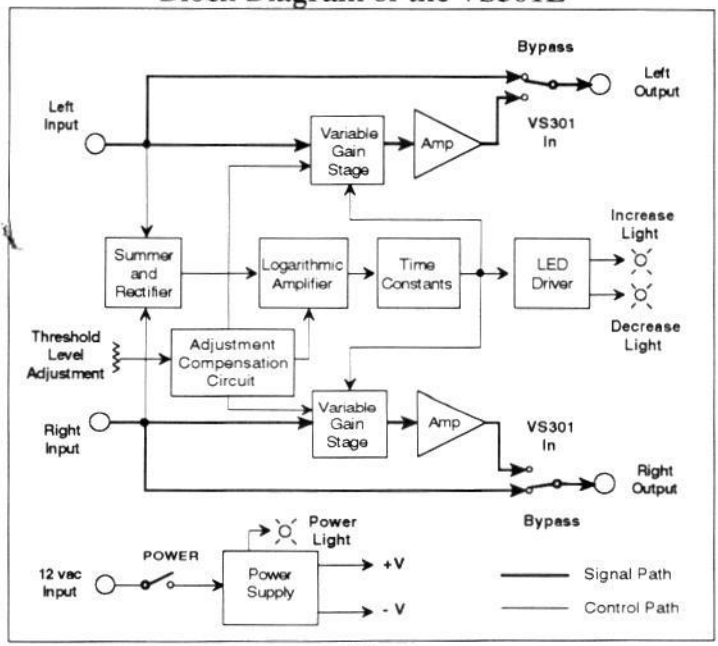
Technical Information

The Volume Stabilizer is a device designed to minimize unwanted volume fluctuations in music or other audio sources while maintaining the dynamics of the music. It works by monitoring the input signals and then adjusting a variable gain circuit to provide the proper output signal. It increases the signals below a threshold and decreases the signals above this threshold.

The VS301E changes only the volume just like a volume control. It does not change any frequency response or phase information for optimal sound quality.

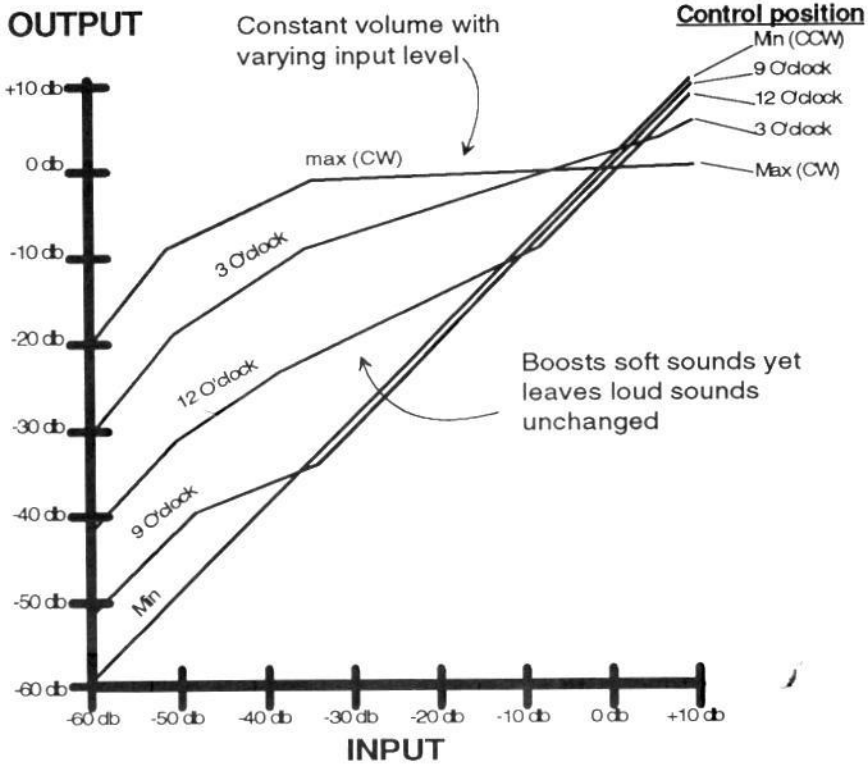
Refer to figure 6 for the following discussion. The left and right audio signals are rectified then summed together and fed into a logarithmic amplifier. The logarithmic converter is used to convert from the linear voltages to logarithmic voltages that follow the db curve to give proper volume adjustment. A single control channel is used to eliminate volume differences between the left and right channels that would cause imaging shifting of the sounds. This control signal is fed to the dual time constant circuit and then to the left and right variable gain amplifiers. The Volume Stabilization control goes through a special adjustment compensation circuit to minimize changes as the control is adjusted.

Figure 6
Block Diagram of the VS301E



The VS301E uses a variable volume stabilization ratio that ranges from 1 to 1 (no change) to greater than 10 to 1. That is, for every increase of 10 db of the input signal, the output changes only 1 db. This allows you to select the amount of Volume Stabilization you desire for a given situation.

Figure 7
Effect of the Volume Stabilization adjustment on Output



As you can see in figure 7, The VS301E's volume stabilization adjustment allows you to change from zero to full volume stabilization. At the minimal position (counter-clockwise), the output signal is the same level as the input signal regardless of volume. As the control is rotated clockwise, the lower level signals are increased with high level signals unchanged. When the adjustment is in the full clockwise position, the output is now reduced by a factor of about 10:1.

With the volume stabilization control set at the clockwise position, notice that when the input signal varies from -30 db to +10db (40db change), the output changes from -4db to +0db (4db change). Therefore, the volume change is reduced by a factor of 10:1 (40/4=10). At about the 3 O'clock position this slope is about 2.5:1.

You can also see that when the volume stabilization adjustment is rotated clockwise towards the maximum position, three things happen. First, the "break point" where the volume stabilization effect occurs is shifted to higher levels of input signal. Second, the slope of the curve is increase to give greater Volume Stabilization. Third, the entire curve is shifted to automatically compensate for the VS301E increasing the gain as you make the adjustment. This minimizes the changes in volume that would otherwise occur as you make adjustments to the level threshold control. (Please note that some volume changes will occur as the level is adjusted depending upon the volume of the music that is playing. If the music is very soft, then rotating the adjustment clockwise will increase the volume. On the other hand, if the music is very loud (red decrease LED is on) then rotating the adjustment clockwise will decrease the volume.)

Increase and Decrease Lights

The Increase and Decrease lights show you how the VS301E is either increasing the volume (amber = Increase) or decreasing the volume (Red = Decrease). When the unit is at zero gain (no volume change), both the Increase and Decrease lights will be off or very dim. As the volume is changed, the appropriate light will increase in brightness over the range shown in the chart below.

Volume Change	Increase light (amber)	Decrease light (red)
15 to 30 db (large increase)	On	Off
0 to 15 db (some increase)	Dim to full on	Off
0 db (no change)	Off	Off
0 to -5db (some decrease)	Off	Dim to full on
-5 to -10db (decrease)	Off	On

When the Volume Stabilization control is turned to Min (full counter clockwise), the lights indicate that no volume stabilization is occurring because both of the lights will be off or very dim regardless of the music.

Typical Questions

What is the difference between the VS301E Volume Stabilizer and compressors, companders, limiters, expanders, and automatic gain controls?
The key difference is in the purpose of how each used.

- Compressors are typically used for two key reasons: 1) To be part of a companding system to eliminate tape hiss (in which music is COMPressed then recorded on to tape and exPANDED when played back) and 2) To make radio stations (typically top 40) sound as loud as possible. Here multi band compressors are used which maximize loudness at the expense of affecting the spectral content of the music; hence everything sounds flat and dull. The Volume Stabilizer, on the other hand, has been designed to provide an improved sound for listening.
- Limiters simply clamp audio signals above a certain level, thus removing all music dynamics. These are typically used at radio station to stay within FCC modulation limits.
- Expanders increase the dynamic range of music. These were popular when all music had to be compressed to fit onto LPs and tapes (with 45 to 65 db of dynamic range). Now with CDs, HiFi Video tape, DAT, MiniDisc, and DCC, it is no longer necessary to compress the source. Music is now recorded with its full dynamic range.
- Automatic gain control devices are really just compressors with an infinite compression slope, so they completely remove the dynamic range from music. In the MAX position, the VS301E also provides a flat output vs. input, yet it retains the instantaneous dynamics of the music.

Why are the attack and decay time constants different?
The attack time is the time for the VS301E to respond to an increase in volume. It needs to be very fast in order to "catch" a sudden burst of music. The attack time constant of the VS301E is 0.45 msec (0.00045 seconds) and is an exponential shape so that the slope (change of db per second) increases with larger changes of music volume. Therefore, a loud burst will cause the unit to reduce the volume more quickly than a small volume change. This provides a more natural sound.

The decay time is the time for the VS301E to turn the volume "up" after loud music. This is much longer (about 1 to 8 seconds) than the attack time and is a linear curve. The slope is constant so the volume changes smoothly, just as you would do. This prevents "pumping" and "breathing" sounds associated with conventional compressors and other such devices.

Troubleshooting

Problem	Possible Solutions
Power light is off	Check that power transformer is plugged into a working outlet
	Power jack is plugged into the VS301E
	Power switch is on (in position)
Increase light is on constantly	Input signal is at a low level. This is quite normal with many types of equipment and recordings that do not produce high output levels. However, on very loud recordings, some flickering of the increase light should occur although the decrease light might never come on.
	Be sure the input of the VS301E is connected to a fixed level output or if it is connected to a variable level output that the volume is set to the maximum.
	No input signal
Unit works in the Bypass mode but no sound in Active mode	Power is off.
	Input and output cables are reversed
Decrease light is on constantly	Input signal very high
	Normal for 10 seconds after power is applied.
Increase and Decrease lights are off or very dim	Volume stabilization control is at the CCW position
	MODE button is in the BYPASS mode
More noise/hiss is present during quiet passages with VS301E active than when bypassed	Normal because the VS301E increases both signal and any inherent master tape hiss with the signal. In most listening environments, this slight additional noise will not be heard. If this is a problem, reduce the volume stabilization control slightly.

Specifications

Frequency Response	20 Hz to 20 KHz, +0 db, -3 db
Signal-to-noise ratio	More than 75 db, A weighted
Total harmonic distortion	Less than 0.1 % THD at 1 KHz at 1 vrms
Input impedance	22 Kohm
Input level	0.55 V rms
Output impedance	1 Kohm
Maximum output level	Greater than 3 V rms into 10 Kohms
Channel separation	More than 75 db
Volume stabilization effects with Volume Stabilization @ CW Maximum gain Minimal gain	 +28 db (input = .25 mv rms [-70 dbm]) -10 db (input =3 V rms [+12 dbm])
Volume Stabilization ratio	Adjustable, greater 10:1 to 1:1
Zero gain level	0.55 V rms
Level matching	Better than +/- 2 db, Volume Stabilization CCW to bypass
Signal polarity	Positive (non-inverting)
Time constants Attack Decay	 0.45 msec, exponential time constant About 6 seconds, linear (6 db / second)
Power requirements	12 vac
Transformer input	120 vac, 7.2 VA
Unit dimensions	Approx. 5" x 5.5" x 1.6" (w/d/h)
Operating temperature	40 to 110 deg F
Supplied accessories	3' stereo connecting cable Power transformer with 6' cord

Design and specifications subject to change without notice.

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Printed in USA

MAN-301D-11/94