FOREWORD

This manual contains all the information you need to operate the 525 Gated Compressor/Limiter. In addition, there’s detailed applications data to help you get started right away, and to illustrate some of the more interesting uses for the 525.

There are seven chapters. The individual sections of each chapter are labeled first with the chapter number, then with the section number. For example, the first section of the first chapter is labeled 1.1, and the third section of the fourth chapter is labeled 4.3, and so on. Use the numbers referenced in the Table of Contents to quickly locate the information you need.

IF YOU'RE GOING TO JUMP RIGHT IN AND START USING THE 525 WITHOUT READING THE MANUAL, JUST TAKE A MINUTE TO RUN THROUGH SECTION 3 - FAST FIRST TIME SETUP.

Text Emphasis

Boldface and BOLDFACE CAPS are used for emphasis. Boldface caps indicate greater emphasis than boldface type.

Some of the text in this manual is set apart by a "boxed" heading Note, Caution, or Warning:

NOTE

A NOTE conveys useful information that’s included to make certain functions more obvious, and to supply extra information about processes, techniques, connectors, etc.

CAUTION

A CAUTION indicates a potential danger to the 525 or associated equipment.

WARNING

A WARNING indicates a potential danger to the user.
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1. Dynamic Range Processors

The 525 Gated Compressor/Limiter utilizes Symetrix' program controlled interactive dynamic range processing technique, that combines the best attributes of both compressor/limiters and expander/gates. "Program controlled" means the 525 analyzes incoming signals, then adjusts its attack and release times to match the transient characteristics of those signals. This type of dynamic range processing makes the 525 an ideal controller for live sound reinforcement, vocal track processing, video post production, audio and video duplicating, paging system control, and general purpose gain control - any situation where "invisible" control of wide ranging levels is needed.

Levels are kept in check by the compressor/limiter, which responds quickly to transients, and gently to smaller level changes. The expander/gate prevents pumping, eliminates leakage from headphones, reduces room ambience, and always maintains the best possible signal-to-noise ratio. Because the compressor/limiter and the expander/gate are interactive, the 525 always provides an appropriate response, while providing automatic control over a wide range of input levels.

Strictly speaking, the terms compressor and limiter refer to two different devices. However, the two are often combined into a single device called a compressor/limiter. Compressors/limiters usually perform as either a compressor or a limiter, but not both at once. Functionally, a compressor/limiter is a device that lets the user define, or predetermine, the maximum level of an audio signal. The ratio of the 525's compressor/limiter may be adjusted from 1:1 to 20:1, allowing it to perform as either a compressor (from about 1.5:1 to 5:1) or as a limiter (from about 5:1 to 20:1).

Expanders and gates are the functional opposites of compressors and limiters. Compressors continuously reduce the dynamic range of signals that are above threshold, while expanders continuously increase the dynamic range of signals that are below threshold. Limiters can be thought of as very high ratio compressors, and gates can be thought of as very high ratio expanders. The 525's circuit is called an expander/gate because it utilizes a ratio higher than that usually employed by expanders, works through a "soft knee" (that makes its turn-on occur more slowly), yet has an "infinite" range.

To put it another way, compressors are to expanders as limiters are to gates. All four of these devices are included in the family of signal processors called dynamic range processors.

1.1 Defining Dynamic Range

To begin a discussion of dynamic range processors it's necessary to have a working definition of dynamic range. The term is really self-descriptive, but has two distinctly different uses:

1. To describe the actual range of signal fluctuations that are going through the equipment, and

2. To define the maximum allowable range of signal fluctuations that can be put through the equipment.

The usual unit of measure for audio signals is the decibel (dB).
1.2 Dynamic Range as a Specification

The maximum usable range of operation for a particular circuit or piece of gear is the distance in dB between the noise floor and the maximum output level. In this context, dynamic range is used as an equipment specification.

Noise floor is defined as the lower limit of a circuit's operating level, and is a function of its self-generated electrical noise. Very noisy circuits have a high noise floor, quiet circuits have a low noise floor. The maximum output level is the upper limit of the operating level, and is the level at which clipping begins. To put levels in perspective they must be referenced to some nominal operating level, like 0dBm. That's why noise specs are stated as minus something. For example, the 525's noise spec is -86dBm, which is 86dB below 0dBm.

Since maximum output level is usually greater than 0dBm, it's stated as plus something. The 525's maximum output is +20dBm, which is 20dB above 0dBm. The difference between the noise floor and the onset of clipping is the dynamic range. To find the 525's dynamic range, subtract -86 from +20. 106dB is the dynamic range.

1.3 Dynamic Range of Sounds and Signals

The other definition of dynamic range describes actual level changes, or the range over which signals fluctuate. The signals under discussion here are electrical representations of sounds, so it follows that sound has dynamic range. The dynamic range of the human voice, from a whisper to a shout, is well over 100dB. So a microphone will convert the sound pressure of a voice going from a whisper to a shout into an electrical output signal with a dynamic range of well over 100dB.

1.4 Why Dynamic Range Processors are Necessary

For signals to stay below distortion and above noise, their actual dynamic range must be kept within the specified dynamic range of the circuits through which those signals flow. Unfortunately, the actual dynamic range of real world signals often exceeds the available dynamic range of even the best equipment.

For example, the dynamic range of the best analog tape recorders is around 80dB, while digital recorders top out at around 96dB. As good as these machines are, there's still not quite enough room for very wide dynamic range signals. In order to maintain a 60dB signal-to-noise ratio (to keep the signals 60dB above the noise floor), the dynamic range of signals stored on the analog tape machine would have to be restricted by 20dB, while the digital recorder would be restricted by 36dB.

A compressor or limiter is often used to reduce dynamic range by setting an upper limit on the larger signals. However, in some cases it's better to put processing to work on the lower end of the dynamic range than on the upper end. In other words, instead of reducing the amount of change at the upper end of the dynamic range with a compressor or limiter, increasing the amount of change at the lower end of the dynamic range with an expander or gate.
Compressors reduce the dynamic range of their output whenever the input signal is above threshold, while expanders increase the dynamic range of their output whenever the input signal is below threshold.

Compressors, limiters, expanders, and gates increase or decrease signal levels by some ratio. Compressors and expanders usually have an adjustable ratio. In other words, the ratio of the input level to the output level can be changed by the user.

A compressor operating with a 2:1 ratio would allow only a 1dB increase in output level for every 2dB increase in input level. An expander operating at a 1:2 ratio would change a 1dB increase at the input into a 2dB change at the output.

Limiters usually have a non-adjustable ratio that is very high (greater than 10:1). At 10:1, the limiter allows only a 1dB increase in the output level every 10dB increase in the input level. Limiters can be thought of as high ratio, high threshold compressors. They are intended to "stay out of the way" until the level goes above threshold. However, above threshold their action is very definite.

Gates on the other hand can be thought of as high ratio, low threshold expanders. They are intended to shut out undesired signals that fall below threshold. Gates are often used for hands-free control of channels that are noisy or are used only sporadically.

The threshold is the level at which a dynamic range processor's activity begins. In operation, the dynamic range processor's sensing circuitry constantly "looks at" the incoming signal and compares it to a reference level, which is called the threshold level. In practice that reference level is set by the operator with the threshold control. Remember, compressors and limiters respond when signals at the input are above threshold, while expanders and gates respond only when signals at the input are lower than the defined threshold.

The action of a dynamic range processor is determined by one of the amplifier circuits inside the unit whose gain is controlled by a DC voltage. That part of the circuit is called a voltage controlled amplifier, or VCA. Inside the 525 a separate buffered audio signal is sent to a group of circuits that comprise the detector. The detector circuits turn the AC audio signal into a DC control voltage, which is sent to the VCA under the direction of the front panel controls.

Expander operation is easily misunderstood unless it's remembered that what's being expanded is the dynamics, or changes, of signals passing through the circuit. Expanders come in two very different types: linear, and downward.

Linear expanders increase the dynamic range of all signals, no matter what their actual level. The linear expander simply makes all changes greater by some ratio, which is sometimes user adjustable. Linear expanders can cause distortion, because clipping occurs when signals just below maximum output level are expanded.

For instance, an unprocessed signal 3dB below clipping that goes up 2dB won't distort, because it's still 1dB below maximum. But if that same signal is passed through an expander operating at a 1:2 ratio, the same 2dB change at the expander's input would become a 4dB change at its output. However, that signal would be 1dB over maximum, causing distortion. Linear expanders must be used with care, because very few systems have enough headroom to handle the upward dynamic range increase they produce.
The kind of processor most commonly called an expander is really a downward expander, because it only affects signals below threshold. This gives the operator control over the expander's activities, allowing it to be used to expand the usable dynamic range of the system without running out of headroom.

1.9 How Expanders and Gates Increase Usable Dynamic Range

The lower limit restriction of a system is the noise floor, which is usually well below the 525's lowest exp/gate threshold (-40dBm). It's important to keep in mind that while the signal levels may change greatly, the noise usually doesn't change very much. The action of the expander/gate increases the dynamics of all signals below threshold that do change. This action increases the apparent loudness of those changing signals, while decreasing the apparent loudness of the noise.

For example, an expander operating at a ratio of 1:2 will cause a signal that falls 10dB at its input to fall 20dB at its output. The downward action of the expander reduces the noise floor by the same ratio applied to the signal. Since the relationship between the signal and the noise stays the same, the noise is reduced 20dB by the action of expander, which is responding to a 10dB drop in the signal with its 1:2 ratio.

Gates work very much like expanders, but are generally used for more specific control functions. With a ratio of 10:1 (or more), and an "action" that's designed to be either open or closed, the gate will respond very definitely to level changes. The open or closed nature of the gate makes it useful for strict control of room noise, ambience, mic leakage and crosstalk.

1.10 Control Loop Processing

The control loop is a patch point in the control circuit of a dynamic range processor, which provides access to the part of the circuitry that tells the VCA what to do. The 525's control loop is routed through a rear panel connector that allows the control signal to be processed outside the unit (see Section 2.4 for specific hookup information).

Look at the block diagram in section 2.3. Notice the control circuit that is taken from the audio signal at the input, routed through the "CONTROL LOOP" connector, then sent through the detector circuits (log amp and comparator), through the front panel control circuits, then on to the VCA. This control signal is derived from, but totally separated from, the audio signal path.

The detector circuitry measures the level of the audio signal, then puts out a voltage that's proportional to the audio signal. But, the control signal that comes out of the detector contains no audio. (That's what the control voltage rejection spec means - the 525's audio-to-control voltage ratio is greater than 80dB.) That means the character of the signal that's on its way to the detector can be processed outside the 525 without actually processing the signal that's going through the VCA (the audio signal itself). This presents some very interesting possibilities for changing or improving the operation of the unit.

The best use of the control loop is to make the action of the 525 frequency dependent, that is, to make it respond more (or less) to certain frequencies. Because the audio signal and the control signal remain completely separate (even while the control circuit tells the VCA whether to turn the gain up or down), you can equalize the control loop without changing the EQ in the main audio path.

Because the detector simply puts out a control voltage in response to the input signal, removing unwanted frequencies from the signal before it reaches the detector prevents the detector from using those frequencies to create the control voltage. And perhaps most importantly, this is accomplished without actually equalizing the signal being processed through the 525. See Section 4.0 for specific applications information on EQ in the control loop.
2. Using the 525

"When all else fails, read the directions."

2.1 Getting Started

This section of your manual will give you all the control and switch settings you need to operate the 525.

IF YOU'RE GOING TO JUMP RIGHT IN AND START USING THE 525 WITHOUT READING THE MANUAL, JUST TAKE A MINUTE TO RUN THROUGH SECTION 3 - FAST FIRST TIME SETUP. REMEMBER, THIS ONLY NEEDS TO BE DONE ONCE TO BECOME FAMILIAR WITH THE 525'S CONTROLS - AFTER THAT IT'S EASY.

2.2 A Word About the Controls

With four fully variable controls on both channels, the 525 can be used effectively in a large number of situations. For that very reason, the level of performance you are able extract from the 525 depends entirely on your understanding of the controls.

2.3 Block Diagram

The functional block diagram in Figure 2.1 illustrates the signal flow into, inside of, and out of the 525. The levels and impedances at the inputs and outputs are designed to match all common line level systems (see 4.6 - Signal levels). All connectors are on the rear panel, all switches and controls are on the front panel.

Figure 2.1 - 525 Block diagram
2.4 Connectors

"INPUT" - 1/4" 3-conductor (stereo type) TRS (tip-ring-sleeve) connector located on the rear panel accepts balanced or unbalanced signals - use either 2-conductor (mono) or 3-conductor (stereo) connectors. As shown in the block diagram in Figure 2.1, the TRS connections are:

Tip = high (+), Ring = low (-), Sleeve = ground (shield).

The balanced input impedance is 46.3k ohms. Unbalanced input impedance is 23.1k ohms. Maximum input level is +20dBm.

"OUTPUT" - 1/4" 2-conductor (mono type) TS (tip-sleeve) connector located on the rear panel. Provides unbalanced, low impedance output signals. The connections are:

Tip = signal, Sleeve = ground (shield).

The impedance at the "OUTPUT" is 100 ohms. Minimum load impedance is 600 ohms.

"CONTROL LOOP". This connector is unusual, and should be studied carefully. Rear panel space constraints require the use of a single TRS (tip-ring-sleeve) connector for both the output and input for the "CONTROL LOOP". This jack accepts 1/4" 3-conductor (stereo type) plugs (Switchcraft #292 or equivalent).

![Figure 2.2 - Control loop patch cord wiring](image)

Tip = return/key in, Ring = send, Sleeve = ground (shield)

"CONTROL LOOP" output impedance is 100 ohms. Minimum load impedance is 600 ohms. The input impedance is 6.98k ohms. Maximum input level is +20dBm.

**CAUTION**

Patch cords used with the control loop connector must be wired as shown in Figure 2.2. Using either 2-conductor (mono) plugs or "military" type plugs will cause the unit to malfunction.

When the "CONTROL LOOP" connector is used as a send/receive patch point, the 525's activity can be made frequency dependent. See section 1.10 for a description of the control loop function.
### 2.5 Switches

"**IN/OUT**" - Switches the 525's control circuitry in or out. Must be depressed, to the "in" position, or nothing will happen.

"**STEREO**" - Converts the 525 from two channel operation to stereo operation. Channel 1 becomes the master control channel, Channel 2 becomes the slave. Channel 2's controls are disabled - the controls for Channel 1 govern the operation of both channels in stereo mode.

In stereo mode the two channel's signals are internally summed into one control signal. The greater signal in either channel determines the amount of gain reduction in both channels. For example, when Channel 1's signal is above the comp/limit threshold, both channels will be compressed equally. If Channel 1's signal is above the expand/gate threshold, and Channel 2's is not, neither channel will be expanded.

"**POWER**" - Switches AC mains on/off.

### 2.6 Controls

"**EXP/GATE THRESHOLD**" - Sets the level below which the expander/gate activity is initiated.

"**COMP/LIMIT THRESHOLD**" - Sets the level above which the comp/limiter activity is initiated.

"**RATIO**" - Sets the comp/limiter's ratio from 1.1:1 to 20:1.

"**OUTPUT**" - Sets the 525's output stage gain from 0dB (unity) to 25dB.

### 2.7 Metering

The LED metering arrangement indicates the actual level change (attenuation) being created by the VCA. With signals present, the LED's will be lighted whenever signals are above the level set by the "**COMP/LIMIT THRESHOLD**". In the absence of signal, the LED's will be lighted whenever signals are below the level set by the "**EXP/GATE THRESHOLD**" control. The green LED associated with the "**OUTPUT GAIN**" control indicates the onset of clipping in the 525's output stage. Reduce output gain if the green LED is lighted.
2.8 Signal Levels

The 525 is designed to be used post-preamp, at a place in the system where the signals have already been amplified to line levels. But, "line level" is a generic term that's been used at one time or another to describe signals ranging anywhere from -40dBm to +20dBm. As a result there's really no way for us to predict what the actual operating levels in your system will be. The very wide range of the 525's two "THRESHOLD" controls allows you to make it work with any "line level." (Microphones and guitars, for example, are not line level and should not be plugged directly into the 525. Doing so will not damage the unit, but will result in excessive noise.)

The overall level in any signal chain is determined to a large extent by the transient content of the program material. Transients are very short duration signals. Peak reading LED type meters will usually respond to transients, but VU meters are designed to indicate average levels and therefore will not respond to transients. As a result, transients are long gone before a VU meter can respond.

Drums, and percussive instruments like piano or banjo, generate the kind of very large transients which are not shown by a VU meter. Signals from these instruments may trigger the 525 when the "THRESHOLD" controls are set at 0 (or above), even though your VU meter says the level never goes above 0. On the other hand, instruments like violins do not create large transients, so the correlation between the VU meter reading and the indicated threshold appears to be more accurate.

2.9 Installation

The unit is designed for mounting in a standard 19" rack, and requires only 1 rack space (1-3/4"). The 525's "INPUTS", "OUTPUTS" and "CONTROL LOOP" connectors should be wired to a patch bay (like the Symetrix Patch 32) for ease of operation. A suggested arrangement is shown in Figure 2.3. The "CONTROL LOOP" output/input connection must remain intact when not used. When the unit is wired into a patch bay, this connection must be normalled.

Figure 2.3 - Patch bay hookup for the 525
3. Fast First Time Setup

Follow this sequence to get the 525 up and running quickly:

3.1 Connections

"INPUT" - Connect to the output of the signal source to be processed.

"OUTPUT" - Connect to the input of the following device.

"CONTROL LOOP" - Connect to equalizer (optional - see Figure 2.2).

3.2 Switch Settings

"CHANNEL IN" - Push in (puts control circuitry "in")

"STEREO" - Leave out (puts system in 2-channel mode)

3.3 Control Settings

"EXP/GATE THRESHOLD" - To find a beginning setting for the "EXP/GATE THRESHOLD" control, patch the 525 into your system and feed a signal at slightly below normal program level to its input.

Set the "EXP/GATE THRESHOLD" control fully counterclockwise, at "0". Slowly turn the control counterclockwise until its associated green LED is lighted during pauses in the program.

Use this setting as a starting point whenever the 525 is patched into your system at this particular place. For another patch point, repeat the procedure and note the setting of the control. (See Section 4 for details.)

"COMP/LIMIT THRESHOLD" - To find a beginning setting for the "COMP/LIMIT THRESHOLD" control, patch the 525 into your system and feed a signal at slightly above normal program level to its input.

Set the "COMP/LIMIT THRESHOLD" control fully clockwise, at +20. Slowly turn the control counterclockwise until the top (-2) red LED is lighted during peaks in the program level.

Generally:

For limiting: the "COMP/LIMIT THRESHOLD" is set more toward the upper end of the dynamic range (and the "ratio" is set at 8:1 or greater).

For compression: the "COMP/LIMIT THRESHOLD" is set lower, and the "ratio" is set at 8:1 or less.

Use this setting as a starting point whenever the 525 is patched into your system at this particular place. For another patch point, repeat the procedure and note the setting of the control.

"RATIO" - To compress - use a setting between 1.5:1 and 5:1.

To limit - use a setting above 8:1.

"OUTPUT GAIN" - Use the "OUTPUT GAIN" control to match the 525's output level to the rest of your system, and to make up any gain loss that occurs as a result of processing.

3.4 Meter Readings

The LED meter on each channel will not be lighted unless the 525 is attenuating the signals. Attenuation will not occur unless at least one of the threshold controls is set to a level that will initiate comp/limit or expander/gate activity. The meters are peak reading, and will accurately track the attenuation of the VCA's. (See Section 2.8 - Signal Levels.)
4. Applications

The 525's program controlled interactive processor provides smooth, natural dynamic range control for a wide variety of signal types. The term "program controlled" means the 525 changes the way it responds by analyzing incoming signals, then adjusting its attack and release times to match their transient characteristics.

The 525 responds quickly to signals with high transient content, like drums, piano and percussive synthesizer sounds. With signals like strings that have a low transient content, it responds gently. Careful adjustment of the two threshold controls allows the operator to put the 525 to work on any portion of the dynamic range. The "exp/gate threshold" control governs the 525's activity in the lower part of the range, while the "COMP/LIMIT THRESHOLD" governs activity in the upper part of the dynamic range.

NOTE

Settings for the "EXP/GATE THRESHOLD" and the "COMP/LIMIT THRESHOLD" are a function of each individual system's actual operating level. Wherever specific threshold settings are mentioned in the applications that follow, they are referenced to either a particular gain reduction level as indicated by the 525's meters, or to an assumed 0dBm operating level. "OUTPUT GAIN" settings are also different for every situation, so they're purposely omitted unless they are essential to the technique being described.

4.1 De-esser

De-essers are used to reduce the level of certain high frequency vocal sounds like sibilance, over-emphasized fricatives, and lip smacking. When a para-metric or graphic equalizer is coupled with the 525, the same technique can be used to selectively control any frequency band.

![Figure 4.1 - 525 with parametric equalizer in the control loop](image-url)
An equalizer is patched into the control loop, so the audio signal that will ultimately become the VCA's control voltage can be equalized before being fed to the detector circuitry (see Section 1.10). A parametric equalizer is preferred because it allows "fine tuning."

To make the 525's comp/limiter more sensitive to high frequencies, boost the high frequencies on the equalizer. This increases the sensitivity of the control circuits to those particular frequencies, so the comp/limiter responds more to those frequencies than any others. If the offending frequencies produce a control signal of greater amplitude than the desired frequencies, they will control how the comp/limiter behaves with the rest of the signal as well. However, if the offending signals are of significantly greater amplitude than the rest of the signal, careful adjustment of the "COMP/LIMIT THRESHOLD" (combined with the boost provided by the EQ in the loop) will make the comp/limiter respond only to the boosted frequencies.

Remember, the "COMP/LIMIT THRESHOLD" becomes a function of the amount of overall gain through the equalizer, including the high frequency boost. This technique can be used with any frequency that can be controlled by the equalizer. Of course, cutting a frequency will create the inverse effect, making the 525 less sensitive to frequencies that are cut from the control signal. Remember, increasing the signal level in the control loop will dictate an equivalent increase in threshold.

Set the "EXP/GATE THRESHOLD" to eliminate noise.

---

4.2 Using Control Loop EQ to Enhance Expander/Gate Action

Since the expander/gate can only discriminate between different levels, the system can be fooled by signals whose levels are nearly the same, even if frequency content of those signals is fundamentally different. When the 525's expander/gate is used to shut out unwanted sounds, any signal that exceeds threshold will trigger the expander/gate. When unwanted signals trigger the system, it's often possible to eliminate the false triggering by equalizing the control signal.

For example, if low frequency signals are triggering the 525's expander/gate in a PA system that utilizes a podium mounted microphone:

- With an equalizer in the control loop, remove the low frequencies from the control signal.

- Boost the higher voice range frequencies.
When the offending frequencies are removed, and the relative level of the desired frequencies is increased, the necessary level difference is created so the expander/gate can tell the difference between the wanted and unwanted signals. Use this technique in any situation where levels are too close, but the fundamental frequencies involved are different.

NOTE

The ability of the expander/gate to discriminate between wanted and unwanted signals is determined in part by mic technique. Be particularly careful of high frequency sounds entering the side or rear pattern of a cardioid mic. Most cardioids exhibit a sharply rising off-axis response characteristic at higher frequencies; check the off-axis curve (the lower one) in the manufacturer's literature. If there's only a 3 dB or 6 dB difference between the on-axis (front) response and the off-axis (side or rear) response in the 5 kHz to 10 kHz region, high frequency sounds may leak like crazy into the side or back of your mic.

Use the mic's directional pattern to keep other sources as far off-axis as possible. Remember - the idea is to do everything you can to extract all the source-to-source discrimination possible through good mic technique. The sounds picked up by the individual mics have to be primarily the sound of the desired signal, or the gate won't be able to tell the difference.

4.3 Vocal Track Processing

The 525 is an ideal vocal processor because it handles a wide variety of program material with ease. When recording vocals, the undesirable side effects that usually result from high ratio comp/limiting, like headphone leakage and room noise, can be eliminated with the 525's interactive expander/gate processing. During mixdown the 525 not only provides compression, but also eliminates the noise that often accompanies vocal tracks that are processed with high frequency EQ, compression, or both.

The soft-knee transition characteristic of the interactive processor allows the use of much higher comp/limiter ratios with much lower thresholds, because the smooth transition through threshold allows the 525's processing to go unnoticed. Use the exp/gate to eliminate noise, lip smacking, breathing, paper rattling, etc.

Set the "COMP/LIMIT THRESHOLD" so the -5 LED is lighted occasionally, and the -9 LED is lighted on peaks.

Begin with the "EXP/GATE THRESHOLD" at the same level as the "COMP/LIMIT THRESHOLD." The idea is to eliminate extraneous noises without cutting off the lower level vocal sounds.

Carefully adjust both threshold settings with the vocal channel in solo, then in context.
4.4 Difficult Vocal Tracks

To get control of tracks that have extreme dynamic variations, the two channels may be operated in series. Use the first channel in the chain for compression and gating, the second for limiting and expansion.

The idea is to set up the first channel to manage the overall level, and to eliminate residual noise. The second channel is used as a limiter to control peaks, and to provide final noise reduction.

Channel 1:

Set the "RATIO" at 5:1 to start with, but use a higher ratio if necessary.

The "COMP/LIMIT THRESHOLD" setting is set to provide overall compression to "homogenize" the sound. For nominal 0dBm signal levels, start at -20.

Set the "EXP/GATE THRESHOLD" to remove noise, without cutting off any of the lower level signals. The "EXP/GATE THRESHOLD" must be set lower than usual in this channel, because it's followed by yet another expander in Channel 2. The compound action of the two expanders can become objectionable if the "EXP/GATE THRESHOLD" of the 1st channel is not at least 10dB below the "EXP/GATE THRESHOLD" of the 2nd channel.

Channel 2:

Set the "RATIO" at 20:1, to provide peak limiting.

Set the "COMP/LIMIT THRESHOLD" so the -2 LED is lighted frequently, and the -5 LED is lighted on peaks.

Set the "EXP/GATE THRESHOLD" to remove noise and undesirable vocal sounds.
4.5 Adding Dynamics, or "Punch"

The 525 can simultaneously create a more dynamic feel, add compression, and reduce noise. Use this kind of processing with percussive instruments like electric bass, snare drum, rhythm guitar, etc.

Set the "EXP/GATE THRESHOLD" above the signal level, so the 525 behaves like a linear expander instead of a downward expander (see Section 1.8 for a description of linear vs. downward expanders). Whenever the instrument is played, the expander/gate will increase the dynamics, both upward and downward.

The comp/limiter is used to control peaks, and with electric bass, to put in a little more apparent "bottom" by creating extra sustain. Set the "COMP/LIMIT THRESHOLD" so the maximum compression is about 5dB.

Since this kind of processing reduces overall output level, make it up by setting the "OUTPUT GAIN" at about 7.

4.6 High Level Stage Monitors

Public address and sound reinforcement situations that require comp/limiting are often plagued by feedback problems. The overall increase in level that results from compression can cause feedback in the absence of signal, when the compressor releases and brings levels back up to normal.

The 525's interactive dynamics processor allows the use of large amounts of comp/limiting. When compression is applied to "normal" signal levels, the compressor returns to unity gain when the signal goes away. This action increases overall system gain. The 525's exp/gate, on the other hand, decreases gain whenever signals fall below threshold. Careful setting of the two threshold controls tells the 525 how and when to adjust the gain.

Stage monitors can be made much "tighter" with compression, but feedback problems often make even gentle, low ratio compression impossible. The 525's interactive processor performs exceedingly well in this situation, because the expander/gate decreases gain to compensate for the gain increase that results from compression.

Careful adjustment of the "EXP/GATE THRESHOLD" control will prevent feedback in the absence of signal, even with substantial compression. Note that in most cases the "EXP/GATE THRESHOLD" must be set higher than the "COMP/LIMIT THRESHOLD."

For this example, it's assumed that the average signal level is 0dBm. Since the successful implementation of this technique requires careful setting of the two threshold controls, be prepared to fine tune the settings to match the levels in your system, and the vocalist's style.
4.7 House Sound Applications

Electric instruments bring their own set of problems to live performance sound reinforcement. Most amplified instruments are noisy, and capable of great dynamic range. The situation is often complicated by a variety of AC distribution problems, multiple ground loops, and RF interference from lighting dimmers.

The characteristic buzz generated by electric instruments is usually heard only in the absence of music signals, so it gets even worse when compression is used. While the instrument is being played, the compressor reduces the overall gain, but when the music stops, the compressor releases and the gain comes back up to unity. The increased system gain, in the absence of signal, makes the noise louder, and still more annoying.

The 525's exp/gate will eliminate this kind of noise, even when a lot of high ratio compression is used. Patch the 525 into individual console channels, or between the board and the amp rack. Used as the final processor in the system, the 525 will control overall levels and eliminate noise from all sources.

In mono systems, use one side of the 525 to control an individual channel, and the other in the main output. For stereo, couple the channels and set the unit's operation with the Channel 1 controls.

To remove excessive noise while compressing individual channels, start with the following settings:

![Diagram showing 525 settings for individual channel compression]

For overall system control, with the 525 in the main output, start with the following settings:

![Diagram showing 525 settings for overall system control]

Set the "EXP/GATE THRESHOLD" carefully. When it's set properly, the music seems to "jump right out of silence" when the band starts to play.
4.8 Spoken Word Master Tapes

The 525 can be used for the preparation of masters for duplicating. The comp/limiter prevents overload, and the exp/gate eliminates noise.

Duplication masters that are prepared with the 525 produce an end product with better intelligibility and improved signal to noise ratio. The object of the processing is to keep dynamic range within the real limits of the recording equipment, and to eliminate extraneous noise.

Set the "RATIO" at 5:1 (higher if necessary).

Set the "COMP/LIMIT THRESHOLD" so the -5 LED is lighted when the recording machine's meter reads 0 VU.

Set the "EXP/GATE THRESHOLD" so the green LED threshold indicator and the -2 LED are lighted during normal speech pauses.

4.9 Music Master Tapes

Set the "RATIO" between 3:1 and 5:1.

Set the "COMP/LIMIT THRESHOLD" so the -2 LED is lighted when the recording machine's meter reads 0VU.

Set the "EXP/GATE THRESHOLD" between -20 and -30, to eliminate noise.

4.10 Voice Activated, Constant Level Paging

All too often paging announcements are either sub-audible, or distorted. The problem is the result of changing input levels from different users, and unpredictable environmental circumstances. The 525 can be preset by the installer to regulate levels, prevent feedback, and provide VOX (voice activated) operation.

To optimize system levels for intelligibility without overload, the 525's comp/limiter is used to govern overall operating level, and the expander/gate is set up to perform the VOX function.
Set the "RATIO" at 5:1, and the "COMP/LIMIT THRESHOLD" so the -2 LED stays lighted during what is considered "normal" level paging. All normal signals will be slightly compressed. With these settings a shy person will be audible, and the guy who thinks he has to shout to be heard won't be to loud, or cause distortion.

Set the "EXP/GATE THRESHOLD" so the green threshold indicator is lighted during normal speech pauses, and between announcements. (For systems with a 0dBm nominal operating level, the "EXP/GATE THRESHOLD" will be between -10 and -20.) For VOX operation, be sure the threshold setting is high enough to exclude incidental sounds.

**NOTE**

Voice activated systems will be triggered by any sound that exceeds threshold. Microphone placement, with regard to extraneous sound sources, can be critical. As an example, sounds from a cash register near the paging mic in a restaurant will trigger the system if the mic is too close. The sound of the cash drawer opening and closing will be heard throughout the restaurant.

To help prevent false triggering when the 525 is used for VOX: Place the microphone as far as practical from any other sound source. Point directional mics away from sound sources. Adjust the threshold setting carefully.

### 4.11

**General Purpose Automatic Gain Control (AGC)**

The program controlled operation of the 525 makes it ideal for general purpose dynamics management. Ratios as high as 8:1 may be employed without adverse side effects (depending on the threshold setting).

For general purpose use, set the "RATIO" at about 5:1, and the "COMP/LIMIT THRESHOLD" at -10. Set the "EXP/GATE THRESHOLD" control so the green LED threshold indicator is lighted just before the program level drops into noise.
### 5. 525 Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compressor Threshold</strong></td>
<td>variable, -50dBm to +20dBm</td>
</tr>
<tr>
<td><strong>Expander/Gate Threshold</strong></td>
<td>variable, 0dBm to -60dBm</td>
</tr>
<tr>
<td><strong>Compression Ratio</strong></td>
<td>variable, 1:1 to 20:1</td>
</tr>
<tr>
<td><strong>Expander/Gate Ratio</strong></td>
<td>approaches 4:1 through &quot;soft knee&quot; threshold</td>
</tr>
<tr>
<td><strong>Dynamic Range</strong></td>
<td>greater than 100dB</td>
</tr>
<tr>
<td><strong>Frequency Response</strong></td>
<td>20Hz-20kHz, +0, -1dB</td>
</tr>
<tr>
<td><strong>Distortion</strong></td>
<td>at 1kHz: less than .03% THD, 10dB gain reduction, 0 dBm output level, 600 ohm load</td>
</tr>
<tr>
<td></td>
<td>at 20kHz: less than .05% THD, 10dB gain reduction, 0dBm output level. (All distortion components are primarily 2nd harmonic.)</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>unity (0dB) to +20dB</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>less than -86dBm, unity gain, 20kHz bandwidth</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Inputs</strong></th>
<th>Balanced</th>
<th>Unbalanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input impedance</strong></td>
<td>46.3k ohms</td>
<td>23.1k ohms</td>
</tr>
<tr>
<td><strong>Maximum input level</strong></td>
<td>+18dBm</td>
<td>+18dBm</td>
</tr>
<tr>
<td><strong>CMMR</strong></td>
<td>&gt; 45dB @ 2 kHz</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>1/4&quot; tip-ring-sleeve</td>
<td>1/4&quot; tip-ring-sleeve</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Outputs</strong></th>
<th>Unbalanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output impedance</strong></td>
<td>100 ohms</td>
</tr>
<tr>
<td><strong>Minimum load impedance</strong></td>
<td>600 ohms</td>
</tr>
<tr>
<td><strong>Maximum output level</strong></td>
<td>+20dBm</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>1/4&quot; tip-ring-sleeve</td>
</tr>
</tbody>
</table>
### Control Loop

**Input**
- Unbalanced
- Input impedance: 6.98k ohms
- Maximum input level: +20dBm

**Output**
- Output impedance: 100 ohms
- Minimum load impedance: 600 ohms
- Maximum output level: +20dBm
- Connector: 1/4" tip-ring-sleeve

**Attack and Release Time**
- Min. attack: 500ms
- Min. comp/limit release: 10ms
- Min exp/gate release: 30ms

(Attack and Release times for both the comp/limit and exp/gate functions are totally program controlled.)

**Maximum Gain Reduction**
- comp/limiter: 65dB
- expander/gate: 60dB

Specifications subject to change without notice. The 572 SPL Computer meets the requirements of Deutsche Bundespost.
6. Troubleshooting Guide

Make the following tests one at a time to isolate a problem you think may be caused by the 525 (or any other unit).

1. Make sure the unit is plugged in, the power switch is turned on, and the pilot LED is lighted.

2. Bypass the device in question by directly connecting the cable feeding the input to the cable feeding the output with a double female adapter. Listen to the system with this direct connection in place. If signal passes through this direct connection, but not through the unit, the trouble is with the unit.

3. Check INPUT, OUTPUT and CONTROL LOOP wires and connectors carefully.

MOST MALFUNCTIONS ARE WIRE OR CONNECTOR RELATED.

4. Plug headphones directly into outputs to see if there is signal present. If you cannot hear the signal at the unit's output, work your way back through the chain until you can hear it. (If you get all the way back to the input without hearing anything, get competent help.)

6.1 Troubleshooting Table

Use the following table to analyze difficulties before calling Symetrix or a technician for help. You may be surprised at how easy it is to solve problems, and you may save us both some time and money. Thanks.

Table 6.1 - Troubleshooting Table

<table>
<thead>
<tr>
<th>Problem</th>
<th>What to check - what to do</th>
</tr>
</thead>
</table>
| 1. No expand/gate action | ■ Is the "channel IN" switch depressed?  
■ Is there something in the control loop that's not turned on?  
■ Is there a 2-conductor (mono) plug in the control loop?  
■ Is the "exp/gate THRESHOLD" set low enough for the present signal level |
| 2. No compress/limit action | ■ Is the "channel in" switch depressed?  
■ Is there something in the control loop that's not turned on?  
■ Is there a 2-conductor (mono) plug in the control loop.  
■ Is the "comp/limit threshold" set low enough for the present signal level? |
| 3. Low or distorted output | ■ Be sure gear patched into the control loop is turned on.  
■ Check "input," "output" and "control loop" connectors for shorts.  
■ Is something patched into the signal chain before or after the 525?  
■ Is the 525 powered up? |
| 4. Distortion or crackling sound at output | ■ Check level and signal at input: Is it too high? Is it distorted? |