



CS 2

**TWO CHANNEL
COMPRESSOR
LIMITER / GATE**

ART

DESIGNED AND MANUFACTURED IN THE USA

USER'S GUIDE



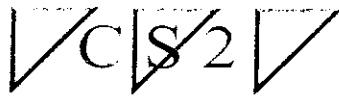


CS2 User's Guide

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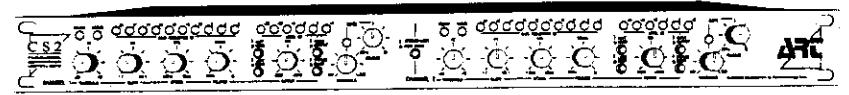


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Fill in the following information for your reference:

DATE OF PURCHASE _____
 PURCHASED FROM _____
 SERIAL NUMBER _____

521-5004-101



Introduction

Thank you for purchasing an ART CS2 Two Channel Compressor/Limiter/Gate—and congratulations: You now own one of the most sophisticated pieces of audio signal-processing technology available. The CS2 places dynamics under your complete control during recording, while operating sound-reinforcement equipment, and in every aspect of onstage performance. Offering a level of processing capabilities and sound quality of units that can cost thousands of dollars, the CS2 uses specially designed circuitry and a straightforward user interface that quickly and easily gives you access to all of its features.

Features

- Two independent compressor/limiter/gates
- Stereo-linked or dual-mono operation
- Detector loop on each channel for side-chain processing
- Balanced or unbalanced operation for both inputs and outputs
- Soft- and hard-knee compression for greatest flexibility
- Bypass switch for each channel
- Input and output level LED monitors
- Limiter/compressor selector on each channel
- Gate has threshold and release controls and threshold LED
- Gain reduction LED display for each channel
- All-steel enclosure
- Designed and manufactured in the United States of America



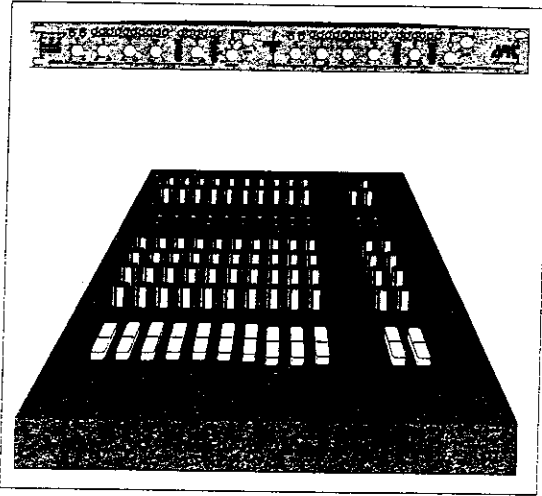


Quick Start Instructions

Ordinarily, we wouldn't tell you to skip the manual, but since you're probably in a hurry to try out your new CS2, at least read the next couple of pages so that you don't startle or scare yourself, your family, or your pets. And, of course, you don't want to damage your speakers, so follow the Quick Start instructions. After you've experimented with some of the CS2's capabilities, we recommend that you read the rest of the manual—in particular the section on page 26 that explains how compression, limiting, and noise gating work. The more you know about how the CS2 functions, the greater the range of uses you'll apply it to, and the easier it will be for you to make your recordings, samples, and onstage sound the best they can be.

Setup With A Mixer

To use your CS2 with a mixing console, connect one of the mixer's line outputs (or insert point's send) to a Line In on the CS2. Connect the Line Out from that channel of the CS2 to a line input of the mixer (or the insert point's return). Duplicate these connections with the CS2's second channel.



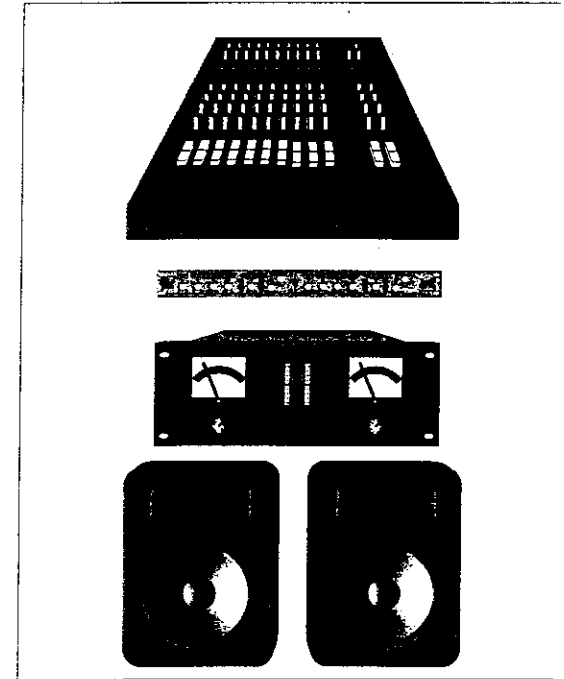
You can plug most synthesizers, samplers, and drum machines directly into the CS2. However, if the CS2 is to be used with a low-output instrument (guitar, bass, etc.) or a microphone, the signal should first be run through a preamplifier to bring the signal up to line levels. The output of the preamplifier should be plugged into one of the CS2's Line In jacks.



The CS2's Line Out should then be run to the input of a mixer or other processor. It's a good idea to set the CS2's Output controls fully counterclockwise (to their -20dB, or minimum, setting) and the Gate Threshold knob to Off before you power-up the CS2 and other gear. Once everything in your system is turned on, then gradually turn up the Output control. See page 20 for an illustration that shows how to connect the CS2 to a mixer.

Setup With An Amplifier

If you are placing the CS2 in line between a mixing console and a power amplifier, or between a preamplifier and a power amplifier, you can use either balanced or unbalanced connections, according to the needs of the other equipment. Use the line output from a pre-amp or any output from a mixer (main, monitor, etc.) to connect to the CS2's Line In. Connect the CS2's Line Out for that channel to the power amp's input. Duplicate these connections with the CS2's second channel. It's a good idea to set the CS2's Output controls fully counterclockwise (to their -20dB, or minimum, setting) and the Gate Threshold knob to Off before you power-up the CS2 and other gear.



Once everything in your system is turned on, then gradually turn up the Output control. See page 24 for a diagram that illustrates connecting the CS2 to an amplifier.





Installation

The CS2 may be used in a variety of setups including: mixing consoles with insert loops, in the effects loop of an instrument or P.A. amplifier, or between a preamp and power amp. Housed in a rugged, all-steel 19" rack-mount enclosure, the CS2 is designed for continuous professional use. Because the unit is compact and does not extend deep into a rack, its mounting location in a rack is not critical. However, for greater reliability we recommend that you do not place the CS2 on top of power amps, tube equipment, or other sources of heat.

Powering The CS2

The CS2 is powered by an external AC adapter. Always make sure that its connector is securely plugged into the rear of the CS2, and that the adapter is held firmly in an electrical outlet. Never operate the CS2 or AC adapter in the rain or in wet locations. If the AC adapter's cord is ever cut or damaged, discontinue using it and replace the adapter with a new one. To prolong its life, unplug the adapter when not in use. Alternatively, if the CS2 is mounted in a rack, plug the adapter into a switched power strip so that you can conveniently turn it off with your other gear. Refer to the label on the adapter for proper operating voltages.

FRONT-PANEL CONTROLS & INDICATORS

Both channels of the CS2 have the same controls and operate identically. Therefore, the information in the following section applies to both channels. The Stereo-Link/Dual-Mono switch for linking the two channels or using them separately is discussed on page 13.

Threshold

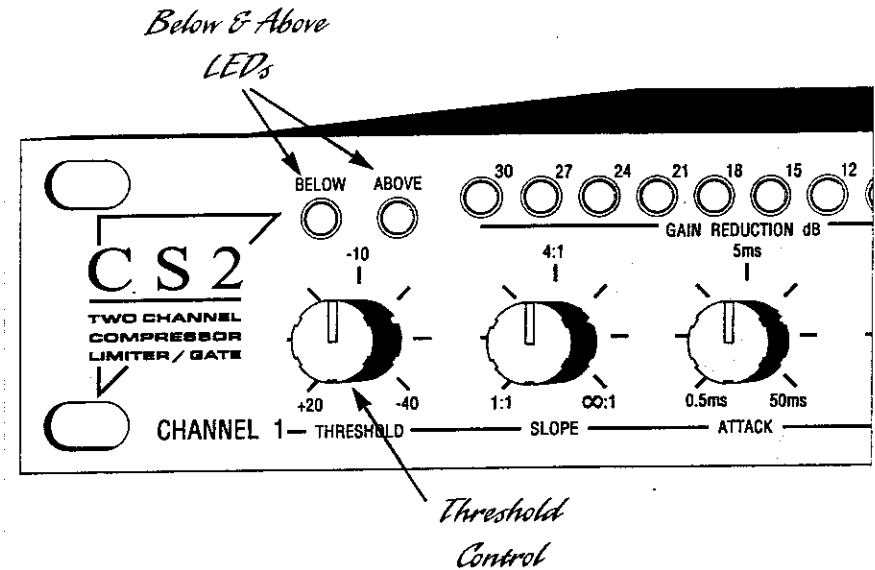
This control sets the point at which incoming signals are compressed or limited by the CS2. (Signal levels lower than the threshold won't be compressed.) When you turn the Threshold knob clockwise, this point—known as the threshold—is raised, and the CS2 reacts to signals at a higher level. This results in less compression or limiting. The control's



range is -40dBu to +20dBu, broad enough to handle practically any signal level that you'll ever encounter.

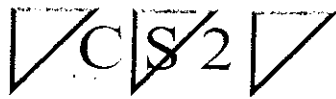
Below & Above LEDs

These two LEDs tell you whether the input signal is above or below the threshold point. When signals are lower than the threshold, the Below



LED glows yellow. When the signals exceed the threshold, the Above LED glows red. These LEDs give you a visual reference to help you avoid over-compressing (or to make sure you are, indeed, over-compressing or limiting, if that's the effect you want). You'll develop your own style of compressing after you've experimented with the CS2, but when you want to keep the compressing effect subtle, you should set the Threshold control so that the red Above LED glows only when extra-hot signals (shouts, unexpectedly hard drum hits, etc.) are present. If the Above LED glows continuously, then the compressor is squeezing the dynamic range all the time, which can sound pretty strange, especially if you're using high Slope settings.

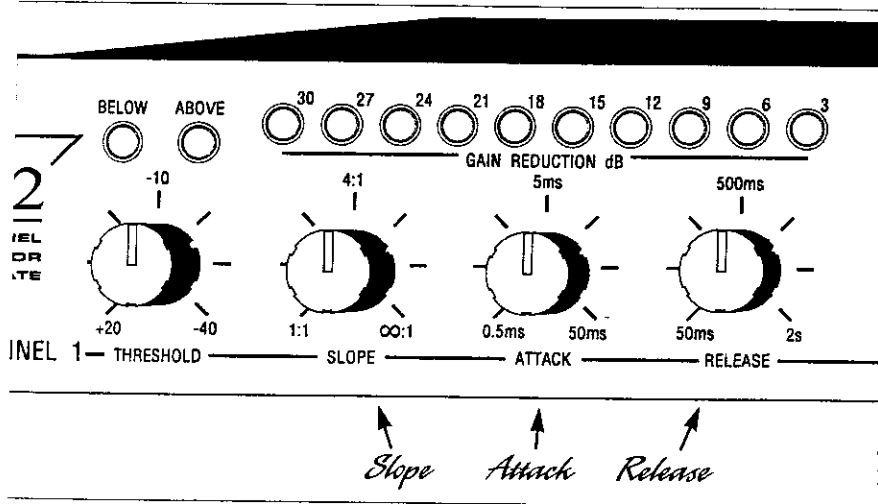




Slope

The Slope control sets the compression ratio—the amount of signal that comes out of the CS2 in relation to what enters at the input. The ratio range is from 1:1 to ∞ :1 (the “ ∞ ” stands for “infinity”). When it’s set to 1:1, the input and output levels are equal (sometimes referred to as “unity gain”). This is the same as bypassing the CS2. As you increase the Slope control to 2:1, a 2dB increase in the input equals only a 1dB increase at the output, and as the control reaches 3:1, a 3dB increase at the input equals a 1dB increase at the output. This results in a compressed dynamic range. Therefore, once you reach the ∞ :1 setting, the output level is almost unchanged, regardless of what kind of level is fed into the CS2. For more on this phenomenon, see page 28. Because of the extreme limitations on the dynamics above about 10:1, where the output changes less and less in comparison to changes in the input level, the effect is known as limiting.

Low Slope settings are excellent for vocals and guitar or horn solos—anything that needs to be kept under control but still needs a good dynamic range. When you want the dynamics more tightly controlled (synthesized or sampled strings, legato backing vocals, etc.), a higher compression ratio keeps the difference between quiet and loud within a very narrow



range, making it more predictable and manageable when you’re doing a mix. The compressed dynamic range keeps you from constantly raising and lowering the level sliders just to keep sounds within the loudness range you want. The Suggested Initial Settings on page 17 list good initial Slope settings for a variety of applications.

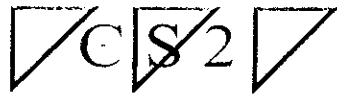
Note: The slope control is infinitely variable from 1:1 to ∞ :1, but only three points are labeled on the front panel, 1:1, 4:1, and ∞ :1. Settings indicated by the lines in between these three points are 2:1 at 9 o’clock, 2.5:1 at 11 o’clock, 7:1 at 2 o’clock, and 12:1 at 5 o’clock.

Attack

Attack time is variable from 0.5ms to 50ms (ms stands for “milliseconds,” or thousandths of a second). It determines how fast the CS2 responds to incoming signals to compress or limit them when their level exceeds the threshold point. Short attack times mean that the compressor clamps down on a signal very quickly—extremely short times can cause the compressor to alter virtually all dynamics. Long attack times, though, keep more dynamics intact. Short attack times are useful when you want to take the pick noise off of a guitar’s note (good for a high-sustain, squeezed sound), or make a snare drum sound extra boomy. Longer attack times let the more natural dynamics of a picked guitar string through, and make drums sound more natural.

Release

Just as the attack control sets how quickly or slowly the CS2’s circuitry reacts to incoming signals before the compressor starts to work, the release control sets how long it takes for the compressor to return to unity gain. The CS2’s release time is variable from 50ms to 2 seconds. When you’re using the CS2 to control sounds like drums, handclaps, or other short bursts, shorter Release times are usually called for, while sounds like saxophone, guitar, and most other instruments that tend to run one note into another benefit from longer Release settings. Remember, though, these are general guidelines. Some great effects have been put on record by going “out of bounds.”

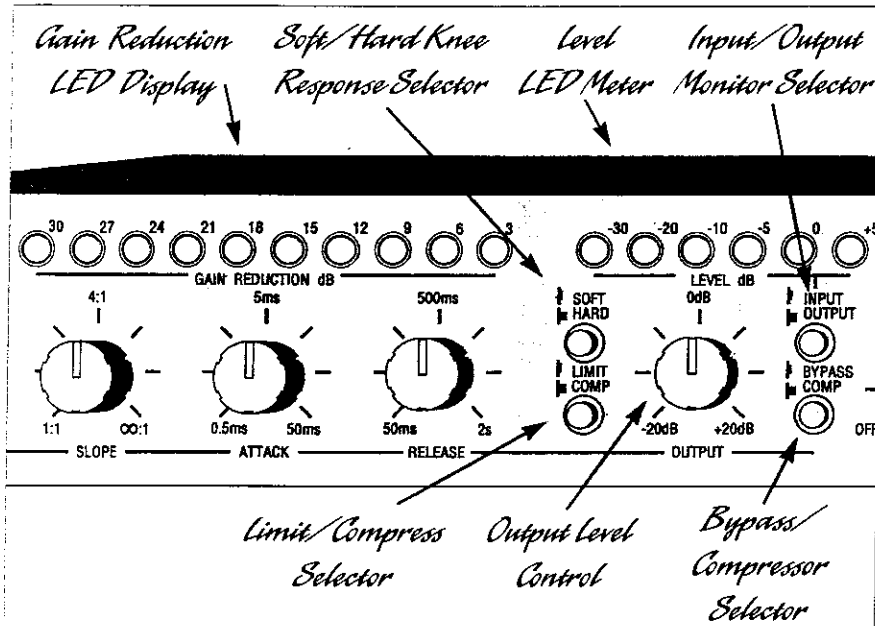


Gain Reduction LED Display

The 10 LEDs in this display monitor the amount of gain reduction that the compression circuitry is producing. For each gain reduction of 3dB another LED glows.

Soft/Hard Knee Response Selector

Hard-knee response means that the compression action is very abrupt once the signal level exceeds the threshold, whereas soft-knee response is more gradual and is better suited to most musical applications. Hard-



knee response is desirable when limiting is used before a power amp to keep speakers from being damaged. A fingerpicked bass line in a ballad would generally be a perfect candidate for soft-knee compression, while slap bass would benefit from the fast action of a hard-knee compression.

Limit/Compress Selector

Even though limiting is often thought of as severe compression, there are ways to optimize a circuit's response for the two different applications.



That's where this switch comes in. When this switch is in the "out" position, the circuitry acts as a compressor. When the switch is depressed, the circuitry automatically becomes a limiter. With the CS2 set to limit, the slope is automatically set to a limiting ratio, and the attack time is set to its fastest setting. The Threshold, Release, and Output controls remain completely adjustable, allowing you to fine-tune the limiting response to suit your musical application.

Output Level

When you use compression or limiting, the signal level is changed, so the output level control lets you compensate for this. The CS2's output level control has an effective range of -20dB to +20dB, enough to make up for even severe gain reductions, or to match the needs of downline equipment.

Level LED Meter

This multi-purpose LED meter has six LEDs that monitor either the input level or the output level, depending on the Input/Output selector's setting. The LEDs indicate levels in 5dB increments, from -30dB to +5dB.

Input/Output Monitor Selector

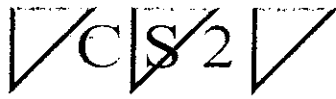
Use this switch to select whether the Level LED meter monitors the input or output level. By switching back and forth between monitoring input and output levels, you can compare them and adjust the Output level control to compensate for any differences between them.

Bypass/Compressor Selector

You may not need to use the compressor all the time, so you can use this switch to bypass it. The Bypass setting also bypasses the noise gate. Therefore, the signal is passing straight through from the CS2's input to its output.

Note: The Bypass is a *hardwired* bypass. Therefore, when no power is applied to the CS2, the bypass function is still active.



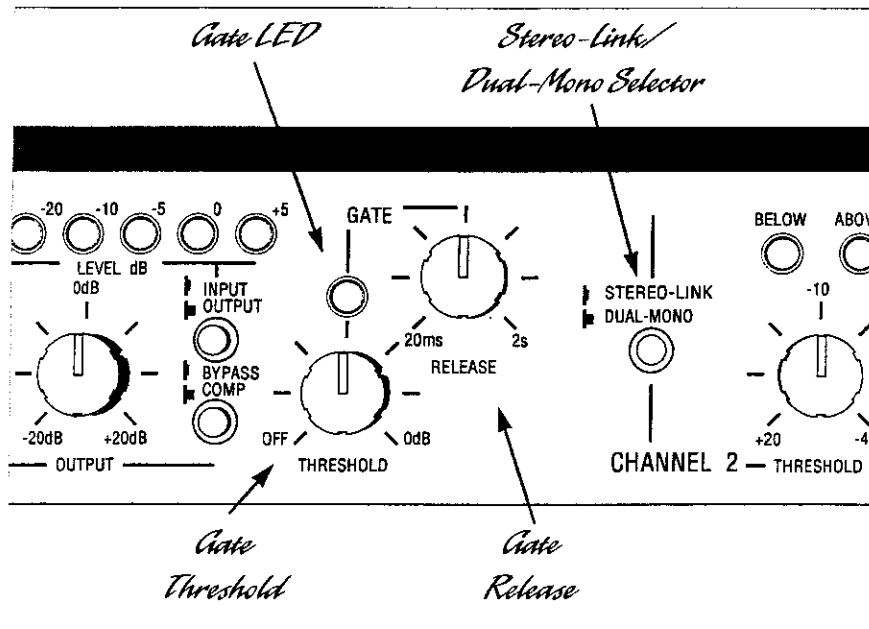


The Noise Gate

A noise gate is useful to mute audio when the intensity of a desirable signal (music, speech, etc.) falls below a set level. This is particularly helpful in controlling background noise, or “bleed,” from an open microphone. For example, when a singer stops singing, a gate turns the mic off, keeping the P.A. from picking up and amplifying unwanted noise—air conditioners, hissing guitar amps, the voices of the people in the third row arguing whether Shemp was funnier than Curly, etc. The CS2’s Noise Gate has two controls: Threshold and Release.

Gate Threshold

This control sets the point at which the input signal is muted. If the ambient noise is low (the hiss from a guitar amp, for example), then the threshold can be set fairly low. If the background noise is higher, the Threshold will have to be raised. Obviously, a bit of trial and error is involved here. In addition, the second Noise Gate control, the Gate Release, enters the picture, too.



Note: If you want to bypass the Noise Gate, just turn the Gate Threshold knob fully counterclockwise to the Off position.

Gate Release

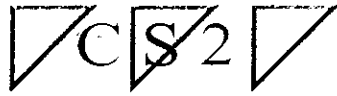
Once you’ve set the Threshold to the desirable level, it’s time to set the Release control, which adjusts how long it takes for the gate to close once the signal falls below the threshold. You can set the Gate Release to close quickly (fully counterclockwise), a good choice for drums or any other sounds that have a fast attack and little or no decay time. Or, you can set the Gate Release for a more gradual fade, turning it clockwise so that the gate closes gradually, as if you were adjusting a volume knob or slider by hand. Depending on how fast the desirable signals decay, how much noise is present, and how abruptly you want the sound cut off, you may find your settings for the Gate Release vary tremendously. Experiment! (To get a better feel for the gating operation, start with shorter Gate Release settings and work up to longer ones.)

Gate LED

This LED glows when the CS2’s Noise Gate is acting upon a signal. This means that the signal is below the threshold point set via the Threshold control. After a bit of experimentation, you’ll find the best Threshold settings, and you’ll have a good feel for how the LED’s action corresponds to the CS2’s response.

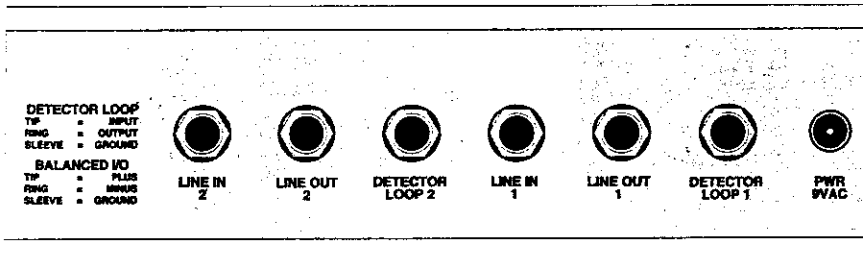
Stereo-Link/Dual-Mono Selector

The CS2 is designed as two independent limiter/noise gate systems, each with its own inputs and outputs and controls. They can work completely separately, or be linked. Depressing the Stereo-Link/Dual-Mono button sets the CS2 for stereo mode, and the settings for Channel 1 are automatically duplicated in Channel 2, regardless of Channel 2’s knob settings. Note that Channel 2’s Output Level, Bypass, and Input/Output meter-select switches remain active.



Use the Stereo-Link option when employing the CS2 to control stereo signals (mixes, overhead microphones, synths, etc.) that need identical processing to maintain a defined stereo image. Why does this matter? Without this linking, if one channel is presented with a quick burst (cowbell-tap, cymbal crash, etc.) that's audible in the other channel, but not as loud, it's likely that the side of the stereo mix with the greatest level from that sudden burst of sound will compress while the other doesn't. If all the other sounds passing through both channels are pretty similar but one channel compresses and the other doesn't, the mix can sound like someone turning the pan control back and forth in weird, unpredictable ways. Stereo linking makes both channels compress together, so that any changes in dynamics occur on both sides. If compression is set right, this results in a more natural overall sound, without strange panning effects.

REAR-PANEL INPUTS AND OUTPUTS



Power Input

The power input jack on the rear panel is designed to be used with the power supply provided with the CS2. Never use other power supplies, as they may harm the CS2's circuitry. If your power supply or its cord is ever damaged, replace it with the same unit. Contact your dealer or ART's Customer Service Department for details regarding a replacement.

Each channel has one Line In and one Line Out, as well as a Detector Loop jack, which is designed for side-chain processing, such as "ducking" and "de-essing."

Line In

The CS2's Line In is designed to accept balanced or unbalanced signal sources. The 1/4" TRS jack (Tip—hot/Ring—cold/Sleeve—ground) can be connected to balanced gear with either 1/4" tip/ring/sleeve or XLR connections (using a cable with a TRS plug on one end and an XLR plug on the other). If you aren't using the CS2 with a balanced source, simply use traditional cords with standard 1/4" jacks, and the connection will be unbalanced.

Line Out

The CS2's Line Out is designed to connect with equipment requiring either balanced or unbalanced signal sources. The 1/4" TRS jack (Tip—hot/Ring—cold/Sleeve—ground) can be connected to balanced gear with either 1/4" tip/ring/sleeve or XLR connections (using a cable with a TRS plug on one end and an XLR plug on the other). If you aren't running the CS2's output to gear with a balanced input, simply use traditional cords with standard 1/4" jacks, and the connection will be unbalanced.

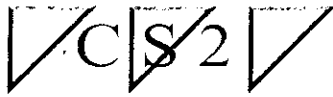
Detector Loop

The Detector Loop lets you get fancy with your compression and limiting applications. Two primary side-chain uses include "ducking" and "de-essing."

Ducking is useful for DJs and other announcers who want the music to run at full level when they aren't talking, but want it to become a bit quieter when they're talking into a microphone—and don't want to have to turn a volume knob up and down every time they speak or stop speaking. Ducking is a great way to keep levels consistent, especially when recording "voice-overs" for commercials, narration in videos, etc.

When operating the CS2 for ducking applications, use a standard shielded cord with 1/4" plugs on both ends to connect the output of a preamp or other source to the CS2's Detector Loop.

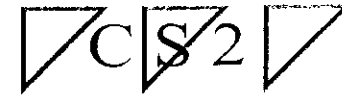
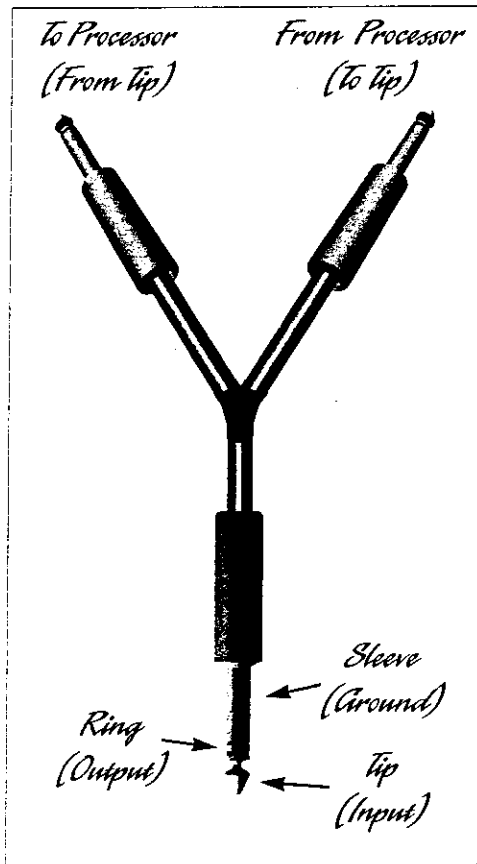




De-essing, also known as sibilance control, is a method of taming those pesky “S,” “T,” and other short bursts of high-frequency-filled sounds that are common in speech and usually downright annoying on TV, radio, or in vocal music. (The fancy name for these “S” and “T” types of sounds coming from your mouth is sibilance.) Because these sibilances take place in a very small range of high frequencies (most of their energy is between 2kHz and 10kHz), using a graphic equalizer in the Detector Loop turns the CS2 into a de-esser. By selecting different bands on the graphic EQ, you can use the CS2 to react to specific frequency ranges and only compress or limit when signals in that range are present.

When operating the CS2 as a de-esser, you need to use a TRS-to-dual-mono Y-cord. The TRS (tip/ring/sleeve) plug goes into the CS2’s Detector Loop jack, while the mono plug connected to the ring should be used to send the signal to an outboard processor—a graphic equalizer, for example—and the mono plug connected to the TRS plug’s tip should act as a return from the processor to the CS2.

See pages 18 and 19 for detailed diagrams showing how to set up your CS2 for ducking and de-essing.



APPLICATIONS

Suggested Initial Settings

There are no correct or standard compression settings. However, the following ratios are good starting points for the instruments listed.

Type Of Sound Source	Slope (Ratio)
Vocals	2:1, 3:1, or 4:1
Bass	4:1 or 6:1
Heavy electric guitar	3:1, 4:1, or 6:1
Light fingerpicked acoustic guitar	2:1 or 3:1
Strings, horns, or synthesizers	3:1 or 4:1
Slap bass	6:1 to 10:1 (or limit)
Overhead percussion	2:1 to 6:1

The following are suggested settings for compression applications. Attack and release times are suggested as follows: Fast—quickest setting to 9 o’clock. Medium—10 o’clock to 1 o’clock. Slow—2 o’clock to slowest setting.

Fattening drums and percussion

<u>Slope</u>	<u>Attack</u>	<u>Release</u>
4:1 to 6:1	Fast	Medium

Bringing out an instrument from the mix

<u>Slope</u>	<u>Attack</u>	<u>Release</u>
2:1 to 4:1	Fast	Fast

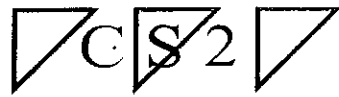
Use the Output level control to adjust the level in the mix.

Adding sustain to an instrument

<u>Slope</u>	<u>Attack</u>	<u>Release</u>
6:1 to ∞:1	Medium	Medium

Recompressing a vocal track

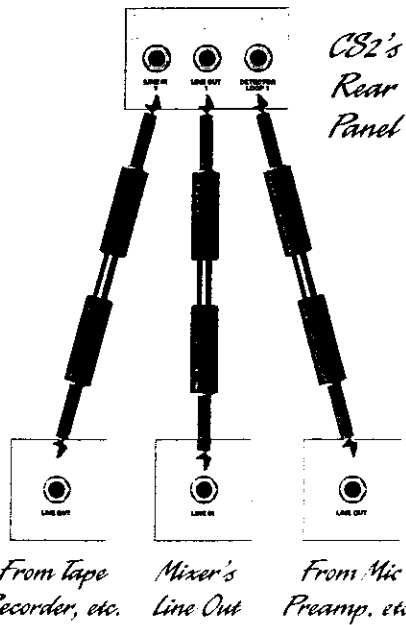
<u>Slope</u>	<u>Attack</u>	<u>Release</u>
1.5:1 to 6:1	Medium	Fast



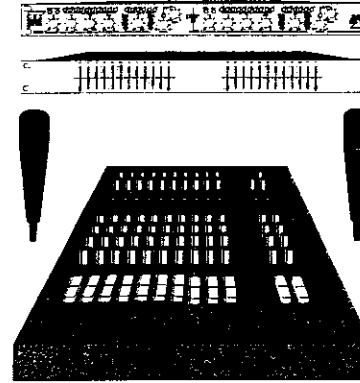
USING THE CS2 FOR DUCKING



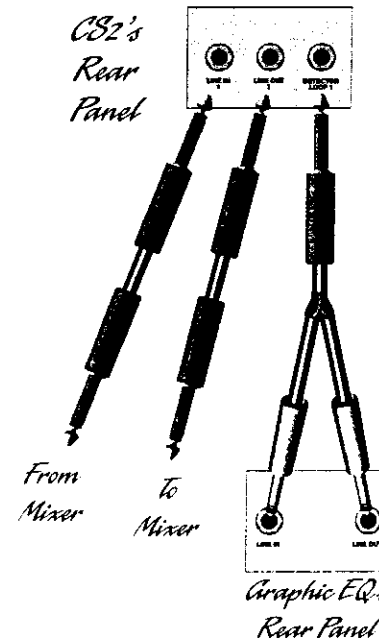
Patch a sound source, such as one channel of a tape player, CD, or mixer's output into a CS2 Line In, using a shielded cord with mono 1/4" plugs at both ends. Connect the Line Out to a Mixer's line input. Plug a microphone into a pre-amplifier or mixer and send its line output to the mixer and to the CS2's Detector Loop. Set the audio level; then speak into the mic. Set the CS2's compression amount to drop the music's level when you speak. Now adjust the mic/audio mix at the mixer. You can use the CS2's channels separately to duck two microphones. Alternatively, you can blend multiple microphones in a mixer before sending their signal to the detector loop, so that any number of mics can make the CS2 "duck." For stereo operation, link the two CS2 channels, and duplicate the Line In and Line Out connections for a second channel from the audio source.



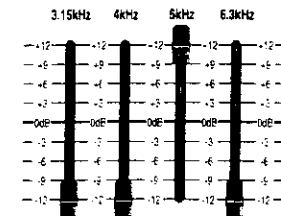
USING THE CS2 FOR VOCAL DE-ESSING

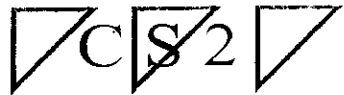


Plug a microphone into a mixer, and send its channel's insert loop out to the CS2's Line In. Connect the CS2's Line Out to the mixer's insert loop return. Now use a TRS-to-dual-mono Y-cord to connect a graphic equalizer's line in and line out to the CS2's Detector Loop. Set the CS2 to compress, and then speak into the mic and boost a band between 2KHz and 10KHz (5KHz is a good starting point) until the compressor reacts to the "S" and "T" sounds. Note: You can simultaneously use the CS2's two channels as individual de-essers; you need two channels of EQ to do this.

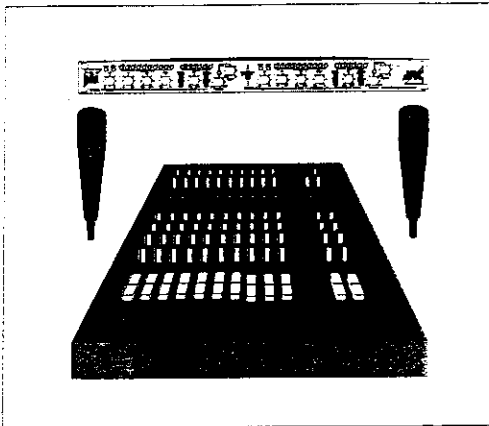


*Boost A Band
Between
2kHz And 10kHz*



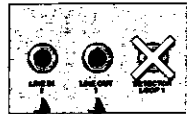


USING THE CS2 TO MANAGE VOCAL LEVELS



Plug a microphone into a mixer, and send its channel's insert loop out to the CS2's Line In. Connect the CS2's Line Out to the mixer's insert loop return. Set the CS2 to suit your musical application. Note: You can use the CS2's two channels simultaneously.

*CS2's
Rear
Panel*



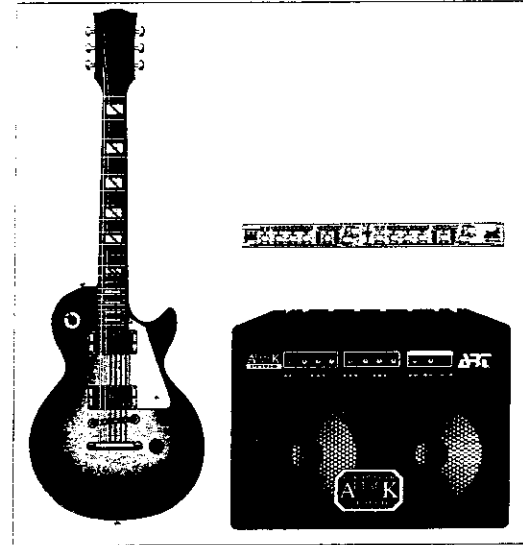
*From
Mixer*



*To
Mixer*



USING THE CS2 TO ADD SUSTAIN



If your amp has a pre-EQ effects loop, you can patch the CS2 into it.

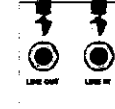
Otherwise, plug your guitar into the CS2's Line In and the CS2's Line Out into an amp or signal processor. Note: If you're not using an amp's pre-EQ loop or a preamp before the CS2, your guitar must have reasonably high-output pickups, a built-in pre-amplifier, or active circuitry to deliver sufficient signal level to the CS2.

Otherwise, the signal-to-noise ratio will be too low, resulting in a hissy, weak sound. Using high amounts of compression clamps down on the incoming note, but if you hold the note for a long time, instead of gradually decaying, the note will get a bit louder.

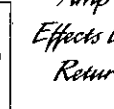
*CS2's
Rear
Panel*



*Amp's
Effects Loop
Send*

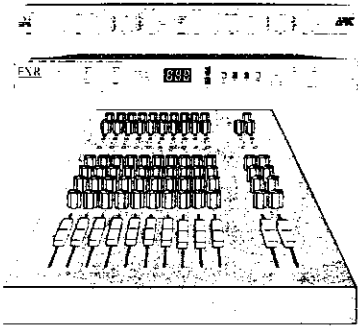


*Amp's
Effects Loop
Return*



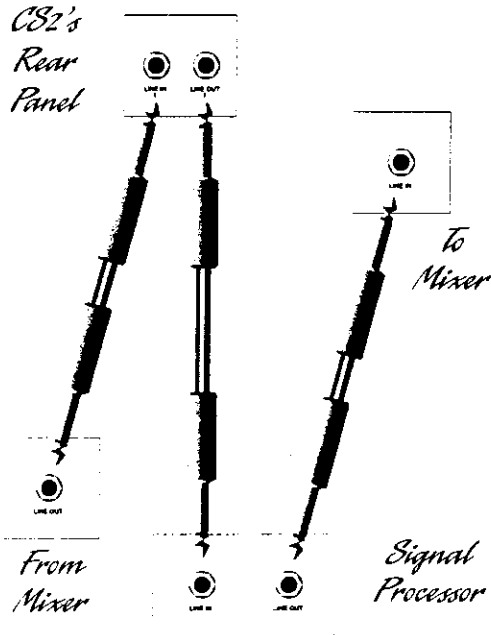


USING THE CS2 TO PROTECT SIGNAL PROCESSORS FROM OVERLOAD

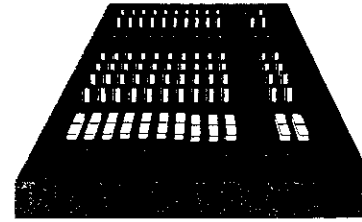


Connect a mixer's effects send or preamp's line out to the CS2's Line In, and the CS2's Line Out to a signal processor's line in. Then connect the signal processor's line out to the mixer's effects return (or another input channel), or an amplifier. Setting the CS2 to compress or limit keeps too-hot signals from overloading

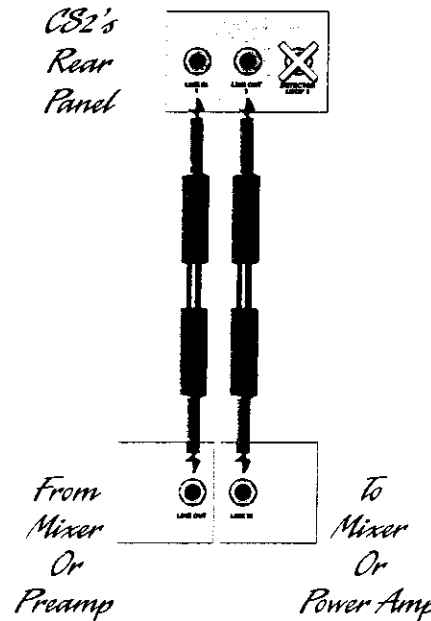
the signal processor's input, and therefore keeps it from distorting. This can be especially useful for older effects, such as a spring reverb or tape delay.

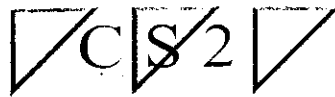


USING THE CS2 AS A LIMITER FOR BASS GUITAR

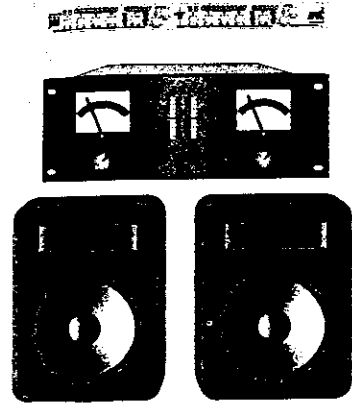


Recording a bass directly into a mixer provides a solid sound, but the dynamics of slapping can overload the mixer. Plug the bass into the mixer, run the channel's effects send to the CS2's Line In, and connect the CS2's Line Out to the mixer channel's effects return. Soft-knee compression works well to keep occasional slaps under control, but if the bass style is primarily percussive, limiting is often the best solution. You can also use the CS2 in an onstage bass rig to protect the speakers. Connect the preamp's output to the CS2 and the CS2's Line Out to the power amp. Limiting the signal lets you set the amp for more overall gain without worrying about distortion or speaker damage when you slap or play extra aggressively.

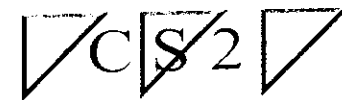
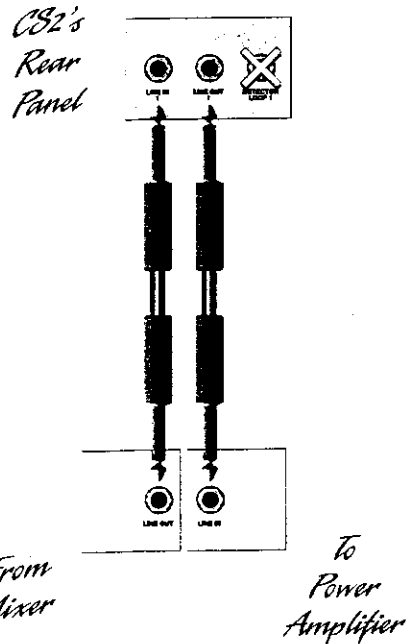




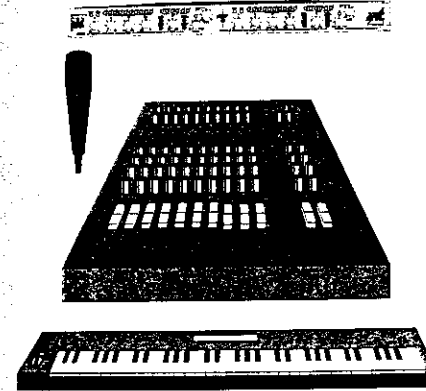
USING THE CS2 AS A LIMITER TO PROTECT SPEAKERS



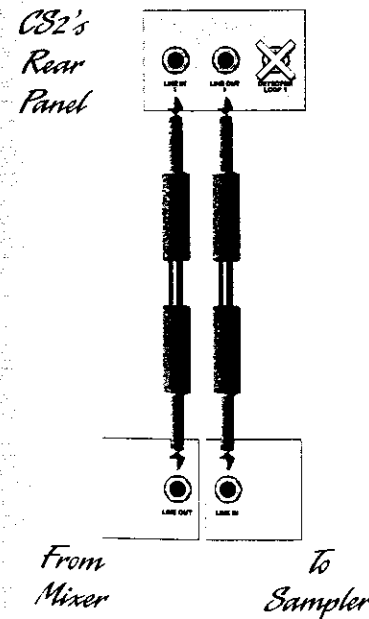
Connect the mixer's line out to the CS2's Line In, and the CS2's Line Out to a power amplifier's input. Setting the CS2 to limit the signal keeps sudden loud sounds (a drummer hitting a mic with a stick, for example) from blowing out speakers in high-power systems. In mono systems, you can use one channel of the CS2 to limit the main P.A. speaker system and the other channel to limit the monitors. In a stereo P.A., both CS2 channels can be used for protection on the left and right sides. Note: You can use multiple CS2s on crossover outputs to limit lows, mids, and highs independently.

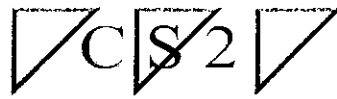


USING THE CS2 TO COMPRESS/LIMIT WHEN SAMPLING



Plug a sound source, such as a microphone or CD player, into a mixer's input and adjust its EQ and level. Connect the mixer's line out to the CS2's Line In and the CS2's Line Out to the sampler's line in. Compressing or limiting the signal reaching the sampler will provide you with a higher signal-to-noise ratio and make better use of the sampler's available headroom than plugging a sound source directly into the sampler. If the sampler is able to record stereo signals, use both channels of the CS2.





COMPRESSION, LIMITING, NOISE GATING

Most people know what a noise gate is: an electronic circuit that only lets signals above a set threshold pass through. Compression and limiting are more mysterious and easily misunderstood, but once you know what they are and what they can do for you, they will quickly become a vital part of your recording and onstage sound.

The reality of all electronic gear is that it has a finite amount of head-room, the greatest amount of signal that it can carry before distorting in unpleasant, unmusical ways. Between absolute silence and that high point is the bandwidth of a system. Whether the sound being passed through the system is a finger gently rubbing a piece of paper, or the roar of a gunshot, all sounds present unique challenges to recording, processing, and amplifying.

How Compression Works

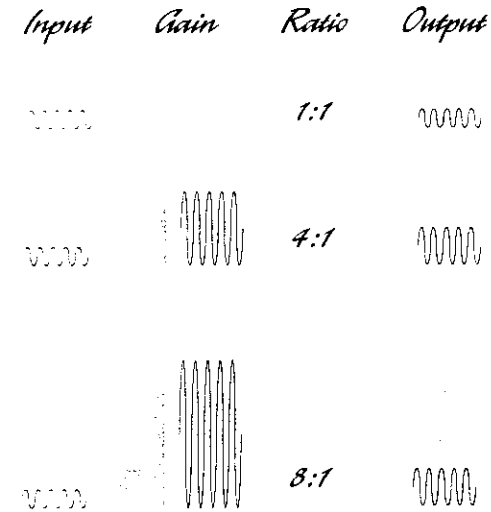
The compressor is a variable-gain amplifier. In simple terms, it monitors the incoming signal's level and adjusts its gain. It can keep suddenly quiet notes from disappearing and extra-loud ones from distorting.

A compressor is used to control the dynamic range of a signal. Dynamic range is defined as the difference between the loudest and softest portions of an audio signal. The Threshold control is used to set the point at which the compressor begins to act on a signal. Use the indicators (Above and Below) as a guide when setting this control. When the red Above light is lit, the signal is being compressed. The Slope control sets the amount of compression that is applied to the input signal. A range of 1:1 (off, or bypassed) to ∞ :1 (limit) is available.

The Attack control adjusts the time it takes for a compressor to react to a signal once its level exceeds the threshold point. The Release control adjusts the amount of time for the compressor to return to its normal gain after the signal falls below the threshold. Proper attack and release



settings depend on the tempo of the input signal. As a general guideline: longer times are best for slow-tempo material (such as ballads), and quicker times are good for up-tempo material. Some experimentation and experience are helpful in finding just the right settings for your appli-

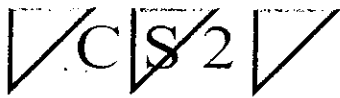


With the Slope control set to a ratio of 1:1, the output signal's level is the same as the input level's. When the Slope is set to a ratio of 4:1, and the input signal increases by 4dB, then the output only increases by 1dB. If the ratio is set to 8:1, and the input signal increases by 8dB, the output still only increases by 1dB, a more severe amount of compression.

cations. A properly set compressor is very difficult to hear. If you experience "pumping," or "breathing," where sounds abruptly drop out, check to see whether the Attack and Release times are set too long, or the Threshold is set too high.

Soft Knee and Hard Knee compression. Hard Knee compression is the most common type of compression, where a threshold and a ratio are set, and the graph of the effect looks like a sharp angle. Once the signal exceeds the threshold, the compressor kicks in, and depending on how

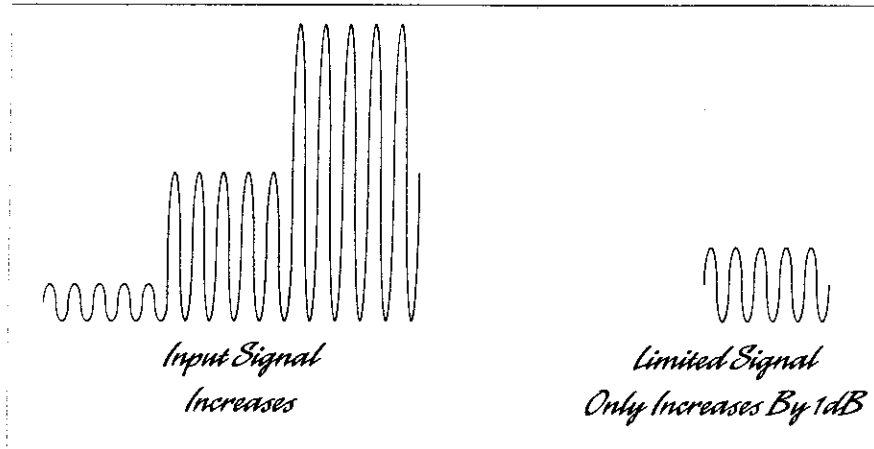




the ratio is set, the sonic effect can be pretty radical, even jarring. Soft Knee compression works differently: The threshold and ratio are linked, so there's almost always compression—very subtle at low signal levels and increasing as the levels rise. It's smoother—some say it's more musical—than Hard Knee compression, and it's best applied to sounds requiring less drastic compression.

How Limiting Works

Limiting is, as the name implies, a process in which no more signal level is allowed through. Period. And that's regardless of how "hot" that signal is. Limiting is useful in P.A. systems or bass amplifier systems to protect speakers. In recording situations, it helps to prevent tape overloading.



When the compression ratio is set to $\infty:1$, or the Limit switch is activated, it doesn't matter whether the input's level increases 1dB or 100dB: the output level is only going to raise by 1dB.

A limiter isn't exactly the most subtle way to treat dynamics, but it is effective as a way to keep signals from overloading equipment and causing distortion, or possibly even damage. In some instances, limiting is useful in recording, particularly when a bass line includes slapping as well as fingered notes. However, limiting is often used primarily between preamps or mixers and power amps to keep the power amps from distorting and

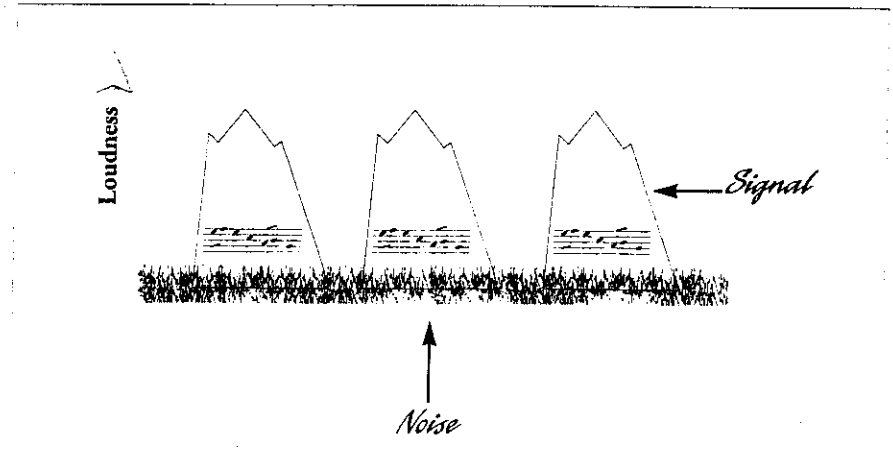


to protect speakers from massive transients that could blow out voice coils.

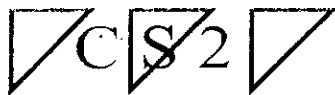
To set up the limiter: Set the Threshold to trigger at the louder portions of the audio source. Use the Output control to set a maximum output level. When properly adjusted, the limiter will prevent input levels from exceeding the set output level.

Compression And Noise

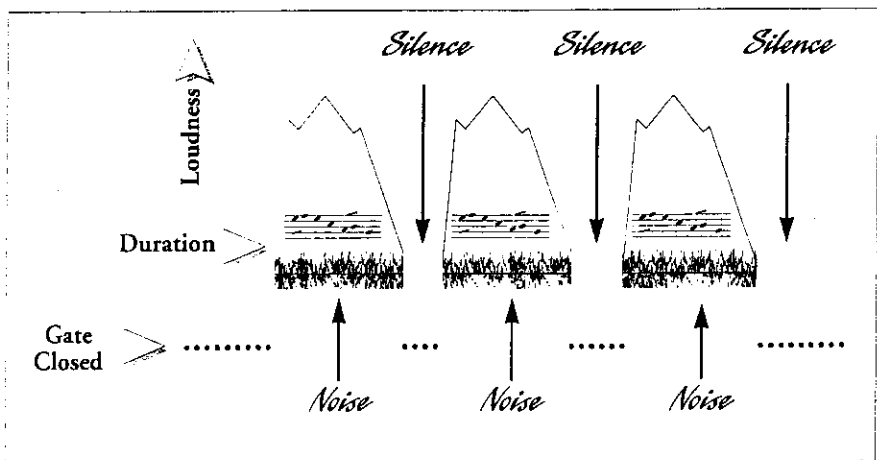
Because compression reduces the dynamic range, it makes the loudest sounds quieter and the quietest sounds louder. Therefore, if you're compressing your loud sounds by, say, 10dB, then you're also bringing up the quiet sounds by 10dB. If those quiet sounds are harmonics on a harp, or a singer's breathy lines, great. If those quiet sounds are hiss, then you're going to be unhappy with the result. One way to reduce the noise is to make sure any equipment before the compressor is as quiet as possible. In fact, for guitarists in particular, it's often a good idea to place the compressor before other signal processors—especially wah-wahs and fuzz boxes, which can be pretty noisy.



Unless a signal is excessively noisy to begin with, the signal itself usually "masks" the noise, making it difficult to hear. When a signal is compressed, the noise becomes more apparent in quiet parts.



A second way to reduce noise is to use a noise gate after a compressor. ART's CS2 has a noise gate for each channel, making noise reduction a simple task. Two controls let you customize the gate's response: Threshold and Release. The Threshold lets you zero in on the level at which you want the gate to open. Listen to any noise that's passing through the system when no notes are playing, and set the Threshold just above that point, so that the gate opens up whenever a desired signal is present, but shuts down in quieter times. The Release knob lets you set the time that it takes for the gate to close. This takes a bit of experimentation because you may not want the gate closing all the way after every single note. For most music, you'll want to have a moderate to long release time so that notes can die away before the gate closes. Of course, the gate can be an effect in itself, or keep extraneous noises out of tracks consisting of fast-attack/fast-decay sounds like drums.



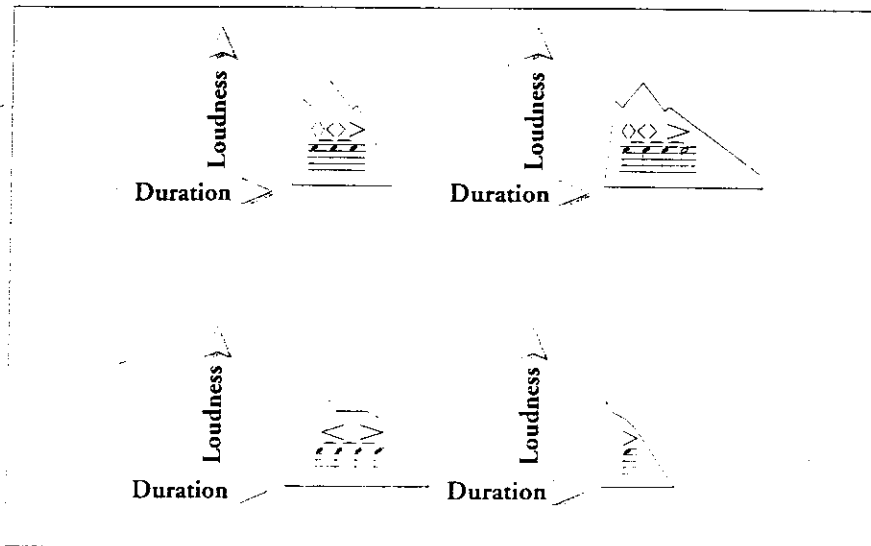
Setting the gate's threshold above the noise during quiet passages makes the gate open only when the signal's level exceeds the noise's level. The result is absolute silence between sounds, and the signal masks the noise when the gate is opened.



Note: Either of the CS2's Noise Gates can be used alone by setting the compressor's Slope to 1:1 and adjusting the Level control to govern the amount of signal passing through. The Level setting acts as a volume control, and the gate follows, turning on and off according to the Noise Gate's Threshold and Release settings you dial in.

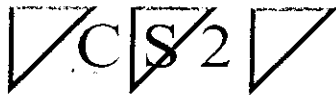
Envelopes And Sound-Shaping

Every sound has what's known as an envelope. If you were to make a graph that plots the duration of the sound and its intensity, you'd see what the envelope looks like. At the start is the attack, and at the end is the decay. Simple enough. Every sound has different attack and decay times, and every sonic event (note, thud, etc.) can be of any loudness. Tapping a spoon on a brick creates a fast attack and a fast decay, while hitting a cymbal with a stick creates a fast attack and a slow decay. Dragging a bow across a cello's string produces a slow attack, but the way the note dies off can be fast or slow, depending on how lively the instrument and the room are.



Fast and slow attacks and a sound's overall duration make up its envelope.





Why should these envelopes concern you? Compressors such as the CS2 have Attack and Release controls that let you customize how they react to sounds. The Attack sets how quickly the circuit reacts to the sound. If you set it for a fast attack on a sound with a fast attack, the compressor can squash the note's onset, taking impact away. If you present it with a fast-attack sound such as a bass guitar slap, snare drum, etc., you can get more impact by setting the compressor's attack control to a slower value. Some guitarists get "backwards" effects by setting a compressor's Attack to an extremely short value while also using a high compression ratio. This squashes the pick attack to almost nothing and makes the sound swell and sustain. With a moderate compression ratio and a longer attack time, it's possible to make harmonics (often notoriously weak) sound as loud as picked notes. This is a great tool for guitar or bass.



ART CS2 Specifications

Frequency response	10 Hz to 40KHz ±0.5dB
Input impedance	20K ohms (balanced)
Maximum input level	+21dBu
Output impedance (balanced)	600 ohms
Output impedance (unbalanced)	300 ohms
Maximum output level (balanced)	+27dBu
Maximum output level (unbalanced)	+21dBu
Distortion	<.009% @ 1KHz typical <.03%, 20 Hz to 20KHz
Noise	-97dBu @ unity gain -108dBu @ gate on (independent of output level) -101dBu Equivalent Input Noise
Dynamic range	117dB unweighted >120dB "A" weighted
Crosstalk	<-85dB @ 1KHz
Country of manufacture	U.S.A.

ART retains a policy of constant product improvement. Therefore, specifications are subject to change without notice.

Designed and manufactured in the United States of America.

Applied Research & Technology
215 Tremont Street
Rochester, NY 14608

(585) 436-2720
(585) 436-3942 (FAX)





WARRANTY & SERVICE INFORMATION

LIMITED WARRANTY

Warranty service for this unit will be provided by Applied Research & Technology, Inc. in accordance with the following warrant statement.

Applied Research & Technology, Inc. (ART) warrants to the original purchaser that this product and the components thereof will be free from defects in workmanship and materials for a period of one year from the date of purchase. Applied Research & Technology, Inc. will, without charge, repair or replace, at its option, defective product or component parts upon prepaid delivery to the factory service department or authorized service center, accompanied by proof of purchase date in the form of a valid sales receipt.

EXCLUSIONS: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. This warranty is void if the serial number is altered, defaced, or removed.

ART reserves the right to make changes in design or make additions to or improvements upon this product without any obligation to install the same on products previously manufactured.

ART shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific rights and you may also have other rights which vary from state to state.

For units purchased outside the United States, service will be provided by an authorized distributor of Applied Research & Technology, Inc.



Service

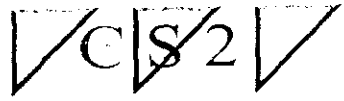
The following information is provided in the unlikely event that your unit requires service.

- 1) Be sure that the unit is the cause of the problem. Check to make sure the unit has power supplied, all cables are connected correctly, and the cables themselves are in working condition.
- 2) If you find the unit to be at fault, write down a description of the problem, including how and when the problem occurs.
- 3) Call the factory for a Return Authorization (RA) number.
- 4) Pack the unit in its original carton or a reasonable substitute. The packing box is not recommended for a shipping carton. Put the packaged unit in another box for shipping. Print the RA number clearly under the address.
- 5) Include with your unit: a return shipping address (we cannot ship to a P.O. Box), a copy of your purchase receipt, a daytime phone number, and a description of the problem.
- 6) Ship the unit to:
 APPLIED RESEARCH & TECHNOLOGY
 215 TREMONT STREET
 ROCHESTER, NY 14608
 ATTN: REPAIR DEPARTMENT
 RA # _____
- 7) Contact our customer service department at (585) 436-2720 for your Return Authorization number or questions regarding repairs. Customer Service hours are 9:00 AM to 4:00 PM Eastern Time, Monday through Friday.

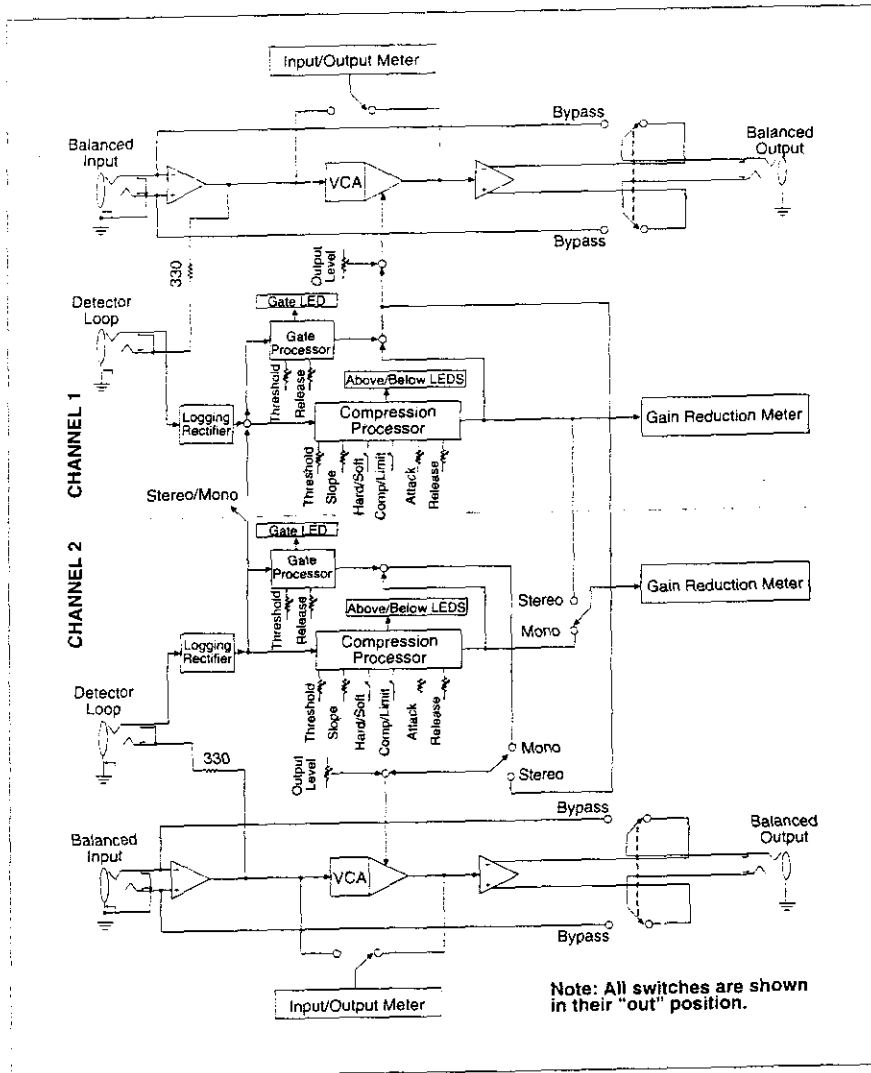
Customer Service

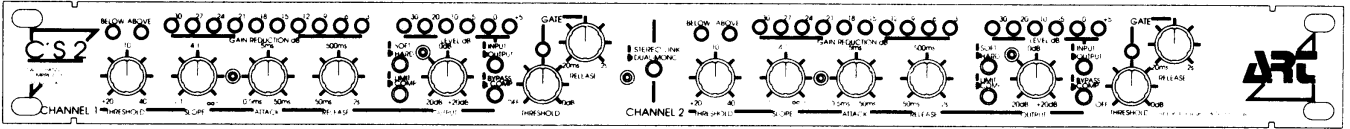
You may contact ART's Customer Service Department between the hours of 9:00 AM and 4:00 PM Eastern Time Monday through Friday. The Customer Service Department will answer technical questions about ART products and provide information concerning service.





ART CS2 Block Diagram





Connections

The CS2 has actively balanced inputs and outputs. The jacks are 1/4" TRS (Tip-Hot, Ring-Cold, Sleeve-Ground). If you do not have a balanced source, simply use traditional 1/4" jacks and the connection will be unbalanced.

Used with a mixing console, a line output (or the send of an insert) should be connected to the Line In of the CS2. The Line Out of the CS2 is then connected to a line input of the mixer or the return of the insert point. If used with an instrument or microphone, the signal should first be run through a preamplifier to bring the signal up to line levels. The output of the preamplifier would then be plugged into the Line In of the CS2. The Line Out of the CS2 would then run to an input of a mixer or other processor.

Using the Compressor

A compressor is used to control the dynamic range of a signal. Dynamic range is defined as the difference between the loudest and softest portions of an audio signal. The **threshold** control is used to set the point at which the compressor will begin to act on a signal. Use the indicators (above and below) as a guide when setting this control. When the red "above" light is lit, the signal is being compressed. The **Slope** control sets the amount of compression that is applied to the input signal. A range of 1:1 (off or

bypassed) to ∞:1 (limit) are available. See Suggested Slope Settings on the reverse of this card.

The **Attack** control adjusts the time it takes for the compressor to react to a signal once the signal rises above the threshold. The **Release** control adjusts the amount of time for the compressor to return to its normal gain after the signal falls below the threshold. Proper attack and release settings depend on the tempo of the input signal. As a general guideline, longer times are used for slow tempo material (ballads), and quicker times are used for up tempo material. A properly set compressor is very difficult to hear. If you experience "pumping" or "breathing", check to see if the attack and release times are set too long or the threshold is set too high.

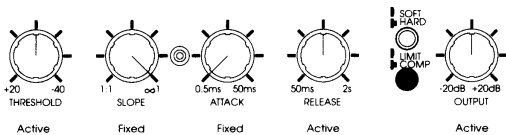
Hard and Soft Knee

Hard and Soft knee are terms used to describe the response characteristics of the compressor. Hard knee causes the compressor to act normally on an input signal once it rises above the threshold. It instantly causes compression of the signal. In soft knee mode the compressor gradually acts on a signal, gently smoothing it into compression. A finger-picked bass line in a ballad would generally use soft knee compression, while a slap bass would use a hard knee compression.



Limit/Comp Switch

When this switch is out the compressor works as previously described. When the switch is depressed, the circuit automatically changes to a Limiting function. When set to Limit, the Slope automatically adjusts to a limit (∞:1) ratio and the attack time is set to its quickest setting. The threshold, release and output controls are adjustable.



Limiting is useful for use on P.A. systems to protect speakers and in recording situations to prevent tape saturation. **To set up the Limiter:** Set the Threshold to the louder portions of the audio source. Use the output control to set a maximum output level. When properly adjusted, the limiter will prevent input levels from exceeding the set output level.

Noise Gate

A noise gate is used to mute an audio signal once it falls beneath a set level. This is particularly useful for controlling background noise or "bleed" from an open microphone. Once the singer stops singing, a gate turns the mic "off". The noise gate has two controls: Threshold and Release time. Set the threshold control to the point at which you wish to mute the input signal. The threshold indicator will light when the gate is turned off. The release control adjusts the amount of time it takes for the gate to close once the signal falls below the threshold. This allows for a gradual fade, like turning down the channel. To bypass the noise gate, simply set the threshold control fully counter-clockwise.

Stereo Link

Depressing the stereo link button sets the CS2 for stereo mode. In stereo mode the settings for channel 1 are automatically duplicated in channel 2.

Channel 1 becomes the master controller for both channels. Compressor controls for channel 2 are disabled since channel 2 is the slaved unit. Output level, bypass and the meter select switches remain active. Use the stereo link

switch when using the CS2 for stereo signals (mixes, overheads, synths) that need identical processing to maintain a defined stereo image.

Suggested Initial Compression Slopes

There are no correct or standard compression settings, however, the following ratios are good starting points for the instruments listed.

Vocals	2:1, 3:1, or 4:1
Bass	4:1 or 6:1
Heavy Electric Guitar	3:1, 4:1, or 6:1
Light Finger Picked Acoustic Guitar	2:1 or 3:1
Strings, Horns and Synths	3:1 or 4:1
Slap Bass	6:1 to 10:1 (limit)
Overhead Percussion	2:1 to 6:1

The following are suggested settings for compressor applications. Attack and Release times are suggested as follows: Fast - quickest setting to 9 o'clock. Med - 10 o'clock to 1 o'clock. Slow - 2 o'clock to slowest setting.

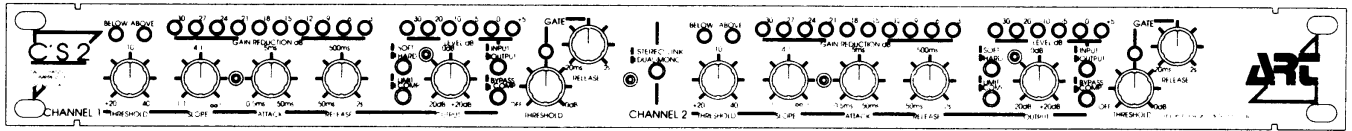
Fattening drums and percussion:
Slope - 4:1 to 6:1 Attack - Med Release - Med

Bringing out an instrument from the mix:
Slope - 2:1 to 4:1 Attack - Fast Release - Fast
*Use the output level to adjust level in the mix.

Adding sustain to an instrument:
Slope - 6:1 to ∞:1 Attack - Med Release - Med

Re-compressing a vocal track:
Slope - 1.5:1 or 3:1 Attack - Med Release - Fast

For further information regarding operation of your CS2 please refer to the owner's manual.



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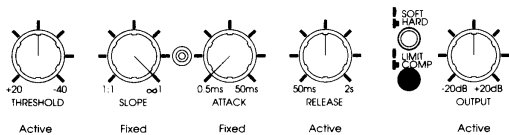
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Limit/Comp Switch

When this switch is out the compressor works as previously described. When the switch is depressed, the circuit automatically changes to a Limiting function. When set to Limit, the Slope automatically adjusts to a limit (∞:1) ratio and the attack time is set to its quickest setting. The threshold, release and output controls are adjustable.



Limiting is useful for use on P.A. systems to protect speakers and in recording situations to prevent tape saturation. **To set up the Limiter:** Set the Threshold to the louder portions of the audio source. Use the output control to set a maximum output level. When properly adjusted, the limiter will prevent input levels from exceeding the set output level.

Noise Gate

A noise gate is used to mute an audio signal once it falls beneath a set level. This is particularly useful for controlling background noise or "bleed" from an open microphone. Once the singer stops singing, a gate turns the mic "off". The noise gate has two controls: Threshold and Release time. Set the threshold control to the point at which you wish to mute the input signal. The threshold indicator will light when the gate is turned off. The release control adjusts the amount of time it takes for the gate to close once the signal falls below the threshold. This allows for a gradual fade, like turning down the channel. To bypass the noise gate, simply set the threshold control fully counter-clockwise.

Stereo Link

Depressing the stereo link button sets the CS2 for stereo mode. In stereo mode the settings for channel 1 are automatically duplicated in channel 2.

Channel 1 becomes the master controller for both channels. Compressor controls for channel 2 are disabled since channel 2 is the slaved unit. Output level, bypass and the meter select switches remain active. Use the stereo link

switch when using the CS2 for stereo signals (mixes, overheads, synths) that need identical processing to maintain a defined stereo image.

Suggested Initial Compression Slopes

There are no correct or standard compression settings, however, the following ratios are good starting points for the instruments listed.

Vocals	2:1, 3:1, or 4:1
Bass	4:1 or 6:1
Heavy Electric Guitar	3:1, 4:1, or 6:1
Light Finger Picked Acoustic Guitar	2:1 or 3:1
Strings, Horns and Synths	3:1 or 4:1
Slap Bass	6:1 to 10:1 (limit)
Overhead Percussion	2:1 to 6:1

The following are suggested settings for compressor applications. Attack and Release times are suggested as follows: Fast - quickest setting to 9 o'clock. Med - 10 o'clock to 1 o'clock. Slow - 2 o'clock to slowest setting.

Fattening drums and percussion:

Slope - 4:1 to 6:1 Attack - Med Release - Med

Bringing out an instrument from the mix:

Slope - 2:1 to 4:1 Attack - Fast Release - Fast
*Use the output level to adjust level in the mix.

Adding sustain to an instrument:

Slope - 6:1 to ∞:1 Attack - Med Release - Med

Re-compressing a vocal track:

Slope - 1.5:1 or 3:1 Attack - Med Release - Fast

For further information regarding operation of your CS2 please refer to the owner's manual.