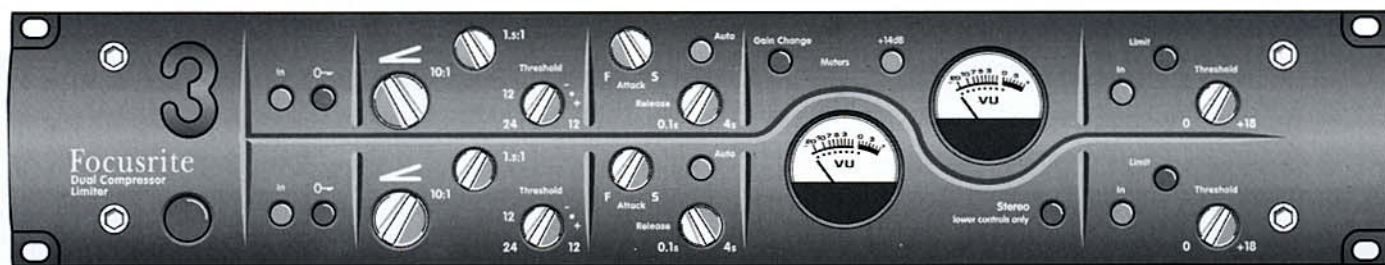# Red 3
compressor/limiter

The Red 3 is a 2-channel compressor and limiter. Each channel can operate independently on two mono signals, or they can be combined to act as a single compressor and limiter on a stereo signal.

Compressors and limiters both act like automatic volume controls, turning down the volume of a signal if it gets too loud. The difference between the two is:

• A limiter sets an upper limit on the volume, and will not allow the signal to go above that volume
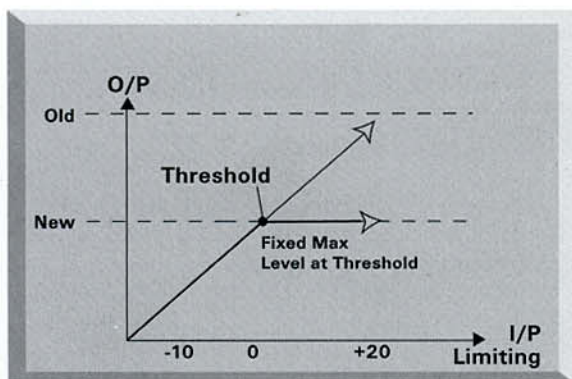
• A compressor reduces changes in volume, so that the dynamic range of the compressed signal is lower than the dynamic range of the input signal
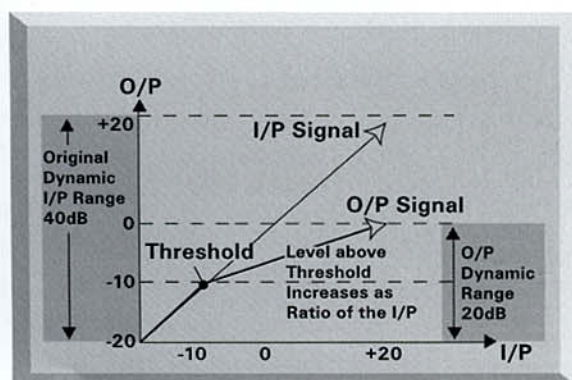
When you are getting to know the unit, particularly if you are not familiar with using a compressor, use it on a track that you are familiar with (for example, you could run a favourite CD through the unit). Try all of the controls in turn, and hear how they affect the sound. Working with a familiar track makes interpretation of the results easier. Note, however, that tracks are already compressed for CD, so you may find it hard to hear the results easily. If this is the case, try using samples instead (if you have access to them), or record your own track uncompressed and then play it back through the Red 3.

There are two separate parts to the Red 3:

• The Compressor
• The Limiter

Compressor

A compressor reduces the dynamic range of a signal by automatically reducing the gain when it gets louder than a certain threshold. To understand a compressor, you must understand dynamic range - if you do not, you should read the following section about dynamic range.

Note that compression tends to even out a performance (particularly of stringed instruments such as guitar) since it stops the instrument getting very loud in the mix. When compressing hard, it also reduces an instrument's attack (again, this is most noticeable with stringed instruments).

Dynamic Range

The dynamic range of a signal is the difference in volume between the quietest and loudest parts: for music, the dynamic range can be as wide as 120 dB.

Signals with wide dynamic range demand greater attention from the listener, and require listening conditions with low background noise. Consequently, in areas with high background noise, such as a restaurant, it is hard to listen to signals with a wide dynamic range - only the loud parts are heard, with the quiet parts being lost in the ambient noise. Compressing the signal reduces the dynamic range and so makes it easier to hear in such situations.

Similarly, the dynamic range of the signal can exceed that of the medium used to carry it:

• 16-bit digital recordings (such as DAT) have a theoretical maximum dynamic range of 96 dB. It is essential that you do not exceed this limit

• Analogue tape has a dynamic range in the order of 60 dB (though noise reduction can add between 15 and 30 dB). It is not always necessary to limit dynamic range when recording onto analogue tape, as the tape saturates naturally when recording loud signals, which in some cases can be useful

• FM radio has a dynamic range of 40 to 50 dB

• AM radio has a dynamic range of 20 to 30 dB

In all of these cases, you can use a compressor to restrict the dynamic range of the signal to that of the medium.

The Controls
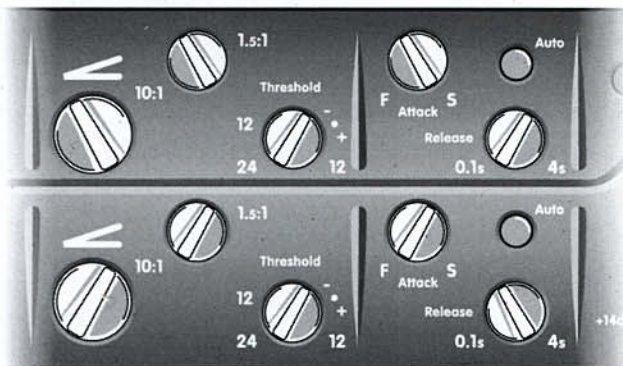
• The ratio and threshold controls set the amount of compression applied to the signal

• The attack and release controls set the duration of the compression

• The make-up gain sets the output volume of the compressed signal.

Ratio

The ratio control determines how much compression is applied to the signal. The ratio (such as 2:1) refers to the ratio of change in input level to the change in output level. So, a ratio of 2:1 means that for every 2 dB change in the input level, the output level changes by 1 dB, as shown in the following diagram:
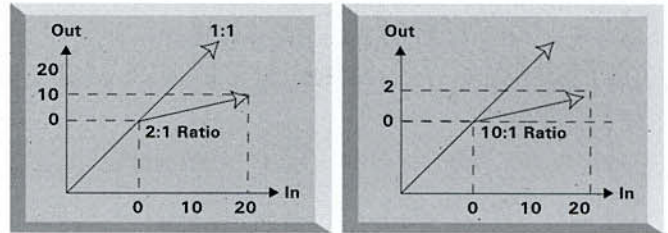

Setting the Ratio

As you increase the ratio, the sound becomes tighter and the effect of the compression becomes more noticeable. A lower ratio has a softer slope, which preserves more of the original dynamic range, since an increase in input level still results in a significant increase in output level.

Threshold

The threshold determines when the compressor starts to compress the signal. By setting a threshold, you do not compress all of the input signal - instead, you compress the signal only when it is louder than the threshold, as shown in the following diagram:
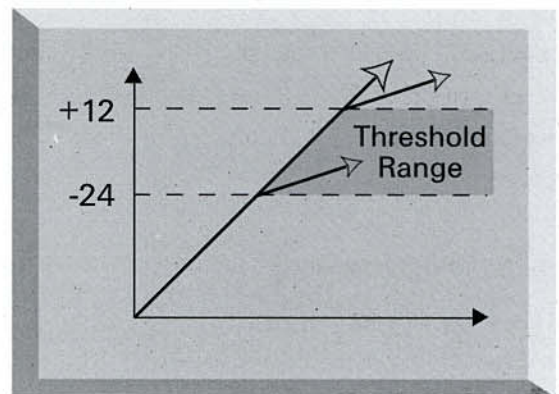
Setting the Threshold

By setting a threshold, you determine that quieter passages maintain their natural dynamic range, and only loud passages (that go above the threshold) are compressed.

Attack and Release

The attack and release controls determine how quickly the compressor switches on and off at the threshold. Without an attack control, full compression would be applied to the signal as soon as it got louder than the threshold. Similarly, without a release control, the compressor would switch off as soon as the signal got quieter than the threshold. While this is fine in some recording situations, in most it gives an unnatural sound to the signal, so you can use the attack and release controls to modify this.

Note that the optimum attack and release rates vary with the instrument being recorded, and with the performance. For example, when recording a snare drum, a fast attack and release are needed - a slow release over-compresses the signal, with all beats after the first dulled slightly because the compressor is still on.

Setting the Attack Rate

By slowing the attack rate, the compressor gradually comes to full compression, instead of compressing
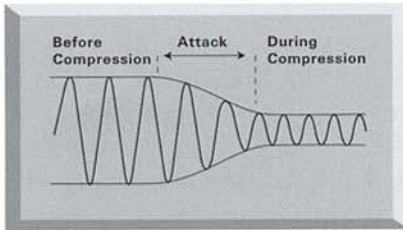

immediately. Transient response is less affected, so maintaining the presence of each note.

Attack times do not need to be very fast when recording onto analogue tape - you can use slower attack times of around 1 ms. The fastest transients are lost by saturation of the tape and become inaudible, and longer duration peaks can be controlled by the compressor, giving a more natural sound.

Setting the Release Rate

By slowing the release rate, the compressor recovers more slowly from compression, so it does not turn off completely when the signal returns below the threshold.

The release rate is probably the most important variable when recording rock music, since it controls loudness.
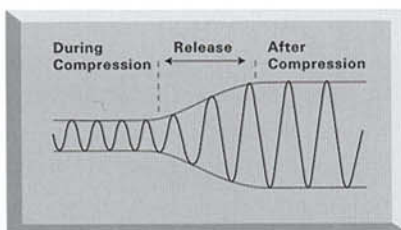

Loudness is determined by the maintenance of high mean levels: compression increases the proportion of high-level signal content, and as the diagram shows, the faster the unit releases, the more low-level signal is brought to a higher level. Therefore, the faster the release rate, the higher the perceived loudness of the recording.
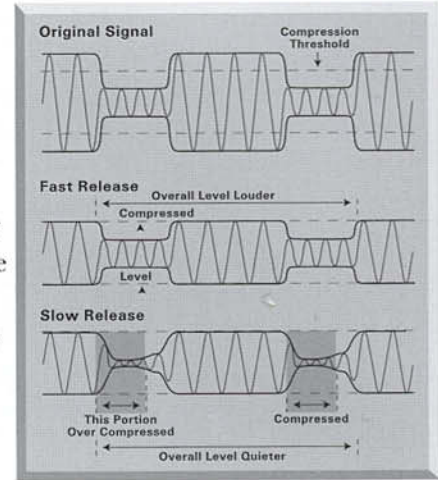

You do not have to set a permanent release time for the whole input signal; instead, you can use the Auto button. Auto reacts to the dynamic range of the input, so the higher the signal is above the threshold, the longer the release. This means that fast signals that aren't compressed hard have a fast release time, while longer signals release more slowly, which makes the compression in context with the signal.

Make-up Gain

Compressing a signal makes it quieter. After you have set the compression on the signal, use the make-up gain to restore the signal's original volume.
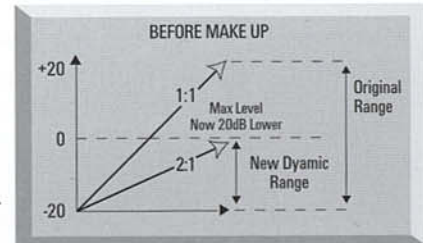
For example, in the diagram the compressor reduces the signal by 20 dB, which reduces the dynamic range of the input and in so doing makes the signal quieter.
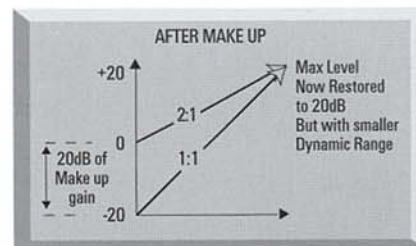
Using the make-up gain restores the volume of the compressed signal.

Gain Change

This modifies what the meter displays. When the switch is out, the meter displays the level of the input signal. When the switch is in, the meter displays the amount of compression. Since compression reduces the volume of the signal, the meter drops as compression is applied. For example, a 3 dB drop shows as -3 VU on the meter.

+14 dB

This switch affects the input-level meter:

• When it is out, a signal of +4 dB registers as 0 VU

• When it is lit, a signal of +14 dB registers as 0 VU

The switch lets you monitor very loud incoming signals without overloading the meters.

Limiter

The limiter sets an absolute threshold for the signal volume after compression, and does not allow the volume to go above that threshold.

Note that the threshold for the limiter is independent of the threshold for the compressor (the dB value of the limiter's threshold is an absolute value, not a relative value above the compressor's threshold). Therefore, it is possible to set the threshold for the limiter below the threshold for the compressor - if you do this, the limiter will not work.

When the limiter is working, the limit light comes on.

The limiter can also be used separately when the compressor is switched out.
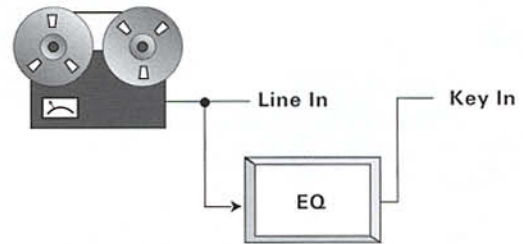
Using the Key Input

Pressing the key input button switches control of the compressor to a signal entering the unit through the
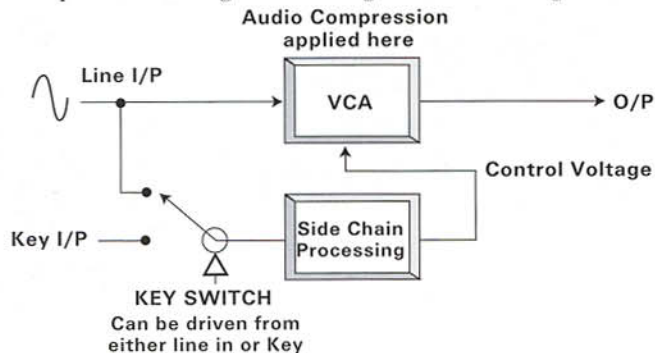
key input. Note that the key input signal is not output from the unit, it is the original input that is compressed, but compression is applied as if the key input signal were being compressed.

For example, one of the problems in compressing a mixed programme is that gain reduction tends to be controlled by one dominant instrument or sound. For more natural compression, you need to attenuate (reduce the volume of) the sound of the dominant instrument, but this is probably not acceptable since it would affect the mix. Therefore, you can use the key input: take a second feed of the programme, and feed it through an equaliser that attenuates the dominant instrument, then take that signal and feed it into the key input, as shown in the diagram.

Now, you can use the key input to control the compression of the original signal. The original signal is compressed as if the dominant instrument had been attenuated.

This technique can be very useful when compressing bass-heavy dance music. By attenuating the bass in the key input signal, the bass in the original retains more of its dynamics.

Another application of this technique is in de-essing. When de-essing, you want sibilants in a voice to be heavily compressed. To achieve this, accentuate the sibilants in the key input signal by adding gain to the correct frequencies, which means they are heavily compressed in the original signal.

Compressing and Limiting a Stereo Signal

Normally the two channels of the Red 3 run independently in mono. Controlling a stereo signal using two independent channels is very difficult, since it is almost impossible to set the controls for both channels identically. If the channels are not compressed identically, you will compress one channel more than the other, thus shifting the stereo position to the left or the right. To avoid this problem, use the stereo button. This disables the top controls: the bottom controls determine the compression applied to both channels.

Compensating for a Quiet Signal

On some consoles, the insert sends are at lower than standard operating levels. You will perceive this as an increase in the overall noise of the unit, since the signal level of the input is close to the noise floor of the unit. To compensate for this, there is a switch on the rear panel of the module, marked as 0 dB and 6 dB. To change the input gain, and improve the signal to noise ratio of the unit, set this switch to the 0dB setting.

How to Use Compression

1. Using an input signal with wide dynamic range, set the controls in the following starting positions:

- Ratio in the middle (around 5:1)

- Threshold at maximum (+12)

- Attack and release at their fastest

- Make-up gain at minimum

- Switch the meter to show gain change, so that you can monitor the effect of compression

2. Reduce the threshold, and monitor the effect this has on the sound:

- Listen to the reduction in the dynamic range

- Watch the meter to see the amount of gain reduction

As you reduce the threshold, increase the make-up gain to restore the level of the signal

3. When you are close to the dynamic range you want, you need to adjust all the controls to achieve the quality of sound that you are looking for:

- Adjust the ratio to compress softer or harder

- Adjust the threshold to compress sooner or later

The combination of ratio and threshold determines the maximum level of the loudest sections.

- Adjust the attack to dampen the sound or to restore transients

- Adjust the release to even out compression between the loud and quiet sections

The release determines the level of the quietest signal. The combination of ratio, threshold and release determines the overall dynamic range.

When to Use Compression

Compress hard:

- To stop dropping in and out (particularly vocals - compress quite hard so they sit above the mix).

- When recording bass (for example) - there is a lot of bass energy that can easily get out of control

- When recording snare

- Anything you want to maintain a continuous presence in the mix

Compress more softly:

- When the attack is an important characteristic of the sound

When compressing softly, set the limiter to the maximum input level of the next stage in the signalchain. This lets you compress softly without the risk of overloading the next stage.