

## Dynamic Range Processors Demonstration

The dynamic range plug-in of Digital Performer can function as a compressor, limiter, gate or expander. Its controls are described below:

Click here to load special presets if lab instructions say so

Don't click on the camera icon

Press the Bypass button to turn off the plug-in

Click here to select plug-ins for other tracks

Controls the key input; don't change for now

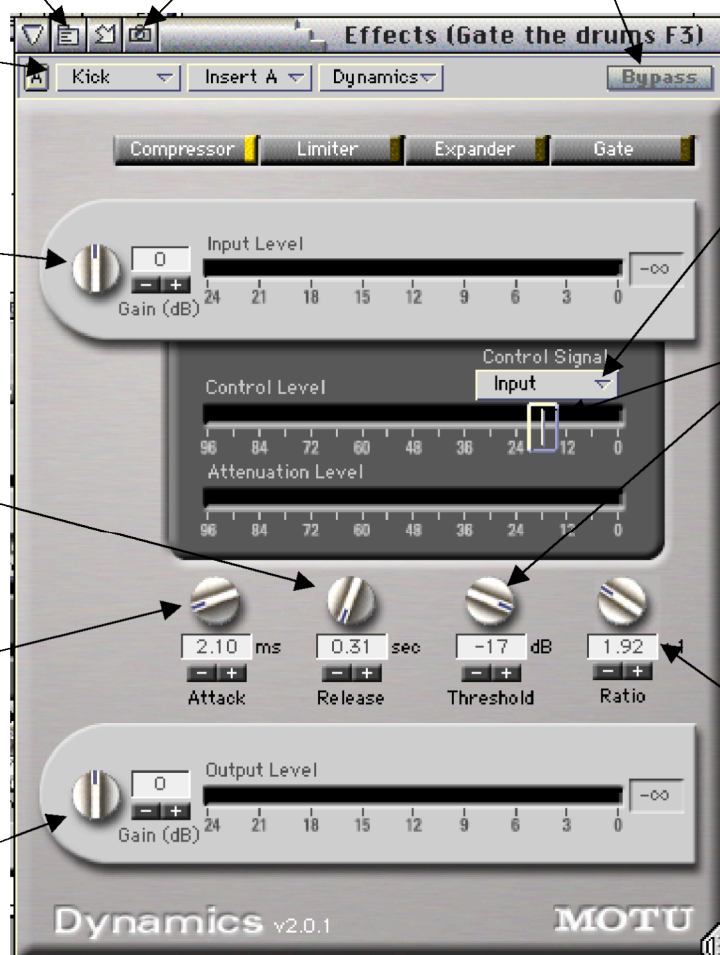
Adjust only if input level is very low

Controls how quickly the compressor reacts to loud and soft sounds

Both controls do the same thing; adjust how much signal is compressed.

Compressors soften sounds, so this control lets you make the track louder. Don't get in the red!

Controls the amount of compression. Note - Limiters don't have an adjustment for ratio - it is set to maximum



**Lab Instructions:** This lab contains 5 examples of dynamic range processing:

1. Compressing the bass guitar
2. Gating the snare

3. Gating the drums
4. Compressing the lead vocal
5. Limiting the overall stereo mix

During this lab you will learn how to adjust the controls of a compressor, gate and limiter. The last example allows you to mix the tracks while limiting the overall volume of the stereo mix.

To select an example to hear, click the Play arrow by the example's name and press the space bar.

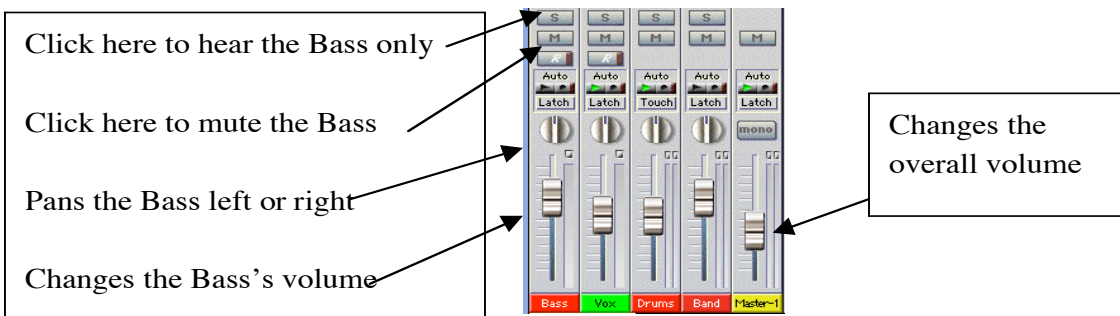


In the picture above, the example "Gate the drums" is play enabled.

**Note:** If you accidentally close a window, press the key **F1** on the top left of the computer keyboard to make it reappear.

**Compressing the Bass Guitar.** Compressors are used to make some tracks louder than other tracks in the mix. Compressors tame the loudest sounds in recordings so the engineer can crank them up without fear of overloading something.

In this first example you'll explore the effect of the compressor's Attack, Release, Ratio, Threshold and Gain controls on the sound of the Bass guitar. The Mixing Board window allows you to solo, mute and adjust the volume of the Bass, Lead Vocal, Drums, Band and the Stereo Mix.



**Using the Compressor’s Threshold control:**

1. Click the play enable arrow of the example “Compress the Bass.”
2. Press the space bar to start and stop the playback.
3. Lower the Threshold knob to –25 dB.

*What happens to the volume of the Bass Guitar?*

---

Compressors lower the volume of sounds higher than the threshold. By lowering the Threshold knob, more of the Bass’s sound is above the Threshold so the compressor makes the Bass’s volume softer. This signal loss is called *attenuation or gain reduction*.

*Please write your definition of attenuation.* \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Exploring the Ratio control:**

1. Keep the Threshold knob at –25dB,
2. Raise the Ratio knob to 100:1

*What happens to the Bass’s volume?*

- 
3. Lower the Ratio knob to 1:1

*What happens to the Bass’s volume?*

---

The Ratio knob determines how much attenuation occurs when the sound crosses the Threshold. For example, if the Ratio is 3:1 and the Bass is 21 dB over the Threshold, the compressor lowers the volume by 14 dB. If the Ratio is 7:1 and the Bass is 21 dB over the Threshold, the compressor lowers the gain by 18 dB. If the Ratio is 1:1, no gain reduction takes place. (Inexperienced engineers often forget to raise the Ratio knob before they lower the Threshold. Then they wonder why the compressor is not working.)

You can figure out the gain reduction this way: First, divide the excess signal by the Ratio. In the first case, divide 21dB by 3. Take this answer, 7, and subtract it from the excess signal: 7 dB from 21dB leaves 14dB. The second example, with a ratio of 7:1, divides 7 into 21dB. Subtract this answer, 3 dB, from 21dB. The attenuation is 18dB. The last example has 21 dB divided by 1, leaving 21dB. 21 minus 21 is 0. That’s why a ratio of 1:1 provides no gain reduction, regardless of threshold setting. For you mathematicians out there, the formula we are using is  $G=E/R-E$  where G is gain reduction, E is excess signal and R is ratio.

Exploring the Gain control.

1. Set the Threshold to  $-25$  dB.
2. Set the Ratio to 2:1
3. Adjust the Gain control until the Bass can be easily heard in the mix (watch out for clipping, though.)

What setting for the Gain control did you choose? \_\_\_\_\_ dB.

The Gain control is sometimes called ‘make-up gain’ because it adds back the volume lost due to compression. Most engineers prefer to restore the volume loss with this control rather than the track’s channel fader. They’ll save the channel faders for adjusting the music during mix down. *In your own words, what is the reason for using the compressor’s Gain control?* \_\_\_\_\_

---

---

Exploring the Attack and Release Controls.

1. Solo the Bass Guitar
2. Set the Threshold to  $-51$  dB (to compress the Bass a lot.)
3. Set the Gain to 18 dB (so we can hear it.)
4. Set the Attack to .10 msec. and Release to 0.21 seconds.
5. Compare the sound quality of the compressed and uncompressed Bass by clicking the Bypass button several times.

Which setting has more hum and noise? *Compressed Uncompressed Same (Circle one)*

6. Set the Release time to 10 seconds.

Which setting has more hum and noise? *Compressed Uncompressed Same (Circle one)*

You can visualize how a compressor works this way: Each time the compressor kicks in it moves a ‘virtual fader’ downward, lowering the volume. The Release time controls how quickly this fader moves back up. The Attack time controls how quickly the ‘virtual fader’ moves down. Decreasing the Release time raises the ‘virtual fader’ quickly whenever the Bass stops, so hum, hiss and other noises are louder than they normally are because we added 18 dB of gain. Increasing the Attack time allows slaps, clicks, pops and other transients to pass through before the virtual fader turns them down. Remember this: A compressor will *always* increase the background noise of a track because it lowers the loud sounds and raises the soft sounds.

Compressors can also distort the sound of low pitched instruments if the Attack time and Release time are set too fast. To hear this distortion, do the following:

1. Make sure the compressor is not Bypassed
2. Set the Attack time to .10 msec
3. Set the Release time to .01 Sec.
4. Solo and play the Bass.

Here’s the reason why the Bass sounds fuzzy. The strings of the Bass vibrate so slowly and the Attack/Release times are so fast that the compressor’s virtual fader moves up and down with every vibration. This abrupt movement alters the bass’ waveform and adds harmonic distortion.

5. Carefully adjust either the Attack or Release control until the distortion disappears.

What are the shortest times that worked for you? Attack \_\_\_\_\_ msec. Release \_\_\_\_\_ Seconds

The Attack, Release and Ratio controls greatly affect the compressor's sound. Experiment with each so that you can hear how they work. Remember to set the Threshold fairly low and Gain high enough so you can hear the compressor. (And don't set the Gain so high that it clips.)

### Gating the Snare

Gates are used to reduce hum, background noise and sound leakage in recordings. In order for a gate to open, the sound must be above the Threshold. Once the sound decays below the Threshold, the gate turns off. How quickly the gate opens and closes is determined by the Attack and Release Controls.

1. Play enable the chunk 'Gate the Snare' by clicking on it play enable arrow.
2. Start and stop playback by pressing the space bar
3. Solo the snare track to hear the gate at work.
4. Raise the Threshold knob until the gate cuts out the sound leakage

What Threshold setting sounded best to you? \_\_\_\_\_

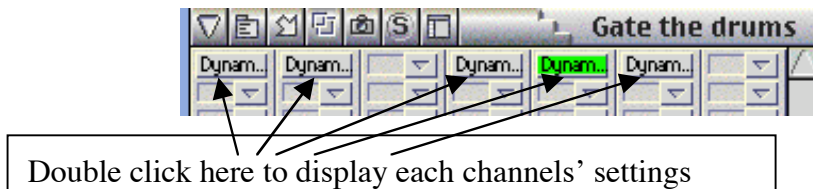
5. Raise the Threshold knob until everything is gated out.

What Threshold setting gates out all of the sound? \_\_\_\_\_

Adjust the Attack and Release controls to hear their effect. You'll notice that the Release will chop sounds off if set too fast. Likewise, sounds lose their percussive quality if the Attack is set too slow. A click or pop sometimes appears if the Attack is set too fast.

### Gating the Drums

This example has gates for the kick, snare and three toms of the drum kit. Try making the drums sound cleaner by gating these instruments. Double click on the word 'Dynam' at the top of each channel to display its settings in the plug-in window.



Write down the Threshold and Release times that sounded best to you:

	Kick	Snare	Tom 1	Tom 2	Tom 3
Threshold	____dB	____dB	____dB	____dB	____dB
Release	____sec.	____sec.	____sec.	____sec.	____sec.

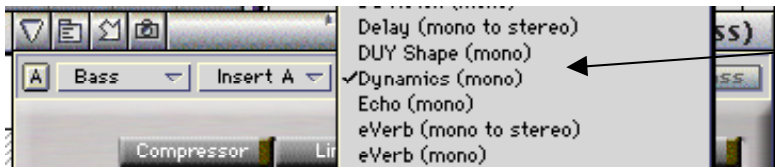
### Compressing the Lead Vocal

In pop music, the vocals and bass guitar are compressed pretty heavily because it is so important to hear them clearly in the mix. Engineers often try many different models of compressors and spend hours tweaking the settings to get the vocals and bass to sound 'just right.' It would take too long to go over every possible compressor setting in this lab, so we won't. Instead, here are a few tips to consider while you experiment with the vocalist's track:

1. Try starting with a Ratio of 2:1 and a Threshold low enough that most words exceed it.
2. To get a 'breathy' sound, shorten the Release time.

3. Too much lip smack and breath? Lengthen the Release time.
4. Are some words a little too soft? Lower the Threshold and raise the Gain to compensate.
5. Does it sound a little too compressed? Lengthen the Attack time. Also, try a ratio of 1.5:1 and lower the Threshold.
6. Does the Bass boom or lack sustain? Decrease the Release time.
7. Have you lost the 'snap' in slapped bass? Increase the Attack time.
8. Does the snare track sound too noisy? Raise the Threshold and reduce the Ratio.

**Limit the Mix:** Limiters are simply compressors with the ratio set higher than 20:1. They are used to increase the overall volume of a mix without overloading the mixdown media. In the old days, LPs and radio stations could not handle the wide dynamic range of music, so the loudest sounds had to be limited. Nowadays, limiters are used to make a mix sound as loud as possible. Digital Performer has two limiters available. The first one is an option in the Dynamics plugin. The other one is called MW Limiter. After experimenting with the simple limiter, select the MW limiter by clicking on the third drop down menu in the plug-in window.



Click here and drag the mouse to highlight MW limiter

This limiter functions a little differently. Lowering the Threshold actually amplifies the incoming signal – no makeup gain control is needed. The 'Lookahead' control anticipates peaks so the limiter is ready for them. The ceiling determines the output level. Like all compressors, if the release time is too quick, bass instruments will distort.