Makeshift Design

Extreme Dynamics

Operation Manual

4-30-2020

Revision 1.2.2

Introduction

Extreme Dynamics is a general purpose dynamic range compressor/expander device, which offers a wide range of control options and monitoring capabilities. It features 5 different gain control functions operating both above and below the threshold level, look-ahead and peak modes, several A/R envelope tuning options, controllable saturation effect, a segmented signal meter and a 2D scope display to monitor the device operation.

Parameters

Extreme Dynamics contains three groups of parameters: Envelope Follower, Gain Control and Saturation.

The Envelope Follower section

Attack

The Attack knob sets the attack time, from 1 to 100 milliseconds. When the signal level goes above the current envelope value, it takes this time for the follower to get closer to the new level by 40 dB (get to 1% of the initial level difference).

Release

The Release knob sets the release time, from 25 to 1600 milliseconds. When the signal level goes below the envelope, it takes this time for the follower to get closer to the new level by 40 dB.

Peak

The Peak knob sets the amount of instant input signal going into the envelope when the level is increasing in the Attack mode. It ranges from 0 to 100%. When set to 100%, the envelope will incorporate the full peak amplitude.

Delay

The Delay knob controls the look-ahead delay (from 0 to 120 ms) of the input signal before the gain changes are applied to it. It allows for reacting to fast level changes while keeping the Attack rate moderate. The resulting output latency is reported the to the host, so that if the delay compensation is on, the effect of this latency is transparent.

Env Scale

The Env Scale switch selects the signal level scale on which the envelope calculations are made. It has three options: Linear, Square and dB. Linear selects the absolute signal value, Square squares the level, dB uses logarithmic scale. This parameter changes the envelope curves and the perceived attack/release rates in certain cases.

LPF Order

The LPF Order switch sets the order (slope) of the follower low-pass filter. The options are from 1 to 4, which corresponds to slopes of 6, 12, 18 and 24 dB/octave. It affects only the Release mode of envelope and it can help to lower the effect of unwanted signal oscillations on the gain modulation stage.

Release Only

The Release Only button disables the Attack and Peak parameters and makes the Release mode work in both directions of signal level change. This allows for emulating a signal average follower. If

Env Scale is set to Square, it becomes a true RMS follower. Note that average levels are lower, so you need to adjust the Threshold accordingly.

Apply to Gain

When this option is off (the default), the Envelope Follower operates on the input (or sidechain) signal, the resulting envelope is then converted to the gain modulation signal. When it is on, the raw input signal is first converted to gain, then the Envelope Follower operates on the gain signal. In this mode, the gain starts changing immediately when the raw input signal crosses the threshold, in contrast to the default mode where the envelope is compared to the threshold. However, this mode assumes a monotonically decreasing gain function and generally should not be used with expanders.

The Gain Control section

The section contains two sub-sections of parameters, for Above Threshold and Below Threshold gain functions.

Gain Control Mode

The Gain Control Mode switch selects one of 6 gain functions to apply if the signal is above or below the threshold. They are all symmetric on the dB scale relative to the threshold point. They are:

None
Constant gain, which is the sum of the make-up gain and the Output knob values.

Comp I
This is the plain linear compressor. The same one is used in the M-Class Compressor (when its soft-knee button is off) and in the COMP-01 half-rack device. Far enough from the threshold, it reduces (increases below the threshold) the level by a constant dB value.

Comp II
This is the logarithmically linear compressor, also a very common type.

Comp III
This is the kind of compressor that is used in the M-Class Compressor (soft-knee button on), the Mix Channel Compressor and the Master Bus Compressor. It effectively limits the output at a certain level dependent on the ratio.

Exp I
This is the linear expander, just an inversion of the Comp I mode. Far enough from the threshold, it increases (reduces below the threshold) the level by a constant dB value.

Exp II
This is an expander with a steeper slope near the threshold. It can serve as a gate.

Makeup

The makeup buttons enable auto-makeup gain for the selected Gain Control Mode. It helps to fix a certain characteristic point of the gain response function so that it does not drift when the Ratio is changed.

Ratio

The Ratio knobs control the main parameter of the selected Gain Control function. It ranges from -60 to +60 dB. The higher the value, the more drastic gain change is applied to the signal. For classic compressors, it relates to the conventional ratio value as: $Ratio_{dB} = 20 \lg(ConvRatio - 1)$. For example, -60 dB corresponds to the ratio of 1.001:1, +60 dB – to 1001:1, and 0 dB – to 2:1.

Low Range

The Low Range knob controls the range of the input signal below the threshold. When the input signal is lower than that range, it is set to the range minimum. Otherwise, the gain function could produce potentially unlimited gains on near silent input in upward compression modes.

Soft Knee
The Soft Knee knob controls the size of the smooth curve segment connecting the two functions in the vicinity of the threshold point.

Width
When set to 0%, the gain change applied to the input stereo channels is the same and based on the average level between two channels of the input (or sidechain). (Note that this is not just the middle channel; it can never sum to zero due to opposite stereo channel phases). When 100%, the channels are processed independently.

Threshold
The Threshold knob sets the level that divides the entire signal level range into the above and below parts, which then determine the Gain Control function to be used. It ranges from -60 to 0 dB.

Output Gain
The Output Gain knob adds the specified gain to the signal. It ranges from -60 to +60 dB. (The range is chosen to be large enough to compensate for potential gain changes generated by the dynamics function, which can reach 120dB).

Saturation
Drive
The Drive knob controls the amount of harmonic distortion added to the output. That amount also depends on the total gain change applied to the input. The gain can be that normally generated by the dynamics logic from the input or the sidechain signal, or it can be directly sourced from Gain Audio or CV input sockets. You can also turn off the dynamics by setting A/B modes to None and simply set the Output Gain knob to a nonzero value in order to get constant saturation effect. When the Drive is zero, the device applies linear gain function, i.e. no harmonic distortion is introduced.

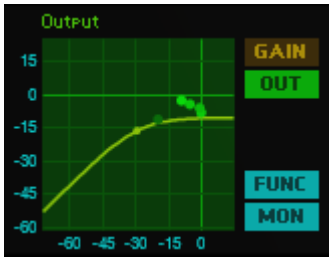
Bias
The Bias knob shifts the input level range where nonlinearity is maximal. It changes the character of the harmonic distortion.

Resample
The Resample switch selects the sample rate that will be used during the output signal amplitude modulation with gain. This can be used to move away the half sample rate aliasing mirror and to filter out the unwanted intermodulation between ultrasonic partials, which can appear back in the audible range.

When it is OFF, no resampling is done. Otherwise, resampling is always done, even when the target sample rate is the same or lower than the current sample rate. It has some sense actually, because the resampling involves applying a brick-wall filter that discards ultrasonic content (> 20 kHz). The filter is applied twice, both when changing to the target sample rate and when going back to the original sample rate. Note that using 44.1k-multiple sample rates will introduce slightly more noise than using 48k multiples (-100dB vs -140dB). Resampling also introduces a small latency (which is reported to the host and can be compensated).

Resampling can also be used when the compressor is turned off (by setting Gain A/B modes to ‘none’) and the Input signal is modulated from an external source connected to Gain In audio input.

Scope Display



The Scope Display shows the gain control function and the signal monitor on a plot. The plot can be mouse-dragged or scaled up and down with Alt(Win) / Option(Mac) button pressed. With Shift, the plot can be moved and scaled more precisely. If the dragging is done in the axis label area, it will change only the translation/scale related to that axis. Mouse-clicking the plot or axis labels together with Ctrl(Win) / Command(Mac) button resets the center position, or the plot scale to default when Alt(Win) / Option(Mac) is pressed as well.

The plot can display the current gain function graph and the signal monitor. They can be turned on and off with “FUNC” and “MON” buttons on the right. The horizontal axis shows the input/sidechain signal level. The vertical axis can be either Gain or Output. The Gain/Output mode can be switched with the “GAIN”/”OUT” buttons on the right. In case Sidechain input is connected, those buttons disappear and the plot mode is forced to Gain mode, because there is no point then in matching the sidechain signal against the output of different source.

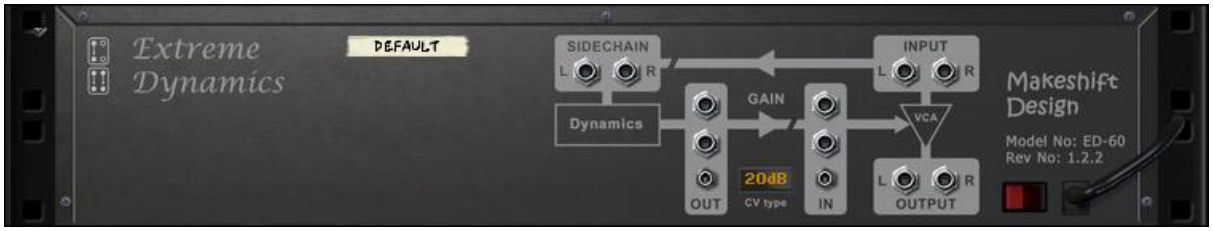
When the device settings are done, you can turn off the display with the Scope Enable button near the upper-left corner, so it does not consume Reason UI resources. This will not affect the device operation in any way.

Meter Display

The Meter Display can show one of three signals: the Gain (either generated by the device or fed on the gain input sockets), the Input (or Sidechain), and the Output. They can be switched in the menu that pops up when the display is clicked with mouse. Additionally, the meter source can be set to “none“ to turn it off. The meter range is -120 to +120 dB. The tick marks are at 20 dB intervals. The resolution is the highest in the middle, near 0 dB. When the meter source is “Input”, the zero mark corresponds to the Threshold level, so that you can see how much of the input signal is crossing the threshold.

The meter display is duplicated on the folded device view but it cannot be switched between the sources there.

Connections



Audio

These are the conventional Input, Output and Sidechain sockets. When connected, Sidechain replaces the Input signal for the dynamics module.

Gain

Gain Output outputs the signal generated by the dynamics. It is a unipolar gain value stream, which defaults to 0 dB DC. You can connect it to a Gain Input of some other device, e.g. to Pulverizer Volume Modulation.

Gain Input allows for modulating the Input signal from some external source or another Extreme Dynamics device. For example, you can feed several devices from one source

Note that the Gain Input is not checked for unipolarity nor rectified, i.e. you can use arbitrary audio signal to get true amplitude (ring) modulation of the Input signal.

Gain CV

The Gain CV Output outputs the generated gain converted to CV values according to the CV Type set. The Gain CV Input uses the same standard as the CV Output. The CV Types are:

20dB
The CV value is the bipolar gain level in decibels scaled to 1 “volt” per 20 dB.

Comp
This is the unipolar 1-Gain standard used in most Reason compressors’ Gain CV. When the gain is positive, the Gain Out CV outputs 0, thus losing positive gain values.

Mix
This is an attempt to generate CV suitable for driving the Mix Channel Level CV input. It is calibrated so that it works when the channel volume fader and CV trim knob are at their maximum. If you want to drive the fader set to 0, adjust the CV trim knob to 93. Note that the Mix Channel itself applies a smoothing envelope to its volume level changes, which is roughly equivalent to attack/release times of 190 milliseconds in terms of this device.