



AHEAD OF WHAT'S POSSIBLE™

Standard Compressor Meter variables and calculations for the Sigma300 and 350 processors.

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Overview

Click here to open Up the control window

Switch to Turn on Level meters

Compressor1

Level

Level Indicators

IN	OUT	Comp
-135 d	-135 d	0 dB

OUTPUT dB

INPUT dB

Threshold

Ratio

Compressor Expander

Knee

Input Gain

Attack (ms)

Hold (ms)

Release (ms)

72

72

868

-71.25 dB

100:1

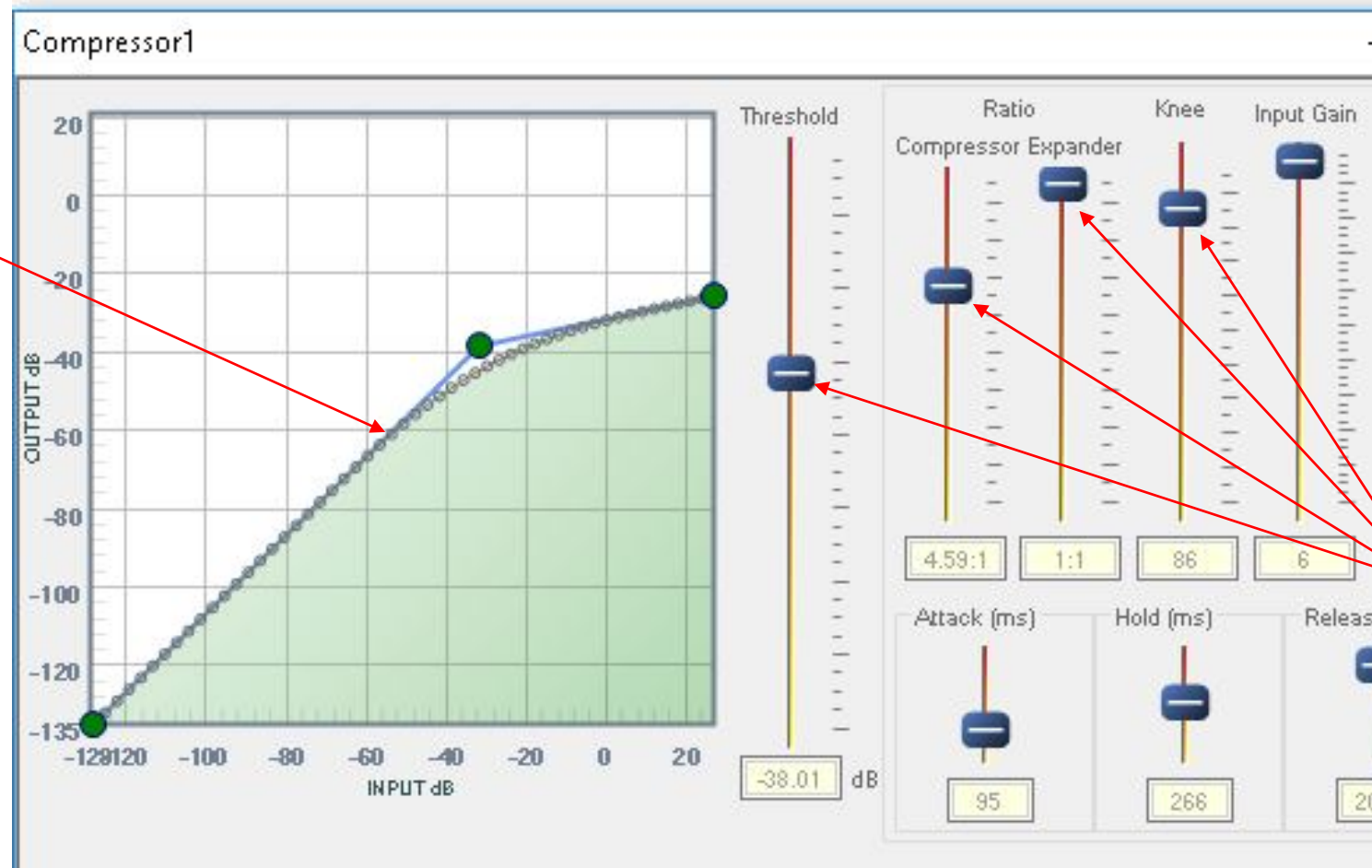
1:1

1

4

Compressor Transfer Function

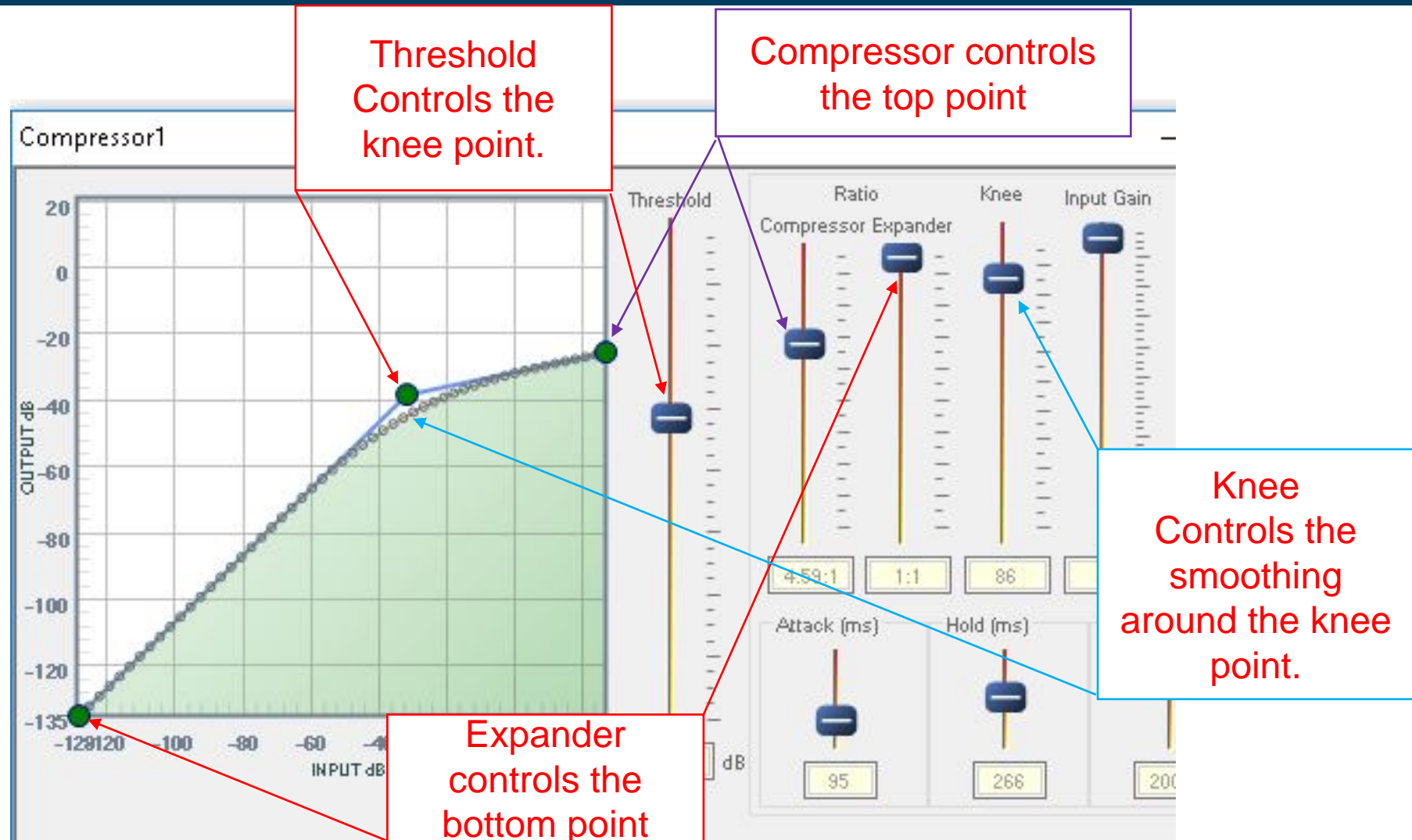
Compression Spline Curve. It details the gain change verses Level



Controls that Change the Spline curve

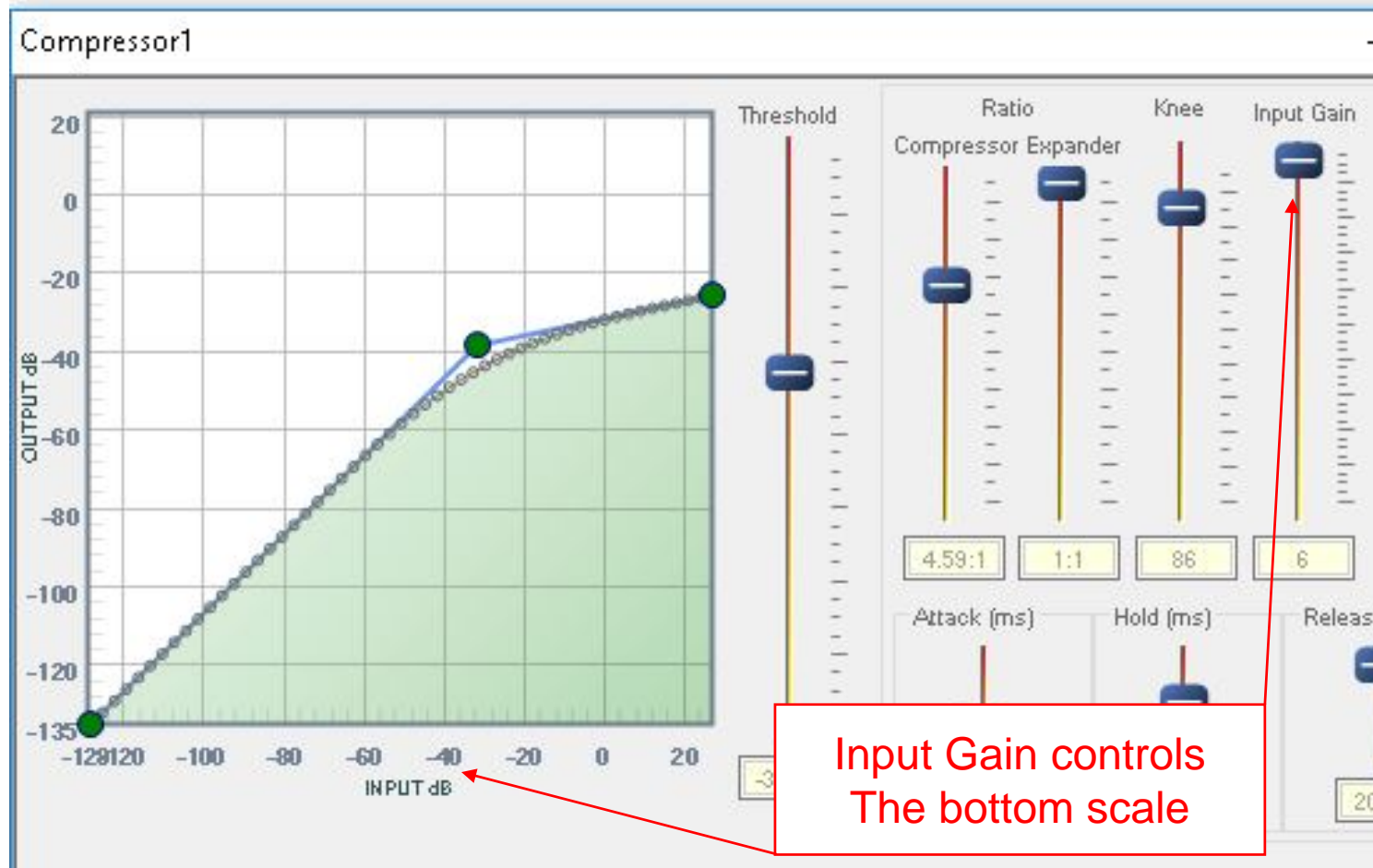
Three Significant points of the graph and the controls for them.

- ▶ All of these controls affect the calculation of the gain factors along the spline curve. These are calculated by SigmaStudio and downloaded to the DSP in real time. Once the spline curve is downloaded it is not changed by the DSP program.



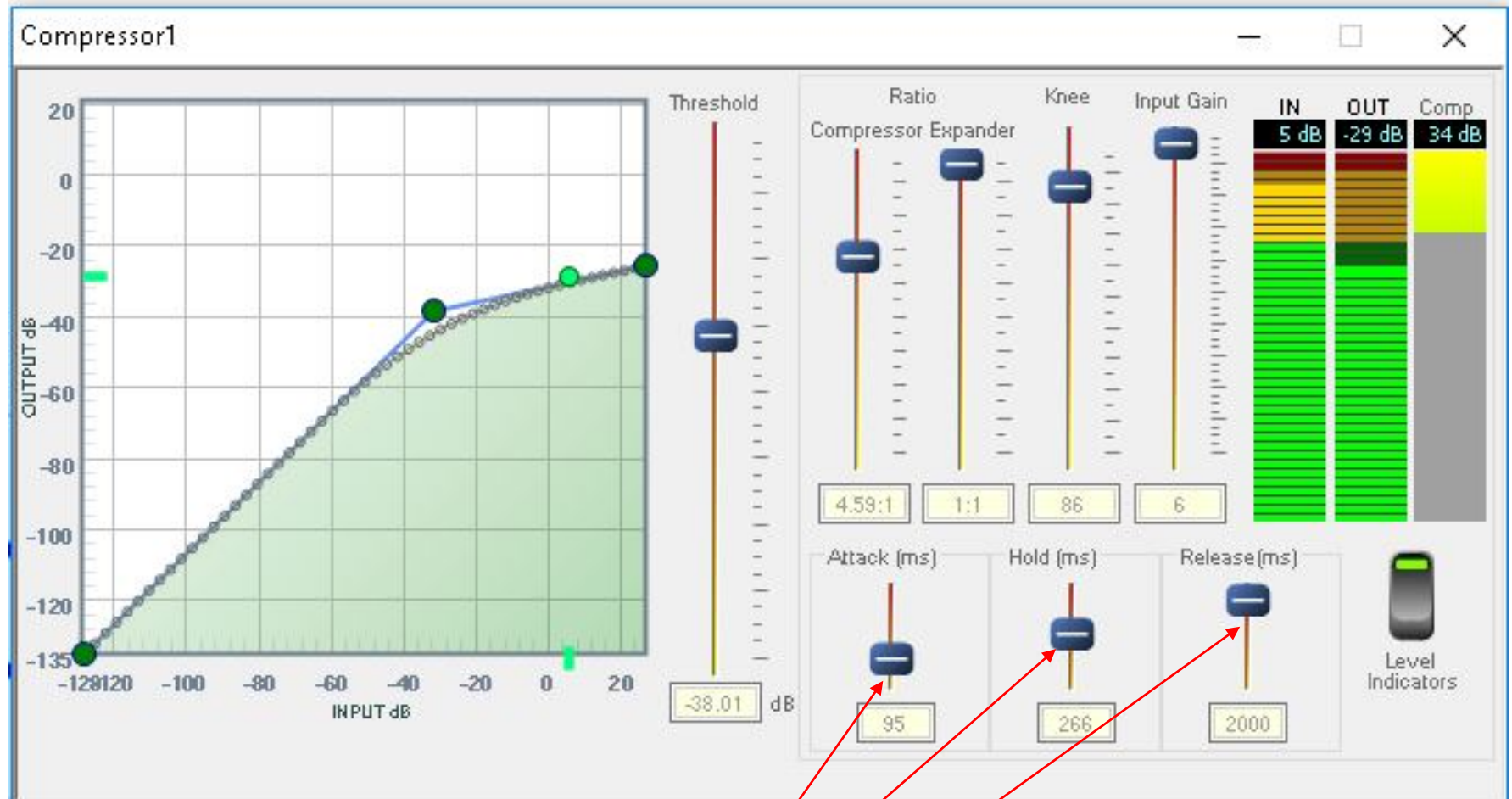
Three Significant points of the graph and the controls for them.

- ▶ The Input Gain control lowers the gain of the input signal before it is fed to the rectifier entering the sidechain. This makes the sensitivity of the sidechain change.
- ▶ This is a parameter that is stored in the DSP and the gain calculation is performed by the DSP



Compressor Response over time controls

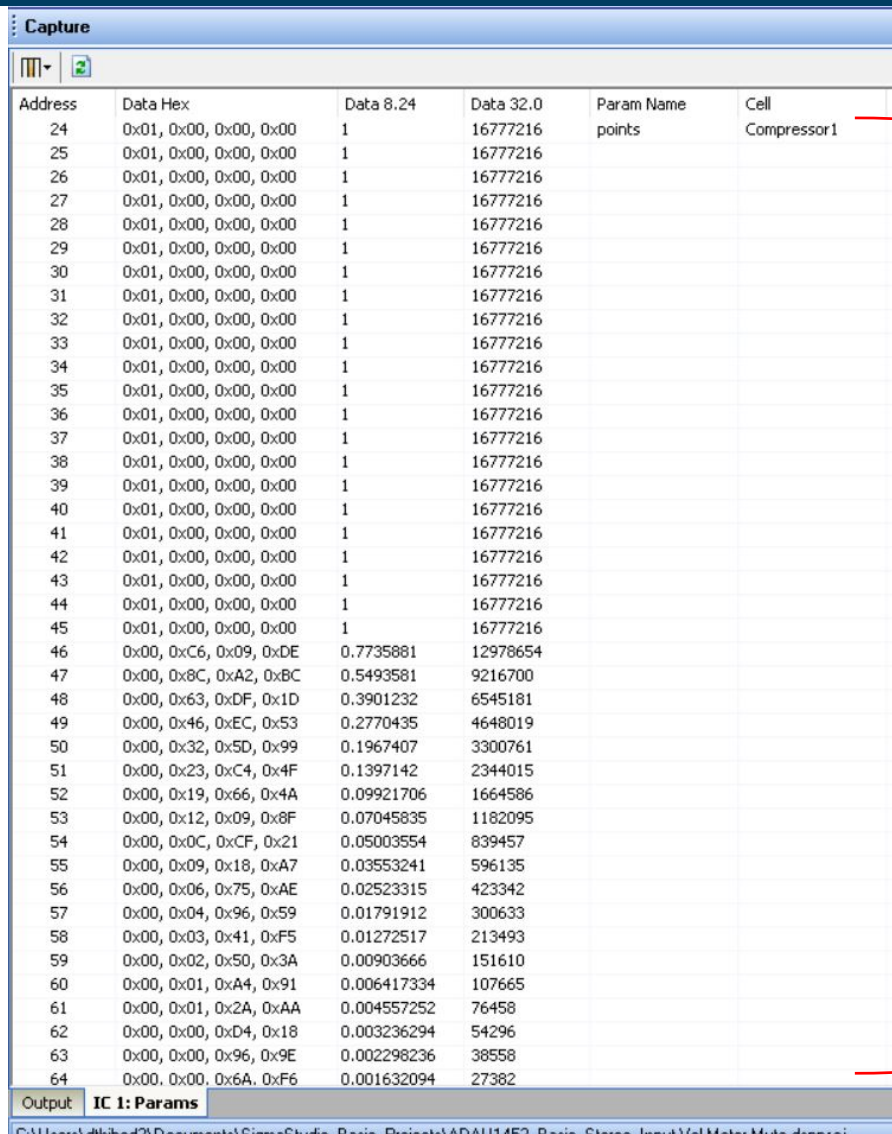
- ▶ These controls affect the how the sidechain final gain factor is calculated and they change over time. Attack changes how fast it rises, Hold is the time the value holds after the input signal reduces and Release is the amount it reduces over time when the input signal lowers in level after the Hold time expires.



Location in Parameter RAM

- ▶ These next sets of slides show where all these controls can be found in Parameter RAM and more detail of how they function
- ▶ These can be found by opening the Capture window in SigmaStudio and selecting the “Params” tab at the bottom of the window.

Parameter Memory for the Compressor (first part of the memory locations)



Address	Data Hex	Data 8.24	Data 32.0	Param Name	Cell
24	0x01, 0x00, 0x00, 0x00	1	16777216	points	Compressor1
25	0x01, 0x00, 0x00, 0x00	1	16777216		
26	0x01, 0x00, 0x00, 0x00	1	16777216		
27	0x01, 0x00, 0x00, 0x00	1	16777216		
28	0x01, 0x00, 0x00, 0x00	1	16777216		
29	0x01, 0x00, 0x00, 0x00	1	16777216		
30	0x01, 0x00, 0x00, 0x00	1	16777216		
31	0x01, 0x00, 0x00, 0x00	1	16777216		
32	0x01, 0x00, 0x00, 0x00	1	16777216		
33	0x01, 0x00, 0x00, 0x00	1	16777216		
34	0x01, 0x00, 0x00, 0x00	1	16777216		
35	0x01, 0x00, 0x00, 0x00	1	16777216		
36	0x01, 0x00, 0x00, 0x00	1	16777216		
37	0x01, 0x00, 0x00, 0x00	1	16777216		
38	0x01, 0x00, 0x00, 0x00	1	16777216		
39	0x01, 0x00, 0x00, 0x00	1	16777216		
40	0x01, 0x00, 0x00, 0x00	1	16777216		
41	0x01, 0x00, 0x00, 0x00	1	16777216		
42	0x01, 0x00, 0x00, 0x00	1	16777216		
43	0x01, 0x00, 0x00, 0x00	1	16777216		
44	0x01, 0x00, 0x00, 0x00	1	16777216		
45	0x01, 0x00, 0x00, 0x00	1	16777216		
46	0x00, 0xC6, 0x09, 0xDE	0.7735881	12978654		
47	0x00, 0x8C, 0xA2, 0xBC	0.5493581	9216700		
48	0x00, 0x63, 0xDF, 0x1D	0.3901232	6545181		
49	0x00, 0x46, 0xEC, 0x53	0.2770435	4648019		
50	0x00, 0x32, 0x5D, 0x99	0.1967407	3300761		
51	0x00, 0x23, 0xC4, 0x4F	0.1397142	2344015		
52	0x00, 0x19, 0x66, 0x4A	0.09921706	1664586		
53	0x00, 0x12, 0x09, 0x8F	0.07045835	1182095		
54	0x00, 0x0C, 0xCF, 0x21	0.05003554	839457		
55	0x00, 0x09, 0x18, 0xA7	0.03553241	596135		
56	0x00, 0x06, 0x75, 0xAE	0.02523315	423342		
57	0x00, 0x04, 0x96, 0x59	0.01791912	300633		
58	0x00, 0x03, 0x41, 0xF5	0.01272517	213493		
59	0x00, 0x02, 0x50, 0x3A	0.00903666	151610		
60	0x00, 0x01, 0xA4, 0x91	0.006417334	107665		
61	0x00, 0x01, 0x2A, 0xAA	0.004557252	76458		
62	0x00, 0x00, 0xD4, 0x18	0.003236294	54296		
63	0x00, 0x00, 0x96, 0x9E	0.002298236	38558		
64	0x00, 0x00, 0x6A, 0xF6	0.001632094	27382		

- ▶ Spline points, (not all are shown)
- ▶ If the point of the compression curve is at unity gain then the number is “1” in 8.24 format
- ▶ If there is compression or expansion, then there is a multiplication gain factor.
- ▶ The DSP code will interpolate values that are between these curve points.
- ▶ This curve is calculated by SigmaStudio using a Spline function utility.
- ▶ Note: The points can be saved from this window into a file for use by a controller.

Parameter Memory for the Compressor (second part of the memory locations)

Address	Data Hex	Data 8.24	Data 32.0	Param Name	Cell
42	0x01, 0x00, 0x00, 0x00	1	16777216		
43	0x01, 0x00, 0x00, 0x00	1	16777216		
44	0x01, 0x00, 0x00, 0x00	1	16777216		
45	0x01, 0x00, 0x00, 0x00	1	16777216		
46	0x00, 0xC6, 0x09, 0xDE	0.7735881	12978654		
47	0x00, 0x8C, 0xA2, 0xBC	0.5493581	9216700		
48	0x00, 0x63, 0xDF, 0x1D	0.3901232	6545181		
49	0x00, 0x46, 0xEC, 0x53	0.2770435	4648019		
50	0x00, 0x32, 0x5D, 0x99	0.1967407	3300761		
51	0x00, 0x23, 0xC4, 0x4F	0.1397142	2344015		
52	0x00, 0x19, 0x66, 0x4A	0.09921706	1664586		
53	0x00, 0x12, 0x09, 0x8F	0.07045835	1182095		
54	0x00, 0x0C, 0xCF, 0x21	0.05003554	839457		
55	0x00, 0x09, 0x18, 0xA7	0.03553241	596135		
56	0x00, 0x06, 0x75, 0xAE	0.02523315	423342		
57	0x00, 0x04, 0x96, 0x59	0.01791912	300633		
58	0x00, 0x03, 0x41, 0xF5	0.01272517	213493		
59	0x00, 0x02, 0x50, 0x3A	0.00903666	151610		
60	0x00, 0x01, 0xA4, 0x91	0.006417334	107665		
61	0x00, 0x01, 0x2A, 0xAA	0.004557252	76458		
62	0x00, 0x00, 0xD4, 0x18	0.003236294	54296		
63	0x00, 0x00, 0x96, 0x9E	0.002298236	38558		
64	0x00, 0x00, 0x6A, 0xF6	0.001632094	27382		
65	0x00, 0x00, 0x4B, 0xF5	0.001159012	19445		
66	0x00, 0x00, 0x35, 0xF1	0.0008230805	13809		
67	0x00, 0x00, 0x26, 0x4E	0.0005844831	9806		
68	0x00, 0x00, 0x1B, 0x34	0.0004150867	6964		
69	0x00, 0x00, 0x13, 0x51	0.000294745	4945		
70	0x00, 0x00, 0x0D, 0xB8	0.0002093315	3512		
71	0x00, 0x00, 0x09, 0xBE	0.000148654	2494		
72	0x00, 0x00, 0x06, 0xEB	0.0001055598	1771		
73	0x00, 0x00, 0x04, 0xEA	7.498264E-05	1258		
74	0x00, 0x00, 0x03, 0x7D	5.322695E-05	893		
75	0x00, 0x00, 0x02, 0x7A	3.778934E-05	634		
76	0x00, 0x00, 0x01, 0xC2	2.682209E-05	450		
77	0x00, 0x00, 0x00, 0x02	1.192093E-07	2	X	Compressor1
78	0x02, 0xA3, 0x23, 0xD6	2.637266	44245974	X_lo	Compressor1
79	0x00, 0xC4, 0xFB, 0x3E	0.7694587	12909374	Y	Compressor1
80	0x00, 0x7C, 0x49, 0x70	0.4854956	8145264	Compression	Compressor1
81	0x00, 0x00, 0x9D, 0x61	0.002401412	40289	TCONST	Level1

- ▶ Spline points, (not all are shown)
- ▶ After the Spline Points is where the compressor parameters are stored for use by external metering or monitoring of the compressor.

Parameters for the compressor response over time behavior.

- ▶ These parameters are not located with the spline curve and the metering parameters. The top four parameters are meant to be changed by SigmaStudio or by a system controller. The bottom three are used by the DSP program as storage and should not be changed.

123	0x00, 0x00, 0x00, 0x00	0	0	LinX	Level1_2
124	0x00, 0x00, 0x00, 0x00	0	0	LinX_lo	Level1_2
125	0x01, 0x00, 0x00, 0x00	1	16777216	value	DC1
126	0x01, 0x00, 0x00, 0x00	1	16777216	value	DC1_2
127	0x00, 0x00, 0x00, 0x02	1.192093E-07	2	index	Nx2-1
128	0x00, 0x00, 0x1C, 0xC0	0.0004386902	7360	tc	Compressor1
129	0x00, 0x00, 0x1D, 0x40	0.0004463196	7488	hold	Compressor1
130	0x00, 0x00, 0x00, 0x20	1.907349E-06	32	decay	Compressor1
131	0x00, 0x16, 0xD0, 0xE7	0.0891251	1495271	attenuation	Compressor1
132	0x00, 0x00, 0x00, 0x00	0	0	rms	Compressor1
133	0x00, 0x00, 0x00, 0x00	0	0	hold_count	Compressor1
134	0x00, 0x00, 0x00, 0x00	0	0	held_db	Compressor1
135	0x00, 0x00, 0x00, 0x00	0	0		
136	0x00, 0x00, 0x00, 0x01	5.960464E-08	1	mute	Mute1
137	0x00, 0x00, 0x00, 0x01	5.960464E-08	1	mute	Mute2
		0	0	__DMO_PADDIN...	
		0	0		

Attack Time Constant

Hold Time

Release Time Constant

Input Attenuation Factor

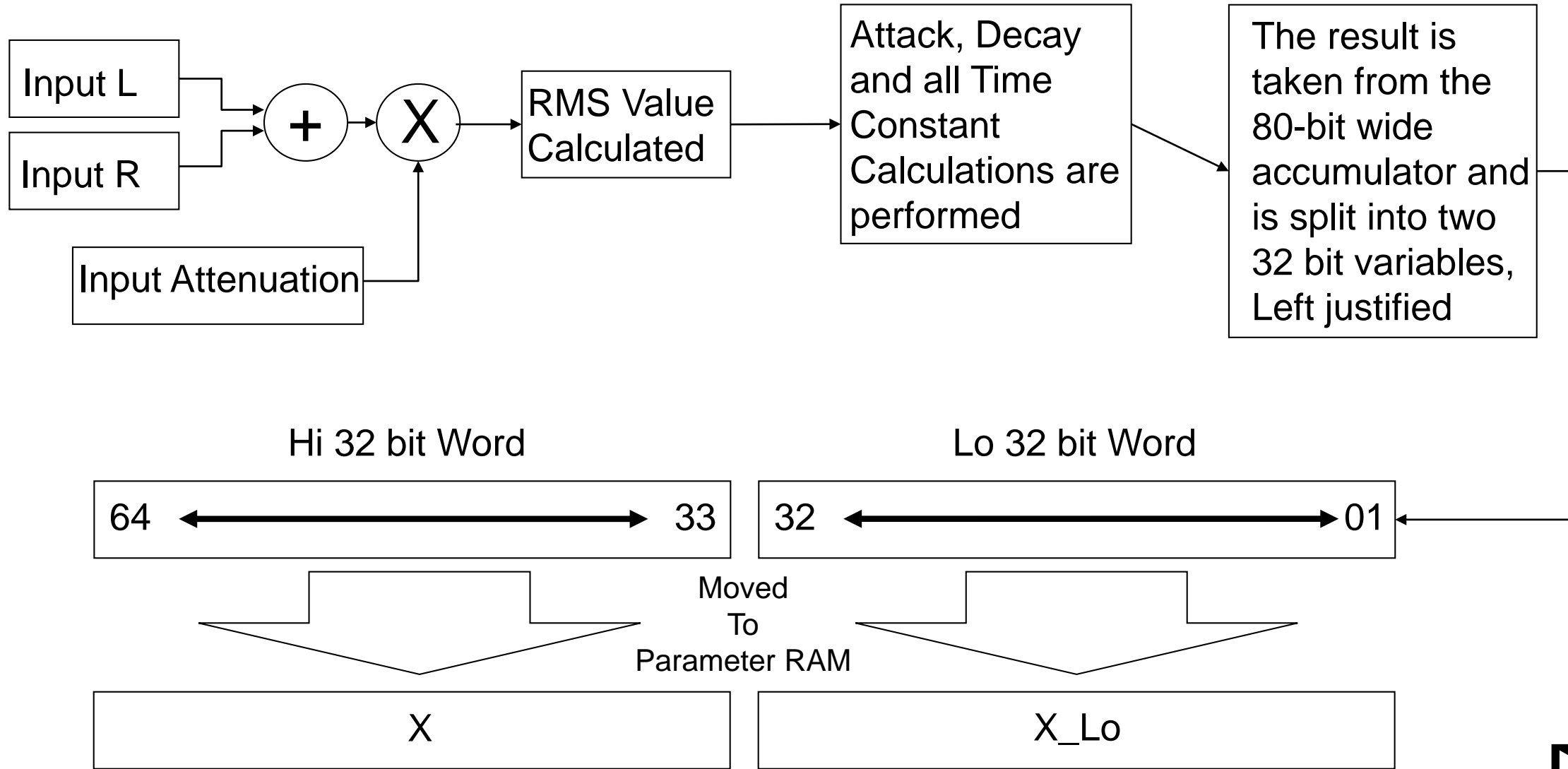
Used by the DSP program, Do Not Change

Compressor Parameters for compressor monitoring

77	0x00, 0x00, 0x00, 0x26	2.264977E-06	38	X	Compressor1
78	0x26, 0x74, 0x1E, 0x02	38.45358	645144066	X_lo	Compressor1
79	0x00, 0x34, 0x39, 0x69	0.204001	3422569	Y	Compressor1
80	0x00, 0x20, 0xF3, 0x87	0.1287159	2159495	Compression	Compressor1
81	0x00, 0x00, 0x9D, 0x61	0.002401412	40289	TCONST	Level1

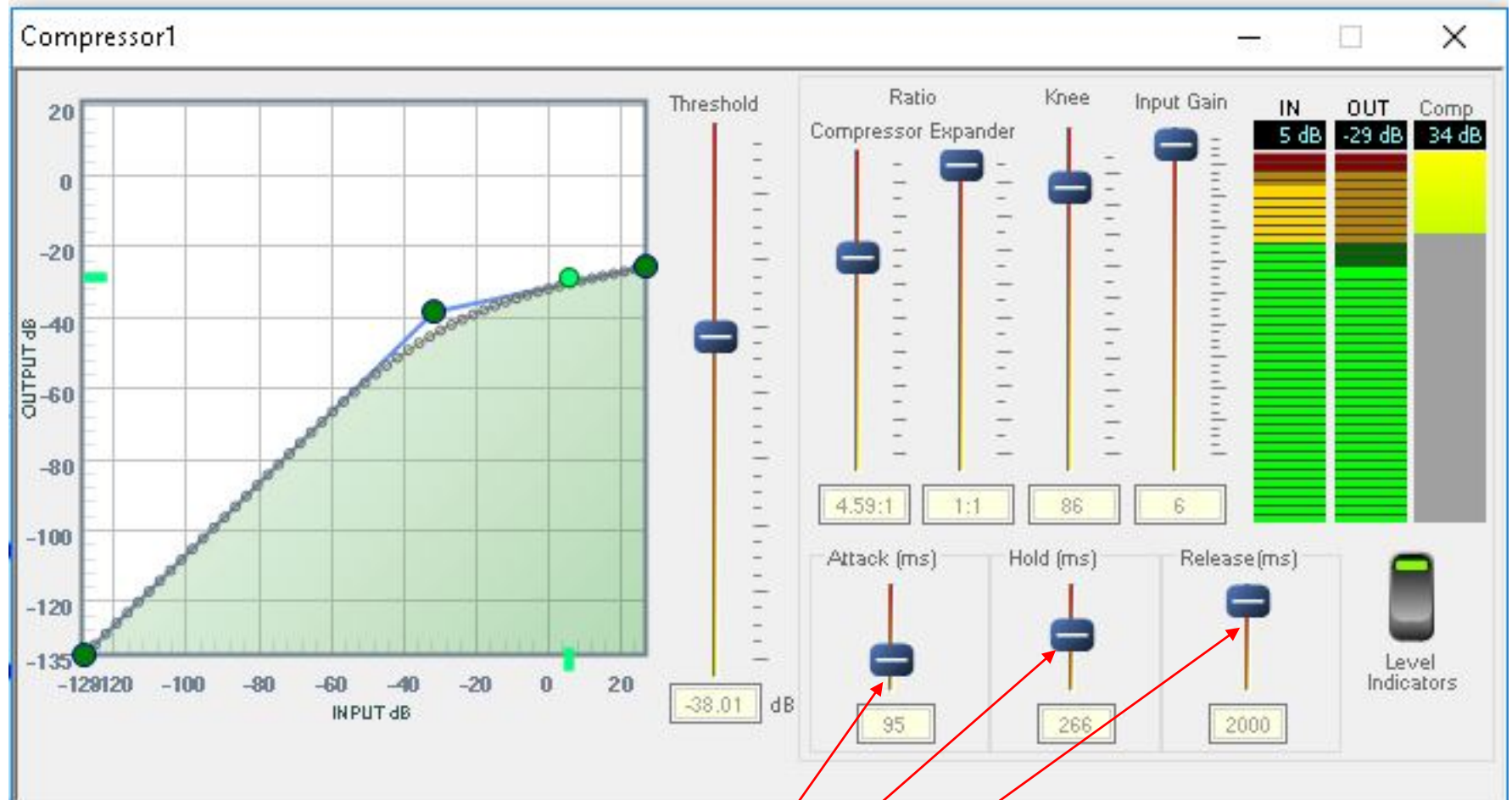
- ▶ **X** and **X_lo** hold the 64 bit audio level in the sidechain signal path. (More on this in subsequent slides). The “X” value is usually sufficient to use as the sidechain level for metering. It is an 8.24 format number that will go down to around -69dB.
- ▶ **Y** holds the current interpolated Spline Curve value after the input signal has been processed through the entire sidechain. So this is the gain factor for the compression.
- ▶ **Compression** is the “Y” variable multiplied by the input gain factor to result in the final compressor gain factor that is applied to the audio signal. So the results in the input signal being reduced by the input gain setting then multiplied by the gain factor.

Sidechain Signal Processing Inside the DSP



Parameter Formats and Calculations

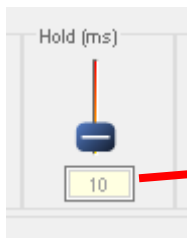
- ▶ The following slides will detail the Attack, Hold and Release parameters and how the numbers in the GUI window are translated to the DSP parameters.



These controls only change parameters in the DSP

Hold Parameter

- ▶ The number typed into the GUI box is in milliseconds. SigmaStudio will translate this into the number of samples using the sample rate shown at the top of the SigmaStudio window. So in the example shown below, the sampling rate is 48kHz so entering a “10” into the window will yield a value of 480 in the parameter RAM for the hold time. That will be 480 samples which is 10ms.



148	0x00, 0x00, 0x00, 0x00	0.5	0.000000	gain	100.0
149	0x00, 0x80, 0x00, 0x00	0.5	8388608		
150	0x00, 0x01, 0x56, 0x39	0.005221903	87609	tc	HF Limiter
151	0x00, 0x00, 0x01, 0xE0	2.861023E-05	480	hold	HF Limiter
152	0x00, 0x00, 0x00, 0xA8	1.001358E-05	168	decay	HF Limiter
153	0x01, 0x00, 0x00, 0x00	1	16777216	attenuation	HF Limiter

Formula:

X = the number that is entered into the GUI in milliseconds

Fs = sample rate

This parameter is just the number of samples in integer format. It is used as a counter.

Hold = $f_s * X / 1000$

Attack Parameter

- ▶ For the Standard compressor, the parameter that is stored in the DSP is the same as all the other compressors which is derived from the dB/second number. What is different in this compressor is that you enter the number as a millisecond of attack or release. So what needs to be done is to translate the millisecond number to dBps (dB per second) then apply the formula to get the gain factor that is applied to every sample.

I will separate these as two different calculations.

dBps = dB per second

X = the number entered into the GUI, in this case it is the time in milliseconds.

Tc = Time Constant that is entered into the DSP parameter memory location

ln = natural log. (This will be a constant, no need to calculate this every time.) ln(10)= 2.302585093 on my calculator

fs = sampling rate



148	0x00, 0x80, 0x00, 0x00	0.5	8388608	gain	Mg1
149	0x00, 0x80, 0x00, 0x00	0.5	8388608		
150	0x00, 0x0A, 0xE4, 0x5B	0.04254693	713819	tc	HF Limiter
151	0x00, 0x00, 0x5D, 0xC0	0.001430511	24000	hold	HF Limiter
152	0x00, 0x00, 0x7B, 0x88	0.001884937	31624	decay	HF Limiter

- ▶ Step 1: $\text{dBps} = 20,000 / (X * \ln(10))$
- ▶ Step 2: $Tc = 1.0 - (10^{(\text{dBps} / (10 * fs))})$

Release (Decay) Parameter

- ▶ For the Standard compressor, the parameter that is stored in the DSP is the same as all the other compressors which is derived from the dB/second number. What is different in this compressor is that you enter the number as a millisecond of attack or release. So what needs to be done is to translate the millisecond number to dBps (dB per second) then apply the formula to get the gain factor that is applied to every sample.

I will separate these as two different calculations.

dBps = dB per second

X = the number entered into the GUI, in this case it is the time in milliseconds.

Release = The Decay factor that is entered into the DSP parameter memory location

ln = natural log. (This will be a constant, no need to calculate this every time.) $\ln(10) = 2.302585093$ on my calculator

fs = sampling rate



150	0x00, 0x0A, 0xE4, 0x5B	0.04254693	713819	tc	HF Limiter
151	0x00, 0x00, 0x5D, 0xC0	0.001430511	24000	hold	HF Limiter
152	0x00, 0x00, 0x7B, 0x88	0.001884937	31624	decay	HF Limiter
153	0x01, 0x00, 0x00, 0x00	1	16777216	attenuation	HF Limiter
154	0x00, 0x00, 0x00, 0x00	0	0	rms	HF Limiter

- ▶ Step 1: $\text{dBps} = 20,000 / (X * \ln(10))$
- ▶ Step 2: $\text{Release} = \text{dBps} / (96 * \text{fs})$