

Appendix F:

Velocity Curve Documentation.

For those of you who are truly gluttons for punishment, we will now get mathematical about Velocity. This will include tables and formulas explaining how the malletKAT PRO determines the MIDI Velocity values that it sends out for the Pads you play on the malletKAT PRO.

The Curves discussed here are discussed in the context of Velocity because that is generally how you will use them. However, these are the same curves that are used for FootControl and Breath Control - so similar principles apply in those situations.

The malletKAT PRO can internally measure 256 distinct levels of dynamics from the malletKAT PRO Pads. Since MIDI Velocity has only 128 levels, the malletKAT PRO has more resolution than it needs. The malletKAT PRO uses this extra resolution in combination with the Pad Training software to give you a personalized dynamic range. The malletKAT PRO uses the LO DYNAMIC and HI DYNAMIC to make a correlation table to adjust to your playing dynamics. This table reduces the individual steps of resolution to 128.

The malletKAT PRO must then take these 128 levels and correlate them to MIDI Velocity numbers that can range from 0 to 127. The malletKAT PRO uses the Minimum Velocity, Maximum Velocity, and Velocity Curve settings to do this correlation. The actual formula used is:

$$\text{MIDI Velocity} = \text{Minimum Velocity} + ((\text{VelCurve}/127) \times (\text{Maximum Velocity} - \text{Minimum Velocity}))$$

This result is then compared to the Maximum Velocity setting to insure that even if you put in backwards values for Minimum and Maximum Velocity, that the final result will always be less than the Maximum setting.

The Velocity Curve has a "% multiplier" for each of the 128 dynamic levels to dictate how to divide up the range between the Minimum and Maximum Velocity settings. The Velocity Curves in the malletKAT PRO are shown in table form below where 1 is your softest hit and 128 is your hardest hit.

(The truth of the matter is that these values are really 0-255 inside the malletKAT PRO, but we show them to you here and in the Global Curve Definition Screen as 0-127 because MIDI has everyone *expecting* to see numbers ranging from 0-127.)

<u>Curve</u>	<u>Description</u>
1	Linear Curve. The basic, natural curve.
2	Accent Curve. Stays low longer, then jumps to the top. Good for Rock drumming.
3	Cross-fade reverse curve.
4	Cross-fade curve to use in conjunction with curve 3.
5	Cross-switch reverse curve. Loud on soft hits, silent on hard hits.
6	Cross-switch curve to use in conjunction with curve 5.
7	Quasi-Linear curve that gets to the top fairly quickly.
8	Effective curve for FootControllers.

Velocity Curve 1:

Steps 1 - 8	1	1	2	3	4	5	6	7
Steps 9 - 16	8	9	10	11	12	13	14	15
Steps 17 - 24	16	17	18	19	20	21	22	23
Steps 25 - 32	24	25	26	27	28	29	30	31
Steps 33 - 40	32	33	34	35	36	37	38	39
Steps 41 - 48	40	41	42	43	44	45	46	47
Steps 49 - 56	48	49	50	51	52	53	54	55
Steps 57 - 64	56	57	58	59	60	61	62	63
Steps 65 - 72	64	65	66	67	68	69	70	71
Steps 73 - 80	72	73	74	75	76	77	78	79
Steps 81 - 88	80	81	82	83	84	85	86	87
Steps 89 - 96	88	89	90	91	92	93	94	95
Steps 97 -104	96	97	98	99	100	101	102	103
Steps 105-112	104	105	106	107	108	109	110	111
Steps 113-120	112	113	114	115	116	117	118	119
Steps 121-128	120	121	122	123	124	125	126	127

Velocity Curve 2:

Steps 1 - 8	1	1	2	2	3	3	4	4
Steps 9 - 16	5	5	6	6	7	7	8	8
Steps 17 - 24	9	9	10	10	11	11	12	12
Steps 25 - 32	13	13	14	14	15	15	16	16
Steps 33 - 40	17	17	18	18	19	19	20	20
Steps 41 - 48	21	21	22	22	23	23	24	24
Steps 49 - 56	25	25	26	26	27	27	28	28
Steps 57 - 64	29	29	30	30	31	31	32	32
Steps 65 - 72	33	33	34	34	35	35	36	40
Steps 73 - 80	44	48	52	56	60	65	70	75
Steps 81 - 88	80	85	90	95	100	110	120	127
Steps 89 - 96	127	127	127	127	127	127	127	127
Steps 97 -104	127	127	127	127	127	127	127	127
Steps 105-112	127	127	127	127	127	127	127	127
Steps 113-120	127	127	127	127	127	127	127	127
Steps 121-128	127	127	127	127	127	127	127	127

Velocity Curve 3:

Steps 1 - 8	127	127	127	127	127	127	127	127
Steps 9 - 16	127	127	127	127	127	127	127	127
Steps 17 - 24	127	127	127	127	127	127	127	127
Steps 25 - 32	127	127	127	127	127	127	127	127
Steps 33 - 40	122	120	118	116	114	112	110	108
Steps 41 - 48	106	104	102	100	98	96	94	92
Steps 49 - 56	90	88	86	84	82	80	78	76
Steps 57 - 64	74	72	70	68	66	64	62	60
Steps 65 - 72	58	54	50	46	42	38	34	30
Steps 73 - 80	26	22	18	14	10	6	2	2
Steps 81 - 88	0	0	0	0	0	0	0	0
Steps 89 - 96	0	0	0	0	0	0	0	0
Steps 97 -104	0	0	0	0	0	0	0	0
Steps 105-112	0	0	0	0	0	0	0	0
Steps 113-120	0	0	0	0	0	0	0	0
Steps 121-128	0	0	0	0	0	0	0	0

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Velocity Curve 4:

Steps 1 - 8	0	0	0	0	0	0	0	0
Steps 9 - 16	0	0	0	0	0	0	0	0
Steps 17 - 24	0	0	0	0	0	0	0	0
Steps 25 - 32	0	0	0	0	0	0	0	0
Steps 33 - 40	2	2	6	10	14	18	22	26
Steps 41 - 48	30	34	38	42	46	50	54	58
Steps 49 - 56	60	62	64	66	68	70	72	74
Steps 57 - 64	76	78	80	82	84	86	88	90
Steps 65 - 72	92	94	96	98	100	102	104	106
Steps 73 - 80	108	110	112	114	116	118	120	122
Steps 81 - 88	127	127	127	127	127	127	127	127
Steps 89 - 96	127	127	127	127	127	127	127	127
Steps 97 -104	127	127	127	127	127	127	127	127
Steps 105-112	127	127	127	127	127	127	127	127
Steps 113-120	127	127	127	127	127	127	127	127
Steps 121-128	127	127	127	127	127	127	127	127

Velocity Curve 5:

Steps 1 - 8	127	127	127	127	127	127	127	127
Steps 9 - 16	127	127	127	127	127	127	127	127
Steps 17 - 24	127	127	127	127	127	127	127	127
Steps 25 - 32	127	127	127	127	127	127	127	127
Steps 33 - 40	127	127	127	127	127	127	127	127
Steps 41 - 48	127	127	127	127	127	127	127	127
Steps 49 - 56	0	0	0	0	0	0	0	0
Steps 57 - 64	0	0	0	0	0	0	0	0
Steps 65 - 72	0	0	0	0	0	0	0	0
Steps 73 - 80	0	0	0	0	0	0	0	0
Steps 81 - 88	0	0	0	0	0	0	0	0
Steps 89 - 96	0	0	0	0	0	0	0	0
Steps 97 -104	0	0	0	0	0	0	0	0
Steps 105-112	0	0	0	0	0	0	0	0
Steps 113-120	0	0	0	0	0	0	0	0
Steps 121-128	0	0	0	0	0	0	0	0

Velocity Curve 6:

Steps 1 - 8	0	0	0	0	0	0	0	0
Steps 9 - 16	0	0	0	0	0	0	0	0
Steps 17 - 24	0	0	0	0	0	0	0	0
Steps 25 - 32	0	0	0	0	0	0	0	0
Steps 33 - 40	0	0	0	0	0	0	0	0
Steps 41 - 48	0	0	0	0	0	0	0	0
Steps 49 - 56	127	127	127	127	127	127	127	127
Steps 57 - 64	127	127	127	127	127	127	127	127
Steps 65 - 72	127	127	127	127	127	127	127	127
Steps 73 - 80	127	127	127	127	127	127	127	127
Steps 81 - 88	127	127	127	127	127	127	127	127
Steps 89 - 96	127	127	127	127	127	127	127	127
Steps 97 -104	127	127	127	127	127	127	127	127
Steps 105-112	127	127	127	127	127	127	127	127
Steps 113-120	127	127	127	127	127	127	127	127
Steps 121-128	127	127	127	127	127	127	127	127

Velocity Curve 7:

Steps 1 - 8	1	1	2	2	3	3	4	4
Steps 9 - 16	5	5	6	6	7	7	8	8
Steps 17 - 24	9	9	10	10	11	11	12	12
Steps 25 - 32	13	13	14	14	15	15	16	16
Steps 33 - 40	17	17	18	18	19	19	20	20
Steps 41 - 48	22	24	25	27	29	31	32	34
Steps 49 - 56	36	38	39	41	43	45	46	48
Steps 57 - 64	50	52	53	55	57	59	60	61
Steps 65 - 72	63	65	66	68	70	72	73	75
Steps 73 - 80	77	79	80	82	84	86	87	89
Steps 81 - 88	91	93	94	96	98	100	101	103
Steps 89 - 96	105	107	108	110	112	114	115	117
Steps 97 -104	119	121	122	124	126	127	127	127
Steps 105-112	127	127	127	127	127	127	127	127
Steps 113-120	127	127	127	127	127	127	127	127
Steps 121-128	127	127	127	127	127	127	127	127

Velocity Curve 8:

Steps 1 - 8	1	1	1	1	2	2	2	3
Steps 9 - 16	3	3	4	4	4	5	5	5
Steps 17 - 24	6	6	6	7	7	7	8	8
Steps 25 - 32	8	9	9	10	10	11	11	12
Steps 33 - 40	12	13	13	14	14	14	15	15
Steps 41 - 48	16	16	16	17	17	18	18	18
Steps 49 - 56	19	19	19	20	20	20	21	21
Steps 57 - 64	21	22	22	22	23	23	23	24
Steps 65 - 72	24	24	25	25	25	26	26	26
Steps 73 - 80	27	27	27	28	28	28	29	29
Steps 81 - 88	29	30	30	30	31	31	31	32
Steps 89 - 96	32	32	33	33	33	34	34	34
Steps 97 -104	35	35	35	36	36	36	37	37
Steps 105-112	37	38	38	38	39	39	39	40
Steps 113-120	45	50	55	60	65	70	75	80
Steps 121-128	85	90	95	100	105	110	120	127