

**CONTROL IMPLEMENTATION**  
**FOR ASHLY PROTEA MODELS:**  
**4.24G, 4.24GS, 2.24GS**  
**DIGITAL AUDIO PROCESSOR/**  
**GRAPHIC EQ**

(Note: the same message structures are used for both  
MIDI - 31.25kbps, as well as RS232 - 9600bps)

All messages in this document are compatible with MIDI and RS-232, provided that the Protea unit(s) and control hardware is configured accordingly. The baud rate and data config switch must be set properly on the Protea unit(s), please refer to the user manual. Any standard RS-232 serial port will directly interface with the DB-9 jack on the Protea. The RS-232 hardware implementation is as follows: 9600bps, 1 start bit + 8 data bits + 1 stop bit, with no parity. In addition, the Protea contains 5-pin DIN jacks, which are completely MIDI compliant. Please refer to the MIDI specification for more details.

Throughout this document byte values are represented as decimal or hexadecimal numbers. The hexadecimal numbers are denoted with a dollar sign (\$). In either case, these numbers represent the actual value of the bytes to be transmitted. So \$0A is interchangeable with decimal value 10, etc.

## **MIDI/RS-232 PROGRAM CHANGE (AKA Preset Recall)**

The Program Change message is used to recall/restore an internal preset to a Protea channel. There are 128 internal preset slots in each Protea unit, all of which may be modified by the user, (refer to the preset save message in the System Exclusive section of this document). The Program Change message tells the Protea to replace the working settings, on any channel assigned a certain MIDI channel number, with a copy of an internal preset. This is a simple, two-byte message, as follows:

\$C*n*, Preset#

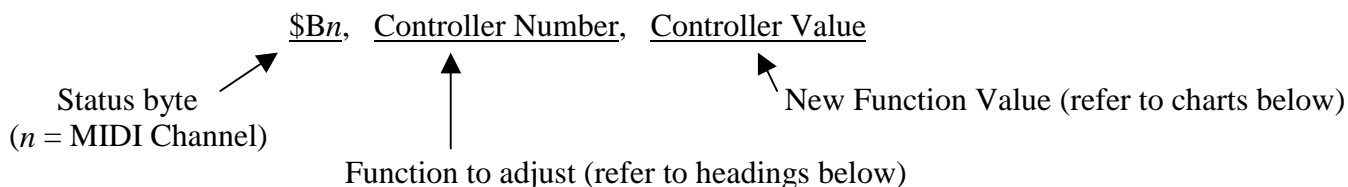
\$C*n* is the status byte, where the upper nibble is always \$C, and the lower nibble (*n*) is the MIDI Channel value assigned to the Protea channel(s) to receive the program change. MIDI channels 1-16 equate to the values 0-\$F respectively. The Preset# may be any number from 0-127 (0-\$7F), corresponding to internal presets 1-128 respectively.

Ex) To recall preset #11 on MIDI channel 16 transmit: **\$CF, \$0A**

(end of MIDI/RS-232 Program Change)

# MIDI/RS-232 CONTINUOUS CONTROLLERS

Most Protea Graphic EQ parameters may be adjusted with three-byte MIDI Continuous Controller Messages. The format for these messages is as follows:



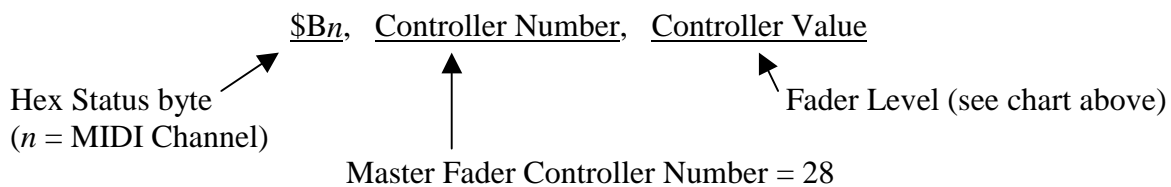
## MIDI Controller Numbers: 0-27 (31hz-16khz EQ faders respectively)

<u>Fader Level(dB):</u>	<u>Controller Value:</u>	<u>Fader Level(dB):</u>	<u>Controller Value:</u>
-15	0-4	0.5	65-66
-14.5	5-6	1	67-68
-14	7-8	1.5	69-70
-13.5	9-10	2	71-72
-13	11-12	2.5	73-74
-12.5	13-14	3	75-76
-12	15-16	3.5	77-78
-11.5	17-18	4	79-80
-11	19-20	4.5	81-82
-10.5	21-22	5	83-84
-10	23-24	5.5	85-86
-9.5	25-26	6	87-88
-9	27-28	6.5	89-90
-8.5	29-30	7	91-92
-8	31-32	7.5	93-94
-7.5	33-34	8	95-96
-7	35-36	8.5	97-98
-6.5	37-38	9	99-100
-6	39-40	9.5	101-102
-5.5	41-42	10	103-104
-5	43-44	10.5	105-106
-4.5	45-46	11	107-108
-4	47-48	11.5	109-110
-3.5	49-50	12	111-112
-3	51-52	12.5	113-114
-2.5	53-54	13	115-116
-2	55-56	13.5	117-118
-1.5	57-58	14	119-120
-1	59-60	14.5	121-122
-0.5	61-62	15	123-127
0 (off)	63-64		

Ex) To set the 315hz fader to 0dB on a Protea channel assigned to MIDI channel 16 transmit:  
 \$BF, 10, 63 -or- \$BF, 10, 64

### Controller #28 – Master Gain Fader:

<u>Fader Level(dB):</u>	<u>Controller Value:</u>	<u>Fader Level(dB):</u>	<u>Controller Value:</u>
-INF	0-4	0.2	65-66
-29.5	5-6	0.4	67-68
-23.5	7-8	0.6	69-70
-20	9-10	0.8	71-72
-17.5	11-12	1	73-74
-15.6	13-14	1.2	75-76
-14	15-16	1.4	77-78
-12.6	17-18	1.6	79-80
-11.5	19-20	1.8	81-82
-10.5	21-22	2	83-84
-9	23-24	2.2	85-86
-8.7	25-26	2.4	87-88
-8	27-28	2.6	89-90
-7.3	29-30	2.8	91-92
-6.6	31-32	3	93-94
-6.0	33-34	3.2	95-96
-5.5	35-36	3.4	97-98
-4.9	37-38	3.6	99-100
-4.4	39-40	3.8	101-102
-4.0	41-42	4	103-104
-3.5	43-44	4.2	105-106
-3.1	45-46	4.4	107-108
-2.7	47-48	4.6	109-110
-2.3	49-50	4.8	111-112
-1.9	51-52	5	113-114
-1.6	53-54	5.2	115-116
-1.2	55-56	5.4	117-118
-0.9	57-58	5.6	119-120
-0.6	59-60	5.8	121-122
-0.3	61-62	6	123-127
0 (unity)	63-64		



Ex) To set the Master fader to +6dB on a Protea channel assigned to MIDI channel 11 transmit:  
\$BA, 28, 123

**Controller #29 – Limiter Threshold:**

<u>Threshold(dBu):</u>	<u>Controller Value:</u>	<u>Threshold(dBu):</u>	<u>Controller Value:</u>
-20	0-44	1	65
-19	45	2	66
-18	46	3	67
-17	47	4	68
-16	48	5	69
-15	49	6	70
-14	50	7	71
-13	51	8	72
-12	52	9	73
-11	53	10	74
-10	54	11	75
-9	55	12	76
-8	56	13	77
-7	57	14	78
-6	58	15	79
-5	59	16	80
-4	60	17	81
-3	61	18	82
-2	62	19	83
-1	63	20	84-127
0	64		

**Controller #30 – Limiter Ratio:**

<u>Ratio:</u>	<u>Controller Value:</u>	<u>Ratio:</u>	<u>Controller Value:</u>
1.2:1	0-60	6:1	65
1.5:1	61	10:1	66
2:1	62	20:1	67
3:1	63	INF:1	68-127
4:1	64		

**Controller #31 – Limiter Attack Time:**

<u>Time(ms):</u>	<u>Controller Value:</u>	<u>Time(ms):</u>	<u>Controller Value:</u>
0.5	0-61	10	65
1	62	20	66
2	63	50	67-127
5	64		

**Controller #32 – Limiter Release Time:**

<u>Time(ms):</u>	<u>Controller Value:</u>	<u>Time(ms):</u>	<u>Controller Value:</u>
10	0-61	200	65
20	62	500	66
50	63	1,000 (1 sec)	67-127
100	64		

**Controller #33 – 4<sup>th</sup> Order High Pass Filter:**

<u>Cut Off Freq.(hz):</u>	<u>Controller Value:</u>	<u>Cut Off Freq.(hz):</u>	<u>Controller Value:</u>
OFF	0-4	471	59
20	5	500	60
22	6	529	61
23	7	561	62
24	8	594	63
26	9	629	64
27	10	667	65
29	11	707	66
31	12	749	67
33	13	793	68
35	14	840	69
37	15	890	70
39	16	943	71
41	17	1,000	72
44	18	1,050	73
46	19	1,120	74
49	20	1,180	75
52	21	1,250	76
55	22	1,330	77
58	23	1,410	78
62	24	1,490	79
66	25	1,580	80
70	26	1,680	81
74	27	1,780	82
78	28	1,880	83
83	29	2,000	84
88	30	2,110	85
93	31	2,240	86
99	32	2,370	87
105	33	2,510	88
111	34	2,660	89
117	35	2,820	90
125	36	2,990	91
132	37	3,170	92
140	38	3,360	93
148	39	3,560	94
157	40	3,770	95
166	41	4,000	96
176	42	4,230	97
187	43	4,480	98
198	44	4,750	99
210	45	5,030	100
222	46	5,330	101
235	47	5,650	102
250	48	5,990	103
264	49	6,340	104
280	50	6,720	105
297	51	7,120	106
314	52	7,550	107
333	53	8,000	108
353	54	8,470	109
374	55	8,970	110
396	56	9,510	111
420	57	10,000	112
445	58	10,600	113-127

**Controller #34 – 4<sup>th</sup> Order Low Pass Filter:**

<u>Cut Off Freq.(hz):</u>	<u>Controller Value:</u>	<u>Cut Off Freq.(hz):</u>	<u>Controller Value:</u>
33	1-13	890	70
35	14	943	71
37	15	1,000	72
39	16	1,050	73
41	17	1,120	74
44	18	1,180	75
46	19	1,250	76
49	20	1,330	77
52	21	1,410	78
55	22	1,490	79
58	23	1,580	80
62	24	1,680	81
66	25	1,780	82
70	26	1,880	83
74	27	2,000	84
78	28	2,110	85
83	29	2,240	86
88	30	2,370	87
93	31	2,510	88
99	32	2,660	89
105	33	2,820	90
111	34	2,990	91
117	35	3,170	92
125	36	3,360	93
132	37	3,560	94
140	38	3,770	95
148	39	4,000	96
157	40	4,230	97
166	41	4,480	98
176	42	4,750	99
187	43	5,030	100
198	44	5,330	101
210	45	5,650	102
222	46	5,990	103
235	47	6,340	104
250	48	6,720	105
264	49	7,120	106
280	50	7,550	107
297	51	8,000	108
314	52	8,470	109
333	53	8,970	110
353	54	9,510	111
374	55	10,000	112
396	56	10,600	113
420	57	11,300	114
445	58	11,900	115
471	59	12,060	116
500	60	13,400	117
529	61	14,200	118
561	62	15,100	119
594	63	16,000	120
629	64	16,900	121
667	65	17,900	122
707	66	19,000	123
749	67	20,100	124
793	68	OFF	125-127, 0
840	69		

### **Controller #35 – Course Delay Adjust:**

<u>Delay Time(ms):</u>	<u>Controller Value:</u>	<u>Delay Time(ms):</u>	<u>Controller Value:</u>
0.00	0	666.66	125
5.33	1	671.99	126
10.67	2 ...	677.32	127

Note: Ashly Control systems use MIDI System Exclusive messages to adjust the delay time. If your system does not support Sys-Ex you may still do a course delay adjustment using Controller #35. The course controller is limited to a resolution of 5.333228ms per step. Sys-Ex delay messages have a resolution of 0.020833ms per step.

### **Controller #36, 37, 38, 39 – EQ, Limiter, Hpf/Lpf, Delay function in/out Status:**

<u>Status:</u>	<u>Controller Value:</u>	<u>Status:</u>	<u>Controller Value:</u>
OUT	0-63	IN	64-127

### **Controller #40 – Channel Mute Status:**

<u>Status:</u>	<u>Controller Value:</u>	<u>Status:</u>	<u>Controller Value:</u>
Not muted	0-63	Muted	64-127

### **Controller #41 – Limiter Location:**

<u>Location:</u>	<u>Controller Value:</u>	<u>Location:</u>	<u>Controller Value:</u>
Pre-EQ	0-63	Post-EQ	64-127

(end of MIDI/RS-232 Continuous Controllers)

# SYSTEM EXCLUSIVE MESSAGES

## Ashly Protea 4.24g, 4.24gs, & 2.24g Sys-Ex Data Inquiry

**Step1:** Control device transmits a MIDI Sys-Ex Channel Data Inquiry Message to the Protea(s)

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
0	<i>Start Byte:</i>	\$F0	Sys-Ex status byte (\$ denotes hexadecimal)
1		00	Sys-Ex id escapement
2		01	Ashly MIDI manufacturer id most significant byte
3		\$2A	Ashly MIDI manufacturer id least significant byte
4		01	Digital Graphic EQ family model number
5	<i>MSG Type:</i>	00	Data inquiry message
6		\$0n	n = MIDI channel number (\$0-F), the channel to satisfy the request
7		01	Mode byte, default = 01
8	<i>End Byte:</i>	\$F7	Sys-Ex end of transmission byte

**Step2:** First assigned Protea unit responds with a MIDI Sys-Ex Channel Data Message. If no units contain the respective MIDI channel, the Data Inquiry Message is echoed back to the control device.

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
0	<i>Start Byte:</i>	\$F0	Sys-Ex status byte (\$ denotes hexadecimal)
		00	Sys-Ex id escapement
		01	Ashly MIDI manufacturer id most significant byte
		\$2A	Ashly MIDI manufacturer id least significant byte
		01	Digital Graphic EQ family model number
5	<i>MSG Type:</i>	06	Channel data message
6	<i>Channel:</i>	\$0n	n = MIDI channel number (\$0-F), channel this message came from
7	<i>Preset #:</i>	xx	Current preset number loaded to that channel, 0-127 (1-128 to the user)
8	<i>Mute Status:</i>	0x	Channel Output Status: 0 = not muted, 1 = muted
9	<i>Name Bytes:</i>	xx	First character - Refer to attached ASCII character chart
		xx	Second Character
		xx	Third Character
		xx	Fourth Character
		xx	Fifth Character
		xx	Sixth Character
		xx	Seventh Character
		xx	Eighth Character
		xx	Ninth Character
		xx	Tenth character
19	<i>EQ Settings:</i>	xx	31.5 Hz - Refer to attached EQ Fader level chart
		xx	40 Hz
		xx	50 Hz
		xx	63 Hz
		xx	80 Hz
		xx	100 Hz
		xx	125 Hz
		xx	160 Hz
		xx	200 Hz
		xx	250 Hz
		xx	315 Hz
		xx	400 Hz
		xx	500 Hz
		xx	630 Hz
		xx	800 Hz
		xx	1.00 KHz

		xx	1.25 KHz
		xx	1.60 KHz
		xx	2.00 KHz
		xx	2.50 KHz
		xx	3.15 KHz
		xx	4.00 KHz
		xx	5.00 KHz
		xx	6.30 KHz
		xx	8.00 KHz
		xx	10.00 KHz
		xx	12.50 KHz
		xx	16.00 KHz
47	Master Gain:	xx	Refer to attached Master Gain Fader chart
48	Limiters:	xx	Threshold - Refer to attached Compressor/Limiter chart
		xx	Ratio
		xx	Attack Time
		xx	Release Time
52	HPF:	xx	24 dB/octave High pass filter - Refer to attached HPF frequency chart
53	LPF:	xx	24 dB/octave Low pass filter - Refer to attached LPF frequency chart
54	Delay M.S.Byte:	xx	Binary: 0xxxxxxx -Upper Byte of the Delay with most significant bit removed*
55	Delay L.S.Byte:	xx	Binary: 0yyyyyyy -Lower Byte of the Delay with most significant bit removed**
56	Status Byte:	xx	Bits 0-3 = EQ, Limiter, HPF/LPF, Delay i/o status respectively, where zero denotes "Out". Bit 4 = Limiter location, where 0 denotes pre-EQ. Bit 5 = the most significant Bit of the Upper Delay Byte (above*).
57	Delay Bit-7:	0x	Binary: 0000000y = the most significant Bit of the Lower Delay Byte (above**) (For details about the 16-bit Delay Word, see page 11)
58	Mode Byte:	01	Protea's display mode, default = 01 (For use with Ashly Remotes)
59	End Byte:	\$F7	Sys-Ex end of transmission byte

**Preset Save Message (Including New Name) for the 4.24g, 4.24gs, & 2.24g**

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
0	Start Byte:	\$F0	Sys-Ex status byte (\$ denotes hexadecimal)
		00	Sys-Ex id escapement
		01	Ashly MIDI manufacturer id most significant byte
		\$2A	Ashly MIDI manufacturer id least significant byte
		01	Digital Graphic EQ family model number
5	MSG Type:	\$03	Preset save message, including preset number to save to and new name
6	Channel:	\$0n	n = MIDI channel number (\$0-F), channel whose data is to be stored
7	Preset Number:	xx	0-127 (1-128 to the user), preset number to save working data to
8	New Name:	xx	First character - Refer to attached ASCII character chart
		xx	Second Character
		xx	Third Character
		xx	Fourth Character
		xx	Fifth Character
		xx	Sixth Character
		xx	Seventh Character
		xx	Eighth Character
		xx	Ninth Character
		xx	Tenth character
18	Mode Byte:	01	1=default (tells the unit which mode the Protea remote is displaying)
19	End Byte:	\$F7	Sys-Ex end of transmission byte

## Sending New Working Settings To The 4.24g, 4.24gs, & 2.24g

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
0	<i>Start Byte:</i>	\$F0	Sys-Ex status byte (\$ denotes hexadecimal)
		00	Sys-Ex id escapement
		01	Ashly MIDI manufacturer id most significant byte
		\$2A	Ashly MIDI manufacturer id least significant byte
		01	Digital Graphic EQ family model number
5	<i>MSG Type:</i>	\$11	New working settings message
6	<i>Channel:</i>	\$0n	n = MIDI channel number (\$0-F), channel to receive new settings
7	<i>EQ Settings:</i>	xx	31.5 Hz - Refer to attached EQ Fader level chart
		xx	40 Hz
		xx	50 Hz
		xx	63 Hz
		xx	80 Hz
		xx	100 Hz
		xx	125 Hz
		xx	160 Hz
		xx	200 Hz
		xx	250 Hz
		xx	315 Hz
		xx	400 Hz
		xx	500 Hz
		xx	630 Hz
		xx	800 Hz
		xx	1.00 KHz
		xx	1.25 KHz
		xx	1.60 KHz
		xx	2.00 KHz
		xx	2.50 KHz
		xx	3.15 KHz
		xx	4.00 KHz
		xx	5.00 KHz
		xx	6.30 KHz
		xx	8.00 KHz
		xx	10.00 KHz
		xx	12.50 KHz
		xx	16.00 KHz
35	<i>Master Gain:</i>	xx	Refer to attached Master Gain Fader chart
36	<i>Limiters:</i>	xx	Threshold - Refer to attached Compressor/Limiter chart
		xx	Ratio
		xx	Attack Time
		xx	Release Time
40	<i>HPF:</i>	xx	24 dB/octave High pass filter - Refer to attached HPF frequency chart
41	<i>LPF:</i>	xx	24 dB/octave Low pass filter - Refer to attached LPF frequency chart
42	<i>Delay M.S.Byte:</i>	xx	Binary: 0xxxxxxx -Upper Byte of the Delay with most significant bit removed*
43	<i>Delay L.S.Byte:</i>	xx	Binary: 0yyyyyyy -Lower Byte of the Delay with most significant bit removed**
44	<i>Delay Bit-7:</i>	0x	Binary: 0000000y = the most significant Bit of the Lower Delay Byte (above**) (For details about the 16-bit Delay Word, see page 11)
45	<i>Status Byte:</i>	xx	Bit 0-3 = EQ, Limiter, HPF/LPF, Delay i/o status respectively, where zero denotes "Out". Bit 4 = Limiter location, where 0 denotes pre-EQ Bit 5 = the most significant Bit of the Upper Delay Byte (above*).
46	<i>End Byte:</i>	\$F7	Sys-Ex end of transmission byte



### Ashly Protea 4.24g, 4.24gs, & 2.24g Sys-Ex Flatten

Control device transmits a MIDI Sys-Ex graphic EQ flatten Message to the Protea(s)

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
0	<i>Start Byte:</i>	\$F0	Sys-Ex status byte (\$ denotes hexadecimal)
1		00	Sys-Ex id escapement
2		01	Ashly MIDI manufacturer id most significant byte
3		\$2A	Ashly MIDI manufacturer id least significant byte
4		01	Digital Graphic EQ family model number
5	<i>MSG Type:</i>	\$01	Flatten EQ message
6		\$0n	n = MIDI channel number (\$0-F), the channel to satisfy the request
7	<i>End Byte:</i>	\$F7	Sys-Ex end of transmission byte

(end of System Exclusive messages)

# CHARTS FOR SYSTEM EXCLUSIVE DATA CHARACTERS

## Custom ASCII Characters for Protea Series Products

You must subtract 32(base 10) from your Ansi Standard ASCII character values before you transmit them to a Protea unit, as in the Sys-Ex Save message and Scene Save message. Likewise, to convert Protea character values to Ansi Standard you must add 32(base 10) to the value.

Examples) characters 0 - 9, are represented by Protea character values \$10 - \$19  
characters A - Z, are represented by Protea character values \$21 - \$3A  
characters a - z, are represented by Protea character values \$41 - \$5A  
blank space = \$00, colon = \$1A, dash = \$0D, & = \$06, period = \$0E, ...

## Graphic EQ Fader Levels & Corresponding Preset Byte Values

<u>Fader Level(dB):</u>	<u>Value(base 10):</u>	<u>Fader Level(dB):</u>	<u>Value(base 10):</u>
-15	4	0.5	66
-14.5	6	1	68
-14	8	1.5	70
-13.5	10	2	72
-13	12	2.5	74
-12.5	14	3	76
-12	16	3.5	78
-11.5	18	4	80
-11	20	4.5	82
-10.5	22	5	84
-10	24	5.5	86
-9.5	26	6	88
-9	28	6.5	90
-8.5	30	7	92
-8	32	7.5	94
-7.5	34	8	96
-7	36	8.5	98
-6.5	38	9	100
-6	40	9.5	102
-5.5	42	10	104
-5	44	10.5	106
-4.5	46	11	108
-4	48	11.5	110
-3.5	50	12	112
-3	52	12.5	114
-2.5	54	13	116
-2	56	13.5	118
-1.5	58	14	120
-1	60	14.5	122
-0.5	62	15	124
0 (off)	64		

**Master Gain Fader Levels & Corresponding Preset Byte Values**

<u>Fader Level(dB):</u>	<u>Value(base 10):</u>	<u>Fader Level(dB):</u>	<u>Value(base 10):</u>
-INF	4	0.2	66
-29.5	6	0.4	68
-23.5	8	0.6	70
-20	10	0.8	72
-17.5	12	1	74
-15.6	14	1.2	76
-14	16	1.4	78
-12.6	18	1.6	80
-11.5	20	1.8	82
-10.5	22	2	84
-9	24	2.2	86
-8.7	26	2.4	88
-8	28	2.6	90
-7.3	30	2.8	92
-6.6	32	3	94
-6.0	34	3.2	96
-5.5	36	3.4	98
-4.9	38	3.6	100
-4.4	40	3.8	102
-4.0	42	4	104
-3.5	44	4.2	106
-3.1	46	4.4	108
-2.7	48	4.6	110
-2.3	50	4.8	112
-1.9	52	5	114
-1.6	54	5.2	116
-1.2	56	5.4	118
-0.9	58	5.6	120
-0.6	60	5.8	122
-0.3	62	6	124
0 (unity)	64		

**Compressor/Limiter Settings & Corresponding Preset Byte Values**

<u>Threshold(dBU):</u>	<u>Value(base 10):</u>	<u>Threshold(dBU):</u>	<u>Value(base 10):</u>
-20	44	1	65
-19	45	2	66
-18	46	3	67
-17	47	4	68
-16	48	5	69
-15	49	6	70
-14	50	7	71
-13	51	8	72
-12	52	9	73
-11	53	10	74
-10	54	11	75
-9	55	12	76
-8	56	13	77
-7	57	14	78
-6	58	15	79
-5	59	16	80
-4	60	17	81
-3	61	18	82
-2	62	19	83
-1	63	20	84
1	64		

<u>Limiter Ratio:</u>	<u>Value(base 10):</u>	<u>Limiter Ratio:</u>	<u>Value(base 10):</u>
1.2:1	60	6:1	65
1.5:1	61	10:1	66
2:1	62	20:1	67
3:1	63	INF:1	68
4:1	64		

<u>Attack Time(ms):</u>	<u>Value(base 10):</u>	<u>Attack Time(ms):</u>	<u>Value(base 10):</u>
0.5	61	10	65
1	62	20	66
2	63	50	67
5	64		

<u>Release Time(ms):</u>	<u>Value(base 10):</u>	<u>Release Time(ms):</u>	<u>Value(base 10):</u>
10	61	200	65
20	62	500	66
50	63	1,000 (1 sec)	67
100	64		

## HPF Cut Off Frequency & Corresponding Preset Byte Values

<u>Frequency(Hz):</u>	<u>Value(base 10):</u>	<u>Frequency(Hz):</u>	<u>Value(base 10):</u>
OFF	0	471	59
20	5	500	60
22	6	529	61
23	7	561	62
24	8	594	63
26	9	629	64
27	10	667	65
29	11	707	66
31	12	749	67
33	13	793	68
35	14	840	69
37	15	890	70
39	16	943	71
41	17	1,000	72
44	18	1,050	73
46	19	1,120	74
49	20	1,180	75
52	21	1,250	76
55	22	1,330	77
58	23	1,410	78
62	24	1,490	79
66	25	1,580	80
70	26	1,680	81
74	27	1,780	82
78	28	1,880	83
83	29	2,000	84
88	30	2,110	85
93	31	2,240	86
99	32	2,370	87
105	33	2,510	88
111	34	2,660	89
117	35	2,820	90
125	36	2,990	91
132	37	3,170	92
140	38	3,360	93
148	39	3,560	94
157	40	3,770	95
166	41	4,000	96
176	42	4,230	97
187	43	4,480	98
198	44	4,750	99
210	45	5,030	100
222	46	5,330	101
235	47	5,650	102
250	48	5,990	103
264	49	6,340	104
280	50	6,720	105
297	51	7,120	106
314	52	7,550	107
333	53	8,000	108
353	54	8,470	109
374	55	8,970	110
396	56	9,510	111
420	57	10,000	112
445	58	10,600	113

**LPF Cut Off Frequency & Corresponding Preset Byte Values**

<u>Frequency(Hz):</u>	<u>Value(base 10):</u>	<u>Frequency(Hz):</u>	<u>Value(base 10):</u>
33	13	890	70
35	14	943	71
37	15	1,000	72
39	16	1,050	73
41	17	1,120	74
44	18	1,180	75
46	19	1,250	76
49	20	1,330	77
52	21	1,410	78
55	22	1,490	79
58	23	1,580	80
62	24	1,680	81
66	25	1,780	82
70	26	1,880	83
74	27	2,000	84
78	28	2,110	85
83	29	2,240	86
88	30	2,370	87
93	31	2,510	88
99	32	2,660	89
105	33	2,820	90
111	34	2,990	91
117	35	3,170	92
125	36	3,360	93
132	37	3,560	94
140	38	3,770	95
148	39	4,000	96
157	40	4,230	97
166	41	4,480	98
176	42	4,750	99
187	43	5,030	100
198	44	5,330	101
210	45	5,650	102
222	46	5,990	103
235	47	6,340	104
250	48	6,720	105
264	49	7,120	106
280	50	7,550	107
297	51	8,000	108
314	52	8,470	109
333	53	8,970	110
353	54	9,510	111
374	55	10,000	112
396	56	10,600	113
420	57	11,300	114
445	58	11,900	115
471	59	12,060	116
500	60	13,400	117
529	61	14,200	118
561	62	15,100	119
594	63	16,000	120
629	64	16,900	121
667	65	17,900	122
707	66	19,000	123
749	67	20,100	124
793	68	OFF	0
840	69		