

ASHLY 4.8SP, 3.6SP Control Protocol

Notes:

- 1) RS-232 settings: 1 Start Bit, 8 Data Bits, 1 Stop Bit, No Parity, 9600bps rate. Cable length limit is 1,000 feet (305m).
- 2) When a valid message type 05-13,21,24,27-30 (below) is received, it is echoed back from the Unit, to verify reception.
- 3) All 'Request' messages cause the Unit to transmit a corresponding response message.
- 4) Message types 15-20 are transmitted from the Unit when a local change occurs via the Unit's front panel. However, these local update messages are inhibited until a valid Data Request message is received, since the Unit was last powered on.
- 5) All message bytes or bits pertaining to Input D, Output 7, and Output 8 are ignored/padded by the 3.6SP.

Message Types:

xx = Meter Request	10 = Limiter Message	21 = Preset Recall
00 = Meter Response	11 = Status Message	22 = Device Name Request
01 = Data Request	12 = Preset Save Message	23 = Device Name Response
02 = Data Response	13 = New Working Preset Name	24 = Device Name Download
03 = Preset Names Request	14 = Bulk Preset Data Request	25 = Group Name Request
04 = Preset Names Response	15 = Local Gain Change Update	26 = Group Name Response
05 = Preset Download	16 = Local EQ Filter Change Update	27 = Group Name Download
06 = Gain Message	17 = Local Delay Change Update	28 = Gain Inc/Dec Message
07 = EQ Filter Message	18 = Local Crossover Change Update	29 = Channel Mute Message
08 = Delay Message	19 = Local Limiter Change Update	30 = Source Selection Message
09 = Crossover Filter Message	20 = Local Status Change Update	127 = Bulk Preset Data

Meter Request:

<u>Byte#</u>	<u>Value</u>	<u>Description</u>
1	\$D0	Meter request byte (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)

00 Meter Response (to previous message):

<u>Byte#</u>	<u>Value</u>	<u>Description</u>
1	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2	00	Start byte 2
3	01	Start byte 3
4	\$2A	Start byte 4
5	\$12	Start byte 5
6	00	Control message class id byte
7	00	Meter response message
8	xx	Input A level
9	xx	Input B level
10	xx	Input C level
11	xx	Input D level
12	xx	Output 1 level
13	xx	Output 2 level
14	xx	Output 3 level
15	xx	Output 4 level
16	xx	Output 5 level
17	xx	Output 6 level
18	xx	Output 7 level

19	xx	Output 8 level
20	xx	Output 1 gain reduction
21	xx	Output 2 gain reduction
22	xx	Output 3 gain reduction
23	xx	Output 4 gain reduction
24	xx	Output 5 gain reduction
25	xx	Output 6 gain reduction
26	xx	Output 7 gain reduction
27	xx	Output 8 gain reduction
28	End Byte: \$F7	End of transmission byte

Meter Notes:

All input and output level bytes use the following binary format: 0CLLLLLL
 Bits 5-0 represent the dBu level, where 0 = <-42 dBu, 1 to \$3F = -42 dBu to +20 dBu.
 Bit 6 represents clipping (>+20 dBu), where 0 = not clipped, 1 = clipped. The clip detector monitors the overall stage level, as well as EQ filters, & HPF/LPF (if applicable).
 All gain reduction bytes represent the actual decibel amount of attenuation applied by the output's limiter (0 = 0 dB, 1 = 1 dB, ...).

01 Data Request:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	01	Data request message
8	End Byte:	\$F7	End of transmission byte

02 Data Response (to previous message):

(Response to a Data Request Message. Refer to "Data Response", at the end of this document)

03 Preset Names Request:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	03	Preset names request message
8	End Byte:	\$F7	End of transmission byte

04 Preset Names Response (to previous message):

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	04	Preset names response message
8-607		xx	ASCII characters in the range \$20-\$7A, for all thirty 20 character preset names
608	End Byte:	\$F7	End of transmission byte

05 Preset Download:

(identical to Data Response, except the Message Type Byte = 05)

06 Gain Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	06	input / output gain message
8		0x	Gain node: 0-11 = Input A through Output 8 respectively
9		xx	Gain bits 13-7; 7792 to 8312 = -40 to +12 dB, (8192 = 0dB)
10		xx	Gain bits 6-0
11	End Byte:	\$F7	End of transmission byte

07 EQ Filter Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	07	EQ filter message
8		xx	Filter number: Input A=0-5 ... Input D=18-23, Output 1=24-27 ... Output 8=52-55
9		xx	Frequency bits 7-1 (x7654321)
10		xx	Frequency bit 0 (x0xxxxxx)
11		xx	Q value
12		xx	Filter Gain bits 13-7 (Refer to miscellaneous info at the end of this document)
13		xx	Filter Gain bits 6-0

14		0x	Type: 0 = Parametric EQ, 1 = Low Shelf 1 st order, 2 = Low Shelf 2 nd order, 3 = High Shelf 1 st order, 4 = High Shelf 2 nd order
15	End Byte:	\$F7	End of transmission byte

08 Delay Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	08	Delay message
8		0x	Delay Node: 0-11 = Input A through Output 8 respectively
9		x-x-x-x-x-x-x-14	Delay Value bit 14 (bits marked with <i>x</i> are always zero)
10		x-13-12-11-10-9-8-7	Delay Value bits 13-7 Delay Time = (Delay Value) * (1/48,000 seconds)
11		x-6-5-4-3-2-1-0	Delay Value bits 6-0 Delay Value range = 0-32,767 (0-682.64ms)
12	End Byte:	\$F7	End of transmission byte

09 Crossover Filter Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	09	Crossover filter message
8		0x	Filter number: 0 = Output 1 HPF, 1 = Output 1 LPF, ... 15 = Output 8 LPF
9		xx	Frequency bits 7-1 (x7654321)
10		xx	Frequency bit 0 (x0xxxxxx)
11		0x	Type: 0 = Butterworth2, 1 = Bessel2, 2 = Linkwitz2, 3 = Butterworth/Linkwitz3, 4 = Bessel3, 5 = Butterworth4, 6 = Bessel4, 7 = Linkwitz4
12	End Byte:	\$F7	End of transmission byte

10 Limiter Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	10	Limiter message

8	0x	Limiter Node: 4-11 = Output 1-8 respectively
9	xx	Limiter Threshold: \$2C-\$54 = -20 to +20dBu
10	xx	Limiter Ratio: 0-8 = 1.2, 1.5, 2, 3, 4, 6, 10, 20, INF:1
11	xx	Limiter Attack: 0-6 = 0.5, 1, 2, 5, 10, 20, 50ms/dB
12	xx	Limiter Release: 0-6 = 10, 20, 50, 100, 200, 500, 1000ms/dB
13	<i>End Byte:</i> \$F7	End of transmission byte

11 Status Message:

<u>Byte#</u>	<u>Value</u>	<u>Description</u>
1	<i>Start Byte:</i> \$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2	00	Start byte 2
3	01	Start byte 3
4	\$2A	Start byte 4
5	\$12	Start byte 5
6	00	Control message class id byte
7	<i>MSG Type:</i> 11	Status message
8	0000ABCD	Output 1 source: Bit3 = Input A, Bit2 = Input B, Bit1 = Input C, Bit0 = Input D
9	0000ABCD	Output 2 source: [0 = disabled, 1 = enabled]
10	0000ABCD	Output 3 source: (as above)
11	0000ABCD	Output 4 source: (as above)
12	0000ABCD	Output 5 source: (as above)
13	0000ABCD	Output 6 source: (as above)
14	0000ABCD	Output 7 source: (as above)
15	0000ABCD	Output 8 source: (as above)
16	00AB1234	EQ enable byte 1: Bits5-0 = Inputs A-B, Outputs 1-4; 0 = bypass, 1 = enable
17	00CD5678	EQ enable byte 2: Bits5-0 = Inputs C-D, Outputs 5-8; 0 = bypass, 1 = enable
18	00001234	Limiter enable byte 1: Bits3-0 = Outputs 1-4; 0 = bypass, 1 = enable
19	00005678	Limiter enable byte 2: Bits3-0 = Outputs 5-8; 0 = bypass, 1 = enable
20	00001234	Polarity byte 1: Bits3-0 = Outputs 1-4; 0 = normal, 1 = inverted
21	00005678	Polarity byte 2: Bits3-0 = Outputs 5-8; 0 = normal, 1 = inverted
22	00AB1234	Mute byte 1: Bits5-0 = Inputs A-B, Outputs 1-4; 0 = not muted, 1 = muted
23	00CD5678	Mute byte 2: Bits5-0 = Inputs C-D, Outputs 5-8; 0 = not muted, 1 = muted
24	<i>End Byte:</i> \$F7	End of transmission byte

12 Preset Save Message:

<u>Byte#</u>	<u>Value</u>	<u>Description</u>
1	<i>Start Byte:</i> \$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2	00	Start byte 2
3	01	Start byte 3
4	\$2A	Start byte 4
5	\$12	Start byte 5
6	00	Control message class id byte
7	<i>MSG Type:</i> 12	Preset save message
8	xx	Preset number to save to: 0-29 = preset 1-30
9-28	xx	New preset name: ASCII characters in the range \$20-\$7A, except \$5C
29	<i>End Byte:</i> \$F7	End of transmission byte

13 New Working Name Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	13	New working name message
8-27		xx	New preset name: ASCII characters in the range \$20-\$7A, except \$5C
28	End Byte:	\$F7	End of transmission byte

14 Bulk Preset Data Request Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	14	Bulk preset data request message
8	End Byte:	\$F7	End of transmission byte

Unit's Local Updates (message types:15-20)

(These messages are generated when a local change occurs on the Units front panel. They provide updated settings to the software. These messages are identical to message types 6-11, except the type byte is changed. NOTE: These messages will only be transmitted if the Unit has received a Data Inquiry message since it was last powered on.)

21 Preset Recall Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	21	Preset recall with mute option message
8		xx	Preset number 0-29 (Presets 1-30)
9		xx	Mute option: 0 = normal preset recall, 1-\$7f = recall preset with all outputs muted
10	End Byte:	\$F7	End of transmission byte

22 Device Name Request:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	22	Device name request message
8	End Byte:	\$F7	End of transmission byte

23 Device Name Response:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	23	Device name response message
8-27		xx	Device name: ASCII characters in the range \$20-\$7A, except \$5C
28	End Byte:	\$F7	End of transmission byte

24 Device Name Download:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	24	Device name download message
8-27		xx	New device name: ASCII characters in the range \$20-\$7A, except \$5C
28	End Byte:	\$F7	End of transmission byte

25 Group Name Request:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte

7	<i>MSG Type:</i>	25	Group name request message
8	<i>End Byte:</i>	\$F7	End of transmission byte

26 Group Name Response:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	<i>Start Byte:</i>	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	<i>MSG Type:</i>	26	Group name response message
8-27		<i>xx</i>	Group name: ASCII characters in the range \$20-\$7A, except \$5C
28	<i>End Byte:</i>	\$F7	End of transmission byte

27 Group Name Download:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	<i>Start Byte:</i>	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	<i>MSG Type:</i>	27	Group name download message
8-27		<i>xx</i>	New group name: ASCII characters in the range \$20-\$7A, except \$5C
28	<i>End Byte:</i>	\$F7	End of transmission byte

28 Gain Inc/Dec Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	<i>Start Byte:</i>	\$F0	Start byte 1 (<i>\$ denotes hexadecimal number, and is not part of the byte</i>)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	<i>MSG Type:</i>	28	Gain increment/decrement message
8		<i>xx</i>	Gain node: 0-11 = Input A through Output 8 respectively
9		<i>yy</i>	Type: 0 = decrement, 1 = increment
10		<i>zz</i>	Amount: 1-50 = 0.1dB to 5.0dB, recommended amount is 10 (1dB)
11	<i>End Byte:</i>	\$F7	End of transmission byte

29 Channel Mute Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	29	Channel mute message
8		0x	Mute node: 0-11 = Input A through Output 8 respectively
9		0y	New mute status: 0 = not muted, 1 = muted
10	End Byte:	\$F7	End of transmission byte

30 Source Selection Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		00	Control message class id byte
7	MSG Type:	30	Source selection message
8		0x	Output node: 4-11 = Output 1-8 respectively
9		0y	Source: 0-3 = Inputs A-D respectively
10		0z	Status: 0 = disabled source on this output, 1 = enable source on this output
11	End Byte:	\$F7	End of transmission byte

127 Bulk Preset Data Message:

<u>Byte#</u>		<u>Value</u>	<u>Description</u>
1	Start Byte:	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2		00	Start byte 2
3		01	Start byte 3
4		\$2A	Start byte 4
5		\$12	Start byte 5
6		7F	Bulk preset data class id
7-15,966		xx	Data bytes
15,967	End Byte:	\$F7	End of transmission byte

4.8SP, 3.6SP Miscellaneous Info.

Frequency: All system exclusive messages that include frequency information use the same format. The first frequency byte contains frequency bits 7-1 (in bit 6-0 positions). The second frequency byte contains frequency bit 0 (in bit 6 position). The frequency is derived from this 8-bit Value using the following equation:

$$\text{Frequency} = 1000 * 2^{[(\text{Value} - 147)/24]}$$

Crossover HPF frequency range: OFF to 21.98kHz, Value = 10 to 254

Crossover LPF frequency range: 19.7Hz to OFF, Value = 11 to 255

Parametric filter frequency range: 19.7Hz to 21.98kHz, Value = 11 to 254

Parametric filter gain range: -30dB to +15dB in 0.1dB steps, Gain Word = 7892 to 8342 (8192 = 0dB)

Low Shelf frequency range: 19.7Hz to 2.0kHz, Value = 11 to 147

High Shelf frequency range: 3.89kHz to 21.98kHz, Value = 194 to 254

Shelf filter gain range: -15dB to +15dB in 0.1dB steps, Gain Word = 8042 to 8342 (8192 = 0dB)

Delay Time = [Delay Value] * 1/48,000 seconds

Delay Value range: 0-32,767 (0-682.64ms)

Note: there is an additional fixed delay of approximately 1.46ms from any input to any output, due to the digital converters

Parametric filter Q byte:

Note: octaves = 1/Q value

<u>byte value</u>	<u>Q value</u>	<u>byte value</u>	<u>Q value</u>	<u>byte value</u>	<u>Q value</u>	<u>byte value</u>	<u>Q value</u>
0	64.00	20	7.13	40	2.24	60	0.71
1	57.02	21	6.73	41	2.12	61	0.67
2	50.80	22	6.35	42	2.00	62	0.63
3	45.25	23	5.99	43	1.89	63	0.59
4	40.32	24	5.66	44	1.78	64	0.56
5	35.92	25	5.34	45	1.68	65	0.53
6	32.00	26	5.04	46	1.59	66	0.50
7	28.51	27	4.76	47	1.50	67	0.47
8	25.40	28	4.49	48	1.41	68	0.45
9	22.63	29	4.24	49	1.33	69	0.42
10	20.16	30	4.00	50	1.26	70	0.40
11	17.96	31	3.78	51	1.19	71	0.37
12	16.00	32	3.56	52	1.12	72	0.35
13	14.25	33	3.36	53	1.06	73	0.33
14	12.70	34	3.17	54	1.00	74	0.31
15	11.31	35	3.00	55	0.94	75	0.30
16	10.08	36	2.83	56	0.89	76	0.28
17	8.98	37	2.67	57	0.84	77	0.26
18	8.00	38	2.52	58	0.79	78	0.25
19	7.55	39	2.38	59	0.75		

4.8SP / 3.6SP - Data Response Message

Byte #	Value/type	Description
1	\$F0	Start byte 1 (\$ denotes hexadecimal number, and is not part of the byte)
2	0	Start byte 2
3	1	Start byte 3
4	\$2A	Start byte 4
5	\$12	Start byte 5
6	0	Control message class id byte
7	2	Message type: Data Response
8	preset name character 1	ASCII values \$20-\$7A, except \$5C
9	preset name character 2	
10	preset name character 3	
11	preset name character 4	
12	preset name character 5	
13	preset name character 6	
14	preset name character 7	
15	preset name character 8	
16	preset name character 9	
17	preset name character 10	
18	preset name character 11	
19	preset name character 12	
20	preset name character 13	
21	preset name character 14	
22	preset name character 15	
23	preset name character 16	
24	preset name character 17	
25	preset name character 18	
26	preset name character 19	
27	preset name character 20	
28	output 1 source	(xxxxABCD); bit3 = Input A, bit2 = Input B, bit1 = Input C, bit0 = Input D
29	output 2 source	0 = off, 1 = on
30	output 3 source	
31	output 4 source	
32	output 5 source	
33	output 6 source	
34	output 7 source	
35	output 8 source	
36	eq i/o 1	00AB1234, 0 = out, 1 = in
37	eq i/o 2	00CD5678, 0 = out, 1 = in
38	limiter i/o 1	00001234, 0 = out, 1 = in
39	limiter i/o 2	00005678, 0 = out, 1 = in
40	output polarities 1	00001234, 0 = normal, 1 = inverted
41	output polarities 2	00005678, 0 = normal, 1 = inverted
42	mutes 1	00AB1234, 0 = not muted, 1 = muted
43	mutes 2	00CD5678, 0 = not muted, 1 = muted
44	input A gain	bits 13-7; 7792 to 8312 = -40dB to +12dB (0.1dB steps)
45	input A gain	bits 6-0; (8192 = 0dB)
46	input B gain	
47	input B gain	
48	input C gain	
49	input C gain	
50	input D gain	
51	input D gain	
52	output 1 gain	
53	output 1 gain	
54	output 2 gain	
55	output 2 gain	
56	output 3 gain	

4.8SP / 3.6SP - Data Response Message

57	output 3 gain	
58	output 4 gain	
59	output 4 gain	
60	output 5 gain	
61	output 5 gain	
62	output 6 gain	
63	output 6 gain	
64	output 7 gain	
65	output 7 gain	
66	output 8 gain	
67	output 8 gain	
68	<i>reserved</i>	
69	<i>reserved</i>	
70	<i>reserved</i>	
71	<i>reserved</i>	
72	<i>reserved</i>	
73	<i>reserved</i>	
74	<i>reserved</i>	
75	<i>reserved</i>	
76	<i>reserved</i>	
77	<i>reserved</i>	
78	<i>reserved</i>	
79	<i>reserved</i>	
80	<i>reserved</i>	
81	<i>reserved</i>	
82	<i>reserved</i>	
83	<i>reserved</i>	
84	output 1 limiter threshold	\$2C-\$54 = -20 to +20dBu
85	output 1 limiter ratio	0-7 = 1.2, 1.5, 2, 3, 4, 6, 10, 20, INF:1
86	output 1 limiter attack	0-6 = 0.5, 1, 2, 5, 10, 20, 50ms
87	output 1 limiter release	0-6 = 10, 20, 50, 100, 200, 500, 1000ms
88	output 2 limiter threshold	
89	output 2 limiter ratio	
90	output 2 limiter attack	
91	output 2 limiter release	
92	output 3 limiter threshold	
93	output 3 limiter ratio	
94	output 3 limiter attack	
95	output 3 limiter release	
96	output 4 limiter threshold	
97	output 4 limiter ratio	
98	output 4 limiter attack	
99	output 4 limiter release	
100	output 5 limiter threshold	
101	output 5 limiter ratio	
102	output 5 limiter attack	
103	output 5 limiter release	
104	output 6 limiter threshold	
105	output 6 limiter ratio	
106	output 6 limiter attack	
107	output 6 limiter release	
108	output 7 limiter threshold	
109	output 7 limiter ratio	
110	output 7 limiter attack	
111	output 7 limiter release	
112	output 8 limiter threshold	

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113	output 8 limiter ratio		
114	output 8 limiter attack		
115	output 8 limiter release		
116	input A delay	bits 20-14	Delay in seconds = [20-bit value]/48,000
117	input A delay	bits 13-7	range: 0 - 32,767 (0-682.64ms)
118	input A delay	bits 6-0	
119	input B delay		
120	input B delay		
121	input B delay		
122	input C delay		
123	input C delay		
124	input C delay		
125	input D delay		
126	input D delay		
127	input D delay		
128	output 1 delay		
129	output 1 delay		
130	output 1 delay		
131	output 2 delay		
132	output 2 delay		
133	output 2 delay		
134	output 3 delay		
135	output 3 delay		
136	output 3 delay		
137	output 4 delay		
138	output 4 delay		
139	output 4 delay		
140	output 5 delay		
141	output 5 delay		
142	output 5 delay		
143	output 6 delay		
144	output 6 delay		
145	output 6 delay		
146	output 7 delay		
147	output 7 delay		
148	output 7 delay		
149	output 8 delay		
150	output 8 delay		
151	output 8 delay		
152	output 1 hpf frequency	bits 7-1 (x7654321);	range: 10-254 = OFF-21.98kHz
153	output 1 hpf frequency	bit 0 (x0xxxxxx);	$F = 1000 * 2^{[(Value - 147)/24]}$, except 10 = OFF
154	output 1 hpf type	0-7 = Bwrth2, Bes2, Lnk2, Bwrth/Lnk3, Bes3, Bwrth4, Bes4, Lnk4	
155	output 1 lpf frequency	bits 7-1 (x7654321);	range: 11-255 = 19.7Hz-OFF
156	output 1 lpf frequency	bit 0 (x0xxxxxx);	$F = 1000 * 2^{[(Value - 147)/24]}$, except 255 = OFF
157	output 1 lpf type	0-7 = Bwrth2, Bes2, Lnk2, Bwrth/Lnk3, Bes3, Bwrth4, Bes4, Lnk4	
158	output 2 hpf frequency		
159	output 2 hpf frequency		
160	output 2 hpf type		
161	output 2 lpf frequency		
162	output 2 lpf frequency		
163	output 2 lpf type		
164	output 3 hpf frequency		
165	output 3 hpf frequency		
166	output 3 hpf type		
167	output 3 lpf frequency		
168	output 3 lpf frequency		

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169	output 3 lpf type	
170	output 4 hpf frequency	
171	output 4 hpf frequency	
172	output 4 hpf type	
173	output 4 lpf frequency	
174	output 4 lpf frequency	
175	output 4 lpf type	
176	output 5 hpf frequency	
177	output 5 hpf frequency	
178	output 5 hpf type	
179	output 5 lpf frequency	
180	output 5 lpf frequency	
181	output 5 lpf type	
182	output 6 hpf frequency	
183	output 6 hpf frequency	
184	output 6 hpf type	
185	output 6 lpf frequency	
186	output 6 lpf frequency	
187	output 6 lpf type	
188	output 7 hpf frequency	
189	output 7 hpf frequency	
190	output 7 hpf type	
191	output 7 lpf frequency	
192	output 7 lpf frequency	
193	output 7 lpf type	
194	output 8 hpf frequency	
195	output 8 hpf frequency	
196	output 8 hpf type	
197	output 8 lpf frequency	
198	output 8 lpf frequency	
199	output 8 lpf type	
200	frequency EQ Filters	A-1 bits 7-1 (x7654321); range: 11-254
201	frequency	bit 0 (x0xxxxxx); $F = 1000 * 2^{[(Value - 147)/24]}$
202	Q	refer to Q table
203	level	bits 13-7; 0.1dB steps, 8192 = 0dB
204	level	bits 6-0
205	type	0-4 = PEQ, LS1, LS2, HS1, HS2
206	frequency	A-2
207	frequency	
208	Q	
209	level	
210	level	
211	type	
212	frequency	A-3
213	frequency	
214	Q	
215	level	
216	level	
217	type	
218	frequency	A-4
219	frequency	
220	Q	
221	level	
222	level	
223	type	
224	frequency	A-5

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225	frequency	
226	Q	
227	level	
228	level	
229	type	
230	frequency	A-6
231	frequency	
232	Q	
233	level	
234	level	
235	type	
236	frequency	B-1
237	frequency	
238	Q	
239	level	
240	level	
241	type	
242	frequency	B-2
243	frequency	
244	Q	
245	level	
246	level	
247	type	
248	frequency	B-3
249	frequency	
250	Q	
251	level	
252	level	
253	type	
254	frequency	B-4
255	frequency	
256	Q	
257	level	
258	level	
259	type	
260	frequency	B-5
261	frequency	
262	Q	
263	level	
264	level	
265	type	
266	frequency	B-6
267	frequency	
268	Q	
269	level	
270	level	
271	type	
272	frequency	C-1
273	frequency	
274	Q	
275	level	
276	level	
277	type	
278	frequency	C-2
279	frequency	
280	Q	

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281	level	
282	level	
283	type	
284	frequency	C-3
285	frequency	
286	Q	
287	level	
288	level	
289	type	
290	frequency	C-4
291	frequency	
292	Q	
293	level	
294	level	
295	type	
296	frequency	C-5
297	frequency	
298	Q	
299	level	
300	level	
301	type	
302	frequency	C-6
303	frequency	
304	Q	
305	level	
306	level	
307	type	
308	frequency	D-1
309	frequency	
310	Q	
311	level	
312	level	
313	type	
314	frequency	D-2
315	frequency	
316	Q	
317	level	
318	level	
319	type	
320	frequency	D-3
321	frequency	
322	Q	
323	level	
324	level	
325	type	
326	frequency	D-4
327	frequency	
328	Q	
329	level	
330	level	
331	type	
332	frequency	D-5
333	frequency	
334	Q	
335	level	
336	level	

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337	type	
338	frequency	D-6
339	frequency	
340	Q	
341	level	
342	level	
343	type	
344	frequency	1-1
345	frequency	
346	Q	
347	level	
348	level	
349	type	
350	frequency	1-2
351	frequency	
352	Q	
353	level	
354	level	
355	type	
356	frequency	1-3
357	frequency	
358	Q	
359	level	
360	level	
361	type	
362	frequency	1-4
363	frequency	
364	Q	
365	level	
366	level	
367	type	
368	frequency	2-1
369	frequency	
370	Q	
371	level	
372	level	
373	type	
374	frequency	2-2
375	frequency	
376	Q	
377	level	
378	level	
379	type	
380	frequency	2-3
381	frequency	
382	Q	
383	level	
384	level	
385	type	
386	frequency	2-4
387	frequency	
388	Q	
389	level	
390	level	
391	type	
392	frequency	3-1

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393	frequency	
394	Q	
395	level	
396	level	
397	type	
398	frequency	3-2
399	frequency	
400	Q	
401	level	
402	level	
403	type	
404	frequency	3-3
405	frequency	
406	Q	
407	level	
408	level	
409	type	
410	frequency	3-4
411	frequency	
412	Q	
413	level	
414	level	
415	type	
416	frequency	4-1
417	frequency	
418	Q	
419	level	
420	level	
421	type	
422	frequency	4-2
423	frequency	
424	Q	
425	level	
426	level	
427	type	
428	frequency	4-3
429	frequency	
430	Q	
431	level	
432	level	
433	type	
434	frequency	4-4
435	frequency	
436	Q	
437	level	
438	level	
439	type	
440	frequency	5-1
441	frequency	
442	Q	
443	level	
444	level	
445	type	
446	frequency	5-2
447	frequency	
448	Q	

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449	level	
450	level	
451	type	
452	frequency	5-3
453	frequency	
454	Q	
455	level	
456	level	
457	type	
458	frequency	5-4
459	frequency	
460	Q	
461	level	
462	level	
463	type	
464	frequency	6-1
465	frequency	
466	Q	
467	level	
468	level	
469	type	
470	frequency	6-2
471	frequency	
472	Q	
473	level	
474	level	
475	type	
476	frequency	6-3
477	frequency	
478	Q	
479	level	
480	level	
481	type	
482	frequency	6-4
483	frequency	
484	Q	
485	level	
486	level	
487	type	
488	frequency	7-1
489	frequency	
490	Q	
491	level	
492	level	
493	type	
494	frequency	7-2
495	frequency	
496	Q	
497	level	
498	level	
499	type	
500	frequency	7-3
501	frequency	
502	Q	
503	level	
504	level	

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505	type	
506	frequency	7-4
507	frequency	
508	Q	
509	level	
510	level	
511	type	
512	frequency	8-1
513	frequency	
514	Q	
515	level	
516	level	
517	type	
518	frequency	8-2
519	frequency	
520	Q	
521	level	
522	level	
523	type	
524	frequency	8-3
525	frequency	
526	Q	
527	level	
528	level	
529	type	
530	frequency	8-4
531	frequency	
532	Q	
533	level	
534	level	
535	type	
536	<i>reserved</i>	
537	<i>reserved</i>	
538	<i>reserved</i>	
539	<i>reserved</i>	
540	\$F7	end byte