Qu Mixer MIDI Protocol - Firmware V1.6

July 2015

This protocol is for use with the Qu-16,24,32 and Qu-Pac loaded with firmware version V1.60 or later.

Note In firmware V1.5 the MIDI channel numbers and NRPN ID previously used by Mute Groups were re-allocated to the added DCA Groups to be consistent with other Allen & Heath mixers. Mute Groups channel numbers were changed and are as detailed in this specification.

Qu transmits MIDI messages when its controls are operated. It also responds to parameter changes it receives via MIDI, for example from a computer, Qu-Pad or an external MIDI controller.

MIDI communicates via:

USB – Rear panel USB B port for direct connection to Apple Mac computers running OSX 10.6 or later. This is the recommended connection for DAW control.

Note USB MIDI is supported natively by Apple Mac computers so no driver is needed. A driver for Windows computers can be downloaded from the Allen & Heath web site.

TCP – Rear panel network port for use with a computer, a touch panel or other remote controller with configurable MIDI over a TCP/IP port.

Note TCP MIDI requires a driver for the data to be seen as a MIDI port. An Allen & Heath TCP MIDI driver for Apple Mac computers can be downloaded from the iLive Software web page. A driver is not available for Windows computers.

Note Qu currently allows only one TCP MIDI connection at a time over its Network port.

The following Qu functions can be controlled via MIDI:

- Mutes
- Faders and Pan
- Mix and FX sends - Level, Pan, Assign, Pre/Post
- Matrix sends – Level, Pan, Assign, Pre/Post (not Qu-16)
- Audio Groups – Assign (not Qu-16)
- Mute Groups – Assign, Master Mute
- DCA Groups – Assign, Master Level, Master Mute
- PAFL select
- Input Channel source
- Preamp (local and dSNAKE) – Gain, Pad, 48V
- Insert In/Out
- Input Channel processing – Trim, Polarity, Gate, PEQ, Compressor, Delay
- Mix processing - PEQ, GEQ, Compressor, Delay
- Group and Matrix processing – PEQ, GEQ, Compressor, Delay (not Qu-16)
- Channel Names
- Scene Recall
- FX Tap Tempo
- MMC Transport Control

DAW Control for Mac computers:

MIDI fader strips can be assigned to the Custom Layer to work with a DAW (Digital Audio Workstation). These send/receive CC and note on/off messages using a different MIDI channel to that used for the Qu functions described above. The MIDI fader strip sends/receives messages relating to:

- Fader position
- Mute key / indicator
- Sel key / indicator
- PAFL key /indicator
- DAW Bank Up/Down

You can work directly with these messages or use the Allen & Heath DAW Control driver to convert them into either of the following popular protocols:

- HUI
- Mackie Control

Note DAW Control is available for Mac computers only. A driver for Windows computers is not available.

Go to the Allen & Heath web site to download the DAW Control driver for Mac and for further information in the DAW Control Setup Notes.

Reference

Refer to the table at the end of this document for value listings.

All MIDI message numbers shown in blue in this document are Hexadecimal

Key

Blue	Hexadecimal number, eg, F0
Green	Variable referred to in table or note, eg, **VA** = parameter value
Red	NRPN **ID** number for parameter type, eg. Polarity = 6A
Orange	NRPN Index to specify a second value, eg, **VX**

MIDI channel number **N** (see table)

MIDI channel 1 to 16 = 0 to F

Qu functions use MIDI channel = **N**

MIDI strips (DAW controls) use MIDI channel = **N+1**

Channel numbers **CH** (see table)

FX Send 1 to 4	= 00 to 03	
FX Return 1 to 4	= 08 to 0B	
DCA Groups 1 to 4	= 10 to 13	**Note** Introduced in V1.5 firmware
Input 1 to 32	= 20 to 3F	
Stereo Channels	= 40 to 42	
Mute Groups 1 to 4	= 50 to 53	**Note** This is a change introduced in V1.5 firmware
Group 1-2 to 7-8	= 68 to 6B	(not Qu-16)
Mix 1 to 10	= 60 to 66	
Main LR	= 67	
Matrix 1-2, 3-4	= 6C , 6D	(not Qu-16)

Active Sensing

Qu supports MIDI Active Sensing over its TCP/IP Ethernet connection to detect connection status. Qu will send an initial Active Sense byte (FE) once an Ethernet connection is established, and then once every 300ms or so during any period of inactivity.

Qu also responds to Active Sense If it receives an Active Sense byte it will expect to receive regular MIDI data from that point onwards (either valid control data, or more Active Sense bytes during any period of inactivity). If it does not receive any data for 12 seconds, it will close the Ethernet connection.

DAW control

MIDI strips assigned to the Custom Layer can provide DAW control.

DAW messages can be translated into HUI or Mackie Control protocol using a driver which can be downloaded from the Allen & Heath web site.

Allen & Heath **DAW Control**

Note DAW Control is available for Mac computers only. A driver for Windows computers is not available.

DAW messages use a different MIDI channel to other Qu MIDI messages:

Qu MIDI channel = **N**
DAW MIDI channel = **N+1**

MIDI strip controls send and respond to the following messages:

Strip Fader

Control Change message:

B(**N+1**), **FD**, **VA**

Where **FD** = Strip fader 00 to 1F (see table)
VA = Fader min to max position = 00 to 7F

Strip keys

The strip keys use **NOTE ON** followed by **NOTE OFF** messages.

Pressing keys send messages.

Key LED indicators respond to received messages.

9(**N+1**), **KY**, 7F, 9(**N+1**), **KY**, 00

Where **KY =** **Mute** Strip 1-32 = 00 to 1F (see table)
Sel Strip 1-32 = 20 to 3F
PAFL Strip 1-32 = 40 to 5F

Bank Up/Down

Qu SoftKeys can be assigned as DAW Bank Up or Bank Down keys.

These use **NOTE ON** followed by **NOTE OFF** messages which are converted by DAW Control to become the Bank Up/Down control.

Bank Up 9(**N+1**), 7E, 7F, 9(**N+1**), 7E, 00
Bank Down 9(**N+1**), 7F, 7F, 9(**N+1**), 7F, 00

Mute control

Mute on NOTE ON with velocity > or = 40 followed by NOTE OFF

9N, CH, 7F, 9N, CH, 00

Mute off NOTE ON with velocity < 40 followed by NOTE OFF

9N, CH, 3F, 9N, CH, 00

Received Mute messages

Velocity 00 and NOTE OFF messages are ignored

Velocity 01 to 3F = Mute off

Velocity 40 to 7F = Mute on

NRPN Parameter control

Qu mixer parameters are transmitted and received as MIDI NRPN (Non-Registered Parameter Number) messages. The MSB (most significant byte) selects the mixer channel (CH), and the LSB (least significant byte) selects the parameter number (ID). The data entry MSB sets the parameter value (VA) and LSB sets the index value for its range (VX) where needed.

(NRPN MSB)	(NRPN LSB)	(Data MSB)	(Data LSB)
BN, 63, CH,	BN, 62, ID,	BN, 06, VA	BN, 26, VX

Fader BN, 63, CH, BN, 62, 17, BN, 06, VA BN, 26, 07

Where VA –inf to +10dB = 00 to 7F, 0dB = 6B (see table)

Pan BN, 63, CH, BN, 62, 16, BN, 06, VA BN, 26, VX

Where VA Full Left = 00 to Centre = 25 to Full Right = 4A

VX 04 , 05, 06, 07 = Mix 5-6, 7-8, 9-10, LR

VX 0C, 0D = MTX1-2, 3-4 (not Qu-16)

LR Assign BN, 63, CH, BN, 62, 18, BN, 06, VA BN, 26, 07

Where VA Off = 00, On = 01

Mix Assign BN, 63, CH, BN, 62, 55, BN, 06, VA BN, 26, VX

Where VA Off = 00, On = 01

VX 00 to 07 = Mix1-10, LR

VX 10 to 13 = FX send 1-4 (Qu-16 FX1,2 only)

VX 08 , 09, 0C, 0D = Grp1-2,3-4, MTX1-2,3-4 (not Qu-16)

Mute Grp Assign BN, 63, CH, BN, 62, 5C, BN, 06, VA BN, 26, 07

Where VA Off Mute Grp 1-4 = 00 to 03,

On Mute Grp 1-4 = 40 to 43

DCA Grp Assign BN, 63, CH, BN, 62, 40, BN, 06, VA BN, 26, 07

Where VA Off Mute Grp 1-4 = 00 to 03,

On Mute Grp 1-4 = 40 to 43

Mix Pre/Post

BN, 63, CH, BN, 62, 50, BN, 06, VA BN, 26, VX

Where VA Post = 00, Pre = 01

VX 00 to 06 = Mix1-10

VX 10 to 13 = FX send 1-4 (Qu-16 FX1,2 only)

VX 0C, 0D = MTX1-2, 3-4 (not Qu-16)

Send Level

BN, 63, CH, BN, 62, 20, BN, 06, VA BN, 26, VX

Where VA –inf to +10dB = 00 to 7F (see table)

VX 00 to 06 = Mix1-10

VX 10 to 13 = FX send 1-4 (Qu-16 FX1,2 only)

VX 0C, 0D = MTX1-2, 3-4 (not Qu-16)

PAFL select

BN, 63, CH, BN, 62, 51, BN, 06, VA BN, 26, 07

Where VA Off = 00, On = 01

Ch USB Source

Switches between channel current Preamp and current USB source

BN, 63, CH, BN, 62, 12, BN, 06, VA BN, 26, 00

Where VA Off (Preamp) = 00, On (USB) = 01

Ch Preamp Source

Switches between mixer rear panel and remote AR rack input source

BN, 63, CH, BN, 62, 57, BN, 06, VA BN, 26, 00

Where VA Off (Local) = 00, On (dSNAKE) = 01

Local Preamp

Applies to rear panel local inputs only

BN, 63, CH, BN, 62, ID, BN, 06, VA BN, 26, 07

Where

Gain	ID = 19	VA Gain -5dB to +60dB = 00 to 7F (see table)
48V PP	ID = 69	VA Off = 00, On = 01

dSNAKE Preamp

Applies to remote AR rack inputs only

BN, 63, CH, BN, 62, ID, BN, 06, VA BN, 26, 07

Where

Gain	ID = 58	VA Gain +5dB to +60dB = 00 to 7F (see table)
Pad	ID = 59	VA Out = 00, In = 01
48V PP	ID = 5A	VA Off = 00, On = 01

Digital Trim

Applies to USB source to channel only

BN, 63, CH, BN, 62, 52, BN, 06, VA BN, 26, 07

Where VA Trim -24 to +24dB = 00 to 7F 0dB = 40

Stereo Trim

Applies to local ST1, ST2 and ST3 inputs only

BN, 63, CH, BN, 62, 54, BN, 06, VA BN, 26, 07

Where VA Trim -24 to +24dB = 00 to 7F 0dB = 40

Polarity

BN, 63, CH, BN, 62, 6A, BN, 06, VA BN, 26, 07

Where VA Off (normal) = 00, On (reversed) = 01

Insert In/Out

BN, 63, CH, BN, 62, 6B, BN, 06, VA BN, 26, 07

Where VA Out = 00, In = 01

PEQ		BN, 63, CH,	BN, 62, ID,	BN, 06, VA	BN, 26, 07
		Where			
	LF Gain	ID = 01	VA -12 to +12dB = 00 to 7F		0dB = 40
	LF Freq	ID = 02	VA 20Hz to 20 kHz = 00 to 7F		
	LF Width	ID = 03	VA 1.5 to 1/9 Oct = 00 to 7F		
	LF Type	ID = 04	VA Bell = 00, Shelf = 06		
	LM Gain	ID = 05	VA -12 to +12dB = 00 to 7F		0dB = 40
	LM Freq	ID = 06	VA 20Hz to 20 kHz = 00 to 7F		
	LM Width	ID = 07	VA 1.5 to 1/9 Oct = 00 to 7F		
	HM Gain	ID = 09	VA -12 to +12dB = 00 to 7F		0dB = 40
	HM Freq	ID = 0A	VA 20Hz to 20 kHz = 00 to 7F		
	HM Width	ID = 0B	VA 1.5 to 1/9 Oct = 00 to 7F		
	HF Gain	ID = 0D	VA -12 to +12dB = 00 to 7F		0dB = 40
	HF Freq	ID = 0E	VA 20Hz to 20 kHz = 00 to 7F		
	HF Width	ID = 0F	VA 1.5 to 1/9 Oct = 00 to 7F		
	HF Type	ID = 10	VA Bell = 00, Shelf = 06		
PEQ	In/Out	BN, 63, CH,	BN, 62, 11,	BN, 06, VA	BN, 26, 00
		Where VA Out = 00, In = 01			
HPF	Freq	BN, 63, CH,	BN, 62, 13,	BN, 06, VA	BN, 26, 07
		Where VA 20Hz to 20kHz = 00 to 7F			
HPF	In/Out	BN, 63, CH,	BN, 62, 14,	BN, 06, VA	BN, 26, 00
		Where VA Out = 00, In = 01			
GEQ	Gain	BN, 63, CH,	BN, 62, 70,	BN, 06, VA	BN, 26, VX
		Where VA Gain -12 to +12dB = 00 to 7F			
		VX 00 to 1B = Each of 28 bands (see table)			
GEQ	In/Out	BN, 63, CH,	BN, 62, 71,	BN, 06, VA	BN, 26, 00
		Where VA Out = 00, In = 01			
Gate		BN, 63, CH,	BN, 62, ID,	BN, 06, VA	BN, 26, 07
		Where			
	Attack	ID = 41	VA 50us to 300ms = 00 to 7F		
	Release	ID = 42	VA 10ms to 1s = 00 to 7F		
	Hold	ID = 43	VA 10ms to 5s = 00 to 7F		
	Threshold	ID = 44	VA -72 to +18dB = 00 to 7F		
	Depth	ID = 45	VA 0 to 60dB = 00 to 7F		
Gate	In/Out	BN, 63, CH,	BN, 62, 46,	BN, 06, VA	BN, 26, 00
		Where VA Out = 00, In = 01			
Comp		BN, 63, CH,	BN, 62, ID,	BN, 06, VA	BN, 26, 07
		Where			
	Type	ID = 61	VA 4 types = 00, 01, 02, 03		
	Attack	ID = 62	VA 300us to 300ms = 00 to 7F		

Release	**ID** = 63	**VA**	100ms to 2s = 00 to 7F
Knee	**ID** = 64	**VA**	Hard knee = 00, Soft knee = 01
Ratio	**ID** = 65	**VA**	1:1 to inf = 00 to 7F, 2.6:1 = 50
Threshold	**ID** = 66	**VA**	-46 to +18dB = 00 to 7F
Gain	**ID** = 67	**VA**	0 +18dB = 00 to 7F

Comp In/Out

BN, 63, **CH**, BN, 62, 68, BN, 06, **VA** BN, 26, 00

Where **VA** Out = 00, In = 01

Delay Time

BN, 63, **CH**, BN, 62, 6C, BN, 06, **VA** BN, 26, 07

Where **VA** Input 0 to 85ms = 00 to 40 (linear)
VA Mix 0 to 170ms = 00 to 7F (linear)
VA Group 0 to 170ms = 00 to 7F (linear)
VA Matrix 0 to 170ms = 00 to 7F (linear)

Delay In/Out

BN, 63, **CH**, BN, 62, 6D, BN, 06, **VA** BN, 26, 00

Where **VA** Out = 00, In = 01

FX Parameter Control

Delay FX Time

To set delay time. Can be used for Tap Tempo.
Can use one or two NRPN messages:
Use MSB message only for course time value resolution.
Use LSB followed by MSB message for fine resolution.

LSB: BN, 63, **CH**, BN, 62, 49, BN, 06, **VAf** BN, 26, **VX**

MSB: BN, 63, **CH**, BN, 62, 48, BN, 06, **VAc** BN, 26, **VX**

Where **VAf** Fine resolution time value = 00 to 7F
VAc Course resolution time value = 00 to 7F
VX Delay parameter 05 = Left tap
07 = Right tap
(See table for examples of time value)

Delay FX Link

To link or unlink the Left and Right tap time.

BN, 63, **CH**, BN, 62, 48, BN, 06, **VA** BN, 26, 06

Where **VA** Off (unlinked) = 00
On (linked) = 7F

Scene Recall

Qu uses **Bank Select** and **Program Change** messages for Scene recall. Only Bank 1 is used.

Transmitted Scene message

Qu transmits this message when a Scene is recalled using the touch screen or a SoftKey:

(Bank1 MSB)	(Bank1 LSB)	Recall Scene
BN, 00, 00,	BN, 20, 00,	CN, SS

Where SS = Scene1 to 100 = 00 to 63 (see table)

Received Scene message

Qu responds to the following message if Bank1 is currently selected:

Recall Scene
CN, SS

Where SS = Scene1 to 100 = 00 to 63 (see table)

To set Bank1

Qu will ignore Scene change messages if the Bank is not set to 1.

(Bank1 MSB)	(Bank1 LSB)
BN, 00, 00,	BN, 20, 00

MMC (Transport Control)

Sysex message F0, 7F, 7F, 06, TC, F7

Where TC transport control:

- 01 = Stop
- 02 = Play
- 04 = Fast Forward
- 05 = Rewind
- 06 = Record Strobe
- 09 = Pause

Device Connection

Note Qu currently allows only one TCP MIDI connection at a time over its Network port.

TCP Client Configuration

Clients should be configured to use TCP port 51325

Active Sensing

Qu supports MIDI Active Sensing over its TCP/IP Ethernet connection to detect connection status. Qu will send an initial Active Sense byte (FE) once an Ethernet connection is established, and then once every 300ms or so during any period of inactivity.

Qu also responds to Active Sense If it receives an Active Sense byte it will expect to receive regular MIDI data from that point onwards (either valid control data, or more Active Sense bytes during any period of inactivity). If it does not receive any data for 12 seconds, it will close the Ethernet connection.

Qu uses Sysex messages to communicate much of its data.

Sysex Header

Sysex Header

	A&H ID	Qu mixer	Major/Minor version	MIDI channel
F0,	00, 00, 1A,	50, 11,	01, 00,	0N

Get System State

An external controller such as an iPad running the Qu-Pad app can use MIDI **Sysex** messages to request and receive the current parameter state of the Qu mixer.

Note On request, the mixer MIDI channel (**N**) is not known therefore an 'All Call' Sysex Header is sent. The reply returns the MIDI channel number. This number should be used in subsequent messages.

REQUEST: **Sysex Header (All Call)**, 10 **<iPadFlag>**, F7

Where **Sysex Header (All Call)** = F0, 00, 00, 1A, 50, 11, 01, 00, 7F

And **<iPadFlag>** = 1 identifies the incoming connection as Qu-pad.

REPLY: **Sysex Header**, 11, **< BoxID >** , **< Version >** , F7

Where **< BoxID >** identifies the outgoing connection Qu mixer model

Where: 1 = Qu-16
2 = Qu-24
3 = Qu-32
4 = Qu-Pac

< Version > = **<Major>**,**<Minor>** = Qu firmware version (7bit data)

Subsequent push of NRPN messages to update current state.

Subsequent End Sync Response:

Sysex Header, 14, F7

If **<iPadFlag>** is set in the initial request the Qu mixer will expect to receive an Active Sense byte within 5 seconds. If not, it will close the Ethernet connection. This is how the lost communication mechanism is enforced for Qu-Pad.

Channel Naming

Get Name from Qu

REQUEST: **Sysex Header**, 01, **CH**, F7

REPLY: **Sysex Header**, 02, **CH**, **<Name>**, F7

Where **< Name >** = string of hex ascii characters

Set Name

Sysex Header, 03, **CH**, **<Name>**, F7

Where **< Name >** = string of hex ascii characters

Get Meter Data

An external controller such as an iPad running the Qu-Pad app can use MIDI **Sysex** messages to request and receive the current meter data from the Qu mixer.

REQUEST:

Sysex Header, 12, F7

REPLY:

Sysex Header, 13, **< MeterData >** , F7

Where **< MeterData>** = Push of all meter data (Described below).

Meter values are signed dB values, coded as fixed point 7Q8 offset 8000 format, stored as unsigned 16 bit numbers, (transmitted in "7-bit-ized" format in the Sysex).

Encoding of meter data:

The 8-bit file data needs to be converted to 7-bit form, with the result that every 7 bytes of file data translates to 8 bytes in the MIDI stream.

For each group of 7 bytes of file data, the top bit from each is used to construct an eighth byte, which is sent first. For example:

AAAAaaaa BBBBbbbb CCCCcccc DDDDdddd EEEEeeee FFFFffff GGGGgggg

becomes :

0ABCDEFG 0AAAaaaa 0BBBbbbb 0CCCcccc 0DDDdddd 0EEEeeee 0FFFffff 0GGGgggg

The final group may have less than 7 bytes, and is coded as follows (example with 2 bytes in the final group):

0AB00000 0AAAaaaa 0BBBbbbb

Example:	7-bit-ized binary	00100000 01111100 00000000
	Unpacks to 8-bit-ized binary	01111100 10000000
	Equivalent to hexadecimal	7C80
	Remove the offset:	(int16_t) 7C80 – (int16_t) 8000 = FC80
	Float and scale:	(float) FC80 / 256.0f = -3.5dB

Transmission of meter data:

The meter data is transmitted in blocks of data in the following order:

Qu-16	Qu-24	Qu-32
16 Mono Input blocks	24 Mono Input blocks	24 Mono Input blocks (CH1-24)
72 unused meters	3 Stereo Input blocks	3 Stereo Input blocks
3 Stereo Input blocks	162 unused meters	18 unused meters
18 unused meters	4 Mono Mix blocks	8 Mono Input blocks (CH25-32)
4 Mono Mix blocks	4 Stereo Mix blocks	4 Mono Mix blocks
4 Stereo Mix blocks	2 Stereo Group blocks	4 Stereo Mix blocks
1 Stereo Monitor block	2 Stereo Matrix blocks	4 Stereo Group blocks
4 Stereo FX blocks	1 Stereo Monitor block	2 Stereo Matrix blocks
	4 Stereo FX blocks	1 Stereo Monitor block
		4 Stereo FX blocks

Note Stereo Mix blocks include Mix 5-6, 7-8, 9-10, LR

The meter blocks transmit the following meter data:

Mono Input block
Post Preamp
Post PEQ
Post Compressor
Post Delay
Gate Side Chain
Compressor Side Chain
Direct Out
Gate Gain reduction
Compressor Gain Reduction

Stereo Input block
Post Preamp L
Post PEQ L
Post Compressor L
Post Delay L
Gate Side Chain L
Compressor Side Chain L
Direct Out L
Gate Gain reduction L
Compressor Gain Reduction L
Post Preamp R
Post PEQ R
Post Compressor R
Post Delay R
Gate Side Chain R
Compressor Side Chain R
Direct Out R
Gate Gain reduction R
Compressor Gain Reduction R

Mono Mix block
TB/SigGen
Pre-Insert
Post-PEQ
Post-GEQ
Post Compressor
Post Fader
Post insert
Compressor Side Chain
Compressor Gain Reduction

Stereo Mix / Group / Matrix block
TB/SigGen L
Pre-Insert L
Post PEQ L
Post GEQ L
Post Compressor L
Post Fader L
Post Insert L

Compressor Side Chain L
Compressor Gain Reduction L
TB/SigGen R
Pre-Insert R
Post PEQ R
Post GEQ R
Post Compressor R
Post Fader R
Post Insert R
Compressor Side Chain R
Compressor Gain Reduction R

Stereo Monitor block
PAFL L
PAFL R
PAFL Mono sum
Talkback
Signal Generator
Main Pre Fader L
Main Pre Fader R
Main Post Fader L
Main Post Fader R
Main Mono Sum Pre Fader
Main Mono Sum Post Fader
USB A Record Out L
USB A Record Out R
3 Unused Meters
RTA 31 bands L
RTA 31 bands R

Stereo FX block
Send L (at FX device input)
Send R (“)
Send Mono sum
Pre PEQ L
Pre PEQ R
Tap Tempo L
Tap Tempo R
Post PEQ L
Post PEQ R
9 unused meters

MIDI channel

Qu	N Hex
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8
10	9
11	A
12	B
13	C
14	D
15	E
16	F

DAW	N +1 Hex
2	1
3	2
4	3
5	4
6	5
7	6
8	7
9	8
10	9
11	0A
12	0B
13	0C
14	0D
15	0E
16	0F
1	00

DAW

MIDI Strip

Strip	MS Hex
1	00
2	01
3	02
4	03
5	04
6	05
7	06
8	07
9	08
10	09
11	0A
12	0B
13	0C
14	0D
15	0E
16	0F
17	10
18	11
19	12
20	13
21	14
22	15
23	16
24	17
25	18
26	19
27	1A
28	1B
29	1C
30	1D
31	1E
32	1F

Mute Sel PAFL

Strip	MS Hex	KY Hex	KY Hex
1	00	20	40
2	01	21	41
3	02	22	42
4	03	23	43
5	04	24	44
6	05	25	45
7	06	26	46
8	07	27	47
9	08	28	48
10	09	29	49
11	0A	2A	4A
12	0B	2B	4B
13	0C	2C	4C
14	0D	2D	4D
15	0E	2E	4E
16	0F	2F	4F
17	10	30	50
18	11	31	51
19	12	32	52
20	13	33	53
21	14	34	54
22	15	35	55
23	16	36	56
24	17	37	57
25	18	38	58
26	19	39	59
27	1A	3A	5A
28	1B	3B	5B
29	1C	3C	5C
30	1D	3D	5D
31	1E	3E	5E
32	1F	3F	5F

Scene number

Scene	SS Hex	Scene	SS Hex
1	00	65	40
2	01	66	41
3	02	67	42
4	03	68	43
5	04	69	44
6	05	70	45
7	06	71	46
8	07	72	47
9	08	73	48
10	09	74	49
11	0A	75	4A
12	0B	76	4B
13	0C	77	4C
14	0D	78	4D
15	0E	79	4E
16	0F	80	4F
17	10	81	50
18	11	82	51
19	12	83	52
20	13	84	53
21	14	85	54
22	15	86	55
23	16	87	56
24	17	88	57
25	18	89	58
26	19	90	59
27	1A	91	5A
28	1B	92	5B
29	1C	93	5C
30	1D	94	5D
31	1E	95	5E
32	1F	96	5F
33	20	97	60
34	21	98	61
35	22	99	62
36	23	100	63
37	24		
38	25		
39	26		
40	27		
41	28		
42	29		
43	2A		
44	2B		
45	2C		
46	2D		
47	2E		
48	2F		
49	30		
50	31		
51	32		
52	33		
53	34		
54	35		
55	36		
56	37		
57	38		
58	39		
59	3A		
60	3B		
61	3C		
62	3D		
63	3E		
64	3F		

Input Channel

CH	CH Hex
1	20
2	21
3	22
4	23
5	24
6	25
7	26
8	27
9	28
10	29
11	2A
12	2B
13	2C
14	2D
15	2E
16	2F
17	30
18	31
19	32
20	33
21	34
22	35
23	36
24	37
25	38
26	39
27	3A
28	3B
29	3C
30	3D
31	3E
32	3F
ST1	40
ST2	41
ST3	42

FX Ret

CH	CH Hex
1	08
2	09
3	0A
4	0B

FX Send

CH	CH Hex	VX Hex
1	00	10
2	01	11
3	02	12
4	03	13

Mix

Mix	CH Hex	VX Hex
1	60	00
2	61	01
3	62	02
4	63	03
5-6	64	04
7-8	65	05
9 -10	66	06
LR	67	07
Grp1-2	68	08
Grp3-4	69	09
Grp5-6	6A	0A
Grp7-8	6B	0B
MTX1-2	6C	0C
MTX3-4	6D	0D

Local Gain value

dB	19 VA Hex
+60	7F
+50	6B
+40	57
+30	44
+20	30
+10	1D
+5	13
0	0A
-5	00

dSNAKE Gain value

dB	58 VA Hex
+60	7F
+50	67
+40	50
+35	45
+30	39
+25	2E
+20	22
+10	0B
+5	00

Fader/Send value

dBu	VA Hex
+10	7F
+5	74
0	6B
-5	61
-10	57
-15	4D
-20	43
-25	39
-30	2F
-35	25
-40	1B
-45	11
-inf	00

GEQ Bands

Freq	70 VX Hex
31.5Hz	00
40Hz	01
50Hz	02
63Hz	03
80Hz	04
100Hz	05
125Hz	06
160Hz	07
200Hz	08
250Hz	09
315Hz	0A
400Hz	0B
500Hz	0C
630Hz	0D
800Hz	0E
1kHz	0F
1k25	10
1k6	11
2kHz	12
2k5	13
3k15	14
4kHz	15
5kHz	16
6k3	17
8kHz	18
10kHz	19
12k5	1A
16kHz	1B

Delay FX time

Time	VAc Hex	VAf Hex
5ms	00	00
100ms	44	31
200ms	54	22
400ms	63	77
800ms	73	68
1.36sec	7F	7F

Compressor Type

Type	61 VA Hex
Manual Peak	00
Manual RMS	01
Auto Slow Opto	02
Auto Punchbag	03

Mute Group

MG	CH Hex
1	50
2	51
3	52
4	53

Mute Grp Assign

MG	off	VA on
1	00	40
2	01	41
3	02	42
4	03	43

DCA Group

MG	CH Hex
1	10
2	11
3	12
4	13

DCA Grp Assign

MG	off	VA on
1	00	40
2	01	41
3	02	42
4	03	43