

This protocol is for use with the Qu-16 or Qu-24 mixer loaded with firmware version V1.50 or later.

V1.50 introduced the following MIDI control:

- Channel Naming
- DCA Groups
- MMC Transport Control
- DAW Bank Up/Down

Note The MIDI channel numbers and NRPN ID previously used by Mute Groups have been re-allocated to the new DCA Groups to be consistent with other Allen & Heath mixers. Mute Groups now use different channel numbers 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 connection at a time over its Network port. This means that Qu supports only one iPad running the Qu-Pad app.

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 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.

REQUEST: **Sysex Header, 10 <iPadFlag>, F7**

Where **<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-16

<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 0FFFfff 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:	$(\text{int16_t}) \mathbf{7C80} - (\text{int16_t}) \mathbf{8000} = \mathbf{FC80}$
	Float and scale:	$(\text{float}) \mathbf{FC80} / 256.0f = -3.5\text{dB}$

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
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			Scene number				Input Channel		Local Gain value		GEQ Bands	
Qu	N Hex	N+1 Hex	Scene	SS Hex	Scene	SS Hex	CH	Hex	19 dB	VA Hex	70 Freq	VX Hex
1	0	1	1	00	65	40	1	20	+60	7F	31.5Hz	00
2	1	2	2	01	66	41	2	21	+50	6B	40Hz	01
3	2	3	3	02	67	42	3	22	+40	57	50Hz	02
4	3	4	4	03	68	43	4	23	+30	44	63Hz	03
5	4	5	5	04	69	44	5	24	+20	30	80Hz	04
6	5	6	6	05	70	45	6	25	+10	1D	100Hz	05
7	6	7	7	06	71	46	7	26	+5	13	125Hz	06
8	7	8	8	07	72	47	8	27	0	0A	160Hz	07
9	8	9	9	08	73	48	9	28	-5	00	200Hz	08
10	9	0A	10	09	74	49	10	29			250Hz	09
11	A	0B	11	0A	75	4A	11	2A			315Hz	0A
12	B	0C	12	0B	76	4B	12	2B			400Hz	0B
13	C	0D	13	0C	77	4C	13	2C			500Hz	0C
14	D	0E	14	0D	78	4D	14	2D			630Hz	0D
15	E	0F	15	0E	79	4E	15	2E			800Hz	0E
16	F	00	16	0F	80	4F	16	2F			1kHz	0F
			17	10	81	50	17	30			1k25	10
			18	11	82	51	18	31			1k6	11
			19	12	83	52	19	32			2kHz	12
			20	13	84	53	20	33			2k5	13
			21	14	85	54	21	34			3k15	14
			22	15	86	55	22	35			4kHz	15
			23	16	87	56	23	36			5kHz	16
			24	17	88	57	24	37			6k3	17
			25	18	89	58	25	38			8kHz	18
			26	19	90	59	26	39			10kHz	19
			27	1A	91	5A	27	3A			12k5	1A
			28	1B	92	5B	28	3B			16kHz	1B
			29	1C	93	5C	29	3C				
			30	1D	94	5D	30	3D				
			31	1E	95	5E	31	3E				
			32	1F	96	5F	32	3F				
			33	20	97	60	33	40				
			34	21	98	61	34	41				
			35	22	99	62	35	42				
			36	23	100	63	36	42				
			37	24			37					
			38	25			38					
			39	26			39					
			40	27			40					
			41	28			41					
			42	29			42					
			43	2A			43					
			44	2B			44					
			45	2C			45					
			46	2D			46					
			47	2E			47					
			48	2F			48					
			49	30			49					
			50	31			50					
			51	32			51					
			52	33			52					
			53	34			53					
			54	35			54					
			55	36			55					
			56	37			56					
			57	38			57					
			58	39			58					
			59	3A			59					
			60	3B			60					
			61	3C			61					
			62	3D			62					
			63	3E			63					
			64	3F			64					

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

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

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

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

Mute Group	CH MG	Hex
1	50	
2	51	
3	52	
4	53	

Mute Grp Assign	MG	off	on
1	00		40
2	01		41
3	02		42
4	03		43

DCA Group	CH MG	Hex
1	10	
2	11	
3	12	
4	13	

DCA Grp Assign	MG	off	on
1	00		40
2	01		41
3	02		42
4	03		43

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

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

Fader/Send value	VA dBu	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	