

This protocol is for use with the Qu-16,24,32 and Qu-Pac loaded with firmware version V1.70 or later.

**Note** Firmware V1.7 introduced dSNAKE socket to input channel patching. There are currently no MIDI messages associated with this patching. Therefore the default one-to-one dSNAKE patching is recommended for users working with MIDI based preamp control.

**Note** Firmware V1.8 introduced Grp/Mix mode for the audio Groups. Send level control is available for groups in mix mode but there are currently no MIDI messages to tell the external controller what mode the group is in.

**Note** For firmware V1.5 onwards 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, 0A, 0B, 0C, 0D = Grp1-2 to 7-8, MTX1-2 to 3-4

**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, VX**

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**

**VX** = dSNAKE socket index (**00** to **27**)

(Does not support dSNAKE input patching)

**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**

<b>Insert In/Out</b>		<b>BN, 63, CH,</b>	<b>BN, 62, 6B,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 07</b>
		Where <b>VA</b> Out = 00, In = 01			
<b>PEQ</b>		<b>BN, 63, CH,</b>	<b>BN, 62, ID,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 07</b>
		Where			
LF Gain		<b>ID = 01</b>	<b>VA</b> -12 to +12dB = 00 to 7F		0dB = 40
LF Freq		<b>ID = 02</b>	<b>VA</b> 20Hz to 20 kHz = 00 to 7F		
LF Width		<b>ID = 03</b>	<b>VA</b> 1.5 to 1/9 Oct = 00 to 7F		
LF Type		<b>ID = 04</b>	<b>VA</b> Bell = 00, Shelf = 06		
LM Gain		<b>ID = 05</b>	<b>VA</b> -12 to +12dB = 00 to 7F		0dB = 40
LM Freq		<b>ID = 06</b>	<b>VA</b> 20Hz to 20 kHz = 00 to 7F		
LM Width		<b>ID = 07</b>	<b>VA</b> 1.5 to 1/9 Oct = 00 to 7F		
HM Gain		<b>ID = 09</b>	<b>VA</b> -12 to +12dB = 00 to 7F		0dB = 40
HM Freq		<b>ID = 0A</b>	<b>VA</b> 20Hz to 20 kHz = 00 to 7F		
HM Width		<b>ID = 0B</b>	<b>VA</b> 1.5 to 1/9 Oct = 00 to 7F		
HF Gain		<b>ID = 0D</b>	<b>VA</b> -12 to +12dB = 00 to 7F		0dB = 40
HF Freq		<b>ID = 0E</b>	<b>VA</b> 20Hz to 20 kHz = 00 to 7F		
HF Width		<b>ID = 0F</b>	<b>VA</b> 1.5 to 1/9 Oct = 00 to 7F		
HF Type		<b>ID = 10</b>	<b>VA</b> Bell = 00, Shelf = 06		
<b>PEQ</b>	In/Out	<b>BN, 63, CH,</b>	<b>BN, 62, 11,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 00</b>
		Where <b>VA</b> Out = 00, In = 01			
<b>HPF</b>	Freq	<b>BN, 63, CH,</b>	<b>BN, 62, 13,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 07</b>
		Where <b>VA</b> 20Hz to 20kHz = 00 to 7F			
<b>HPF</b>	In/Out	<b>BN, 63, CH,</b>	<b>BN, 62, 14,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 00</b>
		Where <b>VA</b> Out = 00, In = 01			
<b>GEQ</b>	Gain	<b>BN, 63, CH,</b>	<b>BN, 62, 70,</b>	<b>BN, 06, VA</b>	<b>BN, 26, VX</b>
		Where <b>VA</b> Gain -12 to +12dB = 00 to 7F			
		<b>VX</b> 00 to 1B = Each of 28 bands (see table)			
<b>GEQ</b>	In/Out	<b>BN, 63, CH,</b>	<b>BN, 62, 71,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 00</b>
		Where <b>VA</b> Out = 00, In = 01			
<b>Gate</b>		<b>BN, 63, CH,</b>	<b>BN, 62, ID,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 07</b>
		Where			
Attack		<b>ID = 41</b>	<b>VA</b> 50us to 300ms = 00 to 7F		
Release		<b>ID = 42</b>	<b>VA</b> 10ms to 1s = 00 to 7F		
Hold		<b>ID = 43</b>	<b>VA</b> 10ms to 5s = 00 to 7F		
Threshold		<b>ID = 44</b>	<b>VA</b> -72 to +18dB = 00 to 7F		
Depth		<b>ID = 45</b>	<b>VA</b> 0 to 60dB = 00 to 7F		
<b>Gate</b>	In/Out	<b>BN, 63, CH,</b>	<b>BN, 62, 46,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 00</b>
		Where <b>VA</b> Out = 00, In = 01			

<b>Comp</b>	<b>BN, 63, CH,</b>	<b>BN, 62, ID,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 07</b>
	Where			
Type	<b>ID = 61</b>	<b>VA</b>	4 types = <b>00, 01, 02, 03</b>	
Attack	<b>ID = 62</b>	<b>VA</b>	300us to 300ms = <b>00</b> to <b>7F</b>	
Release	<b>ID = 63</b>	<b>VA</b>	100ms to 2s = <b>00</b> to <b>7F</b>	
Knee	<b>ID = 64</b>	<b>VA</b>	Hard knee = <b>00</b> , Soft knee = <b>01</b>	
Ratio	<b>ID = 65</b>	<b>VA</b>	1:1 to inf = <b>00</b> to <b>7F</b> , 2.6:1 = <b>50</b>	
Threshold	<b>ID = 66</b>	<b>VA</b>	-46 to +18dB = <b>00</b> to <b>7F</b>	
Gain	<b>ID = 67</b>	<b>VA</b>	0 +18dB = <b>00</b> to <b>7F</b>	

<b>Comp</b> In/Out	<b>BN, 63, CH,</b>	<b>BN, 62, 68,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 00</b>
	Where <b>VA</b> Out = <b>00</b> , In = <b>01</b>			

<b>Delay</b> Time	<b>BN, 63, CH,</b>	<b>BN, 62, 6C,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 07</b>
	Where <b>VA</b> Input 0 to 85ms = <b>00</b> to <b>40</b> (linear)			
	<b>VA</b> Mix 0 to 170ms = <b>00</b> to <b>7F</b> (linear)			
	<b>VA</b> Group 0 to 170ms = <b>00</b> to <b>7F</b> (linear)			
	<b>VA</b> Matrix 0 to 170ms = <b>00</b> to <b>7F</b> (linear)			

<b>Delay</b> In/Out	<b>BN, 63, CH,</b>	<b>BN, 62, 6D,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 00</b>
	Where <b>VA</b> Out = <b>00</b> , In = <b>01</b>			

## FX Parameter Control

<b>Delay FX</b> 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:	<b>BN, 63, CH,</b>	<b>BN, 62, 49,</b>	<b>BN, 06, VAf</b>	<b>BN, 26, VX</b>
MSB:	<b>BN, 63, CH,</b>	<b>BN, 62, 48,</b>	<b>BN, 06, VAc</b>	<b>BN, 26, VX</b>
	Where <b>VAf</b> Fine resolution time value = <b>00</b> to <b>7F</b>			
	<b>VAc</b> Course resolution time value = <b>00</b> to <b>7F</b>			
	<b>VX</b> Delay parameter <b>05</b> = Left tap			
	<b>07</b> = Right tap			
	(See table for examples of time value)			

<b>Delay FX</b> Link	To link or unlink the Left and Right tap time.			
	<b>BN, 63, CH,</b>	<b>BN, 62, 48,</b>	<b>BN, 06, VA</b>	<b>BN, 26, 06</b>
	Where <b>VA</b> Off (unlinked) = <b>00</b>			
	On (linked) = <b>7F</b>			

## 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.

<b>Sysex Header</b>	<b>Sysex Header</b>			
	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, < MeterOnOff > , F7**

### REPLY:

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

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

Where **< MeterOnOff >** = 0 (meters Off), 1 (meters On)

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 CCCcCCC DDDdDDD EEEeeee FFFFfff GGGgggg**

becomes :

**0ABCDEFG 0AAAAaaa 0BBBBbbb 0CCCccc 0DDDddd 0EEEeeee 0FFFfff 0GGGggg**

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	<b>00100000 01111100 00000000</b>
	Unpacks to 8-bit-ized binary	<b>01111100 10000000</b>
	Equivalent to hexadecimal	<b>7C80</b>
	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

16 Mono Input blocks  
80 unused meters  
3 Stereo Input blocks  
20 unused meters  
4 Mono Mix blocks  
4 Stereo Mix blocks  
1 Stereo Monitor block  
4 Stereo FX blocks

#### Qu-24

24 Mono Input blocks  
3 Stereo Input blocks  
180 unused meters  
4 Mono Mix blocks  
4 Stereo Mix blocks  
2 Stereo Group blocks  
2 Stereo Matrix blocks  
1 Stereo Monitor block  
4 Stereo FX blocks

#### Qu-32

24 Mono Input blocks (CH1-24)  
3 Stereo Input blocks  
20 unused meters  
8 Mono Input blocks (CH25-32)  
4 Mono Mix blocks  
4 Stereo Mix blocks  
4 Stereo Group blocks  
2 Stereo Matrix 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  
Ducker 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  
Ducker 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  
Ducker 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  
Ducker 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  
Ducker 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  
Ducker 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

