Waldorf MIDI Implementations

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This documentation details how to control Waldorf synthesizers from MIDI, especially via MIDI System Exclusive Messages.
Currently this draft copy includes an unfinished version for the Q, Q+, microQ and rackAttack. Documentation for other Waldorf synths, especially the Blofeld, microWave and WAVE will follow as time permits.
Please report any errors you may find, suggestions for improvement are also welcome.
If you have documentation for the Waldorf Midibay, 4Pole etc., please let me know.

Contents

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1 General

1.1 Notation

Elements of MIDI messages will be shown in fixed width font. Single words appear without any further qualification, a name within angles signifies that the actual parameter will potentially consist of more than one word and anything within brackets is optional or depends on context.

```
Example := ID <MSG>[n] [PARA]
```

The above example defines a message with the name Example consisting of a single word `ID`, followed by an undefined `<MSG>` comprised of `n` words (or of unspecified length if `[n]` is ommitted) and a one-word-parameter PARA that may or may not be present depending on context (esp. the content of the message). Numbers without any tagging will be decimal. Hexadecimal numbers will be tagged with the suffix "h", binary numbers with the suffix "b". For both hexadecimal and binary numbers all digits including any leading zeros will be shown to disambiguate the number of bits that are used.

```
127 := 7Fh
5Ah := 01011010b
```

The possible values for a parameter will be enumerated and separated by comma, a contiguous range is abbreviated by the first and last value separated by a double colon, a contiguous range with defined increment other than one additionally will have the increment in parens. Combinations are possible.

```
Example1    := 00h, 10h, 18h
13h::15h    := 13h, 14h, 15h
00h::09h(3) := 00h, 03h, 06h, 09h
Complex     := 00h, 10h, 13h::15h, 16h::6Eh(2)
Low_Mid_Top := 00h::40h::7fh
```

For bitstrings and packed fields the comprising components will be defined as symbols that are then used in the definition of the field or bitstring.

```
x           := 3h::Bh
y           := 4h, 7h, Ch
TWONIBBLES  := xyh
ttt         := 010b::101b
uuu         := 000b::111b
BITSTRING   := 0ttt1uuub
```

Features that are either not implemented or behave different from the specification are shown in red.

1.2 MIDI System Exclusive Messages

System Exclusive Messages (SysEx) are a way to send almost anything over MIDI. Only the start and end of a System Exclusive Message is defined by MIDI, the interpretation of the data inbetween is defined by the manufacturer of the MIDI equipment. By convention, the first byte of data is the Manufacturer ID, assigned by the International MIDI Association (IMA) and therefore sometimes called IMA ID. Since all single-byte Manufacturer IDs have been assigned, two-byte Manufacturer IDs are now also used.

System Exclusive Messages as defined in the MIDI standard are of the following general form (for more info see the MIDI specification):

```
SysEx := SOX MID <DATA>[n] [EOX]
```

System Exclusive Message					
Index	Mnemonic	$Value_{16}$	$Value_{10}$	Description	Name
0	SOX	F0h	240		Start of SysEx
1	MID	01h::7Ch 7Dh 7Eh 7Fh	1::124 125 126 127	Commercial Non-Commercial Non-Real-Time Real-Time	Manufacturer ID
1 2 3	MID	00h 00h::7Fh 00h::7Fh	0 0::127 0::127	Extension Escape MID Byte 1 MID Byte 2	
2, 4	<DATA>[n]	00h::7Fh	0::127		SysEx data
2+n 4+n	EOX	F7h	247		End of SysEx

Notes

- System Exclusive Messages are not channel messages and can therefore not be targeted at specific devices on a MIDI wire unless the manufacturer defined protocol provides such functionality. If two devices' interpretation of System Exclusive Messages collide, you have to put them on different MIDI wires.
- Some MIDI interfaces or MIDI interface drivers cannot deal correctly at all with System Exclusive Messages or produce errors for messages exceeding a certain length. Always check if the cause of your problems might be the interface or any accompanying driver software.
- Most software sequencers are by default set to filter System Exclusive Messages. These filters have to be modified or disabled, sometimes on a per track or per interface basis if System Exclusive Messages are to be used.

1.3 Waldorf System Exclusive Messages

Waldorf System Exclusive Messages are of the following general form:

```
SysEx := SOX IDW IDM IDD CMD <MSG>[n] [CHK] EOX
```

Waldorf System Exclusive Message					
Index	Mnemonic	$Value_{16}$	$Value_{10}$	Description	Name
0	SOX	F0h	240		Start of SysEx
1	IDW	3Eh	62	Waldorf	Manufacturer ID
2	IDM	00h, 01h, 03h, 04h, 0Bh, 0Eh, 0Fh, 10h, 11h 13h	0, 1, 3, 4, 11, 14, 15, 16, 17 19	microWave MIDIbay WAVE miniWorks 4-Pole Pulse microWave 2 / XT Q / Q+ microQ rackAttack Blofeld	Model ID
3	IDD	00h, 01h..1Eh, 7Fh	0, 1::126, 127	Default User Defined Broadcast	Device ID
4	CMD			see Table	Command
5	<MSG>[n]	00h::7Fh	0::127	as defined by CMD	Message
5+n	[CHK]	00h::7Fh	0::127	not for all CMD	Checksum
6+n	EOX	F7h	247		End of SysEx

1.3.1 Manufacturer ID

The manufacturer ID for Waldorf is used by all Waldorf equipment, but also on some gear that Waldorf designed for Steinberg and apparently Steinberg has used this ID on some of their own hardware even though they have their own ID assigned by the IMA.

1.3.2 Model ID

Different models of Waldorf gear have different model ID. However the model ID alone is not sufficient to distinguish between different models as some models can convert data meant for other models. For instance the Q reacts to sound dumps coming from a microQ and converts some (but not all) parameters that are differently scaled. Conversely a microQ tries to make the best possible sense of Q sound dumps it receives.

1.3.3 Device ID

The device ID can be used to disambiguate between several machines of the same model or models that have compatible sysex implementations.

Notes

- Factory soundsets are addressed to the default device ID of zero. If you are a creator of soundsets, please adhere to that convention.
- If you don't inadvertently want to overwrite sounds in memory, you can keep the device ID at some other value than zero. Remember to temporarily change it back to zero when loading new soundsets.
- A device ID of 127 adresses all devices (broadcast) regardless of their device ID setting. This is currently used for OS dumps, you thus need to ensure by other means that only the selected device receives the OS dump.

1.3.4 Command

SysEx commands are organized in an X-Y matrix where the column (X, low nibble) defines the data type and the row (Y, high nibble) identifies the type of request or dump. The device will respond with the corresponding Dump Message to well-formed Requests and with the corresponding Parameter Change Message to a well-formed Inquiry . There is no acknowledgement or handshake of any form. Parameter changes and Inquiries are used to access single parameters in any of the data types. This facilitates incremental changes to any of the internal data by outboard gear like other Waldorf synthesizers, master keyboards, control surfaces and editor programs. Most Waldorf synths can be configured to send Parameter Changes in response to user interaction at the device, manual dumps of all data types are possible as well.

Notes

- Waldorf uses undocumented message IDs, for instance for OS updates on those models that have Flash memory. For these messages the checksum is always evaluated. No attempt should be made to modify or send messages of this type, unless provided by Waldorf. Serious damage to the device may occur if messages of these types are tampered with.

1.3.5 Message

This is the actual message, which is not required for certain types of commands (its length then becomes zero).

1.3.6 Checksum

MIDI isn't a very reliable transport medium. Therefore longer sysex messages are protected by a checksum, which is the sum of all sysex bytes from `CMD` to the end of `MSG` truncated to 7 bits (modulo 127). If the sum calculated from the received bytes and the transmitted checksum differ, something has gone wrong. When the checksum is evaluated, a wrong checksum will cause the complete message to be ignored.

Notes

- A checksum of 7Fh is always accepted as valid. This can be used if data is altered manually or produced by MIDI control surfaces with limited capabilities. This option should not be employed by editor programs to skip the checksum calculation.
- On some models or for some message types the command or the first bytes of the message are not included in the checksum calculation or no checksum is required – check the model specific MIDI implementation for details.
- Not all Waldorf gear actually evaluates the checksum for all datatypes when receiving data, even when a checksum byte is defined to be present. Thus corrupt messages can get through and may lead to unexpected reactions. If a corrupt sound program is stored in memory, then selection of that program can reliably crash the synth for instance.

1.4 MIDI Channel Messages

The MIDI specification defines 16 logical channels. Channel Messages are addressed to one of these logical channels and are received by all MIDI instruments set to this channel. The type of message and its logical channel is encoded into the first byte (the so-called status byte) of the message. Examples for Channel Messages are Note On/Off, Polyphonic Aftertouch, Channel Pressure, Program Changes and Control Changes. The interpretation of some of these messages is not defined, so MIDI instruments that differ in their interpretation have to be kept at different logical MIDI channels or even different MIDI wires.

1.4.1 Control Change

MIDI originally defined 32 continous controllers with 14bits resolution, so each controller had an MSB and LSB part plus 32 switch controllers along with some channel mode messages. Later facilities to extend this to more synth parameters were added (RPN and NRPN), but not standardized. Nobody seems to care much about the original definition since the behavior was unspecified anyway. MIDI Control Change messages are nowadays often used as simply channel mode messages that carry seven bit of data. The eight last controllers (CC#120::CC#127) are standardized and thus off limits. Anything else is fair game, which is just another reason for not having two devices receive on the same MIDI channel.

1.4.2 Program Change

Program changes take the general form

```
FullProgChange := <CC#0> BMSB <CC#32> BLSB <ProgChng> PRG
```

as defined in the MIDI standard. The bank select is introduced by sending standard MIDI CC#0 and MIDI CC#32. The values sent are supposed to be ”sticky” so it is possible to switch a program many times without having to re-send the bank number. Bank switches take effect immediately, leaving the program number unchanged.

Depending on the complexity of the corresponding MIDI instrument the bank switch MSB command or both bank switch commands may not be needed. The number and layout of banks is defined by the MIDI implementation of the respective MIDI instrument.

2 Waldorf Q MIDI Implementation OS 3.00
Waldorf Q+ MIDI Implementation OS 3.50

This chapter is based on an earlier document compiled for OS 2.16 by Michael Goins, Mark Pulver and Amanda Pehlke. It was extended to include the changes for OS 3.00 by Achim Gratz. Permission has been granted to re-publish the document unter the GFDL.

The Waldorf Q and the Q+ have a very similar MIDI implementation, therefore both are described together, and only the few differences are noted.

2.1 Message Type Definitions

The model ID of both the Q and the Q+ is `0Fh`.

2.1.1 Message Type Matrix

The message type matrix for the Waldorf Q and Q+ is defined as follows:

Command		**Request** R 0yh	**Dump** D 1yh	**Parameter Change** P 2yh	**Parameter Inquiry** Q 3yh	**Reserved** 4yh::6yh	**Reserved** 7yh
Sound	SND x0h	SNDR 00h	SNDD 10h	SNDP 20h	SNDQ 30h		BOOT 70h
Multi	MUL x1h	MULR 01h	MULD 11h	MULP 21h	MULQ 31h		OS 71h
Drum Map	DRM x2h	DRMR 02h	DRMD 12h	DRMP 22h	DRMQ 32h		BIN 72h
Sequencer Pattern	PAT x3h	PATR 03h	PATD 13h	PATP 23h	PATQ 33h		AFM 73h
Global Parameter	GLB x4h	GLBR 04h	GLBD 14h	GLBP 24h	GLBQ 34h		
Reserved	x5h:x6h						
Mode Parameter	MOD x7h	MODR 07h	MODD 17h	MODP 27h	MODQ 37h		
Reserved	x8h::xfh						

Notes

- Access of parameters directly in memory is currently not implemented. Transfers from and to memory have to use full dumps or go through edit buffers of the appropriate type. Exceptions are Global Parameters, where no corresponding edit buffer exists. Global Parameters are scanned continously for changes by the Q and are automatically saved.
- Full remote control of the Q is currently not possible. The missing functions will very likely be implemented through the MOD functions. Remote Control messages like on the MW/MW2/MWXT may never show up.
- AFM (analog filter module) data is only used on the Q+.

2.1.2 Memory Organization

The memory of the Waldorf Q is organized as three Sound banks with 100 entries each, one Drum Map bank with 20 entries, one sequencer Pattern bank with 100 entries and one Multi bank with 100 entries. Optionally external memory can be provided on a memory card, which adds one Sound bank with 100 entries, one Multi bank with 10 entries and one Drum Map bank with 20 entries. While the Q recognizes 32 kiB and 64 kiB memory cards, it does not provide extra banks or entries on the larger card.

2.1.3 Checksum

The checksum is omitted for parameter changes and requests. The Q currently does not evaluate the checksum for dumps it receives; this is considered a bug and you should not rely on that "feature". The Q will eventually reject data with an incorrect checksum.

2.1.4 SND – Sound Parameters

Messages dealing with Sounds will take one of the following forms, depending on the message type:

```
Request       := SOX IDW IDE DEV   SNDR BUFN SNDN                    EOX
Dump          := SOX IDW IDE DEV ( SNDD BUFN SNDN <SDAT>[384] CHK ) EOX
Para Change   := SOX IDW IDE DEV   SNDP SNDL PAH PAL SNDV            EOX
Para Inquiry  := SOX IDW IDE DEV   SNDQ SNDL PAH PAL                 EOX
```

Sound Location		
BUFN	SNDN	Location
00h	00h::63h	A001::A100 (deprecated)
01h	00h::63h	B001::B100 (deprecated)
02h	00h::63h	C001::C100 (deprecated)
03h	00h::63h	X001::X100 (deprecated)
10h	00h	All Sounds (Bank X is included if a valid QCard is present)
10h	40h	All Sounds of Bank A
10h	41h	All Sounds of Bank B
10h	42h	All Sounds of Bank C
10h	48h	All Sounds of Bank X
20h	00h	Edit Buffer of Current Sound
30h	00h::0Fh	Edit Buffer of Multi Instrument 1::16 (Multi Mode)
30h	00h::03h	Edit Buffer of Sound Layer Inst. 1::4 (Single Mode)
30h	10h::2Fh	Edit Buffer of Drum Map Instrument 1::32
40h	00h::63h	A001::A100
41h	00h::63h	B001::B100
42h	00h::63h	C001::C100
48h	00h::63h	X001::X100
	SNDL	Location
	00h	Edit Buffer of Current Sound
	00h::0Fh	Edit Buffer of Multi Instrument 1::16 (Multi Mode)
	00h::03h	Edit Buffer of Sound Layer Inst. 1::4 (Single Mode)
	10h::2Fh	Edit Buffer of Drum Map Instrument 1::32

Notes

- Requesting edit buffers that are not in use (e.g. edit buffer 04h::0Fh in single mode or edit buffers for unused drum map instruments) may yield spurious data that should not be fed back to the Q.
- The All Sounds location can only be used in a request, the Q will successively dump all sounds in the addressed range.

2.1.5 MUL

Messages dealing with Multis will take one of the following forms:

```
Request       := SOX IDW IDE DEV   MULR BUFN MULN                      EOX
Dump          := SOX IDW IDE DEV ( MULD BUFN MULN <MDAT>[384] ) CHK EOX
Para Change   := SOX IDW IDE DEV   MULP PAH PAL MULV                   EOX
Para Inquiry  := SOX IDW IDE DEV   MULQ PAH PAL                        EOX
```

Multi Location		
BUFN	MULN	Location
00h	00h::63h	001::100 (deprecated)
03h	00h::09h	X01::X10 (deprecated)
10h	00h	All Multis (external Multis are included if a valid QCard is present)
10h	40h	All internal Multis
10h	48h	All external Multis
20h	00h	Edit Buffer of Current Multi
40h	00h::63h	001::100
48h	00h::09h	X01::X10

Notes

- Sending Multi Dumps as well as requesting the multi edit buffer in Single Mode will switch the Q into Multimode (bug or feature?). Multis in memory can not be requested while in single mode, these requests will be ignored.
- The All Multis category can only be used in a request, the Q will dump successively all multis in the addressed range.

2.1.6 DRM

Messages dealing with Drum Maps will take one of the following forms:

```
Request       := SOX IDW IDE DEV   DRMR BUFN DRMN                      EOX
Dump          := SOX IDW IDE DEV ( DRMD BUFN DRMN <DDAT>[384] ) CHK EOX
Para Change   := SOX IDW IDE DEV   DRMP PAH PAL DRMV                   EOX
Para Inquiry  := SOX IDW IDE DEV   DRMQ PAH PAL                        EOX
```

Drum Map Location		
BUFN	DRMN	Location
00h	00h::13h	D01::D20 (deprecated)
01h	00h::13h	E01::E20 (deprecated)
10h	00h	All Drum Maps (external Drum Maps are included if a valid QCard is present)
10h	40h	All internal Drum Maps
10h	48h	All external Drum Maps
20h	00h	Edit Buffer of Current Drum Map
40h	00h::13h	D01::D20
40h	00h::13h	E01::E20

Notes

- Parameter changes for Drum Maps are currently not implemented, the Q will neither send nor receive those messages.
- In single mode it is possible to request the current Drum Map edit buffer even though no Drum Map is currently active. The data received may be spurious and should not be fed back to the Q.
- In Multimode or in a Sound Layer it is not necessary to switch to the instrument with the active Drum Map. Since there can only be one Drum Map, requesting the edit buffer of the current Drum Map always works.
- The All Drum Maps category can only be used in a request, the Q will dump successively all Drum Maps in the addressed range.

2.1.7 PAT

Messages dealing with Patterns will take one of the following forms:

```
Request      := SOX IDW IDE DEV   PATR BUFN PATN                    EOX
Dump         := SOX IDW IDE DEV ( PATD BUFN PATN <PDAT>[536] ) CHK EOX
Para Change  := SOX IDW IDE DEV   PATP LL PAH PAL PATN              EOX
Para Inquiry := SOX IDW IDE DEV   PATQ LL PAH PAL                   EOX
```

Pattern Location		
BUFN	PATN	Location
00h	00h::63h	001::100 (deprecated)
10h	00h	All Patterns
10h	40h	All internal Patterns
20h	00h	Pattern of Current Sound
30h	00h::0Fh	Edit Buffer of Multi Instrument 1::16 (Multi Mode)
30h	00h::03h	Edit Buffer of Sound Layer Inst. 1::4 (Single Mode)
40h	00h::63h	001::100
	PATL	Location
	00h	Pattern of Current Sound
	00h::0Fh	Edit Buffer of Multi Instrument 1::16 (Multi Mode)
	00h::03h	Edit Buffer of Sound Layer Inst. 1::4 (Single Mode)

Notes

- Patterns do not yet have addressable multi edit buffers even though multi edit buffers of some sort seem to exist in the Q. Currently this functionality has to be emulated by switching to the desired instrument and then requesting or sending the current pattern.
- The All Patterns category can only be used in a request, the Q will dump successively all Patterns in the addressed range.
- Many illegal locations will also yield valid pattern dumps.
- Parameter changes for Patterns are currently not implemented, the Q will neither send nor receive those messages.
- Patterns can currently not be stored on a QCard.

2.1.8 GLB

Messages dealing with Global Data will take one of the following forms:

```
Request      := SOX IDW IDE DEV   GLBR                     EOX
Dump         := SOX IDW IDE DEV ( GLBD <GDATA>[200] ) CHK EOX
Para Change  := SOX IDW IDE DEV   GLBP PAH PAL GLBN        EOX
Para Inquiry := SOX IDW IDE DEV   GLBQ PAH PAL             EOX
```

2.1.9 MOD

Messages dealing with Mode Data will take one of the following forms:

```
Request      := SOX IDW IDE DEV   MODR MODF               EOX
Dump         := SOX IDW IDE DEV ( MODD MODF <FDAT> ) CHK EOX
Para Change  := SOX IDW IDE DEV   MODP MODF PAH PAL MODV EOX
Para Inquiry := SOX IDW IDE DEV   MODQ MODF PAH PAL      EOX
```

2.2 Channel Messages

2.2.1 Control Change

The Q will interpret most CC as changes to sound sound parameters (when reception is enabled via the Global Menu or the Multi Setup). The few standard CC that it recognizes are performance parameters that won't change the sound program.

CC number	Status	Q definition	Standard	Common Clashes
CC#0	*	Bank Select MSB	*	
CC#1	*	Modwheel	*	
CC#3	N/A	Filter Cutoff (F1+F2)		
CC#2	*	Breath Controller	*	
CC#4	*	Foot Controller	*	
CC#5		Glide Rate	*	
CC#6	N/A	Filter Resonance (F1+F2)		Data Entry MSB
CC#7	*	Channel Volume	*	
CC#8	N/A			
CC#9	N/A			
CC#10	*	Pan	*	
CC#11	*	Expression	*	
CC#12		Arp Range		Effect Control #1
CC#13		Arp Length		Effect Control #2
CC#14		Arp Active		
CC#15		LFO 1 Shape		

CC number	Status	Q definition	Standard	Common Clashes
CC#16		LFO 1 Speed		General Purpose #1
CC#17		LFO 1 Sync		General Purpose #2
CC#18		LFO 1 Delay		General Purpose #3
CC#19		LFO 2 Shape		General Purpose #4
CC#20		LFO 2 Speed		
CC#21		LFO 2 Sync		
CC#22		LFO 2 Delay		
CC#23		LFO 3 Shape		
CC#24		LFO 3 Speed		
CC#25		LFO 3 Sync		
CC#26		LFO 3 Delay		
CC#27		Osc 1 Octave		
CC#28		Osc 1 Semitone		
CC#29		Osc 1 Detune		
CC#30		Osc 1 FM		
CC#31		Osc 1 Shape		

CC number	Status	Q definition	Standard	Common Clashes
CC#32	*	Bankselect LSB		
CC#33		Osc 1 PW		
CC#34		Osc 1 PWM		
CC#35		Osc 2 Octave		
CC#36		Osc 2 Semitone		
CC#37		Osc 2 Detune		
CC#38		Osc 2 FM		Data Entry LSB
CC#39		Osc 2 Shape		
CC#40		Osc 2 PW		
CC#41		Osc 2 PWM		
CC#42		Osc 3 Octave		
CC#43		Osc 3 Semitone		
CC#44		Osc 3 Detune		
CC#45		Osc 3 FM		
CC#46		Osc 3 Shape		
CC#47		Osc 3 PW		

CC number	Status	Q definition	Standard	Common Clashes
CC#48		Osc 3 PWM		
CC#49		Sync		
CC#50		Pitchmod		
CC#51		Glide Mode		
CC#52		Osc 1 Level		
CC#53		Osc 1 Balance		
CC#54		Ringmod Level		
CC#55		Ringmod Balance		
CC#56		Osc 2 Level		
CC#57		Osc 2 Balance		
CC#58		Osc 3 Level		
CC#59		Osc 3 Balance		
CC#60		N/E Level		
CC#61		N/E Balance		
CC#62	*	Button1		
CC#63	*	Button2		

CC number	Status	Q definition	Standard	Common Clashes
CC#64	*	Sustain Pedal	*	
CC#65		Glide Active	*	
CC#66	*	Sostenuto	*	
CC#67		Routing		Soft Pedal
CC#68		Filter 1 Type		Legato Pedal
CC#69		Filter 1 Cutoff		Hold 2 Pedal
CC#70		Filter 1 Resonance		Sound Variation
CC#71		Filter 1 Drive		Timbre / Harmonics
CC#72		Filter 1 Keytrack		Release Time
CC#73		Filter 1 Envelope Amount		Attack Time
CC#74		Filter 1 Velocity Amount		Brightness
CC#75		Filter 1 Cutoff Modulation		Sound Control #1
CC#76		Filter 1 FM		Sound Control #2
CC#77		Filter 1 Pan		Sound Control #3
CC#78		Filter 1 Panmod		Sound Control #4
CC#79		Filter 2 Type		Sound Control #5

CC number	Status	Q definition	Standard	Common Clashes
CC#80		Filter 2 Cutoff		General Purpose #5
CC#81		Filter 2 Resonance		General Purpose #6
CC#82		Filter 2 Drive		General Purpose #7
CC#83		Filter 2 Keytrack		General Purpose #8
CC#84		Filter 2 Env. Amount		Portamento Control
CC#85		Filter 2 Env. Velocity		
CC#86		Filter 2 CM		
CC#87		Filter 2 FM		
CC#88		Filter 2 Pan		
CC#89		Filter 2 Panmod		
CC#90		Amp Volume		
CC#91		Amp Velocity		Effect Depth #1
CC#92		Amp Mod		Effect Depth #2
CC#93		FX 1 Mix		Effect Depth #3
CC#94		FX 2 Mix		Effect Depth #4
CC#95		FE Attack		Effect Depth #5
CC number	Status	Q definition	Standard	Common Clashes
CC#96		FE Decay		Data Entry Increment
CC#97		FE Sustain		Data Entry Decrement
CC#98		FE Decay 2		NRPN LSB
CC#99		FE Sustain 2		NRPN MSB
CC#100		FE Release		RPN LSB
CC#101		AE Attack		RPN MSB
CC#102		AE Decay		Mono Pitch
CC#103		AE Sustain		
CC#104		AE Decay 2		
CC#105		AE Sustain 2		
CC#106		AE Release		
CC#107		E3 Attack		
CC#108		E3 Decay		
CC#109		E3 Sustain		
CC#110		E3 Decay 2		
CC#111		E3 Sustain 2		
CC number	Status	Q definition	Standard	Common Clashes
CC#112		E3 Release		
CC#113		E4 Attack		
CC#114		E4 Decay		
CC#115		E4 Sustain		
CC#116		E4 Decay 2		
CC#117		E4 Sustain 2		
CC#118		E4 Release		
CC#119	N/A			
CC#120	*	All Sound Off	*	
CC#121	*	Reset All Controllers	*	
CC#122	*/G	Local Control	*	
CC#123	*	All Notes Off	*	
CC#124	N/A		*	Omni Mode Off
CC#125	N/A		*	Omni Mode On
CC#126	N/A		*	Poly Mode Off
CC#127	N/A		*	Poly Mode On

2.2.2 Program Change

Program Changes are interpreted by the Q according the the mode (Single or Multi) it is in. The behaviour with respect to these messages can be changed by global settings and per Multi Instrument. In particular Program Change messages can be ignored either completely or just the bank switch part of them. In the latter case only sounds within the currently selected sound bank are accessible in Single Mode and only multi programs in the currently selected bank are accessible in Multi Mode. The following table describes the behaviour when the Q is set up to receive complete Program Change messages.

Program Change Parameters			
Parameter	Value	Description	Name
BMSB	00h::7Eh, 7Fh	System DevID 0::126, Broadcast	Bank MSB
BLSB	i: 0b, 1b tt: 00b::11b x: 0b, 1b nnn: 000b::111b ittxnnnb	Pre-OS3, OS3 Sound, DrumMap, Multi, Reserved Internal, External 0::7 (see Table for valid values)	Implementation Data Type Memory Location Bank Bank LSB
PRG	00h::63h 00h::13h 00h::63h 00h::09h	Sound 001::100 Drum Map 001::020 Multi 001::100 (internal) Multi 001::010 (external)	Program Number Program Number Program Number Program Number

The following table lists the valid bank numbers and programs. Some devices or programs will count the bank and program numbers from one instead of zero, especially if they expect decimal input. Adjust

the given bank and program numbers accordingly by adding one if this is the case.

BLSB	PRG	Bank Number	Program Number	Location
00h	00h::63h	0	0::99	A001::A100 (deprecated)
01h	00h::63h	1	0::99	B001::B100 (deprecated)
02h	00h::63h	2	0::99	C001::C100 (deprecated)
03h	00h::63h	3	0::99	X001::X100 (deprecated)
04h	00h::13h	4	0::19	D01::D20 (deprecated)
05h	00h::09h	5	0::9	E01::E10 (deprecated)
40h	00h::63h	64	0::99	A001::A100
41h	00h::63h	65	0::99	B001::B100
42h	00h::63h	66	0::99	C001::C100
48h	00h::63h	72	0::99	X001::X100
50h	00h::13h	80	0::19	D01::D20
58h	00h::09h	88	0::9	E01::E20
60h	00h::63h	96	0::99	Multi 001::100 (internal)
68h	00h::63h	96	0::99	Multi 001::010 (external)

Notes

- The deprecated bank numbers are implemented for compatibility with the behaviour of the former OS versions. This behaviour is not described here and the use of these bank numbers is strongly discouraged.
- The Q currently reacts to a number of invalid program change commands. This includes most of the numbers in the compatibility range and reserved range. Do not use these invalid program change commands.
- The bank select MSB is reserved for distinguishing devices on the same MIDI channel. It should be set to the SysEx Device ID (normally zero). A bank select MSB value of 127 is intended to be received by all devices regardless of their ID, thus acting as a broadcast. The bank select MSB is currently ignored.

2.3 Parameter Encodings

2.3.1 Modulation Sources and Destinations

Modulation Sources and Destinations						
$Value_{10}$	$Value_{16}$	FM Source	Fast Mod Source	Fast Mod Destination	Standard Mod Source	Standard Mod Destination
0	00h	Off	Off	Pitch	Off	Pitch
1	00h	Osc1	LFO1	O1 Pitch	LFO1	O1 Pitch
2	02h	Osc2	LFO1*MW	O1 FM	LFO1*MW	O1 FM
3	03h	Osc3	LFO2	O1 PW	LFO2	O1 PW
4	04h	Noise	LFO2*Prs	O2 Pitch	LFO2*Prs	O2 Pitch
5	05h	Ext L	LFO3	O2 FM	LFO3	O2 FM
6	06h	Ext R	FilterEnv	O2 PW	FilterEnv	O2 PW
7	07h	Ext L+R	AmpEnv	O3 Pitch	AmpEnv	O3 Pitch
8	08h	LFO1	Env3	O3 FM	Env3	O3 FM
9	09h	LFO2	Env4	O3 PW	Env4	O3 PW
10	0Ah	LFO3	Velocity	O1 Level	Keytrack	O1 Level
11	0Bh	FilterEnv	ModWheel	O1 Bal	Velocity	O1 Bal
12	0Ch	AmpEnv	Pitchbend	O2 Level	Rel Velocity	O2 Level
13	0Dh	Env3	Pressure	O2 Bal	Pressure	O2 Bal
14	0Eh	Env4		O3 Level	Poly Pressure	O3 Level
15	0Fh			O3 Bal	PitchBend	O3 Bal
16	10h			Ring Level	Modwheel	Ring Level
17	11h			Ring Bal	Sust. Controller	Ring Bal
18	12h			N/E Level	Foot Controller	N/E Level
19	13h			N/E Bal	Breath Controller	N/E Bal
20	14h			Routing	Control W	Routing
21	15h			F1 Cutoff	Control X	F1 Cutoff
22	16h			F1 Res	Control Y	F1 Res
23	17h			F1 FM	Control Z	F1 FM
24	18h			F1 Drive	Ctr Delay	F1 Drive
25	19h			F1 Pan	Mod1	F1 Pan
26	1Ah			F2 Cutoff	Mod2	F2 Cutoff
27	1Bh			F2 Res	Mod3	F2 Res
28	1Ch			F2 FM	Mod4	F2 FM
29	1Dh			F2 Drive	min	F2 Drive
30	1Eh			F2 Pan	MAX	F2 Pan
31	1Fh			Volume	Button1	Volume
32	20h				Button2	LFO1 Speed
33	21h				Last Button	LFO2 Speed
34	22h				Prev Button	LFO3 Speed
35	23h				Seq Cutoff	FE Attack
36	24h				Seq CV1	FE Decay
37	25h				Seq CV1 Run	FE Sustain
38	26h				Seq CV2	FE Release
39	27h				Seq CV2 Run	AE Attack
40	28h				Seq Step	AE Decay
41	29h				Seq Steplen	AE Sustain
42	2Ah				Seq Notelen	AE Release
43	2Bh				Voice Num	Env3 Attack
44	2Ch				Voice %16	Env3 Decay
45	2Dh				Voice %8	Env3 Sustain
46	2Eh				Voice %4	Env3 Release
47	2Fh				Voice %2	Env4 Attack
48	30h				Unisono Voice	Env4 Decay
49	31h					Env4 Sustain
50	32h					Env4 Release
51	33h					M1F Amount
52	34h					M2F Amount
53	35h					M1S Amount
54	36h					M2S Amount
55	37h					O1 Sub Div
56	38h					O1 Sub Volume
57	39h					O2 Sub Div
58	3Ah					O2 Sub Volume

2.3.2 Tap Delay Parameter

The Tap parameters for the Tap Delay have a complicated encoding. The reason for this is that to store the parameters in a bitfield you'd need 12 Bytes in memory, while only 11 Bytes are available. However, a little back-of-the-envlope math shows that each tap only has 24 different values, which works out to about 74 bits, which together with the two bits for feedback ducking fit easily into the available space. Thanks to Stefan Stenzel of Waldorf Music AG for allowing the reproduction of the following code:

```
// encode pattern to fit into 77 bits
void Gencode(char *packed, char *pat)
{
      int i,k;
      long l,lv[4];
      short s;
      for(k=0; k<3; k++)
          {
            for(l=i=0; i<5; i++) {
                  l*=24;
                  s = *pat++;           // Level 0-7
                  s|= (*pat++ <<3);     // Pan 0-2
                  l+=s;
                }
            lv[k]=1;
          }
      l=lv[0];
      *packed++ = l&0x7F;               // saved 7 16 left
      l>>=7;
      *packed++ = l&0x7F;               // saved 7 9 left
      l>>=7;
      *packed++ = l&0x7F;               // saved 7 2 left
      l>>=7;
      l&=3;
      l|=lv[1]<<2;                      // now 2+23=25 bits
      *packed++ = l&0x7F;               // saved 7 18 left
      l>>=7;
      *packed++ = l&0x7F;               // saved 7 11 left
      l>>=7;
      *packed++ = l&0x7F;               // saved 7 4 left
      l>>=7;
      l&=0x0F;
      l|=lv[2]<<4;                      // now 4+23=27 bits
      *packed++ = l&0x7F;               // saved 7 20 left
      l>>=7;
      *packed++ = l&0x7F;               // saved 7 13 left
      l>>=7;
      *packed++ = l&0x7F;               // saved 7 6 left
      l>>=7;
      *packed++ = l&0x3F;               // saved 6 0 left

      s = *pat++;                       // Level 0-7
      s|= (*pat++ << 3);                // Pan 0-2
      s|=((*pat<<2) & 0x60 );           // Ducking

      *packed = s&0x7F;                 // saved last value
}
```

```
// decode pattern from 77 bits
void Gdecode(unsigned char *packed, char *pat)
{
      int i,k;
      long l,lv[4];
      short s;

      l=packed[3];
      l&=3;
      l<<=7;
      l|=packed[2];                     // 2+7=9 bits
      l<<=7;
      l|=packed[1];                     // 16 bits
      l<<=7;
      l|=packed[0];                     // 23 bits
      lv[0]=l;

      l=packed[6];
      l&=0x0F;
      l<<=7;
      l|=packed[5];                     // 4+7=11 bits
      l<<=7;
      l|=packed[4];                     // 18 bits
      l<<=5;
      l|=packed[3]>>2;                  // 23 bits
      lv[1]=l;

      l=packed[9];                      // 6
      l<<=7;
      l|=packed[8];                     // 6+7=13 bits
      l<<=7;
      l|=packed[7];                     // 20 bits
      l<<=3;
      l|=packed[6]>>4;                  // 23 bits
      lv[2]=l;

      for(k=0; k<3; k++)
          {
            l=lv[k];
            for(i=8; i>=0; i-=2) {
                  s=l\%24;
                  l/=24;
                  pat[i]  = s&7;        // Level 0-7
                  pat[i+1]= s>>3;       // Pan 0-2
                }
             pat+=10;
            lv[k]=l;
          }
      s=packed[10];
      *pat++ = s&7;                     // Level 0-7

      i = (s>>3)&3;                     // Pan 0-2
      if(i >= 3) i=0;
      *pat++ = i;                       // Pan 0-2

      *pat++ = (s & 0x60)>>2;           // Feedback Ducking
}
```

We see that in the actual implementation only the first 15 taps are encoded into 70 bits, while the last tap plus feedback ducking are encoded as a bitfield for the remaining 7 bits (taking up exactly 11 Bytes in memory). One has to be careful to work out that 70 bit number without overflowing the internal range of the DSP. First, for each of the taps a number between 0 and 23 is computed from Pan and Level (the variable `s` in the code). This number is added to a running sum (variable `l`), which starts out at zero and for each tap is multiplied by 24. Every five taps a fresh number is started to keep the number of bits below 24, which is the natural size of an integer on the used Motorola DSP. That produces a binary encoding of three five digit numbers to base 24, each 23 bits long. The bits in these numbers are then simply concatenated and chopped into 7 bit long pieces that are stored successively in memory with the LSB first. For getting the actual taps values back, you need to collect them from memory in the appropriate order, build the three numbers and successively divide by 24, keeping the remainder as the tap value.

2.4 Data Type Definitions

2.4.1 SDAT

The sound data format exists in several versions, the Q stores the version number together with the sound and will do the appropriate conversions for older formats it knows about. The Q currently accepts sound dumps of an unknown version and hopes for the best. Editors should only work on sound formats they know and produce only the latest sound format. If a sound dump is received with an unknown sound version, no data should be changed. The currently known sound formats differ only by the scaling of some parameters. The current format V9 has been stable since about OS1.16, so it is the only format described here. Q's at an older OS version than 3.00 will ignore some of the data listed since the corresponding functionality did not exist in the older OS versions.

The Q+ uses additional parameter encodings for the analog filter types and an additional parameter for the noise colour. Additionally some parameter scalings are different from the Q, however no conversions are done as the sound version number has unfortunately not been changed. It is therefore necessary to keep track of the origin — Q or Q+ — of sound dumps.

Sound							
Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
0	00h 00h			09h	9	Version 9	Sound Format
Oscillator							
Osc1		**Osc2**		**Osc3**			
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
1	00h 01h	17	00h 11h	33	00h 21h	10h,1Ch,28h, 34h,40h,4Ch, 58h,64h,70h	16, 28, 40, 52, 64, 76, 88, 100, 112	128', 64', 32', 16', 8', 4', 2', 1', $\frac{1}{2}$'	Octave
2	00h 02h	18	00h 12h	34	00h 22h	34h::40h::4Ch	52::64::76	-12::0::+12	Semitone
3	00h 03h	19	00h 13h	35	00h 23h	00h::40h::7Fh	0::64::127	-64::0::+63	Detune
4	00h 04h	20	00h 14h	36	00h 24h	28h::40h::58h	40::64::88	-24::0::+24	Bend Range
5	00h 05h	21	00h 15h	37	00h 25h	00h::40h::7Fh	0::64::127	-200%::0%::+196%	Keytrack
6	00h 06h	22	00h 16h	38	00h 26h	00h::0Eh	0::14	Off, Osc1, Osc2, Osc3,Noise, Ext Left, Ext Right, Ext L+R,LFO1, LFO2, LFO3,Filter Env, Amp Env, Env 3, Env 4	FM Source
7	00h 07h	23	00h 17h	39	00h 27h	00h::7Fh	0::127		FM Amount
8	00h 08h	24	00h 18h			00h::05h	0::5	Pulse, Saw, Triangle, Sine, Alt1, Alt2	Shape
				40	00h 28h	00h::03h	0::3	Pulse, Saw, Triangle, Sine	Shape
9	00h 09h	25	00h 19h	41	00h 29h	00h::7Fh	0::127		Pulsewidth
10	00h 0Ah	26	00h 1Ah	42	00h 2Ah	00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4,Velocity, ModWheel, Pitchbend, Pressure	PWM Source
11	00h 0Bh	27	00h 1Bh	43	00h 2Bh	00h::40h::7Fh	0::64::127	-64::0::+63	PWM
12	00h 0Ch	28	00h 1Ch			00h::1Fh	0::31	1::32	Sub Freq Div
13	00h 0Dh	29	00h 1Dh			00h::7Fh	0::127		Sub Volume
Sync							
Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
49	00h 31h			00h, 01h	0, 1	Off, On	Enable
PitchMod							
Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
50	00h 32h			00h::0Dh	0::13	Off, LFO1, LFO1*MW,LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4,Velocity, ModWheel, Pitchbend, Pressure	Source
51	00h 33h			00h::40h::7Fh	-64::0::+63		Amount
Glide							
Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
53	00h 35h			00h::01h		Off, On	Active
56	00h 38h			00h, 01h, 02h, 04h	0, 1, 2, 4	Portamento, Fingd. Portamento, Glissando, Fingd. Glissando	Mode
57	00h 39h			00h::7Fh	0::127		Rate
Sound							
Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
58	00h 3Ah			m:0h::1h n:0h::5h nmh	0, 1 0, 1, 2::5	Poly, Mono Off,Dual,3::6	Voice Mode Unisono Count
59	00h 3Bh			00h::7Fh	0::127		Unisono Detune
Mixer							
Osc1		**Osc2**		**Osc3**			
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
61	00h 3Dh	63	00h 3Fh	65	00h 41h	00h::7Fh	0::127		Level
62	00h 3Eh	64	00h 40h	66	00h 42h	00h::40h::7Fh	0::64::127	F1 64::Mid::F2 63	Balance
Mixer							
Noise/Ext.In		**Ring Mod**							
Idx	PAH PAL	Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
67	00h 43h	71	00h 47h			00h::7Fh	0::127		Mix Level
68	00h 44h	72	00h 48h			00h::40h::7Fh	0::64::127	F1 64::Mid::F2 63	Balance
69	00h 45h					00h::40h::7Fh	0::64::127	Red::White::Blue	Noise Colour (Q+ only)
75	00h 4Bh					00h::03h	0::3	Noise,Ext Left, Ex Right, Ext L+R	Select F1
76	00h 4Ch					00h::03h	0::3	Noise,Ext Left, Ex Right, Ext L+R	Select F2

Filter							
Filter 1		**Filter 2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
77	00h 4Dh	97	00h 61h	00h, 01h, 02h, 03h, 04h, 05h, 06h, 07h, 08h, 09h, 0Ah, 0Bh,	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,	Bypass, 24dB LP, 12dB LP, 24dB BP, 12dB BP, 24dB HP, 12dB HP, 24dB Notch, 12dB Notch, Comb+, Comb-, PPG	Type
				0Ch, 0Dh	12, 13	Analog 24dB LP, Analog 12dB LP	(Q+ only)
78	00h 4Eh	98	00h 62h	00h::7Fh	0::127		Cutoff
80	00h 50h	100	00h 64h	00h::7Fh	0::127		Resonance
81	00h 51h	101	00h 65h	00h::7Fh	0::127		Drive
86	00h 56h	106	00h 6Ah	00h::40h::7Fh		0::64::127 -200%::0%::+196%	Keytrack
87	00h 57h	107	00h 6Bh	00h::40h::7Fh	0::64::127	-64::0::+63	Envelope Modulation
88	00h 58h	108	00h 6Ch	00h::40h::7Fh	0::64::127	-64::0::+63	Velocity Modulation
89	00h 59h	109	00h 6Dh	00h::0Dh		Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Modulation Source
90	00h 5Ah	110	00h 6Eh	00h::40h::7Fh	0::64::127	-63::0::+63	Cutoff Modulation
91	00h 5Bh	111	00h 6Fh	00h::0Eh		Off, Osc1, Osc2, Osc3, Noise, Ext Left, Ext Right, Ext L+R, LFO1, LFO2, LFO3, Filter Env, Amp Env, Env 3, Env 4	FM Source
92	00h 5Ch	112	00h 70h	00h::7Fh	0::127	Off, 1::127	FM Amount
93	00h 5Dh	113	00h 71h	00h::40h::7Fh	0::64::127	Left 64::Center::Right 63	Pan
94	00h 5Eh	114	00h 72h	00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Pan Mod Source
95	00h 5Fh	115	00h 73h	00h::40h::7Fh	0::64::127	-64::0::+63	Pan Modulation

Filter				
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
117	00h 75h	00h::7Fh	0::127	serial::parallel	Routing
118	00h 76h	01h::03h	1::3	F1, F2, F1+F2	Select
Amp					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
121	00h 79h	00h::7Fh	0::127		Volume
122	00h 7Ah	00h::40h::7Fh	0::64::127	-64::0::+63	Velocity
123	00h 7Bh	00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Modulation Source
124	00h 7Ch	00h::40h::7Fh	-64::0::+63		Modulation Amount
XPhorm					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
125	00h 7Dh	00h::02h	0::2	Off, Modwheel, Pressure	Control
126	00h 7Eh	00h::03h	0::3	A::C, X	Sound Bank
127	00h 7Fh	00h::63h	1::100		Sound Number

Effects							
FX1		**FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
128	01h 00h	144	01h 10h	00h::09h	0::9	Bypass, Chorus, Flanger, Phaser, Delay, Overdrive, Five FX, Vocoder, Reverb, Tap Delay	Effect
		144	01h 10h	20h::21h	32, 33	5.1 Delay, 5.1 D.Clk	Effect FX2 only
129	01h 01h	145	01h 11h	00h::7Fh	0::127	Dry::Wet	Mix

Effects											
Chorus FX1		**Chorus FX2**		**Flanger FX1**		**Flanger FX2**					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	130	01h 02h	146	01h 12h	00h::7Fh	0::127		Speed
131	01h 03h	147	01h 13h	131	01h 03h	147	01h 13h	00h::7Fh	0::127		Depth
133	01h 05h	149	01h 15h					00h::7Fh	0::127		Delay
				134	01h 06h	150	01h 16h	00h::7Fh	0::127	0%::100%	Feedback
				138	01h 0Ah	154	01h 1Ah	00h,01h	0, 1	Positive, Negative	Polarity
Phaser FX1		**Phaser FX2**		**Delay FX1**		**Delay FX2**					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h					00h::7Fh	0::127		Speed
131	01h 03h	147	01h 13h					00h::7Fh	0::127		Depth
134	01h 06h	150	01h 16h	134	01h 06h	150	01h 16h	00h::7Fh	0::127	0%::100%	Feedback
135	01h 07h	151	01h 17h					00h::7Fh	0::127		Center
				135	01h 07h	151	01h 17h	00h::7Fh	0::127		Cutoff
136	01h 08h	152	01h 18h					00h::7Fh	0::127		Spacing
				137	01h 09h	153	01h 19h	00h	0	Off	Clocked
138	01h 0Ah	154	01h 1Ah	138	01h 0Ah	154	01h 1Ah	00h, 01h	0, 1	Positive, Negative	Polarity
				139	01h 0Bh	155	01h 1Bh	00h, 01h	0, 1	Off, On	Autopan

Effects							
Clk.Delay FX1		**Clk.Delay FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
132	01h 04h	148	01h 14h	00h, 01h::19h,1Ah::64h,65h::7Fh		Internal, 42::90(2), 91::165(1), 170::300(5)	Tempo
134	01h 06h	150	01h 16h	00h::7Fh	0::127		Feedback
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Cutoff
137	01h 09h	153	01h 19h	01h		0n	Clocked
138	01h 0Ah	154	01h 1Ah	00h, 01h	0, 1	Positive, Negative	Polarity
139	01h 0Bh	155	01h 1Bh	00h, 01h	0, 1	Off, On	Autopan
140	01h 0Ch	156	01h 1Ch	00h::1Dh	0::13	1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
Overdrive FX1		**Overdrive FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
131	01h 03h	147	01h 13h	00h::7Fh	0::127		Drive
132	01h 04h	148	01h 14h	00h::7Fh	0::127		Post Gain
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Cutoff

Effects							
FiveFX FX1		**FiveFX FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::7Fh	1::127		Chorus Speed
131	01h 03h	147	01h 13h	00h::7Fh	0::127		Chorus Depth
132	01h 04h	148	01h 14h	00h::7Fh	0::127		Delay
133	01h 05h	149	01h 15h	00h::7Fh	0::127		Chorus/Delay L
134	01h 06h	150	01h 16h	00h::7Fh	0::127	44.1KHz::2.6Hz	Sample&Hold
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Overdrive
136	01h 08h	152	01h 18h	00h::08h	0::8	External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Ring Mod Source
137	01h 09h	153	01h 19h	00h::7Fh	0::127		Ring Mod Level
Vocoder FX1		**Vocoder FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::17h	2::25		Bands
131	01h 03h	147	01h 13h	00h::08h		External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Analysis Signal
132	01h 04h	148	01h 14h	00h::7Fh		10.9Hz::16.7KHz	A. Lo Freq
133	01h 05h	149	01h 15h	00h::7Fh		10.9Hz::16.7KHz	A. Hi Freq
134	01h 06h	150	01h 16h	00h::40h::7Fh	-128::-32(x3), -34::0::31(x1), +35::+128(x3)		S. Offset
135	01h 07h	151	01h 17h	00h::40h::7Fh	-128::-32(x3), -34::0::31(x1), +35::+128(x3)		Hi Offset
136	01h 08h	152	01h 18h	00h::40h::7Fh		-64::0::+63	Bandwidth
137	01h 09h	153	01h 19h	00h::40h::7Fh		-64::0::+63	Resonance
138	01h 0Ah	154	01h 1Ah	00h::7Fh	0::127		Attack
139	01h 0Bh	155	01h 1Bh	00h::7Fh	0::127		Decay
140	01h 0Ch	156	01h 1Ch	00h::40h::7Fh	-64::0::+63		EQ Low Level
141	01h 0Dh	157	01h 1Dh	00h::18h	1::25		EQ Mid Band
142	01h 0Eh	158	01h 1Eh	00h::40h::7Fh		-64::0::+63	EQ Mid Level
143	01h 0Fh	159	01h 1Fh	00h::40h::7Fh		-64::0::+63	EQ High Level
Reverb FX1		**Reverb FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::7Fh	0::127	3m::30m	Size
131	01h 03h	147	01h 13h	00h::7Fh	0::127		Shape
132	01h 04h	148	01h 14h	00h::7Fh	0::127		Decay
133	01h 05h	149	01h 15h	00h::7Fh	0::127	0ms::300ms	Pre-Delay
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Lowpass
136	01h 08h	152	01h 18h	00h::7Fh	0::127		Highpass
137	01h 09h	153	01h 19h	00h::7Fh	0::127		Diffusion
138	01h 0Ah	154	01h 1Ah	00h::7Fh	0::127		Damping
Tap Delay FX1		**Tap Delay FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::1Dh	0::29	1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
131	01h 03h	147	01h 13h	00h::7Fh	0::127	0%::100%	Feedback
132	01h 04h	148	01h 14h	00h::7Fh	0::127	0%::100%	Swing Factor
133	01h 05h	149	01h 15h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B0::7
134	01h 06h	150	01h 16h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B8::14
135	01h 07h	151	01h 17h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B15::21
136	01h 08h	152	01h 18h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B22::23Taps2 B0::5
137	01h 09h	153	01h 19h	00h::7Fh	0::127	⇒ Tap Parameter	Taps2 B6::13
138	01h 0Ah	154	01h 1Ah	00h::7Fh	0::127	⇒ Tap Parameter	Taps2 B14::20
139	01h 0Bh	155	01h 1Bh	00h::7Fh	0::127	⇒ Tap Parameter	Taps2 B21::23Taps3 B0::3
140	01h 0Ch	156	01h 1Ch	00h::7Fh	0::127	⇒ Tap Parameter	Taps3 B4::10
141	01h 0Dh	157	01h 1Dh	00h::7Fh	0::127	⇒ Tap Parameter	Taps3 B11::17
142	01h 0Eh	158	01h 1Eh	00h::3Fh	0::63	⇒ Tap Parameter	Taps3 B18::23
143	01h 0Fh	159	01h 1Fh	ff:=00b::11b pp:=00b::10b lll:=000b::111b 0ffppplllb		Off, 1::2 Left, Center, Right 0::7	FB Ducking Tap 16 Pan Tap 16 Level
5.1 Delay FX2		**5.1 Clk.Delay FX2**					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
146	01h 12h			00h::7Fh		1.4ms::1.48s	Delay
		146	01h 12h	00h::1Dh		1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
147	01h 13h	147	01h 13h	00h::7Fh	0::127	0%::100%	Feedback
148	01h 14h	148	01h 14h	00h::7Fh	0::127	10.9Hz::16.7KHz	LFE LP
149	01h 15h	149	01h 15h	00h::7Fh	0::127	10.9Hz::16.7KHz	Input HP
150	01h 16h	150	01h 16h	00h::7Fh	0::127	0%::400%	Delay ML
151	01h 17h	151	01h 17h	00h::7Fh	0::127		FSL Volume
152	01h 18h	152	01h 18h	00h::7Fh	0::127	0%::400%	Delay MR
153	01h 19h	153	01h 19h	00h::7Fh	0::127		FSR Volume
154	01h 1Ah	154	01h 1Ah	00h::7Fh	0::127	0%::400%	Delay S2L
155	01h 1Bh	155	01h 1Bh	00h::7Fh	0::127		CntrS Volume
156	01h 1Ch	156	01h 1Ch	00h::7Fh	0::127	0%::400%	Delay S1L
157	01h 1Dh	157	01h 1Dh	00h::7Fh	0::127		RearSL Volume
158	01h 1Eh	158	01h 1Eh	00h::7Fh	0::127	0%::400%	Delay S1R
159	01h 1Fh	159	01h 1Fh	00h::7Fh	0::127		RearSR Volume

LFO									
LFO1		**LFO2**		**LFO3**					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
160	01h 20h	172	01h 2Ch	184	01h 38h	00h::05h	0::5	Sine, Triangle, Square, Saw, Random, S&H	Shape
161	01h 21h	173	01h 2Dh	185	01h 39h	00h::7Fh 00h::7Eh(2)	0::127 0::126(2)	0::127 256, 192, 160, 144, 128, 120, 96, 80, 72, 64, 48, 40, 36, 32, 24, 20, 18, 16, 15, 14, 12, 10, 9, 8, 7, 6, 5, 4, 3.5, 3, 2.66, 2.4, 2, 1.75, 1.5, 1.33, 1.2, 1, 7/8, 1/2., 1/2T, 5/8, 1/2, 7/16, 1/4., 1/4T, 5/16, 1/4, 7/32, 1/8., 1/8T, 5/32, 1/8, 7/64, 1/16., 1/16T, 5/64, 1/16, 1/32., 1/32T, 1/32, 1/64T, 1/64, 1/96 bars	Speed (Clocked:=Off) Speed (Clocked:=On)
163	01h 23h	175	01h 2Fh	187	01h 3Bh	00h, 01h	0, 1	Off, On	Sync
164	01h 24h	176	01h 30h	188	01h 3Ch	00h, 01h	0, 1	Off, On	Clocked
165	01h 25h	177	01h 31h	189	01h 3Dh	00h, 01h::7Fh	0, 1::127	Free, 0::360	Start Phase
166	01h 26h	178	01h 32h	190	01h 3Eh	00h::7Fh	0::127	0::127	Delay
167	01h 27h	179	01h 33h	191	01h 3Fh	00h::40h::7Fh	0::64::127	-64::0::+63	Fade
170	01h 2Ah	182	01h 36h	194	01h 42h	00h::40h::7Fh	0::64::127	-200%::0%::+196%	Keytrack

Envelopes

FiltEnv		AmpEnv		Env 3		Env 4					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
196	01h 44h	208	01h 50h	220	01h 5Ch	232	01h 68h	m:0h, 1h, 2h, 3h, 4h t:0h, 2h tmh	0::4 0, 2	ADSR, ADS1DS2R, One Shot, Loop S1S2, Loop All Normal, Single	Env Mode Trigger Mode
197	01h 47h	211	01h 53h	223	01h 5Fh	235	01h 6Bh	00h::7Fh	0::127	0::127	Attack
198	01h 48h	212	01h 54h	224	01h 60h	236	01h 6Ch	00h::7Fh	0::127	0::127	Attack Level
199	01h 49h	213	01h 55h	225	01h 61h	237	01h 6Dh	00h::7Fh	0::127	0::127	Decay
200	01h 4Ah	214	01h 56h	226	01h 62h	238	01h 6Eh	00h::7Fh	0::127	0::127	Sustain
201	01h 4Bh	215	01h 57h	227	01h 63h	239	01h 6Fh	00h::7Fh	0::127	0::127	Decay 2
202	01h 4Ch	216	01h 58h	228	01h 64h	240	01h 70h	00h::7Fh	0::127	0::127	Sustain 2
203	01h 4Dh	217	01h 59h	229	01h 65h	241	01h 71h	00h::7Fh	0::127	0::127	Release

Env Select

Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
244	01h 74h	01h, 02h	0, 2	Filter/Amp, Env 3/4	Env Select

Modifiers

Mod 1		Mod 2		Mod 3		Mod 4					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
246	01h 76h	250	01h 7Ah	254	01h 7Eh	258	02h 02h	00h::30h	0::48	⇒ Standard Mod Source	Source1
247	01h 77h	251	01h 7Bh	255	01h 7Fh	259	02h 03h	00h::30h	0::48	⇒ Standard Mod Source	Source 2
248	01h 78h	252	01h 7Ch	256	02h 00h	260	02h 04h	00h::07h	0::7	+, -, *, AND, OR, XOR, MAX, min	Operator
249	01h 79h	253	01h 7Dh	257	02h 01h	261	02h 05h	00h::40h::7Fh	0::64::127	-64::0::+63	Constant

Fast Mod Matrix

Slot 1F		Slot 3F		Slot 5F		Slot 7F					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
262	02h 06h	268	02h 0Ch	274	02h 12h	280	02h 18h	00h::0Dh	0::13	⇒ Fast Mod Source	Source
263	02h 07h	269	02h 0Dh	275	02h 13h	281	02h 19h	00h::1Fh	0::31	⇒ Fast Mod Destination	Destination
264	02h 08h	270	02h 0Eh	276	02h 14h	282	02h 1Ah	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Fast Mod Matrix

Slot 2F		Slot 4F		Slot 6F		Slot 8F					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
265	02h 09h	271	02h 0Fh	277	02h 15h	283	02h 1Bh	00h::0Dh	0::13	⇒ Fast Mod Source	Source
266	02h 0Ah	272	02h 10h	278	02h 16h	284	02h 1Ch	00h::1Fh	0::31	⇒ Fast Mod Destination	Destination
267	02h 0Bh	273	02h 11h	279	02h 17h	285	02h 1Dh	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Standard Mod Matrix

Slot 1S		Slot 3S		Slot 5S		Slot 7S					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
286	02h 1Eh	292	02h 24h	298	02h 2Ah	304	02h 30h	00h::30h	0::48	⇒ Standard Mod Source	Source
287	02h 1Fh	293	02h 25h	299	02h 2Bh	305	02h 31h	00h::3Ah	0::58	⇒ Standard Mod Destination	Destination
288	02h 20h	294	02h 26h	300	02h 2Ch	306	02h 32h	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Standard Mod Matrix

Slot 2S		Slot 4S		Slot 6S		Slot 8S					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
289	02h 21h	295	02h 27h	301	02h 2Dh	307	02h 33h	00h::30h	0::48	⇒ Standard Mod Source	Source
290	02h 22h	296	02h 28h	302	02h 2Eh	308	02h 34h	00h::3Ah	0::58	⇒ Standard Mod Destination	Destination
291	02h 23h	297	02h 29h	303	02h 2Fh	309	02h 35h	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Controller Delay

Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
310	02h 36h	00h::30h	0::48	⇒ Standard Mod Source	Source
311	02h 37h	00h::7Fh	0::127		Ctr.Delay

Arp

Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
312	02h 38h	00h::03h	0::3	Off, On, One shot, Hold	Mode
313	02h 39h	00h, 01h, 02h::10h	0, 1, 2::16	Off, User, ROM1::ROM15	Pattern
314	02h 3Ah	00h::0Fh	0::15	1::16	Max. Notes
315	02h 3Bh	00h::7Fh	0::127	3/192::130/192	Clock
316	02h 3Ch	00h, 01h::7Fh	0, 1::127	Legato, 1::127	Length
317	02h 3Dh	00h::09h	0::9	1::10	Octave Range
318	02h 3Eh	00h::03h	0::3	Up, Down, Alt Up, Alt Down	Direction
319	02h 3Fh	00h::05h	0::5	As played, Reversed, NumLo¿Hi, NumHi¿Lo, VelLo¿Hi, VelHi¿Lo	Sort Order
320	02h 40h	00h, 01h, 02h	0, 1, 2	Each note, First note, Last note	Velo Mode
321	02h 41h	00h::7Fh	0::127	0::127	T. Factor
322	02h 42h	00h::01h	0, 1	Off, On	Same note overlap
323	02h 43h	00h::01h	0, 1	Off, On	Pattern Reset
324	02h 44h	00h::0Fh	0::15	1::16	Pattern Length

Tempo

Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
327	02h 47h	00h::7Fh	0::127	0::39, 40::90(2), 91::164, 165::300(5)	Tempo (bpm)

Arp Step / Glide / Accent

Step 1-4		Step 5-8		Step 9-12		Step 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
328	02h 48h	332	02h 4Ch	336	02h 50h	340	02h 54h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
329	02h 49h	333	02h 4Dh	337	02h 51h	341	02h 55h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
330	02h 4Ah	334	02h 4Eh	338	02h 52h	342	02h 56h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
331	02h 4Bh	335	02h 4Fh	339	02h 53h	343	02h 57h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent

Arp Step Length / Timing												
Step 1-4		Step 5-8		Step 9-12		Step 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
344	02h 58h	348	02h 5Ch	352	02h 60h	356	02h 64h	lll:=000b::111b ttt:=000b::111b 01110tttb	0::7 0::7	∧, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
345	03h 59h	349	02h 5Dh	353	02h 61h	357	02h 65h	lll:=000b::111b ttt:=000b::111b 01110tttb	0::7 0::7	∧, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
346	04h 5Ah	350	02h 5Eh	354	02h 62h	358	02h 66h	lll:=000b::111b ttt:=000b::111b 01110tttb	0::7 0::7	∧, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
347	05h 5Bh	351	02h 5Fh	355	02h 63h	359	02h 67h	lll:=000b::111b ttt:=000b::111b 01110tttb	0::7 0::7	∧, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing

Sound Name											
Char 1-4		Char 5-8		Char 9-12		Char 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
364	02h 6Ch	368	02h 70h	372	02h 74h	376	02h 78h	20h::7Fh	32::127	ASCII	Sound Name
365	02h 6Dh	369	02h 71h	373	02h 75h	377	02h 79h	20h::7Fh	32::127	ASCII	Sound Name
366	02h 6Eh	370	02h 72h	374	02h 76h	378	02h 7Ah	20h::7Fh	32::127	ASCII	Sound Name
367	02h 6Dh	371	02h 73h	375	02h 77h	379	02h 7Bh	20h::7Fh	32::127	ASCII	Sound Name

Sound Category					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
380	02h 7Ch	20h::7Fh	32::127	ASCII	Sound Category
381	02h 7Dh	20h::7Fh	32::127	ASCII	Sound Category
382	02h 7Eh	20h::7Fh	32::127	ASCII	Sound Category
383	02h 7Fh	20h::7Fh	32::127	ASCII	Sound Category

Notes

- Controller Delay is not implemented.

2.4.2 MDAT

The Multi Data has a length of 384 bytes.

Multi				
Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
0	00h 00h	00h::7Fh	1::127	Multi Volume	

Controllers											
Control W		Control X		Control Y		Control Z					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
1	00h 01h	2	00h 02h	3	00h 03h	4	00h 04h	00h::78h, 79h	0::119, 120	CC#0::CC#120,Global	Controller Assignment

Sound Name											
Char 1-4		Char 5-8		Char 9-12		Char 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
16	00h 10h	20	00h 14h	24	00h 18h	28	00h 1Ch	20h::7Fh	32::127	ASCII	Sound Name
17	00h 11h	21	00h 15h	25	00h 19h	29	00h 1Dh	20h::7Fh	32::127	ASCII	Sound Name
18	00h 12h	22	00h 16h	26	00h 1Ah	30	00h 1Eh	20h::7Fh	32::127	ASCII	Sound Name
19	00h 13h	23	00h 17h	27	00h 1Bh	31	00h 1Fh	20h::7Fh	32::127	ASCII	Sound Name

Multi Instruments											
Inst.1		Inst.5		Inst.9		Inst.13					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
32	00h 20h	120	00h 78h	208	01h 50h	296	02h 28h	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank
33	00h 21h	121	00h 79h	209	01h 51h	297	02h 29h	00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number
34	00h 22h	122	00h 7Ah	210	01h 52h	298	02h 2Ah	00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel
35	00h 23h	123	00h 7Bh	211	01h 53h	299	02h 2Bh	00h::7Fh	0::127	0::127	Volume
36	00h 24h	124	00h 7Ch	212	01h 54h	300	02h 2Ch	10h::70h	16::112	-48::+48	Transpose
37	00h 25h	125	00h 7Dh	213	01h 55h	301	02h 2Dh	00h::7Fh	0::127	-64::+63	Detune
38	00h 26h	126	00h 7Eh	214	01h 56h	302	02h 2Eh	00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output
39	00h 27h	127	00h 7Fh	215	01h 57h	303	02h 2Fh	rr:=00b::11b tt:=00b::11b pp:=00b::10b 00ppttrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status
40	00h 28h	128	01h 00h	216	01h 58h	304	02h 30h	00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan
43	00h 2Bh	131	01h 03h	219	01h 5Bh	307	02h 33h	00h::64h	0::100	Off, 1::100	Pattern Number
44	00h 2Ch	132	01h 04h	220	01h 5Ch	308	02h 34h	01h::7Fh	1::127	1::127	Low Velo
45	00h 2Dh	133	01h 05h	221	01h 5Dh	309	02h 35h	01h::7Fh	1::127	1::127	High Velo
46	00h 2Eh	134	01h 06h	222	01h 5Eh	310	02h 36h	00h::7Fh	0::127	C-2::G8	Low Key
47	00h 2Fh	135	01h 07h	223	01h 5Fh	311	02h 37h	00h::7Fh	0::127	C-2::G8	High Key
48	00h 30h	136	01h 08h	224	01h 60h	312	02h 38h	t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status

Multi Instruments

Inst.2		Inst.6		Inst.10		Inst.14					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
54	00h 36h	142	01h 0Eh	230	01h 66h	318	02h 3Eh	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank
55	00h 37h	143	01h 0Fh	231	01h 67h	319	02h 3Fh	00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number
56	00h 38h	144	01h 10h	232	01h 68h	320	02h 40h	00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel
57	00h 39h	145	01h 11h	233	01h 69h	321	02h 41h	00h::7Fh	0::127	0::127	Volume
58	00h 3Ah	146	01h 12h	234	01h 6Ah	322	02h 42h	10h::70h	16::112	-48::+48	Transpose
59	00h 3Bh	147	01h 13h	235	01h 6Bh	323	02h 43h	00h::7Fh	0::127	-64::+63	Detune
60	00h 3Ch	148	01h 14h	236	01h 6Ch	324	02h 44h	00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output
61	00h 3Dh	149	01h 15h	237	01h 6Dh	325	02h 45h	rr:=00b::11b tt:=00b::11b pp:=00b::10b 00ppttrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status
62	00h 3Eh	150	01h 16h	238	01h 6Eh	326	02h 46h	00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan
65	00h 41h	153	01h 19h	241	01h 71h	329	02h 49h	00h::64h	0::100	Off, 1::100	Pattern Number
66	00h 42h	154	01h 1Ah	242	01h 72h	330	02h 4Ah	01h::7Fh	1::127	1::127	Low Velo
67	00h 43h	155	01h 1Bh	243	01h 73h	331	02h 4Bh	01h::7Fh	1::127	1::127	High Velo
68	00h 44h	156	01h 1Ch	244	01h 74h	332	02h 4Ch	00h::7Fh	0::127	C-2::G8	Low Key
69	00h 45h	157	01h 1Dh	245	01h 75h	333	02h 4Dh	00h::7Fh	0::127	C-2::G8	High Key
70	00h 46h	158	01h 1Eh	246	01h 76h	334	02h 4Eh	t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status

Multi Instruments

Inst.3		Inst.7		Inst.11		Inst.15					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
76	00h 4Ch	164	01h 24h	252	01h 7Ch	340	02h 54h	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank
77	00h 4Dh	165	01h 25h	253	01h 7Dh	341	02h 55h	00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number
78	00h 4Eh	166	01h 26h	254	01h 7Eh	342	02h 56h	00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel
79	00h 4Fh	167	01h 27h	255	01h 7Fh	343	02h 57h	00h::7Fh	0::127	0::127	Volume
80	00h 50h	168	01h 28h	256	02h 00h	344	02h 58h	10h::70h	16::112	-48::+48	Transpose
81	00h 51h	169	01h 29h	257	02h 01h	345	02h 59h	00h::7Fh	0::127	-64::+63	Detune
82	00h 52h	170	01h 2Ah	258	02h 02h	346	02h 5Ah	00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output
83	00h 53h	171	01h 2Bh	259	02h 03h	347	02h 5Bh	rr:=00b::11b tt:=00b::11b pp:=00b::10b 00ppttrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status
84	00h 54h	172	01h 2Ch	260	02h 04h	348	02h 5Ch	00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan
87	00h 57h	175	01h 2Fh	263	02h 07h	351	02h 5Fh	00h::64h	0::100	Off, 1::100	Pattern Number
88	00h 58h	176	01h 30h	264	02h 08h	352	02h 60h	01h::7Fh	1::127	1::127	Low Velo
89	00h 59h	177	01h 31h	265	02h 09h	353	02h 61h	01h::7Fh	1::127	1::127	High Velo
90	00h 5Ah	178	01h 32h	266	02h 0Ah	354	02h 62h	00h::7Fh	0::127	C-2::G8	Low Key
91	00h 5Bh	179	01h 33h	267	02h 0Bh	355	02h 63h	00h::7Fh	0::127	C-2::G8	High Key
92	00h 5Ch	180	01h 34h	268	02h 0Ch	356	02h 64h	t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status

Multi Instruments

Inst.4		Inst.8		Inst.12		Inst.16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
98	00h 62h	186	01h 3Ah	274	02h 12h	362	02h 6Ah	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank
99	00h 63h	187	01h 3Bh	275	02h 13h	363	02h 6Bh	00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number
100	00h 64h	188	01h 3Ch	276	02h 14h	364	02h 6Ch	00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel
101	00h 65h	189	01h 3Dh	277	02h 15h	365	02h 6Dh	00h::7Fh	0::127	0::127	Volume
102	00h 66h	190	01h 3Eh	278	02h 16h	366	02h 6Eh	10h::70h	16::112	-48::+48	Transpose
103	00h 67h	191	01h 3Fh	279	02h 17h	367	02h 6Fh	00h::7Fh	0::127	-64::+63	Detune
104	00h 68h	192	01h 40h	280	02h 18h	368	02h 70h	00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output
105	00h 69h	193	01h 41h	281	02h 19h	369	02h 71h	rr:=00b::11b tt:=00b::11b pp:=00b::10b 00ppttrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status
106	00h 6Ah	194	01h 42h	282	02h 1Ah	370	02h 72h	00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan
109	00h 6Dh	197	01h 45h	285	02h 1Dh	373	02h 75h	00h::64h	0::100	Off, 1::100	Pattern Number
110	00h 6Eh	198	01h 46h	286	02h 1Eh	374	02h 76h	01h::7Fh	1::127	1::127	Low Velo
111	00h 6Fh	199	01h 47h	287	02h 1Fh	375	02h 77h	01h::7Fh	1::127	1::127	High Velo
112	00h 70h	200	01h 48h	288	02h 20h	376	02h 78h	00h::7Fh	0::127	C-2::G8	Low Key
113	00h 71h	201	01h 49h	289	02h 21h	377	02h 79h	00h::7Fh	0::127	C-2::G8	High Key
114	00h 72h	202	01h 4Ah	290	02h 22h	378	02h 7Ah	t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status

2.4.3 DDAT

The Drum Map Data has a length of 384 bytes.

Drum Map Instruments											
Inst.1		Inst.9		Inst.17		Inst.25					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
0	00h 00h	72	00h 48h	144	01h 10h	216	01h 58h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
1	00h 00h	73	00h 49h	145	01h 11h	217	01h 59h	00h::63h	0::99	1::100	Sound Number
2	00h 02h	74	00h 4Ah	146	01h 12h	218	01h 5Ah	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
3	00h 03h	75	00h 4Bh	147	01h 13h	219	01h 5Bh	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
4	00h 04h	76	00h 4Ch	148	01h 14h	220	01h 5Ch	00h::7Fh	0::127	C-2::G8	Key
5	00h 05h	77	00h 4Dh	149	01h 15h	221	01h 5Dh	04h::7Ch	4::124	-60::60	Transpose
6	00h 06h	78	00h 4Eh	150	01h 16h	222	01h 5Eh	00h::7Fh	0::127	0::127	Volume
Inst.2		Inst.10		Inst.18		Inst.26					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
9	00h 09h	81	00h 51h	153	01h 19h	225	01h 61h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
10	00h 0Ah	82	00h 52h	154	01h 1Ah	226	01h 62h	00h::63h	0::99	1::100	Sound Number
11	00h 0Bh	83	00h 53h	155	01h 1Bh	227	01h 63h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
12	00h 0Ch	84	00h 54h	156	01h 1Ch	228	01h 64h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
13	00h 0Dh	85	00h 55h	157	01h 1Dh	229	01h 65h	00h::7Fh	0::127	C-2::G8	Key
14	00h 0Eh	86	00h 56h	158	01h 1Eh	230	01h 66h	04h::7Ch	4::124	-60::60	Transpose
15	00h 0Fh	87	00h 57h	159	01h 1Fh	231	01h 67h	00h::7Fh	0::127	0::127	Volume
Inst.3		Inst.11		Inst.19		Inst.27					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
18	00h 12h	90	00h 5Ah	162	01h 22h	234	01h 6Ah	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
19	00h 13h	91	00h 5Bh	163	01h 23h	235	01h 6Bh	00h::63h	0::99	1::100	Sound Number
20	00h 14h	92	00h 5Ch	164	01h 24h	236	01h 6Ch	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
21	00h 15h	93	00h 5Dh	165	01h 25h	237	01h 6Dh	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
22	00h 16h	94	00h 5Eh	166	01h 26h	238	01h 6Eh	00h::7Fh	0::127	C-2::G8	Key
23	00h 17h	95	00h 5Fh	167	01h 27h	239	01h 6Fh	04h::7Ch	4::124	-60::60	Transpose
24	00h 18h	96	00h 60h	168	01h 28h	240	01h 70h	00h::7Fh	0::127	0::127	Volume
Inst.4		Inst.12		Inst.20		Inst.28					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
27	00h 1Bh	99	00h 63h	171	01h 2Bh	243	01h 73h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
28	00h 1Ch	100	00h 64h	172	01h 2Ch	244	01h 74h	00h::63h	0::99	1::100	Sound Number
29	00h 1Dh	101	00h 65h	173	01h 2Dh	245	01h 75h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
30	00h 1Eh	102	00h 66h	174	01h 2Eh	246	01h 76h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
31	00h 1Fh	103	00h 67h	175	01h 2Fh	247	01h 77h	00h::7Fh	0::127	C-2::G8	Key
32	00h 20h	104	00h 68h	176	01h 30h	248	01h 78h	04h::7Ch	4::124	-60::60	Transpose
33	00h 21h	105	00h 69h	177	01h 31h	249	01h 79h	00h::7Fh	0::127	0::127	Volume
Inst.5		Inst.13		Inst.20		Inst.29					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
36	00h 24h	108	00h 6Ch	180	01h 34h	252	01h 7Ch	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
37	00h 25h	109	00h 6Dh	181	01h 35h	253	01h 7Dh	00h::63h	0::99	1::100	Sound Number
38	00h 26h	110	00h 6Eh	182	01h 36h	254	01h 7Eh	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
39	00h 27h	111	00h 6Fh	183	01h 37h	255	01h 7Fh	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
40	00h 28h	112	00h 70h	184	01h 38h	256	02h 00h	00h::7Fh	0::127	C-2::G8	Key
41	00h 29h	113	00h 71h	185	01h 39h	257	02h 01h	04h::7Ch	4::124	-60::60	Transpose
42	00h 2Ah	114	00h 72h	186	01h 3Ah	258	02h 02h	00h::7Fh	0::127	0::127	Volume
Inst.6		Inst.14		Inst.22		Inst.30					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
45	00h 2Dh	117	00h 75h	189	01h 3Dh	261	02h 05h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
46	00h 2Eh	118	00h 76h	190	01h 3Eh	262	02h 06h	00h::63h	0::99	1::100	Sound Number
47	00h 2Fh	119	00h 77h	191	01h 3Fh	263	02h 07h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
48	00h 30h	120	00h 78h	192	01h 40h	264	02h 08h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
49	00h 31h	121	00h 79h	193	01h 41h	265	02h 09h	00h::7Fh	0::127	C-2::G8	Key
50	00h 32h	122	00h 7Ah	194	01h 42h	266	02h 0Ah	04h::7Ch	4::124	-60::60	Transpose
51	00h 33h	123	00h 7Bh	195	01h 43h	267	02h 0Bh	00h::7Fh	0::127	0::127	Volume
Inst.7		Inst.15		Inst.23		Inst.31					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
54	00h 36h	126	00h 7Eh	198	01h 46h	270	02h 0Eh	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
55	00h 37h	127	00h 7Fh	199	01h 47h	271	02h 0Fh	00h::63h	0::99	1::100	Sound Number
56	00h 38h	128	01h 00h	200	01h 48h	272	02h 10h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
57	00h 39h	129	01h 01h	201	01h 49h	273	02h 11h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
58	00h 3Ah	130	01h 02h	202	01h 4Ah	274	02h 12h	00h::7Fh	0::127	C-2::G8	Key
59	00h 3Bh	131	01h 03h	203	01h 4Bh	275	02h 13h	04h::7Ch	4::124	-60::60	Transpose
60	00h 3Ch	132	01h 04h	204	01h 4Ch	276	02h 14h	00h::7Fh	0::127	0::127	Volume
Inst.8		Inst.16		Inst.24		Inst.32					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
63	00h 3Fh	135	01h 07h	207	01h 4Fh	279	02h 17h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank
64	00h 40h	136	01h 08h	208	01h 50h	280	02h 18h	00h::63h	0::99	1::100	Sound Number
65	00h 41h	137	01h 09h	209	01h 51h	281	02h 19h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output
66	00h 42h	138	01h 0Ah	210	01h 52h	282	02h 1Ah	00h::40h::7Fh	0::64::127	L64::0::R63	Pan
67	00h 43h	139	01h 0Bh	211	01h 53h	283	02h 1Bh	00h::7Fh	0::127	C-2::G8	Key
68	00h 44h	140	01h 0Ch	212	01h 54h	284	02h 1Ch	04h::7Ch	4::124	-60::60	Transpose
69	00h 45h	141	01h 0Dh	213	01h 55h	285	02h 1Dh	00h::7Fh	0::127	0::127	Volume

Effects							
FX1		**FX2**					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
288	01h 00h	304	01h 10h	00h::09h		Bypass, Chorus, Flanger, Phaser, Delay, Overdrive, Five FX, Vocoder, Reverb, Tap Delay	Effect
		304	01h 10h	20h::21h		5.1 Delay, 5.1 D.Clk	Effect (FX2 only)
289	01h 01h	305	01h 11h	00h::7Fh		Dry::Wet	Mix

Effects											
Chorus FX1		**Chorus FX2**		**Flanger FX1**		**Flanger FX2**					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	290	01h 02h	306	01h 12h	00h::7Fh	0::127		Speed
291	01h 03h	307	01h 13h	291	01h 03h	307	01h 13h	00h::7Fh	0::127		Depth
293	01h 05h	309	01h 15h					00h::7Fh	0::127		Delay
				294	01h 06h	310	01h 16h	00h::7Fh	0::127	0%::100%	Feedback
				298	01h 0Ah	314	01h 1Ah	00h,01h	0, 1	Positive, Negative	Polarity
Phaser FX1		**Phaser FX2**		**Delay FX1**		**Delay FX2**					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h					00h::7Fh	0::127		Speed
291	01h 03h	307	01h 13h					00h::7Fh	0::127		Depth
294	01h 06h	310	01h 16h	294	01h 06h	310	01h 16h	00h::7Fh	0::127	0%::100%	Feedback
295	01h 07h	311	01h 17h					00h::7Fh	0::127		Center
				295	01h 07h	311	01h 17h	00h::7Fh	0::127		Cutoff
296	01h 08h	312	01h 18h					00h::7Fh	0::127		Spacing
				297	01h 09h	313	01h 19h	00h	0	Off	Clocked
298	01h 0Ah	314	01h 1Ah	298	01h 0Ah	314	01h 1Ah	00h::01h	0, 1	Positive, Negative	Polarity
				299	01h 0Bh	315	01h 1Bh	00h::01h	0, 1	Off, On	Autopan

Effects							
Clk.Delay FX1		**Clk.Delay FX2**					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
292	01h 04h	308	01h 14h	00h, 01h::19h,1Ah::64h,65h::7Fh		Internal, 42::90(2), 91::165(1), 170::300(5)	Tempo
294	01h 06h	310	01h 16h	00h::7Fh	0::127		Feedback
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Cutoff
297	01h 09h	313	01h 19h	01h		0n	Clocked
298	01h 0Ah	314	01h 1Ah	01h::01h		Positive, Negative	Polarity
299	01h 0Bh	315	01h 1Bh	00h::01h		Off, On	Autopan
300	01h 0Ch	316	01h 1Ch	00h::1Dh		1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length

Effects							
Overdrive FX1		**Overdrive FX2**					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
291	01h 03h	307	01h 13h	00h::7Fh	0::127		Drive
292	01h 04h	308	01h 14h	00h::7Fh	0::127		Post Gain
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Cutoff
FiveFX FX1		**FiveFX FX2**					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::7Fh	1::127		Chorus Speed
291	01h 03h	307	01h 13h	00h::7Fh	0::127		Chorus Depth
292	01h 04h	308	01h 14h	00h::7Fh	0::127		Delay
293	01h 05h	309	01h 15h	00h::7Fh	0::127		Chorus/Delay L
294	01h 06h	310	01h 16h	00h::7Fh		44.1KHz::2.6Hz	Sample&Hold
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Overdrive
296	01h 08h	312	01h 18h	00h::08h		External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Ring Mod Source
297	01h 09h	313	01h 19	00h::7Fh	0::127		Ring Mod Level
Vocoder FX1		**Vocoder FX2**					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::17h	2::25		Bands
291	01h 03h	307	01h 13h	00h::08h	0::8	External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Analysis Signal
292	01h 04h	308	01h 14h	00h::7Fh	0::127	10.9Hz::16.7KHz	A. Lo Freq
293	01h 05h	309	01h 15h	00h::7Fh	0::127	10.9Hz::16.7KHz	A. Hi Freq
294	01h 06h	310	01h 16h	00h::40h::7Fh	0::64::127	-128::-32(x3), -34::0::31(x1), +35::+128(x3)	S. Offset
295	01h 07h	311	01h 17h	00h::40h::7Fh	0::64::127	-128::-32(x3), -34::0::31(x1), +35::+128(x3)	Hi Offset
296	01h 08h	312	01h 18h	00h::40h::7Fh	0::64::127	-64::0::+63	Bandwidth
297	01h 09h	313	01h 19h	00h::40h::7Fh	0::64::127	-64::0::+63	Resonance
298	01h 0Ah	314	01h 1Ah	00h::7Fh	0::127		Attack
299	01h 0Bh	315	01h 1Bh	00h::7Fh	0::127		Decay
300	01h 0Ch	316	01h 1Ch	00h::40h::7Fh	0::64::127	-64::0::+63	EQ Low Level
301	01h 0Dh	317	01h 1Dh	00h::18h	1::25		EQ Mid Band
302	01h 0Eh	318	01h 1Eh	00h::40h::7Fh	0::64::127	-64::0::+63	EQ Mid Level
303	01h 0Fh	319	01h 1Fh	00h::40h::7Fh	0::64::127	-64::0::+63	EQ High Level
Reverb FX1		**Reverb FX2**					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::7Fh	3m::30m		Size
291	01h 03h	307	01h 13h	00h::7Fh	0::127		Shape
292	01h 04h	308	01h 14h	00h::7Fh	0::127		Decay
293	01h 05h	309	01h 15h	00h::7Fh	0::127	0ms::300ms	Pre-Delay
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Lowpass
296	01h 08h	312	01h 18h	00h::7Fh	0::127		Highpass
297	01h 09h	313	01h 19h	00h::7Fh	0::127		Diffusion
298	01h 0Ah	314	01h 1Ah	00h::7Fh	0::127		Damping

Effects

Tap Delay FX1 / **Tap Delay FX2**

Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::1Dh		1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
291	01h 03h	307	01h 13h	00h::7Fh	0::127	0%::100%	Feedback
292	01h 04h	308	01h 14h	00h::7Fh	0::127	0%::100%	Swing Factor
293	01h 05h	309	01h 15h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B0::7
294	01h 06h	310	01h 16h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B8::14
295	01h 07h	311	01h 17h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B15::21
296	01h 08h	312	01h 18h	00h::7Fh	0::127	⇒ Tap Parameter	Taps1 B22::23Taps2 B0::5
297	01h 09h	313	01h 19h	00h::7Fh	0::127	⇒ Tap Parameter	Taps2 B6::13
298	01h 0Ah	314	01h 1Ah	00h::7Fh	0::127	⇒ Tap Parameter	Taps2 B14::20
299	01h 0Bh	315	01h 1Bh	00h::7Fh	0::127	⇒ Tap Parameter	Taps2 B21::23Taps3 B0::3
300	01h 0Ch	316	01h 1Ch	00h::7Fh	0::127	⇒ Tap Parameter	Taps3 B4::10
301	01h 0Dh	317	01h 1Dh	00h::7Fh	0::127	⇒ Tap Parameter	Taps3 B11::17
302	01h 0Eh	318	01h 1Eh	00h::3Fh	0::63	⇒ Tap Parameter	Taps3 B18::23
303	01h 0Fh	319	01h 1Fh	ff:=00b::11b pp:=00b::10b lll:=000b::111b 0ffpppllllb		Off, 1::2 Left, Center, Right 0::7	FB Ducking Tap 16 Pan Tap 16 Level

5.1 Delay FX2 / **5.1 Clk.Delay FX2**

Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
306	01h 12h			00h::7Fh		1.4ms::1.48s	Delay
		306	01h 12h	00h::1Dh		1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
307	01h 13h	307	01h 13h	00h::7Fh	0::127	0%::100%	Feedback
308	01h 14h	308	01h 14h	00h::7Fh	0::127	10.9Hz::16.7KHz	LFE LP
309	01h 15h	309	01h 15h	00h::7Fh	0::127	10.9Hz::16.7KHz	Input HP
310	01h 16h	310	01h 16h	00h::7Fh	0::127	0%::400%	Delay ML
311	01h 17h	311	01h 17h	00h::7Fh	0::127		FSL Volume
312	01h 18h	312	01h 18h	00h::7Fh	0::127	0%::400%	Delay MR
313	01h 19h	313	01h 19h	00h::7Fh	0::127		FSR Volume
314	01h 1Ah	314	01h 1Ah	00h::7Fh	0::127	0%::400%	Delay S2L
315	01h 1Bh	315	01h 1Bh	00h::7Fh	0::127		CntrS Volume
316	01h 1Ch	316	01h 1Ch	00h::7Fh	0::127	0%::400%	Delay S1L
317	01h 1Dh	317	01h 1Dh	00h::7Fh	0::127		RearSL Volume
318	01h 1Eh	318	01h 1Eh	00h::7Fh	0::127	0%::400%	Delay S1R
319	01h 1Fh	319	01h 1Fh	00h::7Fh	0::127		RearSR Volume

Arp

Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
320	02h 38h	00h::03h	0::3	Off, On, One shot, Hold	Mode
321	02h 39h	00h, 01h, 02h::10h	0, 1, 2::16	Off, User, ROM1::ROM15	Pattern
322	02h 3Ah	00h::0Fh	0::15	1::16	Max. Notes
323	02h 3Bh	00h::7Fh	0::127	3/192::130/192	Clock
324	02h 3Ch	00h, 01h::7Fh	0, 1::127	Legato, 1::127	Length
325	02h 3Dh	00h::09h	0::9	1::10	Octave Range
326	02h 3Eh	00h::03h	0::3	Up, Down, Alt Up, Alt Down	Direction
327	02h 3Fh	00h::05h	0::5	As played, Reversed, NumLo¿Hi, NumHi¿Lo, VelLo¿Hi, VelHi¿Lo	Sort Order
328	02h 40h	00h, 01h, 02h	0, 1, 2	Each note, First note, Last note	Velo Mode
329	02h 41h	00h::7Fh	0::127	0::127	T. Factor
330	02h 42h	00h::01h	0, 1	Off, On	Same note overlap
331	02h 43h	00h::01h	0, 1	Off, On	Pattern Reset
332	02h 44h	00h::0Fh	0::15	1::16	Pattern Length

Tempo

Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
335	02h 47h	00h::7Fh	0::127	0::39, 40::90(2), 91::164, 165::300(5)	Tempo (bpm)

Arp Step / Glide / Accent

Step 1-4 / **Step 5-8** / **Step 9-12** / **Step 13-16**

Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
336	02h 48h	340	02h 4Ch	344	02h 50h	348	02h 54h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
337	02h 49h	341	02h 4Dh	345	02h 51h	349	02h 55h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
338	02h 4Ah	342	02h 4Eh	346	02h 52h	350	02h 56h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
339	02h 4Bh	343	02h 4Fh	347	02h 53h	351	02h 57h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent

Arp Step Length / Timing

Step 1-4 / **Step 5-8** / **Step 9-12** / **Step 13-16**

Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
352	02h 58h	356	02h 5Ch	360	02h 60h	364	02h 64h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
353	03h 59h	357	02h 5Dh	361	02h 61h	365	02h 65h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
354	04h 5Ah	358	02h 5Eh	362	02h 62h	366	02h 66h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
355	05h 5Bh	359	02h 5Fh	363	02h 63h	367	02h 67h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing

Drum Map Name

Char 1-4 / **Char 5-8** / **Char 9-12** / **Char 13-16**

Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
368	02h 6Ch	372	02h 70h	376	02h 74h	380	02h 78h	20h::7Fh	32::127	ASCII	Drum Map Name
369	02h 6Dh	373	02h 71h	377	02h 75h	381	02h 79h	20h::7Fh	32::127	ASCII	Drum Map Name
370	02h 6Eh	374	02h 72h	378	02h 76h	382	02h 7Ah	20h::7Fh	32::127	ASCII	Drum Map Name
371	02h 6Dh	375	02h 73h	379	02h 77h	383	02h 7Bh	20h::7Fh	32::127	ASCII	Drum Map Name

Notes

- The Key parameter must be strictly ascending from Instrument 1 through 32, as it defines the splits between the instruments.
- Arp parameters for Drum Maps exist and edits are correctly stored, but are not always evaluated when the Drum Map is loaded. If that happens, it is necessary to initialize the Drum Map and immediately do a Recall. Sometimes just doing an edit followed by a Recall helps, too.

2.4.4 PDAT

The Pattern Data has a length of 536 bytes.

Pattern					
Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
1	00h 01h	00h::1Fh	1::32		Pattern Length

Transpose					
Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
2	00h 02h	00h, 01h, 02h	0, 1, 2	Off, On, 1 Octave	Mode
3	00h 03h	00h::7Fh	0::127	C-2::G8	Key
4	00h 04h	00h, 01h, 02h	0, 1, 2	Step, Cycle, Bank	Quantize

Option					
Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
5	00h 05h	10h, 11h, 12h, 13h, 14h::1Bh, 1Ch	16, 17, 18, 19, 20::27, 28	CtrVal1, CtrVal2, Notelen, Steplen, Note1::Note8, Transpose	Line parameter

Pattern Name											
Char 1-4		Char 5-8		Char 9-12		Char 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
8	00h 08h	12	00h 0Ch	16	00h 10h	20	00h 14h	20h::7Fh	32::127	ASCII	Pattern Name
9	00h 09h	13	00h 0Dh	17	00h 11h	21	00h 15h	20h::7Fh	32::127	ASCII	Pattern Name
10	00h 0Ah	14	00h 0Eh	18	00h 12h	22	00h 16h	20h::7Fh	32::127	ASCII	Pattern Name
11	00h 0Bh	31	00h 0Fh	19	00h 13h	23	00h 17h	20h::7Fh	32::127	ASCII	Pattern Name

Steps											
Step 1		Step 9		Step 17		Step 25					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
24	00h 18h	152	01h 18h	280	02h 18h	408	03h 18h	01h::7Fh	1::127	1::127	Cutoff
25	00h 19h	153	01h 19h	281	02h 19h	409	03h 19h	01h::7Fh	1::127	1::127	Velocity
26	00h 1Ah	154	01h 1Ah	282	02h 1Ah	410	03h 1Ah	01h::7Fh	1::127	1::127	CtrVal1
27	00h 1Bh	155	01h 1Bh	283	02h 1Bh	411	03h 1Bh	01h::7Fh	1::127	1::127	CtrVal2
28	00h 1Ch	156	01h 1Ch	284	02h 1Ch	412	03h 1Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
29	00h 1Dh	157	01h 1Dh	285	02h 1Dh	413	03h 1Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
30	00h 1Eh	158	01h 1Eh	286	02h 1Eh	414	03h 1Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
32	00h 20h	160	01h 20h	288	02h 20h	416	03h 20h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
33	00h 21h	161	01h 21h	289	02h 21h	417	03h 21h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
34	00h 22h	162	01h 22h	290	02h 22h	418	03h 22h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
35	00h 23h	163	01h 23h	291	02h 23h	419	03h 23h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
36	00h 24h	164	01h 24h	292	02h 24h	420	03h 24h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
37	00h 25h	165	01h 25h	293	02h 25h	421	03h 25h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
38	00h 26h	166	01h 26h	294	02h 26h	422	03h 26h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
39	00h 27h	167	01h 27h	295	02h 27h	423	03h 27h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8
Step 2		Step 10		Step 18		Step 26					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
40	00h 28h	168	01h 28h	296	02h 28h	424	03h 28h	01h::7Fh	1::127	1::127	Cutoff
41	00h 29h	169	01h 29h	297	02h 29h	425	03h 29h	01h::7Fh	1::127	1::127	Velocity
42	00h 2Ah	170	01h 2Ah	298	02h 2Ah	426	03h 2Ah	01h::7Fh	1::127	1::127	CtrVal1
43	00h 2Bh	171	01h 2Bh	299	02h 2Bh	427	03h 2Bh	01h::7Fh	1::127	1::127	CtrVal2
44	00h 2Ch	172	01h 2Ch	300	02h 2Ch	428	03h 2Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
45	00h 2Dh	173	01h 2Dh	301	02h 2Dh	429	03h 2Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
46	00h 2Eh	174	01h 2Eh	302	02h 2Eh	430	03h 2Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
48	00h 30h	176	01h 30h	304	02h 30h	432	03h 30h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
49	00h 31h	177	01h 31h	305	02h 31h	433	03h 31h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
50	00h 32h	178	01h 32h	306	02h 32h	434	03h 32h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
51	00h 33h	179	01h 33h	307	02h 33h	435	03h 33h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
52	00h 34h	180	01h 34h	308	02h 34h	436	03h 34h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
53	00h 35h	181	01h 35h	309	02h 35h	437	03h 35h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
54	00h 36h	182	01h 36h	310	02h 36h	438	03h 36h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
55	00h 37h	183	01h 37h	311	02h 37h	439	03h 37h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8
Step 3		Step 11		Step 19		Step 27					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
56	00h 38h	184	01h 38h	312	02h 38h	440	03h 38h	01h::7Fh	1::127	1::127	Cutoff
57	00h 39h	185	01h 39h	313	02h 39h	441	03h 39h	01h::7Fh	1::127	1::127	Velocity
58	00h 3Ah	186	01h 3Ah	314	02h 3Ah	442	03h 3Ah	01h::7Fh	1::127	1::127	CtrVal1
59	00h 3Bh	187	01h 3Bh	315	02h 3Bh	443	03h 3Bh	01h::7Fh	1::127	1::127	CtrVal2
60	00h 3Ch	188	01h 3Ch	316	02h 3Ch	444	03h 3Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
61	00h 3Dh	189	01h 3Dh	317	02h 3Dh	445	03h 3Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
62	00h 3Eh	190	01h 3Eh	318	02h 3Eh	446	03h 3Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
64	00h 40h	192	01h 40h	320	02h 40h	448	03h 40h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
65	00h 41h	193	01h 41h	321	02h 41h	449	03h 41h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
66	00h 42h	194	01h 42h	322	02h 42h	450	03h 42h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
67	00h 43h	195	01h 43h	323	02h 43h	451	03h 43h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
68	00h 44h	196	01h 44h	324	02h 44h	452	03h 44h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
69	00h 45h	197	01h 45h	325	02h 45h	453	03h 45h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
70	00h 46h	198	01h 46h	326	02h 46h	454	03h 46h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
71	00h 47h	199	01h 47h	327	02h 47h	455	03h 47h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8
Step 4		Step 12		Step 20		Step 28					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
72	00h 48h	200	01h 48h	328	02h 48h	456	03h 48h	01h::7Fh	1::127	1::127	Cutoff
73	00h 49h	201	01h 49h	329	02h 49h	457	03h 49h	01h::7Fh	1::127	1::127	Velocity
74	00h 4Ah	202	01h 4Ah	330	02h 4Ah	458	03h 4Ah	01h::7Fh	1::127	1::127	CtrVal1
75	00h 4Bh	203	01h 4Bh	331	02h 4Bh	459	03h 4Bh	01h::7Fh	1::127	1::127	CtrVal2
76	00h 4Ch	204	01h 4Ch	332	02h 4Ch	460	03h 4Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
77	00h 4Dh	205	01h 4Dh	333	02h 4Dh	461	03h 4Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
78	00h 4Eh	206	01h 4Eh	334	02h 4Eh	462	03h 4Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
80	00h 50h	208	01h 50h	336	02h 50h	464	03h 50h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
81	00h 51h	209	01h 51h	337	02h 51h	465	03h 51h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
82	00h 52h	210	01h 52h	338	02h 52h	466	03h 52h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
83	00h 53h	211	01h 53h	339	02h 53h	467	03h 53h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
84	00h 54h	212	01h 54h	340	02h 54h	468	03h 54h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
85	00h 55h	213	01h 55h	341	02h 55h	469	03h 55h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
86	00h 56h	214	01h 56h	342	02h 56h	470	03h 56h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
87	00h 57h	215	01h 57h	343	02h 57h	471	03h 57h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8

Steps												
Step 5			**Step 13**			**Step 21**			**Step 29**					
Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
88	00h	58h	216	01h	58h	344	02h	58h	472	03h	58h	01h::7Fh	1::127	1::127	Cutoff
89	00h	59h	217	01h	59h	345	02h	59h	473	03h	59h	01h::7Fh	1::127	1::127	Velocity
90	00h	5Ah	218	01h	5Ah	346	02h	5Ah	474	03h	5Ah	01h::7Fh	1::127	1::127	CtrVal1
91	00h	5Bh	219	01h	5Bh	347	02h	5Bh	475	03h	5Bh	01h::7Fh	1::127	1::127	CtrVal2
92	00h	5Ch	220	01h	5Ch	348	02h	5Ch	476	03h	5Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
93	00h	5Dh	221	01h	5Dh	349	02h	5Dh	477	03h	5Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
94	00h	5Eh	222	01h	5Eh	350	02h	5Eh	478	03h	5Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
96	00h	60h	224	01h	60h	352	02h	60h	480	03h	60h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
97	00h	61h	225	01h	61h	353	02h	61h	481	03h	61h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
98	00h	62h	226	01h	62h	354	02h	62h	482	03h	62h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
99	00h	63h	227	01h	63h	355	02h	63h	483	03h	63h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
100	00h	64h	228	01h	64h	356	02h	64h	484	03h	64h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
101	00h	65h	229	01h	65h	357	02h	65h	485	03h	65h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
102	00h	66h	230	01h	66h	358	02h	66h	486	03h	66h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
103	00h	67h	231	01h	67h	359	02h	67h	487	03h	67h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8
Step 6			**Step 14**			**Step 22**			**Step 30**						
Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
104	00h	68h	232	01h	68h	360	02h	68h	488	03h	68h	01h::7Fh	1::127	1::127	Cutoff
105	00h	69h	233	01h	69h	361	02h	69h	489	03h	69h	01h::7Fh	1::127	1::127	Velocity
106	00h	6Ah	234	01h	6Ah	362	02h	6Ah	490	03h	6Ah	01h::7Fh	1::127	1::127	CtrVal1
107	00h	6Bh	235	01h	6Bh	363	02h	6Bh	491	03h	6Bh	01h::7Fh	1::127	1::127	CtrVal2
108	00h	6Ch	236	01h	6Ch	364	02h	6Ch	492	03h	6Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
109	00h	6Dh	237	01h	6Dh	365	02h	6Dh	493	03h	6Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
110	00h	6Eh	238	01h	6Eh	366	02h	6Eh	494	03h	6Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
112	00h	70h	240	01h	70h	368	02h	70h	496	03h	70h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
113	00h	71h	241	01h	71h	369	02h	71h	497	03h	71h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
114	00h	72h	242	01h	72h	370	02h	72h	498	03h	72h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
115	00h	73h	243	01h	73h	371	02h	73h	499	03h	73h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
116	00h	74h	244	01h	74h	372	02h	74h	500	03h	74h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
117	00h	75h	245	01h	75h	373	02h	75h	501	03h	75h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
118	00h	76h	246	01h	76h	374	02h	76h	502	03h	76h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
119	00h	77h	247	01h	77h	375	02h	77h	503	03h	77h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8
Step 7			**Step 15**			**Step 23**			**Step 31**						
Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
120	00h	78h	248	01h	78h	376	02h	78h	504	03h	78h	01h::7Fh	1::127	1::127	Cutoff
121	00h	79h	249	01h	79h	377	02h	79h	505	03h	79h	01h::7Fh	1::127	1::127	Velocity
122	00h	7Ah	250	01h	7Ah	378	02h	7Ah	506	03h	7Ah	01h::7Fh	1::127	1::127	CtrVal1
123	00h	7Bh	251	01h	7Bh	379	02h	7Bh	507	03h	7Bh	01h::7Fh	1::127	1::127	CtrVal2
124	00h	7Ch	252	01h	7Ch	380	02h	7Ch	508	03h	7Ch	00h::1Ah		0::26 1/64::4Bars	Step Length
125	00h	7Dh	253	01h	7Dh	381	02h	7Dh	509	03h	7Dh	00h::1Ah		0::26 1/64::4Bars	Note Length
126	00h	7Eh	254	01h	7Eh	382	02h	7Eh	510	03h	7Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
128	01h	00h	256	02h	00h	384	03h	00h	512	04h	00h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
129	01h	01h	257	02h	01h	385	03h	01h	513	04h	01h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
290	01h	02h	258	02h	02h	386	03h	02h	514	04h	02h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
291	01h	03h	259	02h	03h	387	03h	03h	515	04h	03h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
292	01h	04h	260	02h	04h	388	03h	04h	516	04h	04h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
293	01h	05h	261	02h	05h	389	03h	05h	517	04h	05h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
294	01h	06h	262	02h	06h	390	03h	06h	518	04h	06h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
295	01h	07h	263	02h	07h	391	03h	07h	519	04h	07h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8
Step 8			**Step 16**			**Step 24**			**Step 32**						
Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	Idx	PAH	PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
296	01h	08h	264	02h	08h	392	03h	08h	520	04h	08h	01h::7Fh	1::127	1::127	Cutoff
297	01h	09h	265	02h	09h	393	03h	09h	521	04h	09h	01h::7Fh	1::127	1::127	Velocity
298	01h	0Ah	266	02h	0Ah	394	03h	0Ah	522	04h	0Ah	01h::7Fh	1::127	1::127	CtrVal1
299	01h	0Bh	267	02h	0Bh	395	03h	0Bh	523	04h	0Bh	01h::7Fh	1::127	1::127	CtrVal2
300	01h	0Ch	268	02h	0Ch	396	03h	0Ch	524	04h	0Ch	00h::1Ah	0::26	1/64::4Bars	Step Length
301	01h	0Dh	269	02h	0Dh	397	03h	0Dh	525	04h	0Dh	00h::1Ah	0::26	1/64::4Bars	Note Length
302	01h	0Eh	270	02h	0Eh	398	03h	0Eh	526	04h	0Eh	00h, 01h, 02h	0, 1, 3	Off, Hold, Pause	Hold/Pause
304	01h	10h	272	02h	10h	400	03h	10h	528	04h	10h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note1
305	01h	11h	273	02h	11h	401	03h	11h	529	04h	11h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note2
306	01h	12h	274	02h	12h	402	03h	12h	530	04h	12h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note3
307	01h	13h	275	02h	13h	403	03h	13h	531	04h	13h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note4
308	01h	14h	276	02h	14h	404	03h	14h	532	04h	14h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note5
309	01h	15h	277	02h	15h	405	03h	15h	533	04h	15h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note6
150	01h	16h	278	02h	16h	406	03h	16h	534	04h	16h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note7
151	01h	17h	279	02h	17h	407	03h	17h	535	04h	17h	00h, 01h::7Fh	0, 1::127	C#-2::G8	Note8

2.4.5 GDAT

The Global Data has a length of 200 bytes.

Initial Instrument Settings					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
32	00h 20h	00h::0Fh	0::15	Inst.1::Inst.16	Selection
33	00h 21h	00h, 01h	0, 1	Single Mode, Multi Mode	Mode
34	00h 22h	00h::63h	0::99	1::100	Multi Number
35	00h 23h	00h, 01h	0, 1	Internal, External	Multi Bank

Inst.1		Inst.2		Inst.3		Inst.4					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
0	00h 00h	1	00h 01h	2	00h 02h	3	00h 03h	00h::63h	0::99	1::100	Sound Number
16	00h 00h	17	00h 01h	18	00h 02h	19	00h 03h	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Bank Number
48	00h 00h	49	00h 01h	50	00h 02h	51	00h 03h	00h::64h	0, 1::100	Off, Pattern 1::100	Pattern Number

Pedals + Switches							
CV Pedal 1		CV Pedal 2					
Idx	PAH PAL	Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
4	00h 04h	8	00h 08h	00h::40h::7Fh	0::127	-64::00::+63	Pedal Offset
5	00h 05h	9	00h 09h	00h::7Fh	0::127	0::127	Pedal Gain
6	00h 06h	10	00h 0Ah	00h::7Fh	0::127	0::127	Pedal Curve
7	00h 07h	11	00h 0Bh	00h::07h	0::7	Off, Volume,Control W, Control X,Control Y, Control Z,F1 Cutoff, F2 Cutoff	Pedal Ctl
Foot Switch 1		Foot Switch 2					
Idx	PAH PAL	Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
64	00h 40h	66	00h 42h	00h::04h	0::4	Off,Switch Closed, Toggle Closed,Switch Open, Toggle Open	Mode
65	00h 41h	67	00h 43h	00h::05h	0::5	Sustain, Sostenuto,Control W, Control X,Control Y, Control Z	Controller

MIDI Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
12	00h 0Ch	36h::40h::4Ah	54::64::74	430::440::450	Tuning
13	00h 0Dh	34h::40h::4Ch	52::64::76	-12::0::+12	Transpose
14	00h 0Eh	00h, 01h, 02h, 03h	0, 1, 2, 3	Off, CC, SysEx, CC+SysEx	Controller Send
15	00h 0Fh	00h, 01h	0, 1	Off, On	Controller Recv
23	00h 17h	00h::78h	0::119	CC#0::CC#120	Controller W
24	00h 18h	00h::78h	0::119	CC#0::CC#120	Controller X
25	00h 19h	00h::78h	0::119	CC#0::CC#120	Controller Y
26	00h 1Ah	00h::78h	0::119	CC#0::CC#120	Controller Z
27	00h 1Bh	00h, 01h	0, 1	Off, On	Arpeggiator Send
31	00h 1Fh	00h, 01h, 02h, 03h	0, 1, 2, 3	Internal, Send, Auto, Auto-Thru	Clock
36	00h 24h	00h, 01h::10h	0, 1::16	omni, 1::16	MIDI Channel
37	00h 25h	00h::7Eh	0::126	0::126	SysEx Dev ID
38	00h 26h	00h, 01h	0, 1	Off, On	Local Control

DAC Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
20	00h 14h	00h::03h	0::3	1::4	DAC format

Program Change					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
21	00h 15h	00h, 01h, 02h	0, 1, 2	Off, Num, Num+Bank	RX
46	00h 2Eh	00h, 01h, 02h	0, 1, 2	Off, Num, Num+Bank	TX

Display Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
39	00h 27h	00::7Fh	0::127	0.1s::15.5s	Display Timeout
40	00h 28h	00::7Fh	0::127	0::127	Display Contrast

Keyboard Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
41	00h 29h	00h::08h	0::8	Exp2, Exp1, Linear, Log1, Log2, Fix32, Fix64, Fix100, Fix127	OnVelocity Curve
42	00h 2Ah	00h::09h	0::9	Off, Exp2, Exp1, Linear, Log1, Log2, Fix32, Fix64, Fix100, Fix127	ReleaseVelocity Curve
43	00h 2Bh	00h::04h	0::4	Exp2, Exp1, Linear,Log1, Log2	Pressure Curve
44	00h 2Ch	00h::03h	0::3	1::4	Input Gain

HMT					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
68	00h 44h	00h::05h	0::5	Tempered, Tonal,3/5, 3/5/ref, 3/5/7, Import	Mode
69	00h 45h	00h::64h	0::100	0%::100%	Depth
70	00h 46h	00h, 01h	0, 1	Off, On	MIDI Export

Mix In					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
71	00h 47h	00h::08h	0::8	Off, Aux, FX1::FX4,Main, Sub1, Sub2	Send
72	00h 48h	00h::7Fh	0::127	0::127	Level

AFM					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
73	00h 49h	00h, 01h	0, 1	Off, On	Auto Analog on SysEx (Q+ only)

2.4.6 FDAT

The Mode Data has a length of 1 byte.

Mode Data					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
00h	00h 00h	m:0b, 1b iiii:0000b::1111b 000iiiimb	m:0, 1 iiii:0::15	Single Mode, Multi Mode Inst.1::Inst.16	Mode Select Inst. Select Select

3 Waldorf microQ MIDI Implementation OS 2.20

3.1 Message Type Definitions

The model ID of the microQ is 10h.

3.1.1 Message Type Matrix

The message type matrix for the Waldorf microQ is defined as follows:

Command		Request R 0yh	Dump D 1yh	Parameter Change P 2yh	Parameter Inquiry Q 3yh	Reserved 4yh::6yh	Reserved
Sound	SND x0h	SNDR 00h	SNDD 10h	SNDP 20h	SNDQ 30h		70h
Multi	MUL x1h	MULR 01h	MULD 11h	MULP 21h	MULQ 31h		OS 71h
Drum Map	DRM x2h	DRMR 02h	DRMD 12h	DRMP 22h	DRMQ 32h		BIN 72h
Reserved	x3h	03h	13h	23h	33h		
Global Parameter	GLB x4h	GLBR 04h	GLBD 14h	GLBP 24h	GLBQ 34h		
Reserved	x5h::xfh						

Notes

- Access of parameters directly in memory is currently not implemented. Transfers from and to memory have to use full dumps or go through edit buffers of the appropriate type. Exceptions are Global Parameters, where no corresponding edit buffer exists. Global Parameters are scanned continously for changes by the Q and are automatically saved.
- Full remote control of the microQ is currently not possible.

3.1.2 Memory Organization

The memory of the Waldorf microQ is organized as three Sound banks with 100 entries each, one Drum Map bank with 20 entries and one Multi bank with 100 entries. No external memory can be provided.

3.1.3 Checksum

The checksum is omitted for parameter changes and requests. The microQ currently does not evaluate the checksum for dumps it receives; this is considered a bug and you should not rely on that "feature". The microQ will eventually reject data with an incorrect checksum.

3.1.4 SND – Sound Parameters

Messages dealing with Sounds will take one of the following forms, depending on the message type:

```
Request      := SOX IDW IDE DEV   SNDR BUFN SNDN                    EOX
Dump         := SOX IDW IDE DEV ( SNDD BUFN SNDN <SDAT>[383] CHK ) EOX
Para Change  := SOX IDW IDE DEV   SNDP SNDL PAH PAL SNDV            EOX
Para Inquiry := SOX IDW IDE DEV   SNDQ SNDL PAH PAL                 EOX
```

Sound Location		
BUFN	SNDN	Location
00h	00h::63h	A001::A100 (deprecated)
01h	00h::63h	B001::B100 (deprecated)
02h	00h::63h	C001::C100 (deprecated)
03h	00h::63h	X001::X100 (deprecated)
10h	00h	All Sounds
10h	40h	All Sounds of Bank A
10h	41h	All Sounds of Bank B
10h	42h	All Sounds of Bank C
10h	48h	All Sounds of Bank X
20h	00h	Edit Buffer of Current Sound
30h	00h::0Fh	Edit Buffer of Multi Instrument 1::16 (Multi Mode)
30h	00h::03h	Edit Buffer of Sound Layer Inst. 1::4 (Single Mode)
30h	10h::2Fh	Edit Buffer of Drum Map Instrument 1::32
40h	00h::63h	A001::A100
41h	00h::63h	B001::B100
42h	00h::63h	C001::C100
48h	00h::63h	X001::X100
	SNDL	Location
	00h	Edit Buffer of Current Sound
	00h::0Fh	Edit Buffer of Multi Instrument 1::16 (Multi Mode)
	00h::03h	Edit Buffer of Sound Layer Inst. 1::4 (Single Mode)
	10h::2Fh	Edit Buffer of Drum Map Instrument 1::32

Notes

- Requesting edit buffers that are not in use (e.g. edit buffer 04h::0Fh in single mode or edit buffers for unused drum map instruments) may yield spurious data that should not be fed back to the microQ.
- The All Sounds location can only be used in a request, the microQ will successively dump all sounds in the addressed range.

3.1.5 MUL

Messages dealing with Multis will take one of the following forms:

```
Request      := SOX IDW IDE DEV   MULR BUFN MULN                    EOX
Dump         := SOX IDW IDE DEV ( MULD BUFN MULN <MDAT>[384] ) CHK EOX
Para Change  := SOX IDW IDE DEV   MULP PAH PAL MULV                 EOX
Para Inquiry := SOX IDW IDE DEV   MULQ PAH PAL                      EOX
```

Multi Location		
BUFN	MULN	Location
00h	00h::63h	001::100 (deprecated)
03h	00h::09h	X01::X10 (deprecated)
10h	00h	All Multis
10h	40h	All internal Multis
10h	48h	All external Multis
20h	00h	Edit Buffer of Current Multi
40h	00h::63h	001::100
48h	00h::09h	X01::X10

Notes

- Sending Multi Dumps as well as requesting the multi edit buffer in Single Mode will switch the microQ into Multimode (bug or feature?). Multis in memory can not be requested while in single mode, these requests will be ignored.
- The All Multis category can only be used in a request, the microQ will dump successively all multis in the addressed range.

3.1.6 DRM

Messages dealing with Drum Maps will take one of the following forms:

```
Request       := SOX IDW IDE DEV   DRMR BUFN DRMN                    EOX
Dump          := SOX IDW IDE DEV ( DRMD BUFN DRMN <DDAT>[384] ) CHK EOX
Para Change   := SOX IDW IDE DEV   DRMP PAH PAL DRMV                 EOX
Para Inquiry  := SOX IDW IDE DEV   DRMQ PAH PAL                      EOX
```

Drum Map Location		
BUFN	DRMN	Location
00h	00h::13h	D01::D20 (deprecated)
01h	00h::13h	E01::E20 (deprecated)
10h	00h	All Drum Maps
10h	40h	All internal Drum Maps
10h	48h	All external Drum Maps
20h	00h	Edit Buffer of Current Drum Map
40h	00h::13h	D01::D20
40h	00h::13h	E01::E20

Notes

- Parameter changes for Drum Maps are currently not implemented, the microQ will neither send nor receive those messages.
- In single mode it is possible to request the current Drum Map edit buffer even though no Drum Map is currently active. The data received may be spurious and should not be fed back to the microQ.
- In Multimode or in a Sound Layer it is not necessary to switch to the instrument with the active Drum Map. Since there can only be one Drum Map, requesting the edit buffer of the current Drum Map always works.
- The All Drum Maps category can only be used in a request, the microQ will dump successively all Drum Maps in the addressed range.

3.1.7 GLB

Messages dealing with Global Data will take one of the following forms:

```
Request       := SOX IDW IDE DEV   GLBR                      EOX
Dump          := SOX IDW IDE DEV ( GLBD <GDATA>[200] ) CHK EOX
Para Change   := SOX IDW IDE DEV   GLBP PAH PAL GLBN         EOX
Para Inquiry  := SOX IDW IDE DEV   GLBQ PAH PAL              EOX
```

3.1.8 MOD

Messages dealing with Mode Data will take one of the following forms:

```
Request       := SOX IDW IDE DEV   MODR MODF                EOX
Dump          := SOX IDW IDE DEV ( MODD MODF <FDAT> ) CHK EOX
Para Change   := SOX IDW IDE DEV   MODP MODF PAH PAL MODV EOX
Para Inquiry  := SOX IDW IDE DEV   MODQ MODF PAH PAL       EOX
```

3.2 Channel Messages

3.2.1 Control Change

The microQ will interpret most CC as changes to sound sound parameters (when reception is enabled via the Global Menu or the Multi Setup). The few standard CC that it recognizes are performance parameters that won't change the sound program.

CC number	Status	microQ definition	Standard	Common Clashes
CC#0	*	Bank Select MSB	*	
CC#1	*	Modwheel	*	
CC#3	N/A	Filter Cutoff (F1+F2)		
CC#2	*	Breath Controller	*	
CC#4	*	Foot Controller	*	
CC#5		Glide Rate	*	
CC#6	N/A	Filter Resonance (F1+F2)		Data Entry MSB
CC#7	*	Channel Volume	*	
CC#8	N/A			
CC#9	N/A			
CC#10	*	Pan	*	
CC#11	*	Expression	*	
CC#12		Arp Range		Effect Control #1
CC#13		Arp Length		Effect Control #2
CC#14		Arp Active		
CC#15		LFO 1 Shape		

CC number	Status	microQ definition	Standard	Common Clashes
CC#16		LFO 1 Speed		General Purpose #1
CC#17		LFO 1 Sync		General Purpose #2
CC#18		LFO 1 Delay	General Purpose #3	
CC#19		LFO 2 Shape		General Purpose #4
CC#20		LFO 2 Speed		
CC#21		LFO 2 Sync		
CC#22		LFO 2 Delay		
CC#23		LFO 3 Shape		
CC#24		LFO 3 Speed		
CC#25		LFO 3 Sync		
CC#26		LFO 3 Delay		
CC#27		Osc 1 Octave		
CC#28		Osc 1 Semitone		
CC#29		Osc 1 Detune		
CC#30		Osc 1 FM		
CC#31		Osc 1 Shape		

CC number	Status	microQ definition	Standard	Common Clashes
CC#32	*	Bankselect LSB		
CC#33		Osc 1 PW		
CC#34		Osc 1 PWM		
CC#35		Osc 2 Octave		
CC#36		Osc 2 Semitone		
CC#37		Osc 2 Detune		
CC#38		Osc 2 FM		Data Entry LSB
CC#39		Osc 2 Shape		
CC#40		Osc 2 PW		
CC#41		Osc 2 PWM		
CC#42		Osc 3 Octave		
CC#43		Osc 3 Semitone		
CC#44		Osc 3 Detune		
CC#45		Osc 3 FM		
CC#46		Osc 3 Shape		
CC#47		Osc 3 PW		

CC number	Status	microQ definition	Standard	Common Clashes
CC#48		Osc 3 PWM		
CC#49		Sync		
CC#50		Pitchmod		
CC#51		Glide Mode		
CC#52		Osc 1 Level		
CC#53		Osc 1 Balance		
CC#54		Ringmod Level		
CC#55		Ringmod Balance		
CC#56		Osc 2 Level		
CC#57		Osc 2 Balance		
CC#58		Osc 3 Level		
CC#59		Osc 3 Balance		
CC#60		N/E Level		
CC#61		N/E Balance		
CC#62	*	Button1		
CC#63	*	Button2		

CC number	Status	microQ definition	Standard	Common Clashes
CC#64	*	Sustain Pedal	*	
CC#65		Glide Active	*	
CC#66	*	Sostenuto	*	
CC#67		Routing		Soft Pedal
CC#68		Filter 1 Type		Legato Pedal
CC#69		Filter 1 Cutoff		Hold 2 Pedal
CC#70		Filter 1 Resonance		Sound Variation
CC#71		Filter 1 Drive		Timbre / Harmonics
CC#72		Filter 1 Keytrack		Release Time
CC#73		Filter 1 Envelope Amount		Attack Time
CC#74		Filter 1 Velocity Amount		Brightness
CC#75		Filter 1 Cutoff Modulation		Sound Control #1
CC#76		Filter 1 FM		Sound Control #2
CC#77		Filter 1 Pan		Sound Control #3
CC#78		Filter 1 Panmod		Sound Control #4
CC#79		Filter 2 Type		Sound Control #5

CC number	Status	microQ definition	Standard	Common Clashes
CC#80		Filter 2 Cutoff		General Purpose #5
CC#81		Filter 2 Resonance		General Purpose #6
CC#82		Filter 2 Drive		General Purpose #7
CC#83		Filter 2 Keytrack		General Purpose #8
CC#84		Filter 2 Env. Amount		Portamento Control
CC#85		Filter 2 Env. Velocity		
CC#86		Filter 2 CM		
CC#87		Filter 2 FM		
CC#88		Filter 2 Pan		
CC#89		Filter 2 Panmod		
CC#90		Amp Volume		
CC#91		Amp Velocity		Effect Depth #1
CC#92		Amp Mod		Effect Depth #2
CC#93		FX 1 Mix		Effect Depth #3
CC#94		FX 2 Mix		Effect Depth #4
CC#95		FE Attack		Effect Depth #5
CC number	Status	microQ definition	Standard	Common Clashes
CC#96		FE Decay		Data Entry Increment
CC#97		FE Sustain		Data Entry Decrement
CC#98		FE Decay 2		NRPN LSB
CC#99		FE Sustain 2		NRPN MSB
CC#100		FE Release		RPN LSB
CC#101		AE Attack		RPN MSB
CC#102		AE Decay		Mono Pitch
CC#103		AE Sustain		
CC#104		AE Decay 2		
CC#105		AE Sustain 2		
CC#106		AE Release		
CC#107		E3 Attack		
CC#108		E3 Decay		
CC#109		E3 Sustain		
CC#110		E3 Decay 2		
CC#111		E3 Sustain 2		
CC number	Status	microQ definition	Standard	Common Clashes
CC#112		E3 Release		
CC#113		E4 Attack		
CC#114		E4 Decay		
CC#115		E4 Sustain		
CC#116		E4 Decay 2		
CC#117		E4 Sustain 2		
CC#118		E4 Release		
CC#119	N/A			
CC#120	*	All Sound Off	*	
CC#121	*	Reset All Controllers	*	
CC#122	*/G	Local Control	*	
CC#123	*	All Notes Off	*	
CC#124	N/A		*	Omni Mode Off
CC#125	N/A		*	Omni Mode On
CC#126	N/A		*	Poly Mode Off
CC#127	N/A		*	Poly Mode On

3.2.2 Program Change

Program Changes are interpreted by the microQ according the the mode (Single or Multi) it is in. The behaviour with respect to these messages can be changed by global settings and per Multi Instrument. In particular Program Change messages can be completely ignored or just the bank switch part of them. In the latter case only sounds within the currently selected sound bank are accessible in Sinlge Mode and only multi programs in the currently selected bank are accessible in Multi Mode. In the following it is assumed that the microQ is set up to receive complete Program Change messages.

Program Change Parameters			
Parameter	Value	Description	Name
BMSB	00h::7Eh, 7Fh	System DevID 0::126, Broadcast	Bank MSB
BLSB	i: 0b, 1b tt: 00b::11b x: 0b nnn: 000b::111b ittxnnnb	Pre-OS3, OS3 Sound, DrumMap, Multi, Reserved Internal 0::7 (see Table for valid values)	Implementation Data Type Memory Location Bank Bank LSB
PRG	00h::63h 00h::13h 00h::63h	Sound 001::100 Drum Map 001::020 Multi 001::100 (internal)	Program Number Program Number Program Number

The following table lists the valid bank numbers and programs. Some devices or programs will count the bank and program numbers from one instead of zero, especially if they expect decimal input. Adjust

the given bank and program numbers accordingly by adding one if this is the case.

BLSB	PRG	Bank Number	Program Number	Location
00h	00h::63h	0	0::99	A001::A100 (deprecated)
01h	00h::63h	1	0::99	B001::B100 (deprecated)
02h	00h::63h	2	0::99	C001::C100 (deprecated)
04h	00h::13h	4	0::19	D01::D20 (deprecated)
40h	00h::63h	64	0::99	A001::A100
41h	00h::63h	65	0::99	B001::B100
42h	00h::63h	66	0::99	C001::C100
50h	00h::13h	80	0::19	D01::D20
60h	00h::63h	96	0::99	Multi 001::100 (internal)

Notes

- The deprecated bank numbers are implemented for compatibility with the behaviour of the former OS versions. This behaviour is not described here and the use of these bank numbers is strongly discouraged.
- The microQ currently reacts to a number of invalid program change commands. This includes most of the numbers in the compatibility range and reserved range. Do not use these invalid program change commands.
- The bank select MSB is reserved for distinguishing devices on the same MIDI channel. It should be set to the SysEx Device ID (normally zero). A bank select MSB value of 127 is intended to be received by all devices regardless of their ID, thus acting as a broadcast. The bank select MSB is currently ignored.

3.3 Parameter Encodings

3.3.1 Modulation Sources and Destinations

Modulation Sources and Destinations						
$Value_{10}$	$Value_{16}$	FM Source	Fast Mod Source	Fast Mod Destination	Standard Mod Source	Standard Mod Destination
0	00h	Off	Off	Pitch	Off	Pitch
1	00h	Osc1	LFO1	O1 Pitch	LFO1	O1 Pitch
2	02h	Osc2	LFO1*MW	O1 FM	LFO1*MW	O1 FM
3	03h	Osc3	LFO2	O1 PW	LFO2	O1 PW
4	04h	Noise	LFO2*Prs	O2 Pitch	LFO2*Prs	O2 Pitch
5	05h	Ext L	LFO3	O2 FM	LFO3	O2 FM
6	06h	Ext R	FilterEnv	O2 PW	FilterEnv	O2 PW
7	07h	Ext L+R	AmpEnv	O3 Pitch	AmpEnv	O3 Pitch
8	08h	LFO1	Env3	O3 FM	Env3	O3 FM
9	09h	LFO2	Env4	O3 PW	Env4	O3 PW
10	0Ah	LFO3	Velocity	O1 Level	Keytrack	O1 Level
11	0Bh	FilterEnv	ModWheel	O1 Bal	Velocity	O1 Bal
12	0Ch	AmpEnv	Pitchbend	O2 Level	Rel Velocity	O2 Level
13	0Dh	Env3	Pressure	O2 Bal	Pressure	O2 Bal
14	0Eh	Env4		O3 Level	Poly Pressure	O3 Level
15	0Fh			O3 Bal	PitchBend	O3 Bal
16	10h			Ring Level	Modwheel	Ring Level
17	11h			Ring Bal	Sust. Controller	Ring Bal
18	12h			N/E Level	Foot Controlle r	N/E Level
19	13h			N/E Bal	Breath Controller	N/E Bal
20	14h			F1 Cutoff	Control W	F1 Cutoff
21	15h			F1 Res	Control X	F1 Res
22	16h			F1 FM	Control Y	F1 FM
23	17h			F1 Drive	Control Z	F1 Drive
24	18h			F1 Pan	Ctr Delay	F1 Pan
25	19h			F2 Cutoff	Mod1	F2 Cutoff
26	1Ah			F2 Res	Mod2	F2 Res
27	1Bh			F2 FM	Mod3	F2 FM
28	1Ch			F2 Drive	Mod4	F2 Drive
29	1Dh			F2 Pan	min	F2 Pan
30	1Eh			Volume	MAX	Volume
31	1Fh				Voice Num	LFO1 Speed
32	20h				Voice %16	LFO2 Speed
33	21h				Voice %8	LFO3 Speed
34	22h				Voice %4	FE Attack
35	23h				Voice %2	FE Decay
36	24h				Unisono Voice	FE Sustain
37	25h				U.Detune	FE Release
38	26h				U.De-Pan	AE Attack
39	27h				U.De-Oct	AE Decay
40	28h					AE Sustain
41	29h					AE Release
42	2Ah					Env3 Attack
43	2Bh					Env3 Decay
44	2Ch					Env3 Sustain
45	2Dh					Env3 Release
46	2Eh					Env4 Attack
47	2Fh					Env4 Decay
48	30h					Env4 Sustain
49	31h					Env4 Release
50	32h					M1F Amount
51	33h					M2F Amount
52	34h					M1S Amount
53	35h					M2S Amount
54	36h					O1 Sub Div
55	37h					O1 Sub Volume
56	38h					O2 Sub Div
57	39h					O2 Sub Volume

3.4 Data Type Definitions

3.4.1 SDAT

The sound data format exists in several versions on the Q and Q+, for the microQ only version 1 exists, which is roughly comparable to the version 9 on the Q. The microQ currently accepts sound dumps of an unknown version and hopes for the best. Editors should only work on sound formats they know and produce only the latest sound format. If a sound dump is received with an unknown sound version, no data should be changed. The currently known sound formats differ only by the scaling of some parameters. Waldorf microQ's at an older OS version than 2.20 will ignore some of the data listed since the corresponding functionality did not exist in older OS versions.

Compared to the sound dump of the Q the (unused) byte at index 244 is missing and the following bytes have moved up one position. Therefore the microQ sound dump is one byte shorter than the Q sound dump. Additionally, the parameter scaling of various parameters is different in the microQ. If sounds are converted between Q and microQ, some of these differences are automatically corrected, while others need to be changed manually.

Sound											
Idx	PAH PAL							$SNDV_{16}$	$SNDV_{10}$	Description	Name
0	00h 00h							01h	1	Version 1	Sound Format
Oscillator											
Osc1		**Osc2**		**Osc3**							
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
1	00h 01h	17	00h 11h	33	00h 21h			10h,1Ch,28h, 34h,40h,4Ch, 58h,64h,70h	16, 28, 40, 52, 64, 76, 88, 100, 112	128', 64', 32', 16', 8', 4', 2', 1', $\frac{1}{2}$'	Octave
2	00h 02h	18	00h 12h	34	00h 22h			34h::40h::4Ch	52::64::76	-12::0::+12	Semitone
3	00h 03h	19	00h 13h	35	00h 23h			00h::40h::7Fh	0::64::127	-64::0::+63	Detune
4	00h 04h	20	00h 14h	36	00h 24h			28h::40h::58h	40::64::88	-24::0::+24	Bend Range
5	00h 05h	21	00h 15h	37	00h 25h			00h::40h::7Fh	0::64::127	-200%::0%::+196%	Keytrack
6	00h 06h	22	00h 16h	38	00h 26h			00h::0Eh	0::14	Off, Osc1, Osc2, Osc3, Noise, Ext Left, Ext Right, Ext L+R, LFO1, LFO2, LFO3, Filter Env, Amp Env, Env 3, Env 4	FM Source
7	00h 07h	23	00h 17h	39	00h 27h			00h::7Fh	0::127		FM Amount
8	00h 08h	24	00h 18h					00h::06h	0::6	Off, Pulse, Saw, Triangle, Sine, Alt1, Alt2	Shape
				40	00h 28h			00h::04h	0::4	Off, Pulse, Saw, Triangle, Sine	Shape
9	00h 09h	25	00h 19h	41	00h 29h			00h::7Fh	0::127		Pulsewidth
10	00h 0Ah	26	00h 1Ah	42	00h 2Ah			00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	PWM Source
11	00h 0Bh	27	00h 1Bh	43	00h 2Bh			00h::40h::7Fh	0::64::127	-64::0::+63	PWM
12	00h 0Ch	28	00h 1Ch					00h::1Fh	0::31	1::32	Sub Freq Div
13	00h 0Dh	29	00h 1Dh					00h::7Fh	0::127		Sub Volume
Sync											
Idx	PAH PAL							$SNDV_{16}$	$SNDV_{10}$	Description	Name
49	00h 31h							00h::01h		Off, On	Enable
PitchMod											
Idx	PAH PAL							$SNDV_{16}$	$SNDV_{10}$	Description	Name
50	00h 32h							00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Source
51	00h 33h							00h::40h::7Fh	0::64::127	-64::0::+63	Amount
Glide											
Idx	PAH PAL							$SNDV_{16}$	$SNDV_{10}$	Description	Name
53	00h 35h							00h, 01h	0, 1	Off, On	Active
56	00h 38h							00h, 01h, 02h, 04h	0, 1, 2, 4	Portamento, Fingd. Portamento, Glissando, Fingd. Glissando	Mode
57	00h 39h							00h::7Fh	0::127		Rate
Sound											
Idx	PAH PAL							$SNDV_{16}$	$SNDV_{10}$	Description	Name
58	00h 3Ah							m:0h::1h n:0h::5h nmh	0, 1 0, 1, 2::5	Poly, Mono Off,Dual,3::6	Voice Mode Unisono Count
59	00h 3Bh							00h::7Fh	0::127		Unisono Detune
Mixer											
Osc1		**Osc2**		**Osc3**							
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL			$SNDV_{16}$	$SNDV_{10}$	Description	Name
61	00h 3Dh	63	00h 3Fh	65	00h 41h			00h::7Fh	0::127		Level
62	00h 3Eh	64	00h 40h	66	00h 42h			00h::40h::7Fh	0::64::127	F1 64::Mid::F2 63	Balance
Noise/Ext.In		**Ring Mod**									
Idx	PAH PAL	Idx	PAH PAL					$SNDV_{16}$	$SNDV_{10}$	Description	Name
67	00h 43h	71	00h 47h					00h::7Fh	0::127		Mix Level
68	00h 44h	72	00h 48h					00h::40h::7Fh	0::64::127	F1 64::Mid::F2 63	Balance
75	00h 4Bh							00h::03h	0::3	Noise,Ext Left, Ex Right, Ext L+R	Select F1
76	00h 4Ch							00h::03h	0::3	Noise,Ext Left, Ex Right, Ext L+R	Select F2

Filter

Filter 1		Filter 2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
77	00h 4Dh	97	00h 61h	00h, 01h, 02h, 03h, 04h, 05h, 06h, 07h, 08h, 09h, 0Ah	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Bypass, 24dB LP, 12dB LP, 24dB BP, 12dB BP, 24dB HP, 12dB HP, 24dB Notch, 12dB Notch, Comb+, Comb-	Type
78	00h 4Eh	98	00h 62h	00h::7Fh	0::127		Cutoff
80	00h 50h	100	00h 64h	00h::7Fh	0::127		Resonance
81	00h 51h	101	00h 65h	00h::7Fh	0::127		Drive
86	00h 56h	106	00h 6Ah	00h::40h::7Fh	0::64::127	-200%::0%::+196%	Keytrack
87	00h 57h	107	00h 6Bh	00h::40h::7Fh	0::64::127	-64::0::+63	Envelope Modulation
88	00h 58h	108	00h 6Ch	00h::40h::7Fh	0::64::127	-64::0::+63	Velocity Modulation
89	00h 59h	109	00h 6Dh	00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Modulation Source
90	00h 5Ah	110	00h 6Eh	00h::40h::7Fh	0::64::127	-63::0::+63	Cutoff Modulation
91	00h 5Bh	111	00h 6Fh	00h::0Eh	0::14	Off, Osc1, Osc2, Osc3, Noise, Ext Left, Ext Right, Ext L+R, LFO1, LFO2, LFO3, Filter Env, Amp Env, Env 3, Env 4	FM Source
92	00h 5Ch	112	00h 70h	00h::7Fh	0::127	Off, 1::127	FM Amount
93	00h 5Dh	113	00h 71h	00h::40h::7Fh	0::64::127	Left 64::Center::Right 63	Pan
94	00h 5Eh	114	00h 72h	00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Pan Mod Source
95	00h 5Fh	115	00h 73h	00h::40h::7Fh	0::64::127	-64::0::+63	Pan Modulation

Filter

Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
117	00h 75h	00h, 01h	0, 1	parallel, serial	Routing

Amp

Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
121	00h 79h	00h::7Fh	0::127		Volume
122	00h 7Ah	00h::40h::7Fh	0::64::127	-64::0::+63	Velocity
123	00h 7Bh	00h::0Dh	0::13	Off, LFO1, LFO1*MW, LFO2, LFO2*Prs, LFO3, FilterEnv, AmpEnv, Env3, Env4, Velocity, ModWheel, Pitchbend, Pressure	Modulation Source
124	00h 7Ch	00h::40h::7Fh	0::64::127	-64::0::+63	Modulation Amount

Effects

FX1		FX2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
128	01h 00h	144	01h 10h	00h::06h	0::6	Bypass, Chorus, Flanger, Phaser, Overdrive, Five FX, Vocoder	Effect
		144	01h 10h	07h::0Ah	7::10	Delay, Reverb, 5.1 Delay, 5.1 D.Clk	Effect FX2 only
129	01h 01h	145	01h 11h	00h::7Fh	0::127	Dry::Wet	Mix

Chorus FX1		Chorus FX2		Flanger FX1		Flanger FX2					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	130	01h 02h	146	01h 12h	00h::7Fh	0::127		Speed
131	01h 03h	147	01h 13h	131	01h 03h	147	01h 13h	00h::7Fh	0::127		Depth
133	01h 05h	149	01h 15h					00h::7Fh	0::127		Delay
				134	01h 06h	150	01h 16h	00h::7Fh	0::127	0%::100%	Feedback
				138	01h 0Ah	154	01h 1Ah	00h,01h	0, 1	Positive, Negative	Polarity

Phaser FX1		Phaser FX2		Delay FX2					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h			00h::7Fh	0::127		Speed
131	01h 03h	147	01h 13h			00h::7Fh	0::127		Depth
134	01h 06h	150	01h 16h	150	01h 16h	00h::7Fh	0::127	0%::100%	Feedback
135	01h 07h	151	01h 17h			00h::7Fh	0::127		Center
				151	01h 17h	00h::7Fh	0::127		Cutoff
136	01h 08h	152	01h 18h			00h::7Fh	0::127		Spacing
138	01h 0Ah	154	01h 1Ah	154	01h 1Ah	00h::01h	0, 1	Positive, Negative	Polarity
				155	01h 1Bh	00h::01h	0, 1	Off, On	Autopan

Overdrive FX1		Overdrive FX2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
131	01h 03h	147	01h 13h	00h::7Fh	0::127		Drive
132	01h 04h	148	01h 14h	00h::7Fh	0::127		Post Gain
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Cutoff

FiveFX FX1		FiveFX FX2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::7Fh	1::127		Chorus Speed
131	01h 03h	147	01h 13h	00h::7Fh	0::127		Chorus Depth
132	01h 04h	148	01h 14h	00h::7Fh	0::127		Delay
133	01h 05h	149	01h 15h	00h::7Fh	0::127		Chorus/Delay L
134	01h 06h	150	01h 16h	00h::7Fh	0::127	44.1KHz::2.6Hz	Sample&Hold
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Overdrive
136	01h 08h	152	01h 18h	00h::08h	0::8	External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Ring Mod Source
137	01h 09h	153	01h 19h	00h::7Fh	0::127		Ring Mod Level

Vocoder FX1		Vocoder FX2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::17h	2::25		Bands
131	01h 03h	147	01h 13h	00h::08h	0::8	External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Analysis Signal
132	01h 04h	148	01h 14h	00h::7Fh	0::127	10.9Hz::16.7KHz	A. Lo Freq
133	01h 05h	149	01h 15h	00h::7Fh	0::127	10.9Hz::16.7KHz	A. Hi Freq
134	01h 06h	150	01h 16h	00h::40h::7Fh	0::64::127 -128::-32(x3), -34::0::31(x1), +35::+128(x3)	S. Offset	
135	01h 07h	151	01h 17h	00h::40h::7Fh	0::64::127 -128::-32(x3), -34::0::31(x1), +35::+128(x3)	Hi Offset	
136	01h 08h	152	01h 18h	00h::40h::7Fh	0::64::127	-64::0::+63	Bandwidth
137	01h 09h	153	01h 19h	00h::40h::7Fh	0::64::127	-64::0::+63	Resonance
138	01h 0Ah	154	01h 1Ah	00h::7Fh	0::127		Attack
139	01h 0Bh	155	01h 1Bh	00h::7Fh	0::127		Decay
140	01h 0Ch	156	01h 1Ch	00h::40h::7Fh	0::64::127	-64::0::+63	EQ Low Level
141	01h 0Dh	157	01h 1Dh	00h::18h	0::24	Band 1::Band 25	EQ Mid Band
142	01h 0Eh	158	01h 1Eh	00h::40h::7Fh	0::64::127	-64::0::+63	EQ Mid Level
143	01h 0Fh	159	01h 1Fh	00h::40h::7Fh	0::64::127	-64::0::+63	EQ High Level

Reverb FX1		Reverb FX2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
130	01h 02h	146	01h 12h	00h::7Fh	0::127	3m::30m	Size
131	01h 03h	147	01h 13h	00h::7Fh	0::127		Shape
132	01h 04h	148	01h 14h	00h::7Fh	0::127		Decay
133	01h 05h	149	01h 15h	00h::7Fh	0::127	0ms::300ms	Pre-Delay
135	01h 07h	151	01h 17h	00h::7Fh	0::127		Lowpass
136	01h 08h	152	01h 18h	00h::7Fh	0::127		Highpass
137	01h 09h	153	01h 19h	00h::7Fh	0::127		Diffusion
138	01h 0Ah	154	01h 1Ah	00h::7Fh	0::127		Damping

5.1 Delay FX2		5.1 Clk.Delay FX2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
146	01h 12h			00h::7Fh	0::127	1.4ms::1.48s	Delay
		146	01h 12h	00h::1Dh	0::29	1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
147	01h 13h	147	01h 13h	00h::7Fh	0::127	0%::100%	Feedback
148	01h 14h	148	01h 14h	00h::7Fh	0::127	10.9Hz::16.7KHz	LFE LP
149	01h 15h	149	01h 15h	00h::7Fh	0::127	10.9Hz::16.7KHz	Input HP
150	01h 16h	150	01h 16h	00h::7Fh	0::127	0%::400%	Delay ML
151	01h 17h	151	01h 17h	00h::7Fh	0::127		FSL Volume
152	01h 18h	152	01h 18h	00h::7Fh	0::127	0%::400%	Delay MR
153	01h 19h	153	01h 19h	00h::7Fh	0::127		FSR Volume
154	01h 1Ah	154	01h 1Ah	00h::7Fh	0::127	0%::400%	Delay S2L
155	01h 1Bh	155	01h 1Bh	00h::7Fh	0::127		CntrS Volume
156	01h 1Ch	156	01h 1Ch	00h::7Fh	0::127	0%::400%	Delay S1L
157	01h 1Dh	157	01h 1Dh	00h::7Fh	0::127		RearSL Volume
158	01h 1Eh	158	01h 1Eh	00h::7Fh	0::127	0%::400%	Delay S1R
159	01h 1Fh	159	01h 1Fh	00h::7Fh	0::127		RearSR Volume

LFO									
LFO1		LFO2		LFO3					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
160	01h 20h	172	01h 2Ch	184	01h 38h	00h::05h	0::5	Sine, Triangle, Square, Saw, Random, S&H	Shape
161	01h 21h	173	01h 2Dh	185	01h 39h	00h::7Fh 00h::7Eh(2)	0::127 0::126(2)	0::127 256, 192, 160, 144, 128, 120, 96, 80, 72, 64, 48, 40, 36, 32, 24, 20, 18, 16, 15, 14, 12, 10, 9, 8, 7, 6, 5, 4, 3.5, 3, 2.66, 2.4, 2, 1.75, 1.5, 1.33, 1.2, 1, 7/8, 1/2., 1/2T, 5/8, 1/2, 7/16, 1/4., 1/4T, 5/16, 1/4, 7/32, 1/8., 1/8T, 5/32, 1/8, 7/64, 1/16., 1/16T, 5/64, 1/16, 1/32., 1/32T, 1/32, 1/64T, 1/64, 1/96 bars	Speed (Clocked:=Off) Speed (Clocked:=On)
163	01h 23h	175	01h 2Fh	187	01h 3Bh	00h, 01h	0, 1	Off, On	Sync
164	01h 24h	176	01h 30h	188	01h 3Ch	00h, 01h	0, 1	Off, On	Clocked
165	01h 25h	177	01h 31h	189	01h 3Dh	00h, 01h::7Fh	0, 1::127	Free, 0::360	Start Phase
166	01h 26h	178	01h 32h	190	01h 3Eh	00h::7Fh	0::127	0::127	Delay
167	01h 27h	179	01h 33h	191	01h 3Fh	00h::40h::7Fh	0::64::127	-64::0::+63	Fade
170	01h 2Ah	182	01h 36h	194	01h 42h	00h::40h::7Fh	0::64::127	-200%::0%::+196%	Keytrack

Envelopes													
FiltEnv		AmpEnv		Env 3		Env 4							
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
196	01h 44h	208	01h 50h	220	01h 5Ch	232	01h 68h	m:0h, 1h, 2h, 3h, 4h t:0h, 2h tmh	0::4 0, 2	ADSR, ADS1DS2R, One Shot, Loop S1S2, Loop All Normal, Single	Env Mode Trigger Mode
197	01h 47h	211	01h 53h	223	01h 5Fh	235	01h 6Bh	00h::7Fh	0::127	0::127	Attack
198	01h 48h	212	01h 54h	224	01h 60h	236	01h 6Ch	00h::7Fh	0::127	0::127	Attack Level
199	01h 49h	213	01h 55h	225	01h 61h	237	01h 6Dh	00h::7Fh	0::127	0::127	Decay
200	01h 4Ah	214	01h 56h	226	01h 62h	238	01h 6Eh	00h::7Fh	0::127	0::127	Sustain
201	01h 4Bh	215	01h 57h	227	01h 63h	239	01h 6Fh	00h::7Fh	0::127	0::127	Decay 2
202	01h 4Ch	216	01h 58h	228	01h 64h	240	01h 70h	00h::7Fh	0::127	0::127	Sustain 2
203	01h 4Dh	217	01h 59h	229	01h 65h	241	01h 71h	00h::7Fh	0::127	0::127	Release

Modifiers											
Mod 1		Mod 2		Mod 3		Mod 4					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
245	01h 75h	249	01h 79h	253	01h 7Dh	257	02h 01h	00h::27h	0::39	⇒ Standard Mod Source	Source1
246	01h 76h	250	01h 7Ah	254	01h 7Eh	258	02h 02h	00h::27h	0::39	⇒ Standard Mod Source	Source 2
247	01h 77h	251	01h 7Bh	255	01h 7Fh	259	02h 03h	00h::07h	0::7	+, -, *, AND, OR, XOR, MAX, min	Operator
248	01h 78h	252	01h 7Ch	256	02h 00h	260	02h 04h	00h::40h::7Fh	0::64::127	-64::0::+63	Constant

Fast Mod Matrix											
Slot 1F		Slot 3F		Slot 5F		Slot 7F					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
261	02h 05h	267	02h 0Bh	273	02h 11h	279	02h 17h	00h::0Dh	0::13	⇒ Fast Mod Source	Source
262	02h 06h	268	02h 0Ch	274	02h 12h	280	02h 18h	00h::1Eh	0::30	⇒ Fast Mod Destination	Destination
263	02h 07h	269	02h 0Dh	275	02h 13h	281	02h 19h	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Fast Mod Matrix											
Slot 2F		Slot 4F		Slot 6F		Slot 8F					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
264	02h 08h	270	02h 0Eh	276	02h 14h	282	02h 1Ah	00h::0Dh	0::13	⇒ Fast Mod Source	Source
265	02h 09h	271	02h 0Fh	277	02h 15h	283	02h 1Bh	00h::1Eh	0::31	⇒ Fast Mod Destination	Destination
266	02h 0Ah	272	02h 10h	278	02h 16h	284	02h 1Ch	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Standard Mod Matrix											
Slot 1S		Slot 3S		Slot 5S		Slot 7S					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
285	02h 1Dh	291	02h 23h	297	02h 29h	303	02h 2Fh	00h::27h	0::39	⇒ Standard Mod Source	Source
286	02h 1Eh	292	02h 24h	298	02h 2Ah	304	02h 30h	00h::39h	0::57	⇒ Standard Mod Destination	Destination
287	02h 1Fh	293	02h 25h	299	02h 2Bh	305	02h 31h	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Standard Mod Matrix											
Slot 2S		Slot 4S		Slot 6S		Slot 8S					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
288	02h 20h	294	02h 26h	300	02h 2Ch	306	02h 32h	00h::27h	0::39	⇒ Standard Mod Source	Source
289	02h 21h	295	02h 27h	301	02h 2Dh	307	02h 33h	00h::39h	0::57	⇒ Standard Mod Destination	Destination
290	02h 22h	296	02h 28h	302	02h 2Eh	308	02h 34h	00h::40h::7Fh	0::64::127	-64::0::+63	Amount

Controller Delay					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
309	02h 35h	00h::27h	0::39	⇒ Standard Mod Source	Source
310	02h 36h	00h::7Fh	0::127		Ctr.Delay

Arp					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
311	02h 37h	00h::03h	0::3	Off, On, One shot, Hold	Mode
312	02h 38h	00h, 01h, 02h::10h	0, 1, 2::16	Off, User, ROM1::ROM15	Pattern
313	02h 39h	00h::0Fh	0::15	1::16	Max. Notes
314	02h 3Ah	00h::7Fh	0::127	3/192::130/192	Clock
315	02h 3Bh	00h, 01h::7Fh	0, 1::127	Legato, 1::127	Length
316	02h 3Ch	00h::09h	0::9	1::10	Octave Range
317	02h 3Dh	00h::03h	0::3	Up, Down, Alt Up, Alt Down	Direction
318	02h 3Eh	00h::05h	0::5	As played, Reversed, NumLo¿Hi, NumHi¿Lo, VelLo¿Hi, VelHi¿Lo	Sort Order
319	02h 3Fh	00h, 01h, 02h	0, 1, 2	Each note, First note, Last note	Velo Mode
320	02h 40h	00h::7Fh	0::127	0::127	T. Factor
321	02h 41h	00h::01h	0, 1	Off, On	Same note overlap
322	02h 42h	00h::01h	0, 1	Off, On	Pattern Reset
323	02h 43h	00h::0Fh	0::15	1::16	Pattern Length

Tempo					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
326	02h 46h	00h::7Fh	0::127	0::39, 40::90(2), 91::164, 165::300(5)	Tempo (bpm)

Arp Step / Glide / Accent										
Step 1-4		Step 5-8		Step 9-12		Step 13-16				
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
327	02h 47h	331	02h 4Bh	335	02h 4Fh	339	02h 53h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
328	02h 48h	332	02h 4Ch	336	02h 50h	340	02h 54h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
329	02h 49h	333	02h 4Dh	337	02h 51h	341	02h 55h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
330	02h 4Ah	334	02h 4Eh	338	02h 52h	342	02h 56h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0sssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent

Arp Step Length / Timing											
Step 1-4		Step 5-8		Step 9-12		Step 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
343	02h 57h	347	02h 5Bh	351	02h 5Fh	355	02h 63h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
344	03h 58h	348	02h 5Ch	352	02h 60h	356	02h 64h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
345	04h 59h	349	02h 5Dh	353	02h 61h	357	02h 65h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
346	05h 5Ah	350	02h 5Eh	354	02h 62h	358	02h 66h	lll:=000b::111b ttt:=000b::111b 01ll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing

Sound Name											
Char 1-4		Char 5-8		Char 9-12		Char 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
363	02h 6Bh	367	02h 6Fh	371	02h 73h	375	02h 77h	20h::7Fh	32::127	ASCII	Sound Name
364	02h 6Ch	368	02h 70h	372	02h 74h	376	02h 78h	20h::7Fh	32::127	ASCII	Sound Name
365	02h 6Dh	369	02h 71h	373	02h 75h	377	02h 79h	20h::7Fh	32::127	ASCII	Sound Name
366	02h 6Eh	370	02h 72h	374	02h 76h	378	02h 7Ah	20h::7Fh	32::127	ASCII	Sound Name

Sound Category					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
379	02h 7Ch	20h::7Fh	32::127	ASCII	Sound Category
380	02h 7Dh	20h::7Fh	32::127	ASCII	Sound Category
381	02h 7Eh	20h::7Fh	32::127	ASCII	Sound Category
382	02h 7Fh	20h::7Fh	32::127	ASCII	Sound Category

Notes

- Controller Delay is not implemented.

3.4.2 MDAT

The Multi Data has a length of 384 bytes.

Multi																	
Idx	PAH PAL								$MULV_{16}$	$MULV_{10}$	Description	Name					
0	00h 00h								00h::7Fh	1::127		Multi Volume					
Controllers																	
Control W		**Control X**		**Control Y**		**Control Z**											
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL		$MULV_{16}$	$MULV_{10}$	Description	Name					
1	00h 01h	2	00h 02h	3	00h 03h	4	00h 04h		00h::78h, 79h	0::119, 120	CC#0::CC#120,Global	Controller Assignment					
Sound Name																	
Char 1-4		**Char 5-8**		**Char 9-12**		**Char 13-16**											
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL		$MULV_{16}$	$MULV_{10}$	Description	Name					
16	00h 10h	20	00h 14h	24	00h 18h	28	00h 1Ch		20h::7Fh	32::127	ASCII	Sound Name					
17	00h 11h	21	00h 15h	25	00h 19h	29	00h 1Dh		20h::7Fh	32::127	ASCII	Sound Name					
18	00h 12h	22	00h 16h	26	00h 1Ah	30	00h 1Eh		20h::7Fh	32::127	ASCII	Sound Name					
19	00h 13h	23	00h 17h	27	00h 1Bh	31	00h 1Fh		20h::7Fh	32::127	ASCII	Sound Name					
Multi Instruments																	
Inst.1		**Inst.5**		**Inst.9**		**Inst.13**											
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL		$MULV_{16}$	$MULV_{10}$	Description	Name					
32	00h 20h	120	00h 78h	208	01h 50h	296	02h 28h		00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank					
33	00h 21h	121	00h 79h	209	01h 51h	297	02h 29h		00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number					
34	00h 22h	122	00h 7Ah	210	01h 52h	298	02h 2Ah		00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel					
35	00h 23h	123	00h 7Bh	211	01h 53h	299	02h 2Bh		00h::7Fh	0::127	0::127	Volume					
36	00h 24h	124	00h 7Ch	212	01h 54h	300	02h 2Ch		10h::70h	16::112	-48::+48	Transpose					
37	00h 25h	125	00h 7Dh	213	01h 55h	301	02h 2Dh		00h::7Fh	0::127	-64::+63	Detune					
38	00h 26h	126	00h 7Eh	214	01h 56h	302	02h 2Eh		00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output					
39	00h 27h	127	00h 7Fh	215	01h 57h	303	02h 2Fh		rr:=00b::11b tt:=00b::11b pp:=00b::10b 00ppttrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status					
40	00h 28h	128	01h 00h	216	01h 58h	304	02h 30h		00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan					
43	00h 2Bh	131	01h 03h	219	01h 5Bh	307	02h 33h		00h::64h	0::100	Off, 1::100	Pattern Number					
44	00h 2Ch	132	01h 04h	220	01h 5Ch	308	02h 34h		01h::7Fh	1::127	1::127	Low Velo					
45	00h 2Dh	133	01h 05h	221	01h 5Dh	309	02h 35h		01h::7Fh	1::127	1::127	High Velo					
46	00h 2Eh	134	01h 06h	222	01h 5Eh	310	02h 36h		00h::7Fh	0::127	C-2::G8	Low Key					
47	00h 2Fh	135	01h 07h	223	01h 5Fh	311	02h 37h		00h::7Fh	0::127	C-2::G8	High Key					
48	00h 30h	136	01h 08h	224	01h 60h	312	02h 38h		t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status					
Inst.2		**Inst.6**		**Inst.10**		**Inst.14**											
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL		$MULV_{16}$	$MULV_{10}$	Description	Name					
54	00h 36h	142	01h 0Eh	230	01h 66h	318	02h 3Eh		00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank					
55	00h 37h	143	01h 0Fh	231	01h 67h	319	02h 3Fh		00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number					
56	00h 38h	144	01h 10h	232	01h 68h	320	02h 40h		00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel					
57	00h 39h	145	01h 11h	233	01h 69h	321	02h 41h		00h::7Fh	0::127	0::127	Volume					
58	00h 3Ah	146	01h 12h	234	01h 6Ah	322	02h 42h		10h::70h	16::112	-48::+48	Transpose					
59	00h 3Bh	147	01h 13h	235	01h 6Bh	323	02h 43h		00h::7Fh	0::127	-64::+63	Detune					
60	00h 3Ch	148	01h 14h	236	01h 6Ch	324	02h 44h		00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output					
61	00h 3Dh	149	01h 15h	237	01h 6Dh	325	02h 45h		rr:=00b::11b tt:=00b::11b pp:=00b::10b 00ppttrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status					
62	00h 3Eh	150	01h 16h	238	01h 6Eh	326	02h 46h		00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan					
66	00h 42h	154	01h 1Ah	242	01h 72h	330	02h 4Ah		01h::7Fh	1::127	1::127	Low Velo					
67	00h 43h	155	01h 1Bh	243	01h 73h	331	02h 4Bh		01h::7Fh	1::127	1::127	High Velo					
68	00h 44h	156	01h 1Ch	244	01h 74h	332	02h 4Ch		00h::7Fh	0::127	C-2::G8	Low Key					
69	00h 45h	157	01h 1Dh	245	01h 75h	333	02h 4Dh		00h::7Fh	0::127	C-2::G8	High Key					
70	00h 46h	158	01h 1Eh	246	01h 76h	334	02h 4Eh		t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status					

Inst.3		Inst.7		Inst.11		Inst.15					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
76	00h 4Ch	164	01h 24h	252	01h 7Ch	340	02h 54h	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank
77	00h 4Dh	165	01h 25h	253	01h 7Dh	341	02h 55h	00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number
78	00h 4Eh	166	01h 26h	254	01h 7Eh	342	02h 56h	00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel
79	00h 4Fh	167	01h 27h	255	01h 7Fh	343	02h 57h	00h::7Fh	0::127	0::127	Volume
80	00h 50h	168	01h 28h	256	02h 00h	344	02h 58h	10h::70h	16::112	-48::+48	Transpose
81	00h 51h	169	01h 29h	257	02h 01h	345	02h 59h	00h::7Fh	0::127	-64::+63	Detune
82	00h 52h	170	01h 2Ah	258	02h 02h	346	02h 5Ah	00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output
83	00h 53h	171	01h 2Bh	259	02h 03h	347	02h 5Bh	rr:=00b::11b tt:=00b::11b pp:=00b::10b 00pptrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status
84	00h 54h	172	01h 2Ch	260	02h 04h	348	02h 5Ch	00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan
88	00h 58h	176	01h 30h	264	02h 08h	352	02h 60h	01h::7Fh	1::127	1::127	Low Velo
89	00h 59h	177	01h 31h	265	02h 09h	353	02h 61h	01h::7Fh	1::127	1::127	High Velo
90	00h 5Ah	178	01h 32h	266	02h 0Ah	354	02h 62h	00h::7Fh	0::127	C-2::G8	Low Key
91	00h 5Bh	179	01h 33h	267	02h 0Bh	355	02h 63h	00h::7Fh	0::127	C-2::G8	High Key
92	00h 5Ch	180	01h 34h	268	02h 0Ch	356	02h 64h	t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status

Inst.4		Inst.8		Inst.12		Inst.16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$MULV_{16}$	$MULV_{10}$	Description	Name
98	00h 62h	186	01h 3Ah	274	02h 12h	362	02h 6Ah	00h::02h, 03h, 04h, 05h	0::2, 3, 4, 5	A::C, X, D, E	Sound Bank Drum Map Bank
99	00h 63h	187	01h 3Bh	275	02h 13h	363	02h 6Bh	00h::63h 00h::13h	0::99 0:19	1::100 (banks A::C,X) 1::20 (banks D,E)	Sound Number
100	00h 64h	188	01h 3Ch	276	02h 14h	364	02h 6Ch	00h, 01h, 02h::11h	0, 1, 2::17	Global, Omni, Channel 1::16	MIDI Channel
101	00h 65h	189	01h 3Dh	277	02h 15h	365	02h 6Dh	00h::7Fh	0::127	0::127	Volume
102	00h 66h	190	01h 3Eh	278	02h 16h	366	02h 6Eh	10h::70h	16::112	-48::+48	Transpose
103	00h 67h	191	01h 3Fh	279	02h 17h	367	02h 6Fh	00h::7Fh	0::127	-64::+63	Detune
104	00h 68h	192	01h 40h	280	02h 18h	368	02h 70h	00h, 01h, 02h, 03h::06h, 07h	0, 1, 2, 3::6, 7	Main, Sub1, Sub2, FX1::FX4, Aux	Output
105	00h 69h	193	01h 41h	281	02h 19h	369	02h 71h	rr:=00b::11b tt:=00b::11b pp:=00b::10b 00pptrrb	1, 2, 3, 4 1, 2, 3, 4 1, 2, 3	Off, Local, MIDI, Local+MIDI Off, Direct, Seq, Seq+Arp Play, Mute, Solo	RX TX Engine Status
106	00h 6Ah	194	01h 42h	282	02h 1Ah	370	02h 72h	00h::40h::7Fh	0::64::127	Left::Center::Right	Instrument Pan
110	00h 6Eh	198	01h 46h	286	02h 1Eh	374	02h 76h	01h::7Fh	1::127	1::127	Low Velo
111	00h 6Fh	199	01h 47h	287	02h 1Fh	375	02h 77h	01h::7Fh	1::127	1::127	High Velo
112	00h 70h	200	01h 48h	288	02h 20h	376	02h 78h	00h::7Fh	0::127	C-2::G8	Low Key
113	00h 71h	201	01h 49h	289	02h 21h	377	02h 79h	00h::7Fh	0::127	C-2::G8	High Key
114	00h 72h	202	01h 4Ah	290	02h 22h	378	02h 7Ah	t:=0b,1b m:=0b,1b a:=0b,1b s:=0b,1b n:=0b,1b p:=0b,1b 00pnsamtb	0, 1 0, 1 0, 1 0, 1 0, 1	Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable Enable, Disable	Pitchbend Modwheel Aftertouch Sustain Button 1 / 2 Prog Change Control Status

3.4.3 DDAT

The Drum Map Data has a length of 384 bytes.

Drum Map Instruments												
Inst.1		**Inst.9**		**Inst.17**		**Inst.25**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
0	00h 00h	72	00h 48h	144	01h 10h	216	01h 58h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
1	00h 00h	73	00h 49h	145	01h 11h	217	01h 59h	00h::63h	0::99	1::100	Sound Number	
2	00h 02h	74	00h 4Ah	146	01h 12h	218	01h 5Ah	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
3	00h 03h	75	00h 4Bh	147	01h 13h	219	01h 5Bh	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
4	00h 04h	76	00h 4Ch	148	01h 14h	220	01h 5Ch	00h::7Fh	0::127	C-2::G8	Key	
5	00h 05h	77	00h 4Dh	149	01h 15h	221	01h 5Dh	04h::7Ch	4::124	-60::60	Transpose	
6	00h 06h	78	00h 4Eh	150	01h 16h	222	01h 5Eh	00h::7Fh	0::127	0::127	Volume	
Inst.2		**Inst.10**		**Inst.18**		**Inst.26**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
9	00h 09h	81	00h 51h	153	01h 19h	225	01h 61h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
10	00h 0Ah	82	00h 52h	154	01h 1Ah	226	01h 62h	00h::63h	0::99	1::100	Sound Number	
11	00h 0Bh	83	00h 53h	155	01h 1Bh	227	01h 63h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
12	00h 0Ch	84	00h 54h	156	01h 1Ch	228	01h 64h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
13	00h 0Dh	85	00h 55h	157	01h 1Dh	229	01h 65h	00h::7Fh	0::127	C-2::G8	Key	
14	00h 0Eh	86	00h 56h	158	01h 1Eh	230	01h 66h	04h::7Ch	4::124	-60::60	Transpose	
15	00h 0Fh	87	00h 57h	159	01h 1Fh	231	01h 67h	00h::7Fh	0::127	0::127	Volume	
Inst.3		**Inst.11**		**Inst.19**		**Inst.27**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
18	00h 12h	90	00h 5Ah	162	01h 22h	234	01h 6Ah	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
19	00h 13h	91	00h 5Bh	163	01h 23h	235	01h 6Bh	00h::63h	0::99	1::100	Sound Number	
20	00h 14h	92	00h 5Ch	164	01h 24h	236	01h 6Ch	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
21	00h 15h	93	00h 5Dh	165	01h 25h	237	01h 6Dh	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
22	00h 16h	94	00h 5Eh	166	01h 26h	238	01h 6Eh	00h::7Fh	0::127	C-2::G8	Key	
23	00h 17h	95	00h 5Fh	167	01h 27h	239	01h 6Fh	04h::7Ch	4::124	-60::60	Transpose	
24	00h 18h	96	00h 60h	168	01h 28h	240	01h 70h	00h::7Fh	0::127	0::127	Volume	
Inst.4		**Inst.12**		**Inst.20**		**Inst.28**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
27	00h 1Bh	99	00h 63h	171	01h 2Bh	243	01h 73h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
28	00h 1Ch	100	00h 64h	172	01h 2Ch	244	01h 74h	00h::63h	0::99	1::100	Sound Number	
29	00h 1Dh	101	00h 65h	173	01h 2Dh	245	01h 75h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
30	00h 1Eh	102	00h 66h	174	01h 2Eh	246	01h 76h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
31	00h 1Fh	103	00h 67h	175	01h 2Fh	247	01h 77h	00h::7Fh	0::127	C-2::G8	Key	
32	00h 20h	104	00h 68h	176	01h 30h	248	01h 78h	04h::7Ch	4::124	-60::60	Transpose	
33	00h 21h	105	00h 69h	177	01h 31h	249	01h 79h	00h::7Fh	0::127	0::127	Volume	
Inst.5		**Inst.13**		**Inst.20**		**Inst.29**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
36	00h 24h	108	00h 6Ch	180	01h 34h	252	01h 7Ch	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
37	00h 25h	109	00h 6Dh	181	01h 35h	253	01h 7Dh	00h::63h	0::99	1::100	Sound Number	
38	00h 26h	110	00h 6Eh	182	01h 36h	254	01h 7Eh	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
39	00h 27h	111	00h 6Fh	183	01h 37h	255	01h 7Fh	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
40	00h 28h	112	00h 70h	184	01h 38h	256	02h 00h	00h::7Fh	0::127	C-2::G8	Key	
41	00h 29h	113	00h 71h	185	01h 39h	257	02h 01h	04h::7Ch	4::124	-60::60	Transpose	
42	00h 2Ah	114	00h 72h	186	01h 3Ah	258	02h 02h	00h::7Fh	0::127	0::127	Volume	
Inst.6		**Inst.14**		**Inst.22**		**Inst.30**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
45	00h 2Dh	117	00h 75h	189	01h 3Dh	261	02h 05h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
46	00h 2Eh	118	00h 76h	190	01h 3Eh	262	02h 06h	00h::63h	0::99	1::100	Sound Number	
47	00h 2Fh	119	00h 77h	191	01h 3Fh	263	02h 07h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
48	00h 30h	120	00h 78h	192	01h 40h	264	02h 08h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
49	00h 31h	121	00h 79h	193	01h 41h	265	02h 09h	00h::7Fh	0::127	C-2::G8	Key	
50	00h 32h	122	00h 7Ah	194	01h 42h	266	02h 0Ah	04h::7Ch	4::124	-60::60	Transpose	
51	00h 33h	123	00h 7Bh	195	01h 43h	267	02h 0Bh	00h::7Fh	0::127	0::127	Volume	
Inst.7		**Inst.15**		**Inst.23**		**Inst.31**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
54	00h 36h	126	00h 7Eh	198	01h 46h	270	02h 0Eh	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
55	00h 37h	127	00h 7Fh	199	01h 47h	271	02h 0Fh	00h::63h	0::99	1::100	Sound Number	
56	00h 38h	128	01h 00h	200	01h 48h	272	02h 10h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
57	00h 39h	129	01h 01h	201	01h 49h	273	02h 11h	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
58	00h 3Ah	130	01h 02h	202	01h 4Ah	274	02h 12h	00h::7Fh	0::127	C-2::G8	Key	
59	00h 3Bh	131	01h 03h	203	01h 4Bh	275	02h 13h	04h::7Ch	4::124	-60::60	Transpose	
60	00h 3Ch	132	01h 04h	204	01h 4Ch	276	02h 14h	00h::7Fh	0::127	0::127	Volume	
Inst.8		**Inst.16**		**Inst.24**		**Inst.32**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
63	00h 3Fh	135	01h 07h	207	01h 4Fh	279	02h 17h	00h::02h, 03h	0::2, 3	A::C, X	Sound Bank	
64	00h 40h	136	01h 08h	208	01h 50h	280	02h 18h	00h::63h	0::99	1::100	Sound Number	
65	00h 41h	137	01h 09h	209	01h 51h	281	02h 19h	00h, 01h, 02h	0, 1, 2	Main, Sub1, Sub2	Output	
66	00h 42h	138	01h 0Ah	210	01h 52h	282	02h 1Ah	00h::40h::7Fh	0::64::127	L64::0::R63	Pan	
67	00h 43h	139	01h 0Bh	211	01h 53h	283	02h 1Bh	00h::7Fh	0::127	C-2::G8	Key	
68	00h 44h	140	01h 0Ch	212	01h 54h	284	02h 1Ch	04h::7Ch	4::124	-60::60	Transpose	
69	00h 45h	141	01h 0Dh	213	01h 55h	285	02h 1Dh	00h::7Fh	0::127	0::127	Volume	
Effects												
FX1		**FX2**										
Idx	PAH PAL	Idx	PAH PAL					$DRMV_{16}$	$DRMV_{10}$	Description	Name	
288	01h 00h	304	01h 10h					00h::07h		Bypass, Chorus, Flanger, Phaser, Overdrive, Five FX, Vocoder	Effect	
		304	01h 10h					20h::21h		Delay, Reverb, 5.1 Delay, 5.1 D.Clk	Effect (FX2 only)	
289	01h 01h	305	01h 11h					00h::7Fh		Dry::Wet	Mix	
Chorus FX1		**Chorus FX2**		**Flanger FX1**		**Flanger FX2**						
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name	
290	01h 02h	306	01h 12h	290	01h 02h	306	01h 12h	00h::7Fh	0::127		Speed	
291	01h 03h	307	01h 13h	291	01h 03h	307	01h 13h	00h::7Fh	0::127		Depth	
293	01h 05h	309	01h 15h					00h::7Fh	0::127		Delay	
				294	01h 06h	310	01h 16h	00h::7Fh	0::127	0%::100%	Feedback	
				298	01h 0Ah	314	01h 1Ah	00h,01h	0, 1	Positive, Negative	Polarity	
Phaser FX1		**Phaser FX2**		**Delay FX2**								
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL			$DRMV_{16}$	$DRMV_{10}$	Description	Name	
290	01h 02h	306	01h 12h					00h::7Fh	0::127		Speed	
291	01h 03h	307	01h 13h					00h::7Fh	0::127		Depth	
294	01h 06h	310	01h 16h	310	01h 16h			00h::7Fh	0::127	0%::100%	Feedback	
295	01h 07h	311	01h 17h					00h::7Fh	0::127		Center	
				311	01h 17h			00h::7Fh	0::127		Cutoff	
296	01h 08h	312	01h 18h					00h::7Fh	0::127		Spacing	
				313	01h 19h			00h	0	Off	Clocked	
298	01h 0Ah	314	01h 1Ah	314	01h 1Ah			00h::01h	0, 1	Positive, Negative	Polarity	
				315	01h 1Bh			00h::01h	0, 1	Off, On	Autopan	

Clk.Dly FX1		Clk.Dly FX2					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
292	01h 04h	308	01h 14h	00h, 01h::19h,1Ah::64h,65h::7Fh		Internal, 42::90(2), 91::165(1), 170::300(5)	Tempo
294	01h 06h	310	01h 16h	00h::7Fh	0::127		Feedback
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Cutoff
297	01h 09h	313	01h 19h	01h		0n	Clocked
298	01h 0Ah	314	01h 1Ah	01h::01h		Positive, Negative	Polarity
299	01h 0Bh	315	01h 1Bh	00h::01h		Off, On	Autopan
300	01h 0Ch	316	01h 1Ch	00h::1Dh		1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length

Overdrive FX1		Overdrive FX2					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
291	01h 03h	307	01h 13h	00h::7Fh	0::127		Drive
292	01h 04h	308	01h 14h	00h::7Fh	0::127		Post Gain
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Cutoff

FiveFX FX1		FiveFX FX2					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::7Fh	1::127		Chorus Speed
291	01h 03h	307	01h 13h	00h::7Fh	0::127		Chorus Depth
292	01h 04h	308	01h 14h	00h::7Fh	0::127		Delay
293	01h 05h	309	01h 15h	00h::7Fh	0::127		Chorus/Delay L
294	01h 06h	310	01h 16h	00h::7Fh		44.1KHz::2.6Hz	Sample&Hold
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Overdrive
296	01h 08h	312	01h 18h	00h::08h		External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Ring Mod Source
297	01h 09h	313	01h 19	00h::7Fh	0::127		Ring Mod Level

Vocoder FX1		Vocoder FX2					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::17h	2::25		Bands
291	01h 03h	307	01h 13h	00h::08h		External, Aux, FX1::FX4,Main In, Sub1 In, Sub2 In	Analysis Signal
292	01h 04h	308	01h 14h	00h::7Fh		10.9Hz::16.7KHz	A. Lo Freq
293	01h 05h	309	01h 15h	00h::7Fh		10.9Hz::16.7KHz	A. Hi Freq
294	01h 06h	310	01h 16h	00h::40h::7Fh	-128::-32(x3), -34::0::31(x1), +35::+128(x3)		S. Offset
295	01h 07h	311	01h 17h	00h::40h::7Fh	-128::-32(x3), -34::0::31(x1), +35::+128(x3)		Hi Offset
296	01h 08h	312	01h 18h	00h::40h::7Fh		-64::0::+63	Bandwidth
297	01h 09h	313	01h 19h	00h::40h::7Fh		-64::0::+63	Resonance
298	01h 0Ah	314	01h 1Ah	00h::7Fh	0::127		Attack
299	01h 0Bh	315	01h 1Bh	00h::7Fh	0::127		Decay
300	01h 0Ch	316	01h 1Ch	00h::40h::7Fh	-64::0::+63		EQ Low Level
301	01h 0Dh	317	01h 1Dh	00h::18h	1::25		EQ Mid Band
302	01h 0Eh	318	01h 1Eh	00h::40h::7Fh		-64::0::+63	EQ Mid Level
303	01h 0Fh	319	01h 1Fh	00h::40h::7Fh		-64::0::+63	EQ High Level

Reverb FX1		Reverb FX2					
Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
290	01h 02h	306	01h 12h	00h::7Fh	3m::30m		Size
291	01h 03h	307	01h 13h	00h::7Fh	0::127		Shape
292	01h 04h	308	01h 14h	00h::7Fh	0::127		Decay
293	01h 05h	309	01h 15h	00h::7Fh		0ms::300ms	Pre-Delay
295	01h 07h	311	01h 17h	00h::7Fh	0::127		Lowpass
296	01h 08h	312	01h 18h	00h::7Fh	0::127		Highpass
297	01h 09h	313	01h 19h	00h::7Fh	0::127		Diffusion
298	01h 0Ah	314	01h 1Ah	00h::7Fh	0::127		Damping

5.1 Delay FX2					
Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
306	01h 12h	00h::7Fh		1.4ms::1.48s	Delay
307	01h 13h	00h::7Fh		0%::100%	Feedback
308	01h 14h	00h::7Fh		10.9Hz::16.7KHz	LFE LP
309	01h 15h	00h::7Fh		10.9Hz::16.7KHz	Input HP
310	01h 16h	00h::7Fh		0%::400%	Delay ML
311	01h 17h	00h::7Fh	0::127		FSL Volume
312	01h 18h	00h::7Fh		0%::400%	Delay MR
313	01h 19h	00h::7Fh	0::127		FSR Volume
314	01h 1Ah	00h::7Fh		0%::400%	Delay S2L
315	01h 1Bh	00h::7Fh	0::127		CntrS Volume
316	01h 1Ch	00h::7Fh		0%::400%	Delay S1L
317	01h 1Dh	00h::7Fh	0::127		RearSL Volume
318	01h 1Eh	00h::7Fh		0%::400%	Delay S1R
319	01h 1Fh	00h::7Fh	0::127		RearSR Volume

5.1 Clk.Delay FX2					
Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
306	01h 12h	00h::1Dh		1/128, 1/128T, 1/128, 1/64, 1/64T, 1/64, 1/32, 1/32T, 1/32, 1/16, 1/16T, 1/16, 1/8, 1/8T, 1/8, 1/4, 1/4T, 1/4, 2/4, 2/4T, 2/4, 3/4, 3/4T, 4/4, 4/4, 4/4T, 4/4, 8/4, 8/4T, 8/4	Length
307	01h 13h	00h::7Fh		0%::100%	Feedback
308	01h 14h	00h::7Fh		10.9Hz::16.7KHz	LFE LP
309	01h 15h	00h::7Fh		10.9Hz::16.7KHz	Input HP
310	01h 16h	00h::7Fh		0%::400%	Delay ML
311	01h 17h	00h::7Fh	0::127		FSL Volume
312	01h 18h	00h::7Fh		0%::400%	Delay MR
313	01h 19h	00h::7Fh	0::127		FSR Volume
314	01h 1Ah	00h::7Fh		0%::400%	Delay S2L
315	01h 1Bh	00h::7Fh	0::127		CntrS Volume
316	01h 1Ch	00h::7Fh		0%::400%	Delay S1L
317	01h 1Dh	00h::7Fh	0::127		RearSL Volume
318	01h 1Eh	00h::7Fh		0%::400%	Delay S1R
319	01h 1Fh	00h::7Fh	0::127		RearSR Volume

Arp					
Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
320	02h 38h	00h::03h	0::3	Off, On, One shot, Hold	Mode
321	02h 39h	00h, 01h, 02h::10h	0, 1, 2::16	Off, User, ROM1::ROM15	Pattern
322	02h 3Ah	00h::0Fh	0::15	1::16	Max. Notes
323	02h 3Bh	00h::7Fh	0::127	3/192::130/192	Clock
324	02h 3Ch	00h, 01h::7Fh	0, 1::127	Legato, 1::127	Length
325	02h 3Dh	00h::09h	0::9	1::10	Octave Range
326	02h 3Eh	00h::03h	0::3	Up, Down, Alt Up, Alt Down	Direction
327	02h 3Fh	00h::05h	0::5	As played, Reversed, NumLo¿Hi, NumHi¿Lo, VelLo¿Hi, VelHi¿Lo	Sort Order
328	02h 40h	00h, 01h, 02h	0, 1, 2	Each note, First note, Last note	Velo Mode
329	02h 41h	00h::7Fh	0::127	0::127	T. Factor
330	02h 42h	00h::01h	0, 1	Off, On	Same note overlap
331	02h 43h	00h::01h	0, 1	Off, On	Pattern Reset
332	02h 44h	00h::0Fh	0::15	1::16	Pattern Length

Tempo					
Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
335	02h 47h	00h::7Fh	0::127	0::39, 40::90(2), 91::164, 165::300(5)	Tempo (bpm)

Arp Step / Glide / Accent											
Step 1-4		Step 5-8		Step 9-12		Step 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
336	02h 48h	340	02h 4Ch	344	02h 50h	348	02h 54h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
337	02h 49h	341	02h 4Dh	345	02h 51h	349	02h 55h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
338	02h 4Ah	342	02h 4Eh	346	02h 52h	350	02h 56h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent
339	02h 4Bh	343	02h 4Fh	347	02h 53h	351	02h 57h	sss:=000b::111b g:=0b::1b aaa:=000b::111b 0ssssgaaab	0::7 0, 1 0::7	*, , -, <, >, <>, chord, ? Off, On x, ⋘, ≪, <, -, >, ≫, ⋙	Step Glide Accent

Arp Step Length / Timing											
Step 1-4		Step 5-8		Step 9-12		Step 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
352	02h 58h	356	02h 5Ch	360	02h 60h	364	02h 64h	lll:=000b::111b ttt:=000b::111b 0lll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
353	03h 59h	357	02h 5Dh	361	02h 61h	365	02h 65h	lll:=000b::111b ttt:=000b::111b 0lll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
354	04h 5Ah	358	02h 5Eh	362	02h 62h	366	02h 66h	lll:=000b::111b ttt:=000b::111b 0lll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing
355	05h 5Bh	359	02h 5Fh	363	02h 63h	367	02h 67h	lll:=000b::111b ttt:=000b::111b 0lll0tttb	0::7 0::7	^, ⋘, ≪, <, -, >, ≫, ⋙ ?, ⋘, ≪, <, -, >, ≫, ⋙	Length Timing

Drum Map Name											
Char 1-4		Char 5-8		Char 9-12		Char 13-16					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$DRMV_{16}$	$DRMV_{10}$	Description	Name
368	02h 6Ch	372	02h 70h	376	02h 74h	380	02h 78h	20h::7Fh	32::127	ASCII	Drum Map Name
369	02h 6Dh	373	02h 71h	377	02h 75h	381	02h 79h	20h::7Fh	32::127	ASCII	Drum Map Name
370	02h 6Eh	374	02h 72h	378	02h 76h	382	02h 7Ah	20h::7Fh	32::127	ASCII	Drum Map Name
371	02h 6Dh	375	02h 73h	379	02h 77h	383	02h 7Bh	20h::7Fh	32::127	ASCII	Drum Map Name

Notes

- The Key parameter must be strictly ascending from Instrument 1 through 32, as it defines the splits between the instruments.
- Arp parameters for Drum Maps exist and edits are correctly stored, but are not always evaluated when the Drum Map is loaded. If that happens, it is necessary to initialize the Drum Map and immediately do a Recall. Sometimes just doing an edit followed by a Recall helps, too.

3.4.4 GDAT

The Global Data has a length of 200 bytes.

Global Data					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
0	00h 00h	31h	49	"1"	Version

Initial Instrument Settings					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
20	00h 14h	00h::0Fh	0::15	Inst.1::Inst.16	Selection
21	00h 15h	00h, 01h	0, 1	Single Mode, Multi Mode	Mode
22	00h 16h	00h::63h	0::99	1::100	Multi Number

Inst.1		Inst.2		Inst.3		Inst.4					
Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
1	00h 01h	2	00h 02h	3	00h 03h	4	00h 04h	00h::63h	0::99	1::100	Sound Number
9	00h 09h	10	00h 0Ah	11	00h 0Bh	12	00h 0Ch	00h::02h	0::2	A::C	Bank Number

Pedal/CV					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
70	00h 46h	00h::40h::7Fh	0::127	-64::00::+63	Pedal Offset
71	00h 47h	00h::7Fh	0::127	0::127	Pedal Gain
72	00h 48h	00h::7Fh	0::127	0::127	Pedal Curve
73	00h 49h	00h::07h	0::7	Off, Volume,Control W, Control X,Control Y, Control Z,F1 Cutoff, F2 Cutoff	Pedal Ctl

MIDI Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
5	00h 05h	36h::40h::4Ah	54::64::74	430::440::450	Tuning
6	00h 06h	34h::40h::4Ch	52::64::76	-12::0::+12	Transpose
7	00h 07h	00h, 01h, 02h, 03h	0, 1, 2, 3	Off, CC, SysEx, CC+SysEx	Controller Send
8	00h 08h	00h, 01h	0, 1	Off, On	Controller Recv
53	00h 35h	00h::78h	0::119	CC#0::CC#120	Controller W
54	00h 36h	00h::78h	0::119	CC#0::CC#120	Controller X
55	00h 37h	00h::78h	0::119	CC#0::CC#120	Controller Y
56	00h 38h	00h::78h	0::119	CC#0::CC#120	Controller Z
15	00h 0Fh	00h, 01h	0, 1	Off, On	Arpeggiator Send
19	00h 13h	00h, 01h, 02h, 03h	0, 1, 2, 3	Internal, Send, Auto, Auto-Thru	Clock
24	00h 18h	00h, 01h::10h	0, 1::16	omni, 1::16	MIDI Channel
25	00h 19h	00h::7Eh	0::126	0::126	SysEx Dev ID
26	00h 1Ah	00h, 01h	0, 1	Off, On	Local Control

Program Change					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
57	00h 39h	00h, 01h, 02h	0, 1, 2	Off, Num, Num+Bank	RX
74	00h 4Ah	00h, 01h, 02h	0, 1, 2	Off, Num, Num+Bank	TX

Display Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
27	00h 1Bh	00::7Fh	0::127	0.1s::15.5s	Popup Time
28	00h 1Ch	00::7Fh	0::127	0.1s::15.5s	Label Time
29	00h 1Dh	00::7Fh	0::127	0::127	Display Contrast

Keyboard Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
30	00h 1Eh	00h::08h	0::8	Exp2, Exp1, Linear, Log1, Log2, Fix32, Fix64, Fix100, Fix127	On Velocity Curve
31	00h 1Fh	00h::09h	0::9	Off, Exp2, Exp1, Linear, Log1, Log2, Fix32, Fix64, Fix100, Fix127	ReleaseVelocity Curve
32	00h 20h	00h::04h	0::4	Exp2, Exp1, Linear, Log1, Log2	Pressure Curve

External Input					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
33	00h 21h	00h::03h	0::3	1::4	Input Gain

FX Setup					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
35	00h 23h	00h,01h::04h	0,1::4	None, Inst.1::4	Global Link FX2

Mix In					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
58	00h 3Ah	00h::08h	0::8	Off, Aux, FX1::FX4,Main, Sub1, Sub2	Send
59	00h 3Bh	00h::7Fh	0::127	0::127	Level

3.4.5 FDAT

The Mode Data has a length of 1 byte.

Mode Data					
Idx	PAH PAL	$GLBV_{16}$	$GLBV_{10}$	Description	Name
00h	00h 00h	m:0b, 1b iiii:0000b::1111b 000iiiimb	m:0, 1 iiii:0::15	Single Mode, Multi Mode Inst.1::Inst.16	Mode Select Inst. Select

4 Waldorf rackAttack MIDI Implementation OS 1.04

4.1 Message Type Definitions

4.1.1 Message Type Matrix

The message type matrix for the Waldorf rackAttack is defined as follows:

Command	CMD	Request R 0yh	Dump D 1yh	Parameter Change P 2yh	Parameter Inquiry Q 3yh	Reserved 4yh::6yh	Reserved
Sound Parameter	SND x0h	SNDR 00h	SNDD 10h	SNDP 20h	SNDQ 30h		
Program Parameter	PRG x1h	PRGR 01h	PRGD 11h	PRGP 21h	PRGQ 31h		OS 71h
Reserved	x2h						
Pattern Parameter	PAT x3h	PATR 03h	PATD 13h	PATP 23h	PATQ 33h		
Global Parameter	GLB x4h	GLBR 04h	GLBD 14h	GLBP 24h	GLBQ 34h		
FX Parameter	EFX x5h	EFXR 05h	EFXD 15h	EFXP 25h	EFXQ 35h		
Reserved	x6h:x6h						
Mode Command	MOD x7h	MODR 07h	MODD 17h	MODP 27h	MODQ 37h		
Reserved	x8h::xfh						

Notes

- Access of parameters directly in memory is not implemented. Transfers from and to memory have to go through either the assembly or the edit buffer. Exceptions are Global Parameters, where no corresponding memory type exists. Global Parameters are scanned continously for changes by the rackAttack and are automatically saved. To ensure that changes to Global Parameters are properly saved, always switch off the rackAttack with the Power button on the machine.
- Full remote control of the rackAttack is currently not possible. The missing functions will very likely be implemented through the MOD functions. Remote Control messages in the style of the MW/MW2/MWXT may never show up.

4.1.2 Memory organization

The memory of the rackAttack is organized as 50 Drum Kits that each contain a program, 24 sounds with their sequencer patterns and 4 FX unit setups. None of this data can be shared among different Drum Kits, but facilities to copy the data in part or whole exist. To facilitate editing, an edit buffer for the currently selected program and an additional independent assembly buffer is provided.

4.1.3 Checksum

The rackAttack evaluates the checksum for all commands and rejects messages with invalid checksum. The checksum calculation includes the command and the complete message (shown in parenthesis in

the command definitions). It is therefore necessary to change the checksum if for instance the destination of a dump is changed.

4.1.4 SND – Sound Parameters

Messages dealing with Sounds will take one of the following forms, depending on the message type:

```
Request       := SOX IDW IDM IDD ( SNDR BUFN SNDN              ) CHK EOX
Dump          := SOX IDW IDM IDD ( SNDD BUFN SNDN <SDAT>[109] ) CHK EOX
Para Change   := SOX IDW IDM IDD ( SNDP SNDN PAH PAL SNDV      ) CHK EOX
Para Inquiry := SOX IDW IDM IDD ( SNDQ SNDN PAH PAL           ) CHK EOX
```

Sound Location		
BUFN	SNDN	Location
20h	00h::17h	Sound 1::25 from Program Edit Buffer
30h	00h::17h	Sound 1::25 from Program Assembly Buffer

4.1.5 PRG – Program Parameters

Messages dealing with Programs will take one of the following forms, depending on the message type:

```
Request       := SOX IDW IDM IDD ( PRGR BUFN PRGN              ) CHK EOX
Dump          := SOX IDW IDM IDD ( PRGD BUFN PRGN <KDAT>[40] ) CHK EOX
Para Change   := SOX IDW IDM IDD ( PRGP PRGN PAH PAL PRGV     ) CHK EOX
Para Inquiry := SOX IDW IDM IDD ( PRGQ PRGN PAH PAL           ) CHK EOX
```

Program Location		
BUFN	PRGN	Location
20h	00h	Current Program from Program Edit Buffer
30h	00h::31h	Current Program from Program Assembly Buffer

Notes

- The second location byte PRGN is ignored by the rackAttack, however for requests to the Assembly Buffer the PRGN data from the request will by copied into the response. The response dump from a request to the Edit Buffer will always have location 00h regardless of the value for PRGN in the request.

4.1.6 PAT – Pattern Parameters

Messages dealing with Patterns will take one of the following forms, depending on the message type:

```
Request       := SOX IDW IDM IDD ( PATR BUFN PATN              ) CHK EOX
Dump          := SOX IDW IDM IDD ( PATD BUFN PATN <PDAT>[143] ) CHK EOX
Para Change   := SOX IDW IDM IDD ( PATP PATN PAH PAL PATV      ) CHK EOX
Para Inquiry := SOX IDW IDM IDD ( PATQ PATN PAH PAL           ) CHK EOX
```

Pattern Location		
BUFN	PATN	Location
20h	00h::17h	Pattern 1::25 from Program Edit Buffer
30h	00h::17h	Pattern 1::25 from Program Assembly Buffer

4.1.7 EFX – FX Parameters

Messages dealing with FXs will take one of the following forms, depending on the message type:

```
Request      := SOX IDW IDM IDD ( EFXR BUFN EFXN             ) CHK EOX
Dump         := SOX IDW IDM IDD ( EFXD BUFN EFXN <FDAT>[18] ) CHK EOX
Para Change  := SOX IDW IDM IDD ( EFXP EFXN PAH PAL EFXV     ) CHK EOX
Para Inquiry := SOX IDW IDM IDD ( EFXQ EFXN PAH PAL          ) CHK EOX
```

FX Location		
BUFN	EFXN	Location
20h	00h::03h	FX 1::4 from Program Edit Buffer
30h	00h::03h	FX 1::4 from Program Assembly Buffer

4.1.8 GLB – Global Parameters

Messages dealing with Globals will take one of the following forms, depending on the message type:

```
Request      := SOX IDW IDM IDD ( GLBR GLBN              ) CHK EOX
Dump         := SOX IDW IDM IDD ( GLBD GLBN <GDAT>[200] ) CHK EOX
Para Change  := SOX IDW IDM IDD ( GLBP PAH PAL GLBV      ) CHK EOX
Para Inquiry := SOX IDW IDM IDD ( GLBQ PAH PAL           ) CHK EOX
```

4.1.9 MOD – Mode Commands

Messages dealing with Mode Commands will take one of the following forms, depending on the message type:

```
Request      := SOX IDW IDM IDD ( MODR MCMD MOV1 MOV2 ) CHK EOX
```

Mode Command			
MCMD	MOV1	MOV2	Description
00h	00h	—	Recall Current Program from Memory (Discard Edits)
00h	01h	00h::17h	Recall Sound 1::25 from Memory (Discard Edits)
00h	02h	00h::17h	Recall Pattern 1::25 from Memory (Discard Edits)
01h	20h	00h::31h	Store Edit Buffer to Program 1::50
01h	30h	00h::31h	Store Assembly Buffer to Program 1::50
02h	20h	00h::31h	Copy Program 1::50 into Edit Buffer
02h	30h	00h::31h	Copy Program 1::50 into Assembly Buffer
03h	20h	—	Dump Program from Edit Buffer
03h	30h	00h::31h	Dump Program from Memory
04h	20h	—	Init Edit Buffer
04h	30h	—	Init Assembly Buffer

4.2 Channel Messages

4.2.1 Control Change

The rackAttack implements only a few CC messages. Their interpretation depends on the OS version and the MIDI Mode that has been selected in Global Menu. One of these modes is the "MP Bundle" mode that was introduced with OS 1.04 to facilitate integration with the Oxygen 8 MIDI keyboard controller that was sold together with the "Music Production Bundle". Unfortunately no information on the CC mapping of this mode is available.

With OS 1.05, which was only installed on some units sold after Waldorf Music AG went into insolvency, MIDI CC were also available in "Native Mode". The mapping is detailed below, thanks to Holger Steinbrink from Kemel Music for providing it.

CC number	Status	rackAttack definition	Standard	Common Clashes
CC#0	*	Bank Select MSB	*	
CC#1	*	Modwheel	*	
CC#7	*	Channel Volume	*	
CC#10	*	Pan	*	
CC#11	*	Volume Sound 1	*	
CC#12	*	Volume Sound 2		Effect Control #1
CC#13	*	Volume Sound 3		Effect Control #2
CC#14	*	Volume Sound 4		
CC#15	*	Volume Sound 5		
CC number	Status	rackAttack definition	Standard	Common Clashes
CC#16	*	Volume Sound 6		General Purpose #1
CC#17	*	Volume Sound 7		General Purpose #2
CC#18	*	Volume Sound 8		General Purpose #3
CC#19	*	Volume Sound 9		General Purpose #4
CC#20	*	Volume Sound 10		
CC#21	*	Volume Sound 11		
CC#22	*	Volume Sound 12		
CC#23	*	Volume Sound 13		
CC#24	*	Volume Sound 14		
CC#25	*	Volume Sound 15		
CC#26	*	Volume Sound 16		
CC#27	*	Volume Sound 17		
CC#28	*	Volume Sound 18		
CC#29	*	Volume Sound 19		
CC#30	*	Volume Sound 20		
CC#31	*	Volume Sound 21		
CC number	Status	rackAttack definition	Standard	Common Clashes
CC#32	*	Bankselect LSB		
CC#33	*	Volume Sound 23		
CC#34	*	Volume Sound 24		
CC#35	*	Volume Sound 22		
CC#36	*	Pan Sound 1		
CC#37	*	Pan Sound 2		
CC#38	*	Pan Sound 3		Data Entry LSB
CC#39	*	Pan Sound 4		
CC#40	*	Pan Sound 5		
CC#41	*	Pan Sound 6		
CC#42	*	Pan Sound 7		
CC#43	*	Pan Sound 8		
CC#44	*	Pan Sound 9		
CC#45	*	Pan Sound 10		
CC#46	*	Pan Sound 11		
CC#47	*	Pan Sound 12		
CC number	Status	rackAttack definition	Standard	Common Clashes
CC#48	*	Pan Sound 13		
CC#49	*	Pan Sound 14		
CC#50	*	Pan Sound 15		
CC#51	*	Pan Sound 16		
CC#52	*	Pan Sound 17		
CC#53	*	Pan Sound 18		
CC#54	*	Pan Sound 19		
CC#55	*	Pan Sound 20		
CC#56	*	Pan Sound 21		
CC#57	*	Pan Sound 22		
CC#58	*	Pan Sound 23		
CC#59	*	Pan Sound 24		
CC#60	*			
CC#61	*			
CC#62	*			
CC#63	*			
CC number	Status	rackAttack definition	Standard	Common Clashes
CC#64	*	Sustain Pedal	*	
CC#65	*	FX1 send Sound 1		Glide Active
CC#66	*	FX1 send Sound 2		Sostenuto
CC#67	*	FX1 send Sound 3		Soft Pedal
CC#68	*	FX1 send Sound 4		Legato Pedal
CC#69	*	FX1 send Sound 5		Hold 2 Pedal
CC#70	*	FX1 send Sound 6		Sound Variation
CC#71	*	FX1 send Sound 7		Timbre / Harmonics
CC#72	*	FX1 send Sound 8		Release Time
CC#73	*	FX1 send Sound 9		Attack Time
CC#74	*	FX1 send Sound 10		Brightness
CC#75	*	FX1 send Sound 11		Sound Control #1
CC#76	*	FX1 send Sound 12		Sound Control #2
CC#77	*	FX1 send Sound 13		Sound Control #3
CC#78	*	FX1 send Sound 14		Sound Control #4
CC#79	*	FX1 send Sound 15		Sound Control #5

CC number	Status	rackAttack definition	Standard	Common Clashes
CC#80	*	FX1 send Sound 16		General Purpose #5
CC#81	*	FX1 send Sound 17		General Purpose #6
CC#82	*	FX1 send Sound 18		General Purpose #7
CC#83	*	FX1 send Sound 19		General Purpose #8
CC#84	*	FX1 send Sound 20		Portamento Control
CC#85	*	FX1 send Sound 21		
CC#86	*	FX1 send Sound 22		
CC#87	*	FX1 send Sound 23		
CC#88	*	FX1 send Sound 24		
CC#89	*			
CC#90	*			
CC#91				Effect Depth #1
CC#92				Effect Depth #2
CC#93				Effect Depth #3
CC#94				Effect Depth #4
CC#95				Effect Depth #5

CC number	Status	rackAttack definition	Standard	Common Clashes
CC#96				Data Entry Increment
CC#97				Data Entry Decrement
CC#98		2		NRPN LSB
CC#99		2		NRPN MSB
CC#100				RPN LSB
CC#101				RPN MSB
CC#102				Mono Pitch
CC#103				
CC#104		2		
CC#105		2		
CC#106				
CC#107				
CC#108				
CC#109				
CC#110		2		
CC#111		2		

CC number	Status	rackAttack definition	Standard	Common Clashes
CC#112		E3 Release		
CC#113		E4 Attack		
CC#114		E4 Decay		
CC#115		E4 Sustain		
CC#116		E4 Decay 2		
CC#117		E4 Sustain 2		
CC#118		E4 Release		
CC#119	N/A			
CC#120	*	All Sound Off	*	
CC#121	*	Reset All Controllers	*	
CC#122	*/G	Local Control	*	
CC#123	*	All Notes Off	*	
CC#124	N/A		*	Omni Mode Off
CC#125	N/A		*	Omni Mode On
CC#126	N/A		*	Poly Mode Off
CC#127	N/A		*	Poly Mode On

4.3 Data Type Definitions

4.3.1 SDAT – Sound Data

The Sound Dump SDAT has a length of 109 bytes. The last byte is a copy of the first byte of the PDAT dump to facilitate sparse dumps. This can be used by editors and librarians to skip requests of the corresponding Pattern Dumps when the Pattern Mode is set to off. However the pattern in question may not be empty, just switched off.

Sound					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
0	00h 00h	00h::7fh	0::127	→Sound Label	Label

Oscillators							
Osc 1		Osc 2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
1	00h 01h	16	01h 00h				Shape
2	00h 02h	17	01h 01h				Pitch
3	00h 03h	18	01h 02h				Detune
4	00h 04h	19	01h 03h				Start Phase
5	00h 05h	20	01h 04h				Pitch Mod
6	00h 06h	21	01h 05h				Pitch Ctrl
7	00h 07h	22	01h 06h				Pitch Mod Src
8	00h 08h	23	01h 07h				Pitch Ctrl Src
9	00h 09h	—	—				FM Depth
10	00h 0Ah	—	—				FM Mod
11	00h 0Bh	—	—				FM Ctrl
12	00h 0Ch	—	—				FM Mod Src
13	00h 0Dh	—	—				FM Ctrl Src

Mixer					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
26	00h 1Ah				Osc1 Level
27	00h 1Bh				Osc2 Level
28	00h 1Ch				Ringmod Level
29	00h 1Dh				Crack Level
30	00h 1Eh				Osc2 Level Mod
31	00h 1Fh				Osc2 Level Ctrl
32	00h 20h				Osc2 Level Mod Src
33	00h 21h				Osc2 Level Ctrl Src
34	00h 22h				External Level
35	00h 23h				External Src

Notes

- External input is available as an additional oscillator “waveform” and controlled via the Osc1 and Osc2 Level, respectively.

Crack Generator					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
36	00h 24h				Speed
37	00h 25h				Length

Filter					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
38	00h 26h				Type
39	00h 27h				Cutoff
40	00h 28h				Resonance
41	00h 29h				Drive
42	00h 2Ah				Keytrack
43	00h 2Bh				Cutoff Mod 1
44	00h 2Ch				Cutoff Ctrl 1
45	00h 2Dh				Cutoff Mod 1 Src
46	00h 2Eh				Cutoff Ctrl 1 Src
47	00h 2Fh				Cutoff Mod 2
48	00h 30h				Cutoff Ctrl 2
49	00h 31h				Cutoff Mod 2 Src
50	00h 32h				Cutoff Ctrl 2 Src

Amplifier					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
53	00h 35h				Volume
54	00h 36h				Volume Mod
55	00h 37h				Volume Ctrl
56	00h 38h				Volume Mod Src
57	00h 39h				Volume Ctrl Src
58	00h 3Ah				Pan
59	00h 3Bh				Pan Mod
60	00h 3Ch				Pan Ctrl
61	00h 3Dh				Pan Mod Src
62	00h 3Eh				Pan Ctrl Src

Envelopes							
Env 1		Env 2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
63	00h 3Fh	69	00h 45h	00h::7Fh	0::127		Attack
64	00h 40h	70	00h 46h	00h::7Fh	0::127		Decay
65	00h 41h	71	00h 47h	00h::7Fh	0::127		Sustain
66	00h 42h	72	00h 48h	00h::7Fh	0::127		Release
67	00h 43h	73	00h 49h	00h::7Fh	0::127		Shape

LFO							
LFO 1		LFO 2					
Idx	PAH PAL	Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
75	00h 4Bh	79	00h 4Fh				Speed
76	00h 4Ch	80	05h 00h				Shape
77	00h 4Dh	81	05h 01h				Sync
78	00h 4Eh						One Shot
		82	00h 52h				Mod
		83	00h 53h				Mod Src

Output					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
85	00h 55h				Dry Output
86	00h 56h				FX Select
87	00h 57h				FX Send Mix
88	00h 58h				Tuned Channel
89	00h 59h				Tuned Transpose
90	00h 5Ah				Tuned Low Key
91	00h 5Bh				Tuned High Key
92	00h 5Ch				Tuned Low Velo
93	00h 5Dh				Tuned High Velo
94	00h 5Eh				XOR Group
Pattern					
Idx	PAH PAL	$SNDV_{16}$	$SNDV_{10}$	Description	Name
108	00h 6Ch				Mode

4.3.2 KDAT – Program Data

The Program Dump KDAT has a length of 40 bytes.

Program						
Char 1-8		Char 9-16				
Idx	PAH PAL	Idx	PAH PAL	$PRGV_{16}$	$PRGV_{10}$	Description	Name
1	00h 01h	9	00h 09h	20h::7Fh	32::127	ASCII	Name
2	00h 02h	10	00h 0Ah	20h::7Fh	32::127	ASCII	Name
3	00h 03h	11	00h 0Bh	20h::7Fh	32::127	ASCII	Name
4	00h 04h	12	00h 0Ch	20h::7Fh	32::127	ASCII	Name
5	00h 05h	13	00h 0Dh	20h::7Fh	32::127	ASCII	Name
6	00h 06h	14	00h 0Eh	20h::7Fh	32::127	ASCII	Name
7	00h 07h	15	00h 0Fh	20h::7Fh	32::127	ASCII	Name
8	00h 08h	16	00h 10h	20h::7Fh	32::127	ASCII	Name
Program							
Idx	PAH PAL			$PRGV_{16}$	$PRGV_{10}$	Description	Name
17	00h 11h			00h, 01h, 02h	0, 1, 2	Native Plug-In Compatible Global Channel	MIDI Mode
18 19	00h 12h 00h 13h			00h::18h 00h::7Fh	0::24 0::127	Hi=12.8*(0::24) Lo=0.1*(0::127) Hi+Lo= External,Global, 0.2::319.9 bpm	Tempo
20	00h 14h			00h::17h	1::24	Instrument 1::25	Instrument A
21	00h 15h			00h::7Fh	0::127	Trigger Velocity	Velocity A
22	00h 16h			00h::17h	1::23	Instrument 1::25	Instrument B
23	00h 17h			00h::7Fh	0::127	Trigger Velocity	Velocity B
24	00h 18h			00h::17h	1::23	Instrument 1::25	Instrument C
25	00h 19h			00h::7Fh	0::127	Trigger Velocity	Velocity C
27	00h 1Bh			00h::17h	1::23	Instrument 1::25	Velocity Selected
28	00h 1Ch			00h::7Fh	0::127	Trigger Velocity	Instrument Selected
29	00h 1Dh			00h::02h	0::2	4/4, 3/4, 5/4	Time Signature

4.3.3 PDAT – Pattern Data

The Pattern Dump PDAT has a length of 143 bytes.

Pattern					
Idx	PAH PAL	$PATV_{16}$	$PATV_{10}$	Description	Name
0	00h 00h	00h::02h, 03h::05h	0::2, 3::5	Off, On, Latch Toggle, One Shot	Mode
1	00h 01h	00h::7Fh	0::127		Length
2	00h 02h	00h::02h, 03h::05h, 06h::08h, 09h::0Bh, 0Ch::0Eh, 0Fh::10h, 11h::12h	0::2, 3::5, 6::8, 9::11, 12::14, 15::16, 17::18	1/64T, 1/32T, 1/32, 1/16T, 1/16, 1/16., 1/8T, 1/8, 1/8., 1/4T, 1/4, 1/4., 1/2T, 1/2, 1/2., 1 Bar, 2 Bars, 4 Bars, 8 Bars	Step Clk
3	00h 03h				Note Length
4	00h 04h	00h::03h	0::3	Off, 33%, 66%, 75%	Swing
5	00h 05h	00h::01h 02h::05h	0::1 2::5	Immediate, Next Bar, 1/2, 1/4, 1/8,1/16	Start When
6	00h 06h	00h::01h	0::1	Current, Step 1	Start Where
7	00h 07h	00h::7Fh	0::127		Velocity 1
8	00h 08h	00h::7Fh	0::127		Velocity 2
9	00h 09h	00h::7Fh	0::127		Velocity 3
10	00h 0Ah				Control 1
11	00h 0Bh				Control 2
12	00h 0Ch				Control 3
13	00h 0Dh				Stop When
14	00h 0Dh				Stop Where
15	00h 0Fh	00h, 01h::03h	0, 1::3	Off, On Velocity 1::3	Step 1
14 +n	00h 0Fh	00h, 01h::03h	0, 1::3	Off, On Velocity 1::3	Step n
142	00h 0Fh	00h, 01h::03h	0, 1::3	Off, On Velocity 1::3	Step 128

4.3.4 FDAT – FX Data

The FX Dump FDAT has a length of 18 bytes.

FX					
Idx	PAH PAL	$EFXV_{16}$	$EFXV_{10}$	Description	Name
0	00h 00h	00h, 01h, 02h, 03h, 04h, 05h, 06h, 07h, 08h	0, 1, 2, 3, 4, 5, 6, 7, 8	Bypass, Chorus, Flanger, Phaser, Overdrive, Delay, ModDelay, Reverb, LoFi	Type
1	00h 01h	00h::02h, 03h::05h, 06h::08h	0, 1, 2 3, 4, 5 6, 7, 8	Out1, Out1+2, Out2 Out3, Out3+4, Out4 Out5, Out5+6, Out6	Output

Notes

- The validity and meaning of the following bytes depends on the FX type. Bytes unused by the current FX type are ignored but may become effective when the FX type is changed.

Chorus		Flanger					
Idx	PAH PAL	Idx	PAH PAL	EFXV$_{16}$	EFXV$_{10}$	Description	Name
2	00h 02h	2	00h 02h	00h::7Fh	0::127		Speed
3	00h 03h	3	00h 03h	00h::7Fh	0::127		Depth
5	00h 05h	—	—	00h::7Fh	0::127		Delay
—	—	6	00h 06h	00h::7Fh	0::127		Feedback
—	—	10	00h 0Ah	00h::01h	0::1	Positive, Negative	Polarity

Phaser					
Idx	PAH PAL	EFXV$_{16}$	EFXV$_{10}$	Description	Name
2	00h 02h	00h::7Fh	0::127		Speed
3	00h 03h	00h::7Fh	0::127		Depth
6	00h 06h	00h::7Fh	0::127		Feedback
7	00h 07h	00h::7Fh	0::127		Center
8	00h 08h	00h::7Fh	0::127		Spacing
10	00h 0Ah	00h::01h	0::1	Positive, Negative	Polarity

Delay		Overdrive					
Idx	PAH PAL	Idx	PAH PAL	EFXV$_{16}$	EFXV$_{10}$	Description	Name
—	—	3	00h 03h	00h::7Fh	0::127		Drive
—	—	4	00h 04h	00h::7Fh	0::127		Postgain
5	00h 05h	—	—	00h::7Fh	0::127		Length
6	00h 06h	—	—	00h::7Fh	0::127		Feedback
7	00h 07h	7	00h 07h	00h::7Fh	0::127		Cutoff
10	00h 0Ah	—	—	00h::01h	0::1	Positive, Negative	Polarity
11	00h 0Bh	—	—				Auto-Pan
12	00h 0Ch	—	—				Sync

ModDelay		Reverb					
Idx	PAH PAL	Idx	PAH PAL	EFXV$_{16}$	EFXV$_{10}$	Description	Name
2	00h 02h	—	—	00h::7Fh	0::127		Speed
—	—	2	00h 02h	00h::7Fh	0::127		Size
3	00h 03h	—	—	00h::7Fh	0::127		Depth
—	—	3	00h 03h	00h::7Fh	0::127		Shape
4	00h 04h	—	—	00h::03h, 04h::07h, 08h::0Bh, 0Ch::0Eh, 0Fh::11h, 12h::14h, 15h	0::3, 4::7, 8::11, 12::14, 15::17, 18::20, 21	Off, 2/1, 1/1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/2., 1/4., 1/8., 1/16., 1/32., 1/64., 1/1T, 1/2T, 1/4T, 1/8T, 1/16T, 1/32T, 1/64T	Sync
—	—	4	00h 04h	00h::7Fh	0::127		Decay
5	00h 05h	—	—	00h::7Fh	0::127		Length
—	—	5	00h 05h	00h::7Fh	0::127		Predelay
6	00h 06h	—	—	00h::7Fh	0::127		Feedback
7	00h 07h	7	00h 07h	00h::7Fh	0::127		Lo-Cut
8	00h 08h	8	00h 08h	00h::7Fh	0::127		Hi-Cut
9	00h 09h	—	—	0h::7Fh	0::127		Spread
—	—	9	00h 09h	00h::7Fh	0::127		Diffusion
—	—	10	00h 0Ah	00h::7Fh	0::127		Damping

LoFi					
Idx	PAH PAL	EFXV$_{16}$	EFXV$_{10}$	Description	Name
6	00h 06h	00h::7Fh	0::127		S&H Rate
7	00h 07h	00h::7Fh	0::127		Drive
8	00h 08h	00h::7Fh	0::127		Gain

4.3.5 GDAT – Global Data

The Global Dump GDAT has a length of 200 bytes.

Global Data					
Idx	PAH PAL	GLBV$_{16}$	GLBV$_{10}$	Description	Name
0	00h 00h	31h	49	ASCII “1”	Version
2	00h 02h	01h::08h, 09h::7Bh, 7Ch::7Fh	1::8, 9::123, 124::127	0.1::0.9(0.1) s 1.1::15.0(0.1) s 15.2::15:5(0.1) s	Popup Time
3 2	00h 03h	00h, 01h::08h, 09h::7Bh, 7Ch::7Fh	0, 1::8, 9::123, 124::127	Off 0.1::0.9(0.1) s 1.1::15.0(0.1) s 15.2::15:5(0.1) s	Label Time
4	00h 04h	00h::7Fh	0::127	Maximum::Minimum	LCD Contrast
5	00h 05h	00h, 01h, 02h, 03h	0, 1, 2, 3	1 (-8 dB) 2 (0 dB) 3 (+10 dB) 4 (+29 dB)	Input Gain
6	00h 06h				Mastertune
7	00h 07h	00h, 01h::10h	0, 1::16	Omni MIDI Channel 1::16	Global Channel
8	00h 08h	00h, 01h::0Eh	0, 1::126	Default ID Custom ID	SysEx ID
9	00h 09h	00h::7fh	0::127		Global Volume
12	00h 0Ch	00h::31h	0::49	Program 1::50	Active Program
13	00h 0Dh	00h::7Fh	0::127	C-2::G8	Map Base Key
14 15	00h 0Eh 00h 0Fh	00h::18h 00h::7Fh	0::24 0::127	Hi=12.8*(0::24) Lo=0.1*(0::127) Hi+Lo= External, 0.1::319.9 bpm	Global Tempo
16	00h 10h	00h, 01h	0, 1	On, Off	TX Clock
17	00h 11h	00h, 01h	0, 1	Off, SysEx	Ctl. Send
18	00h 12h	00h, 01h 02h	0, 1, 2	Off, On MP-Bundle	Ctl. Recv
19	00h 13h	00h, 01h	0, 1	On, Off	TX ProgCh
20	00h 14h	00h, 01h	0, 1	On, Off	RX ProgCh
22	00h 16h	00h::39h, 3Ah, 3Bh::7Fh	0::57, 58, 59::127	On, Off, On,	Screen Saver
24	00h 18h	00h, 01h	0, 1	On, Off	Glb. Pattern Mode