MIDI System Exclusive Implementation Specification - version 1.43 for: SQ–1, SQ–1+, SQ–1+/32, SQ-2, SQ–2/32, and KS–32

Note: This document applies equivalently to all systems listed above. The systems are identical with respect to SysEx implementation, with any exceptions or differences noted as necessary.

1 Introduction and Overview

This document describes the MIDI System Exclusive (SysEx) communication protocol used when the SQ-1 is communicating with an external computer (EXT). The protocol is designed to aid the implementation of editing programs running on EXT, and so this information is especially relevant to designers and programmers of editing programs. The commands described here allow editor/librarian programs to collect and alter information about sounds and sequences within the SQ-1.

1.1 Universal System Exclusive Device Inquiry Message

The SQ-1 supports the MIDI Device Inquiry message which allows instruments and computers to ascertain the identity of the unit(s) to which they are connected via MIDI. The SQ-1 responds to the following Identity Request message by sending an Identity Reply message. The SQ-1 will respond to the inquiry if the channel information in the message contains *either* the base MIDI channel of the SQ-1 *or* the all channel broadcast code ($7F), but the message should not contain both.

11110000	F0	System Exclusive status byte
01111110	7E	Non Real Time message code
0000nnnn	0x	Base MIDI channel number
-or -		
01111111	7F	All Channel Broadcast code
00000110	06	General Information message code
00000001	01	Identity Request message code
11110111	F7	End of System Exclusive

1.2 System Exclusive Device Identity Reply Message

The following Identity Reply message contains information about the SQ-1, and is transmitted in response to an Identity Request.

11110000	F0	System Exclusive status byte
01111110	7E	Non Real Time message code
0000nnnn	0x	Base MIDI channel number
00000110	06	General Information message code
00000010	02	Identity Reply message code
00001111	0F	ENSONIQ manufacturer's Code
00000101	06	SQ-x Product Family ID code - LSByte
00000000	00	SQ-x Product Family ID code - MSByte
00000000	**0 0**	SQ-1 Family Member (Model ID) code LSByte
00000000	00	SQ-1 Family Member (Model ID) code MSByte
00000000	00	Software revision information
00000000	00	(not used)
0nnnnnnn	NN	Major Version Number (integer portion)
0nnnnnnn	NN	Minor Version Number (decimal fraction portion)
11110111	F7	End of System Exclusive

2 MIDI System Exclusive Packet Pieces

A packet is a bunch of information, i.e. a message, in the form of a MIDI data stream. Each packet can be divided into three sections or pieces. The first and last packet pieces form the *frame* for a message. The message contains the commands described in section 3. Every message must be preceded with a SysEx head and followed with a SysEx tail. A complete packet looks like this:

SysEx Head . . . . . Message . . . . . SysEx Tail

2.1 MIDI System Exclusive Packet Head

This is the common MIDI system exclusive header which must be used on all system exclusive messages to and from the SQ-1. These six bytes are always sent preceding the message portion of the packet. The SQ-1 Model ID Code in this header is also recognized by the SQ-R in order to allow transfer of common messages between an SQ-1 and an SQ-R. All messages which are not common to both machines will be ignored.

11110000	F0	System Exclusive status byte
00001111	0F	ENSONIQ Code
00000101	06	SQ-x Family ID Code
00000000	00	SQ-1 Model ID Code
0000nnnn	0x	Base MIDI channel number
00000nnn	0x	Message Type (see section 3)

2.2 MIDI System Exclusive Packet Tail

For every head there is a tail. The tail follows the message portion, and is the last byte of every complete SysEx packet.

11110111	F7	End of System Exclusive

2.3 Message Format

The SQ-1 message format within the packet frame allows 8 bit data bytes to be transmitted and received using the 7 bit data of MIDI. The MSB (bit 7) of the data bytes must always be a zero, so the bytes are converted to two 4 bit nybbles. These nybbles are converted to bytes whose upper four bits are all zero for transmission. Note that bytes whose value is zero must still be nybblized and sent as two bytes to preserve the expected MIDI byte counts. This is a description of the format of all data bytes within the packet frame as they are transmitted or received via MIDI. The details of each message are given in section 3.

0000HHHH	H = Hi 4 bits of data byte - transmitted first
0000LLLL	L = Lo 4 bits of data byte

This represents how the 8 bit byte HHHHLLLL would be transmitted.

2.4 Receiver Errors

If the message received by the SQ-1 is not understood, then an informative error message will be displayed and an error message will be sent as described in section 3.2. Errors typically occur when the MIDI cable is accidentally unplugged during a long dump message such as an All Programs Dump message. If EXT cannot handle the error message, then the displayed message will prompt the user to re-transmit the original message after re-connecting the MIDI cable or otherwise correcting the cause of the error.

3 Message Type List

The next few sections describe the messages to be used between EXT and SQ-1. The message type corresponds to the last byte of the system exclusive packet head described in section 2.1.

Note: The SysEx messages outlined below appear as an ordered description of bytes which do not necessarily represent the MIDI format described in section 2.3. Remember, full 8–bit data bytes are always sent as two "nybble-ized" bytes. Message types are part of the head and are sent as bytes, but Command types are considered data and are sent as two nybbles.

3.1 Command Messages (Message Type = 00)

All messages which need some interpretation by the receiver are called *command messages*. Every command message is transmitted using the message format described in section 2.3. The first byte of each command message is the command type byte, which follows the message type byte in the packet head. The command type is shown in the section headings.

3.1.1 Virtual Buttons (Command Type = 00)

EXT can simulate button presses from the front panel of the SQ-1 by sending this command. Sending the listed button numbers in a command will simulate a single button down being held *down*. Button *up* commands add an offset of 96 (60h) to the the button down numbers. The button number follows the command type byte in the message. Remember to send a button up command for every button down command that is sent. *Note: a brief delay (approximately 2-300 msecs) between button commands, or at least pairs of button commands, is recommended.*

3.1.1.1 Button Numbers

Logical Number	Front Panel Button Name
0	unnamed bank 0
1	unnamed bank 1
2	unnamed bank 2
3	unnamed bank 3
4	unnamed bank 4
5	unnamed bank 5
6	unnamed bank 6
7	unnamed bank 7
8	unnamed bank 8
9	unnamed bank 9
10	unnamed screen 0
11	unnamed screen 1
12	unnamed screen 2
13	unnamed screen 3
14	unnamed screen 4
15	unnamed screen 5
16	unnamed screen 6
17	unnamed screen 7
18	unnamed screen 8
19	unnamed screen 9
20	Select Sounds
21	Select Sequences/Presets
22	Edit Sounds
23	Edit Sequences/Presets
24	Down arrow, DEC
25	Left arrow
26	Up arrow, INC
27	Right arrow
28	Enter/Save
29	Compare
30	Track 1
31	Track 2
32	Track 3
33	Track 4
34	Track 5
35	Track 6
36	Track 7
37	Track 8

Buttons only on KS-32:

Logical Number	Front Panel Button Name
38	System/MIDI
39	Edit Track
40	Replace Track Sound
41	Make Default Preset
42	BankSet

Note: The sequencer button numbers are different on the KS-32 than on other SQ systems. They are offset by +5, allowing for the unique buttons only used on the KS-32 front panel.

Sequencer control buttons:

Front Panel Button Name	**Logical Number**	
	SQ-x	*KS-32*
Record	40	45
Play	41	46
Stop/Continue	42	47

Example:
(in hexadecimal notation, assuming Base MIDI Chan = 01, transmitted as 00)

Header	*Msg*	*Cmd*	*Button*	*EOX*	
F0 0F 06 00 00	00	00 00	01 09	F7	Left Arrow button down
F0 0F 06 00 00	00	00 00	07 09	F7	Left Arrow button up

Note: The SQ-1 receives but does not transmit the following Dump Request commands (command types 01 to 05). The command type is the only byte in these commands. Remember that the command type byte is considered data and must be nybble-ized.

3.1.2 Single Sound Dump Request (Command Type = 01)
The SQ-1 will dump the current sound using the bulk dump message described in section 3.3.1 when it receives this command. If the current program is being edited, the edited version of the program will be transmitted.

3.1.3 Internal Sound Banks Dump Request (Command Type = 02)
The SQ-1 will dump the internal RAM program banks using the bulk dump message described in section 3.3.2 when it receives this command.

3.1.4 Single Sequence Dump Request (Command Type = 03)
The SQ-1 will dump the currently selected sequence using the bulk dump message described in section 3.1.3 when it receives this command.

3.1.5 All Sequence Dump Request (Command Type = 04)
The SQ-1 will dump all sequence memory using the bulk dump message described in section 3.1.4 when it receives this command.

3.1.6 Dump Everything Request (Command Type = 05)
The SQ-1 will dump the internal RAM sound banks and all sequencer memory using the bulk dump messages described in section 3.3 when it receives this command. Each dump is a separate message, i.e. the messages are not combined into one.

***Sequence Dump Protocol**: Since the receiver of a sequence dump message must be prepared to store the sequence data, sequence dumps are performed using two messages from the transmitter and a handshaking message from the receiver. The transmitter sends the dump alert command which informs the receiver of the next message. The receiver should respond with an error message containing an ACK or NAK error code (see section 3.2.1). If the receiver does not respond within one second, the transmitter will send the dump message anyway. This timeout feature allows open loop communication (i.e. "dumb" System Exclusive recorders can store SQ-1 sequence data). If the receiver responds with a NAK error code, the transmitter should not send the dump message.*

3.1.7 Single Sequence Dump Alert (Command Type = 06)

This message is the first message of a sequence dump. The message contains the size of the sequence data segment which will follow in the single sequence dump message.

00001011	06	Command Type
HHHHHHHH	HH	Sequence Data Size in bytes Hi Byte Hi Word
hhhhhhhh	hh	Sequence Data Size in bytes Lo Byte Hi Word
LLLLLLLL	LL	Sequence Data Size in bytes Hi Byte Lo Word
llllllll	ll	Sequence Data Size in bytes Lo Byte Lo Word
ssssssss	ss	Sequence/Song Flag (0=sequence; 255=song)

3.1.8 All Sequence Memory Dump Alert (Command Type = 07)

This message is the first message of a complete sequence memory dump. The message contains the size of the sequence data segment which will follow in the all sequence dump message. It also contains the number of defined preset, sequence, and song locations (also known as sequence presets).

00001100	07	Command Type
HHHHHHHH	HH	Sequence Data Size in bytes Hi Byte Hi Word
hhhhhhhh	hh	Sequence Data Size in bytes Lo Byte Hi Word
LLLLLLLL	LL	Sequence Data Size in bytes Hi Byte Lo Word
llllllll	ll	Sequence Data Size in bytes Lo Byte Lo Word
nnnnnnnn	nn	number of defined sequence presets [2..100]

3.2 Error Messages (Message Type = 01)

Error messages are transmitted by the SQ-1 when an error occurs while processing any of the command messages described in section 3.1. The SQ-1 ignores error messages unless a sequence dump is being processed.

3.2.1 Command Message Error Codes

These codes are the data byte of error messages.

Code	Name	Meaning
00	NAK	The preceding command message could not be processed. The receiver is busy or the message is unintelligible. The preceding dump command is not acceptable.
01	ACK	The preceding dump command is acceptable.
02	INVALID BUTTON NUMBER	The button number in the preceding virtual button message doesn't correspond to any real button number.

3.3 Bulk Dumps of Sounds and Sequences

Bulk dump data messages are transmitted using the message format described in section 2.3. The message type byte, which is part of the system exclusive header, is given in hexadecimal with the name of the dump message. The actual data bytes for sounds and sequences are described in section 4. The MIDI data byte lengths are listed in decimal for each message type.

3.3.1 Single Sound (Message Type = 02)

MIDI Data byte length = 408 + head and tail = 415
This dump contains sound parameters for a single sound (refer to sections 4.2 and 4.4). When this message is *transmitted* from an SQ-1, it contains the currently selected sound. If the compare buffer is active (the Compare LED is on), then the sound in the compare buffer will be transmitted. When this message is *received*, the new sound will be put into the compare buffer so that it can later be written to internal or cartridge memory. Remember that the compare buffer is over-written by the incoming data and its previous contents are lost.

3.3.2 All Sounds (Message Type = 03)

MIDI Data byte length = 408*80 = 32640 + head and tail = 32647
All 80 sounds in the first 8 internal RAM program banks are contained in this message.

3.3.3 Single Sequence (Message Type = 04)

MIDI Data byte length = variable depending on amount of sequence data
This message is transmitted according to the *Sequence Dump Protocol* described before section 3.1.7. It contains sequence data and track parameters (refer to section 4.6).

3.3.4 All Sequences (Message Type = 05)

MIDI Data byte length = variable depending on amount of sequence data
This message is transmitted according to the *Sequence Dump Protocol* described just before section 3.1.7. It contains global sequence parameters, sequence data, and sequence track parameters (refer to section 4.7).

4 Parameter Block Data Descriptions

The following section contains descriptions of the parameter blocks transmitted using the bulk dump messages described in section 3.3. The names and byte offsets of each block parameter are given. The parameter value ranges are included the data structure definitions later in this section. Remember that the following byte layout is the *internal* representation and not the MIDI byte format which is described in section 2.3.

Notes about the structures (referenced by note number from the structure descriptions):

1. **Waveform List** — the numbers adjacent to the wave class name are the range of internal wave number parameter values used to identify the individual waves within the class.

   STRING WAVE (0..12)

   STRING ENSEMBLE, PIZZICATO STRING, GRAND PIANO, PIANO VARIATION, DIGITAL PIANO, CLAVINET PIANO, ACOUSTIC GUITAR, GTR VARIATION-1, GTR VARIATION-2, GUITAR HARMONIC, ELECTRIC GUITAR, PLUCKED GUITAR, CHUKKA GUITAR

   BRASS WAVE (13..18)

   BRASS ENSEMBLE, SOLO TRUMPET, TRUMP VARIATION, SAXOPHONE, SAX VARIATION-1, SAX VARIATION-2

   BASS WAVE (19..24)

   PICKED BASS, THUMB POP BASS, PLUCKED BASS, ACOUSTIC BASS, SYNTH BASS-1, SYNTH BASS-2

BREATH WAVE (25..28)
WOOD FLUTE, CHIFF FLUTE, VOCAL OOOHS, VOCAL ENSEMBLE

TUNED PERCS (29..38)
MARIMBA, KALIMBA, STEEL DRUM, DOORBELL, POT LID HIT, SYNTH PLUCK, PLINK HORN, PIANO PING, ORCHESTRA HIT, RACK BELL

PERCUSSION (39..60)
WOODEN HIT, WOOD BLOCK, TEMPLE BLOCK, CLAVES, TIMBALE, BONGOS, AGOGO BELL, COWBELL, TAMBOURINE, FINGERSNAPS, CLAPS, DINKY HIT, TOY HAMMER, SLINKY POP, MUSICIAN,S TAPE, STEAM DRUM, BIG BLAST, SPRAY CAN, METALLIC DINK, VOCAL PERCUSSION, ANVIL HIT, SYNTH THUMP

DRUM WAVE (61..83)
DYNAMIC KICK, GATED KICK, ROOM KICK, ELECTRIC KICK, TIGHT KICK, THUMP KICK, THUMP SNARE, SYNTH SNARE, ROOM SNARE, BRUSHED SNARE, RIM SHOT SNARE, SIDE STICK SNARE, DRY TOM LOW, DRY TOM HIGH, ROOM TOM LOW, ROOM TOM HIGH, CLOSED HI-HAT 1, CLOSED HI-HAT 2, SYNTH CLOSED HAT, PEDAL HI-HAT, OPEN HI-HAT, RIDE CYMBAL, CRASH CYMBAL

WAVEFORM (84..105)
ORGAN VARIATION1, ORGAN VARIATION2, ORGAN VARIATION3, ORGAN VARIATION4, SAWTOOTH, SQUARE, SINE, TRIANGLE, 1+2 HARMONICS, 2 HARMONIC SAW, DIGITAL PNO GRIT, DIGITAL PNO TINE, BUBBAWAVE, CLAVINET, CLAV VARIATION, WOODWIND, WWIND VARIATION, PIPE ORGAN, BRASS ORGAN, VOCAL BELL, SYNTH BELL, CLARINET

INHARMONIC (106..110)
TRIANGLE LOOP, ANVIL LOOP, CLUSTER LOOP, TUBULAR LOOP, NOISE LOOP

TRANSWAVE (111..119)
FORMANT-X, PLANET-X, ELECTRO-X, PULSE 1-X, PULSE 2-X, RESONANT 1-X, RESONANT 2-X, RESONANT 3-X, RESONANT 4-X

MULTI-WAVE (120)
ALL WAVES

For the SQ-1+, SQ-2 and the KS-32 only, the following wave class is also available:

16BIT PIANO (121..124)
16 BIT PIANO, 16 BIT PIANO- HI, 16 BIT PIANO- LO, THUD

For the SQ-1+/32, SQ-2/32 and the KS-32 only, the following wave class is also available (refer to explanatory note 1A which follows):

EXPANSION (0..42)
VIOLA SECT, SOLO VIOLIN, NYLON GUITAR, HARP, SHAMIZEN, ELEC PIANO 1, ELEC PIANO 2, PERC ORGAN, MUTE TRUMPET, SOPRANO SAX, ACCORDIAN, FRETLESS BASS, SLAP BASS, SYNTH BASS-3, CHOIR, SHAKUHACHI, TIMPANI, VIBES, AGOGO BELL-2, SHEKERE, TAIKO, TAIKO RM, WHISTLE, SHAKER, CONGA SLAP, TRIANGLE, CASTANETS, HYOSHIGI, SYNTH KISS, SYN COWBELL, SYN RIMSHOT, VOCAL AAH, VOCAL UNH, VOCAL UHH, VOCAL TEH, DANCE KICK, ENKA KICK, LONG RAP KICK, HIPHOP KICK1, HIPHOP KICK2, HIPHOP SNARE, FULL PIPEORG

1A. **Expansion Waves** — In systems containing the Expansion Wave ROM (SQ-1+/32, SQ-2/32 and KS-32), the legal values of the 7-bit Waveform Number parameter are 0..42 for the Expansion ROM waves.

There are two methods used to identify the sounds using the expansion ROM waveforms:

1. For "standard" sounds, the MSB (bit 7) of each of the first 8 envelope parameters in one of the Standard Sound Envelope Structures is combined into a code byte which specifies the expansion wave index as follows:

   Use the MSB (bit 7) of each of the first 8 envelope parameters of **Env 1** to form an Expansion ROM ID code byte. The bit number in the code byte corresponds to the envelope parameter offset (0..7). If this ROM ID code byte has a value of 119 (01110111 binary or 77H), it indicates that an expansion ROM wave is used. The waveform is selected from the expansion ROM using the 7-bit Waveform Number from the Standard Sound Voice Structure in the range 0..42.

2. For "drum" sounds, five formerly unused bytes in the Drum Sound Structure are used to identify the expansion waves as follows:

   If the two-byte Drum Expansion ID code at offset 174 is set to "DX" (4458H) then the 4-byte Drum Expansion Sound Mask at offset 170 is used as a long word (32 bits) whose lowest 17 bits contain bit flags for each of the 17 drum sounds indicating which ones use expansion waves (the highest 15 bits of the long word are reserved for future use and should be zeros). The waveform is selected from the expansion ROM using the 7-bit Waveform Number from the Drum Sound Voice Structure in the range 0..42.

1B. **Reserved Envelope Bits** — In all SQ and KS systems, the first 8 envelope parameters in the Standard Sound Envelope Structure use only the low 7 bits for envelope parameter information. For older SQ-1 and SQ-R systems (prior to SQ-1+ and SQ-R+) these bits should always be set to zero. Later systems mask the bits off and handle them as special purpose flags, so sounds programmed on/for these later systems may have some of these bits set, and this is a source of possible conflict with the original older systems.

2. **Modulation Source List** — displayed from lowest to highest value of mod source param:

   For the SQ-1+ and the SQ-1:
   LFO,ENV1, ENV2, AMP, NOISE, NOISE2, VELOC, KEYBD, TIMBRE,
   PEDAL, PITCH, XCTRL, WHEEL, PRESSR, MAX ON, and <OFF>

   For the SQ-2 and KS-32:
   LFO,ENV1, ENV2, AMP, NOISE, NOISE2, VELOC, KEYBD, TIMBRE,
   PEDAL, PITCH, WHEEL, WHL+PR, PRESSR, MAX ON, and XCTRL

3. **Sound names** are sixteen ASCII characters long, but are packed into 14 consecutive bytes in the sound structure. Preset, sequence, and song names are normal ASCII characters stored as full 8-bit bytes, but bit 7 (MSB) of each byte is reserved for track mute status and should not be used or changed.

4. The **voice status** parameter determines whether the sound is a standard sound or a drum sound, and how many voices will be used if the sound is a standard sound. When all three bits of the status parameter are zero, the sound is a drum sound. When at least one bit is set within the status parameter, the sound is a standard sound with one bit per voice. The numbering of the bits is: bit 5 = voice 0, bit 6 = voice 1, bit 7 = voice 2. When a bit is set, the voice will play.

5. **Internal Program Numbers** contain the bank select code and sound number stored as a 16–bit word having the format `ccrrrrrr nnnnnnnn` where `c` = bank select code; `r` = reserved; `n` = sound number. The sound number [00..99] occupies the least significant 8 bits [0..7] in the low byte of the complete program number word. Bits 8 to 13 in the high byte are reserved for future use of MIDI Bank Select numbers [0..63]. The bank select code is stored in bits 14 and 15 of the program number word (see table). Only sound numbers [00..79] are affected by the bank select code because numbers [80..99] are reserved for the permanent drum sounds.

Bank Select Code	*Bank Set*
0	Internal Sounds
1	Permanent ROM sounds
2	Memory Card A sounds
3	Memory Card B sounds

6. The **track pile** is an ordered list of eight bytes with one byte per track. The first byte contains the track number of the primary track. The other seven bytes contain non-zero track numbers for any layered tracks which are active.

7. For parameters which are displayed as [0..99] or [-99..99] but stored internally as [0..127] or [-128..127], the following **conversion table** of 128 bytes is used to translate the internal values into displayed values. For negative internal values (80h..FFh), ignore the MSB or sign bit in order to get the table index (0..127) to use. There are sixteen entries per line in the table.

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

For parameters which are displayed as [0..99] but stored internally as [0..15], a translation procedure is performed to convert the internal value to an index [0..127] for the above table.

General notes on the structure descriptions

The structure tables which follow show the parameter names, locations, and value ranges for each parameter in the particular block. The *offset* is the byte offset of the parameter from the beginning of the structure. The *displayed parameter range* for non-numeric parameters shows the values in order from zero to the maximum internal value. The *bit mask* shows which bit locations within each byte are used for the parameter value (some parameter values do not require all of the bits in the mask, but all bits are significant; assume unused bits are to be zero).

4.1 Drum Sound Voice Structure — This is the structure for *one* of the seventeen voices within a drum sound.

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Envelope Mode	0.,1	OFF, ON	x--- ----
00	Gate Time	0..99	00..99	-xxx xxxx
01	Release Time	0..99	00..99	-xxx xxxx
01	Pitch Tracking Switch	0,1	OFF, ON	x--- ----
02	Waveform Number	0..124	*{see Note #1 & 1A}*	-xxx xxxx
02	Waveform Direction	0,1	FORWRD, BACKWD	x--- ----
03	Root Key (signed semitones)	-59..59	{Octave & Semitone}	xxxx xxxx
04	Fine Tuning	0..15	00..99	---- xxxx
04	Amp Velocity Sensitivity	0..15	00..99	xxxx ----
05	Key Range Low Key	21..108	A0..C8	xxxx xxxx
06	Key Range High Key	21..108	A0..C8	xxxx xxxx
07	Filter Cutoff	0..15	000..127	xxxx ----
07	Filter Velocity Sensitivity	0..15	00..99	---- xxxx
08	Volume Boost Switch	0,1	OFF, ON	x--- ----
08	Volume	0..127	00..99	-xxx xxxx
09	Velocity Curve	0..3	QUICKRISE, CONVEX LINEAR, CONCAVE	xx-- ----
09	Output Bus Routing	0..2	DRY, EFFECT1, EFFECT2	--xx ----
09	Output Pan	0..15	-98..+98	---- xxxx

Total Size = 10 bytes

4.2 Drum Sound Structure — Drum sounds consist of seventeen voices, a name, and an effect description.

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Drum Voice 0	*{refer to Drum Voice Structure, section 4.1}*		
10	Drum Voice 1	*{refer to Drum Voice Structure, section 4.1}*		
20	Drum Voice 2	*{refer to Drum Voice Structure, section 4.1}*		
30	Drum Voice 3	*{refer to Drum Voice Structure, section 4.1}*		
40	Drum Voice 4	*{refer to Drum Voice Structure, section 4.1}*		
50	Drum Voice 5	*{refer to Drum Voice Structure, section 4.1}*		
60	Drum Voice 6	*{refer to Drum Voice Structure, section 4.1}*		
70	Drum Voice 7	*{refer to Drum Voice Structure, section 4.1}*		
80	Drum Voice 8	*{refer to Drum Voice Structure, section 4.1}*		
90	Drum Voice 9	*{refer to Drum Voice Structure, section 4.1}*		
100	Drum Voice 10	*{refer to Drum Voice Structure, section 4.1}*		
110	Drum Voice 11	*{refer to Drum Voice Structure, section 4.1}*		
120	Drum Voice 12	*{refer to Drum Voice Structure, section 4.1}*		
130	Drum Voice 13	*{refer to Drum Voice Structure, section 4.1}*		
140	Drum Voice 14	*{refer to Drum Voice Structure, section 4.1}*		
150	Drum Voice 15	*{refer to Drum Voice Structure, section 4.1}*		
160	Drum Voice 16	*{refer to Drum Voice Structure, section 4.1}*		
170	*Drum Expansion Wave codes	**{32 voice systems only – see Note #1A}*		
177	Drum Sound Name	*{see Note #3}*		
191	unused			
193	Effect Parameters	*{see Effect Structure, section 5.1}*		
203	Voice Status	*{see Note #4}*		xxx- ----
203	Effect Number	*{see Effect Structure, section 5.1}*		---x xxxx

Total Size = 204 bytes

4.3 Standard Sound Envelope Structure — This is the structure for *one* of the three envelopes within a single voice of a three voice sound.

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Initial Level	0..127	00..99	-xxx xxxx
01	Attack Time	0..99	00..99	-xxx xxxx
02	Peak Level	0..127	00..99	-xxx xxxx
03	Decay Time 1	0..99	00..99	-xxx xxxx
04	Breakpoint Level	0..127	00..99	-xxx xxxx
05	Decay Time 2	0..99	00..99	-xxx xxxx
06	Sustain Level	0..127	00..99	-xxx xxxx
07	Release Time	0..99	00..99	-xxx xxxx
00..07		*{see Note #1B}*		x--- ----
08	Envelope Mode	0..2	NORMAL, FINISH REPEAT	xx-- ----
08	Velocity Curve	0..3	QUICKRISE, CONVEX LINEAR, CONCAVE	--xx ----
08	Keyboard Time Scaling	-7..7	00..99	---- xxxx
09	Level Velocity Sensitivity	0..15	00..99	xxxx ----
09	Attack Time Vel Sensitivity	0..15	00..99	---- xxxx

Total Size = 10 bytes

4.4 Standard Sound Voice Structure — This is the structure for *one* of the three voices within a standard sound.

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Envelope 1	*{refer to Envelope Structure, section 4.3}*		
10	Envelope 2	*{refer to Envelope Structure, section 4.3}*		
20	Envelope 3	*{refer to Envelope Structure, section 4.3}*		
30	Root Key (signed semitones)	-59..59	{Octave & Semitone}	xxxx xxxx
31	Fine Tuning	-127..127	-99..+99	xxxx xxxx
32	Env1 Modulation Amount	-127..127	-99..+99	xxxx xxxx
33	LFO Modulation Amount	-127..127	-99..+99	xxxx xxxx
34	Filter Mode	0..3	*Filter 1* *Filter 2* 2LoPass 2HiPass 3LoPass 1HiPass 2LoPass 1HiPass 3LoPass 1HiPass	xx-- ----
34	Glide Mode	0..3	OFF, RETRIGGER, MINI-MODE, LEGATO	--xx ----
34	Pitch Modulation Source	0..15	*{see Note #2}*	---- xxxx
35	Pitch Modulation Amount	-99..99	-99..+99	xxxx xxxx
36	Pitch Tracking Switch	0,1	OFF, ON	x--- ----
36	Filter 1 Cutoff	0..127	000..127	-xxx xxxx
37	Filter 1 Kbd Mod Amount	-127..127	-99..+99	xxxx xxxx
38	Filter 1 Env2 Mod Amount	-127..127	-99..+99	xxxx xxxx
39	Filter 1 Modulation Source	0..15	*{see Note #2}*	---- xxxx
39	Pan	-7..7	-99..+99	xxxx ----
40	Filter 1 Modulation Amount	-127..127	-99..+99	xxxx xxxx
41	Filter 2 Mod Tracking Switch	0,1	OFF, ON	x--- ----
41	Filter 2 Cutoff	0..127	000..127	-xxx xxxx
42	Filter 2 Kbd Mod Amount	-127..127	-99..+99	xxxx xxxx
43	Filter 2 Env2 Mod Amount	-127..127	-99..+99	xxxx xxxx

4.4 Standard Sound Voice Structure (continued)

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
44	Volume Fade Shape	-128..127	GATE, -99..99 (128 = GATE)	xxxx xxxx
45	Key Range Low Key	21..108	A0..C8	xxxx xxxx
46	Key Range High Key	21..108	A0..C8	xxxx xxxx
47	Volume Boost Switch	0,1	OFF, ON	x--- ----
47	Volume	0..127	00..99	-xxx xxxx
48	Voice Priority	0..2	LOW, MEDIUM, HIGH	xx-- ----
48	Output Bus Routing	0..2	DRY, EFFECT1, EFFECT2	--xx ----
48	Volume Modulation Source	0..15	*{see Note #2}*	---- xxxx
49	Volume Modulation Amount	-128..127	-99..99	xxxx xxxx
50	Noise Source Rate	0..15	00..99	xxxx ----
50	LFO Modulation Source	0..15	*{see Note #2}*	---- xxxx
51	LFO Restart Switch	0,1	OFF, ON	x--- ----
51	LFO Depth	0..127	00..99	-xxx xxxx
52	LFO Speed	0..99	00..99	-xxx xxxx
53	LFO Delay Time	0..15	00..99	xxxx ----
53	LFO Waveform	0..6	TRIANGLE, SINE, SINE/TRI POS/SINE, POS/TRI, SAWTOOTH SQUARE,	---- xxxx
54	Waveform Direction	0,1	FORWRD, BACKWD	x--- ----
54	Waveform Number	0..127	*{see Note #1}*	-xxx xxxx
55	Velocity Threshold	-7..7	<=126..>126	xxxx ----
55	Waveform Mod Source	0..15	*{see Note #2}*	---- xxxx

The values for the next two bytes byte depend on the waveform number. If a multi-wave is selected, then the following bytes are Multi-Wave Loop Length and Multi-Wave Loop Start. If a modulatable waveform is selected, then the following bytes are Waveform Modulation Amount and Waveform Start Index.

56	Waveform Mod Amount	-127..127	-99..+99	xxxx xxxx
56	Multi-Wave Loop Length	0..121	000..121	xxxx xxxx
57	Waveform Start Index	0..127	00..99	xxxx xxxx
57	Multi-Wave Loop Start	0..121	000..121	xxxx xxxx
58	Voice Delay Time	0..251	000..250, KEYUP (251 = KEYUP)	xxxx xxxx

Total Size = 59 bytes

4.5 Standard Sound Structure — Standard sounds consist of three voices, a name, some global sound parameters, and an effect description.

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Standard Voice 0	*{refer to Standard Voice Structure, section 4.4}*		
59	Standard Voice 1	*{refer to Standard Voice Structure, section 4.4}*		
118	Standard Voice 2	*{refer to Standard Voice Structure, section 4.4}*		
177	Standard Sound Name	*{see Note #3}*		
191	Glide Time	0..99	00..99	xxxx xxxx
192	Restrike Decay Time	0..99	00..99	xxxx xxxx
193	Effect Parameters	*{see Effect Structure, section 5.1}*		
203	Voice Status	*{see Note #4}*		xxx- ----
203	Effect Number	*{see Effect Structure, section 5.1}*		---x xxxx

Total Size = 204 bytes

*Note: The sequencer data format is not currently documented, so these blocks are only described in general terms. When "**Data Size**" is referenced, it refers to the data size given in the sequence dump alert commands described in sections 3.1.7 and 3.1.8.*

*Note: In the following dump descriptions, the terms "word" and "long word" are used to refer to the size of some of the structures. A **word** is 2 bytes or 16 bits, and a **long word** is 4 bytes or 32 bits.*

4.6 Single Sequence Dump Parameters

This message consists of the data from one sequence and the sequence header.

Byte Offset	Data description
0	Sequence Data
4	Sequence Track Data
4 + Data Size	Sequence Preset (168 bytes - see section 4.8)

4.7 All Sequence Dump Parameters

This message consists of the data from all sequences, all sequence presets, and the global sequencer parameters.

Byte Offset	Data description
0	Sequence Track Data Table Memory Allocation Variables
8	Sequence Track Data Table – There are 100 long word entries in this table, corresponding to the maximum possible number of sequences and songs in the SQ-1. Each entry is a sequence track data offset based on the beginning of track data minus 8 (i.e. the beginning of the Memory Allocation Variables for this table).
408	Sequence Track Data
408 + Data Size	Sequence Preset Table Memory Allocation Variables
416 + Data Size	Sequence Preset Table – There are 100 word size entries in this table, corresponding to the maximum possible number of presets in the SQ-1. Each entry is a preset offset based on the beginning of Sequence Preset Table minus 8 (i.e. the beginning of the Memory Allocation Variables for this table).
616 + Data Size	Sequencer Presets (each preset is 168 bytes long - see section 4.8). The number of presets is specified in the dump alert (see section 3.1.8).
616 + *N* + Data Size	Global Parameters - 21 bytes Note: *N* = 168 * the number of presets in this dump (see section 3.1.8).

4.8 Sequence Preset Structure — A preset dump consists of track parameters for each of the eight tracks, a track "pile" containing information about which tracks are selected and layered, an effect definition, and information about the preset and any associated sequence.

4.8.1 Track Parameter Structure — This structure describes a set of parameters for *one* of the eight tracks in a preset.

		Parameter Range		
Offset	**Parameter Name**	**Internal**	**Displayed**	**Bit Mask**
00	Sound Number	*{see Note #5}*		16 bits
02	Volume	0..127	0..99	xxxx xxxx
03	Pan	-128..127	SOUND, 0..99	xxxx xxxx
04	Timbre Control	0..127	0..99	xxxx xxxx
05	Release Time	-64..63	-64..63	xxxx xxxx
06	- reserved -			xxxx xxxx
07	Output Bus Routing	0..4	DRY, FX1, FX2, VOICE, CONTROL	xxxx xxxx
08	Pressure Type	0..2	NONE, KEY, CHANNEL	xx-- ----
08	MIDI Status	0..3	BOTH, LOCAL, MIDI, *EXT*	--xx ----
08	MIDI Channel	0..15	1..16	---- xxxx
09	Sustain Pedal Switch	0,1	ON, OFF	x--- ----
09	MIDI Program Number	0..127	1..128	-xxx xxxx
10	Key Range Low Key	21..108	A0..C8	xxxx xxxx
11	Transposition	-59..59	{Octave & semitone}	xxxx xxxx
12	Key Range High Key	21..108	A0..C8	xxxx xxxx
13	- reserved -			xxxx xxxx

Total Size = 14 bytes

4.8.2 Preset Structure — This structure describes a single preset.

		Parameter Range		
Offset	**Parameter Name**	**Internal**	**Displayed**	**Bit Mask**
00	Sequence Number	0..99	*{not displayed}*	xxxx xxxx
01	Sequence Flags	0..99	*{not displayed}*	xxxx xxxx
02	Name	*{see Note #3}*		
18	Bar Length	0..999	000.999	16 bits
20	Time Signature			16 bits
22	Edit Start Point (# of clocks)	0..2^{32}-1		32 bits
26	Edit Start Point (# of clocks)	0..2^{32}-1		32 bits
30	Tempo	25..250	25..250	xxxx xxxx
31	Number of Song Steps	0..255	0..255	xxxx xxxx
32	Track 1 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
46	Track 2 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
60	Track 3 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
74	Track 4 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
88	Track 5 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
102	Track 6 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
116	Track 7 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
130	Track 8 Parameters	*{refer to Track Param Structure, section 4.8.1}*		
144	Track Pile (1 byte/track)	*{see Note #6}*		
152	Preset Effect Parameters	*{refer to Effect Structure, section 5.1}*		
163	Size of Sequence			24 bits
166	- reserved -			16 bits

Total Size = 168 bytes

5.1 Effect Structure

There is a standard 10 byte structure size for used effect definitions, but the meaning and value of the bytes depends on the particular effect. The effect parameter pages are dependent on the currently selected effect. When the Effect Number is changed, the other effect parameters assume preset values.

5.1.1 Effect Preset Table — The following table determines which parameter page is used, based upon the value of Effect Number. The Parameter Set Name corresponds to the parameter set descriptions on the following pages.

Effect Number	Preset Name	Parameter Set Name
0	CONCERT HALL	Common Reverb
1	HALL REVERB	Common Reverb
2	ROOM REVERB	Common Reverb
3	WARM CHAMBER	Common Reverb
4	8-VOICE CHORUS.1	Multi-Voice Chorus
5	CHORUS+REVERB	MultiVerb
6	FLANGER+REVERB 1	MultiVerb
7	FLANGER+REVERB 2	MultiVerb
8	PHASE SHIFTER	Phaser
9	PHASER+REVERB	MultiVerb
10	ROTORY SPKR+VERB	Rotary Speaker Simulator
11	DIST+CHORUS+VERB	MultiVerb
12	CMPRSS+DIST+VERB	Guitar Effects

5.1.2 Effect Modulation Source List — This is the list of effect modulation sources as displayed from lowest to highest value:

00	KEYBOARD	08	TIMBRE
01	VELOCITY	09	RAMP-1
02	PRESSURE	10	RAMP-2
03	PITCHWHL	11	RAMP-3
04	MODWHEEL	12	RAMP-4
05	MODPEDAL	13	RAMP-5
06	XCONTROL	14	RAMP-6
07	SUS–PEDL	15	*OFF*

5.2 Effect Parameter Sets

There following pages contain descriptions of the six effects parameter sets which define the meaning and value of each of the ten bytes in the effect structure.

5.2.1 Common Reverb

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Decay Time	0..127	00..99	-xxx xxxx
01	Low Frequency Decay	-128..127	-99..99	xxxx xxxx
	(above does NOT apply to WARM CHAMBER)			
02	Detune Rate	0..99	00..99	-xxx xxxx
03	Detune Depth	0..127	00..99	-xxx xxxx
04	Modulation Destination	0..4	DECAY, DAMPING, FX1-MIX FX2-MIX, NOTHING	xxxx ----
04	Modulation Source	0..15	*{see section 5.1.2}*	---- xxxx
05	Modulation Amount	-128..127	-99..99	xxxx xxxx
06	High Frequency Damping	0..15	00..99	xxxx ----
06	High Frequency Bandwidth	0..15	00..99	---- xxxx
07	Diffusion	0..127	00..99	-xxx xxxx
08	FX1 Mix	0..127	00..99	-xxx xxxx
09	FX2 Mix	0..127	00..99	-xxx xxxx
10	Effect Number	0..32	*{see section 5.1.1}*	---x xxxx
10	- reserved -			xxx- ----

5.2.2 MultiVerb

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Decay Time	0..127	00..99	-xxx xxxx
01	Feedback	-128..127	-99..99	xxxx xxxx
02	Chorus/LFO Rate	0..99	00..99	-xxx xxxx
02	Invert (Flanger & Phaser only)	0,1	OFF, ON	x--- ----
03	Chorus/LFO Depth	0..127	00..99	-xxx xxxx
04	Modulation Destination	0..9	DECAY, DAMPING, FX1-MIX, FX2-MIX, RATE, DEPTH, LEVEL, FDBACK, CENTER, NOTHING	xxxx ----
04	Modulation Source	0..15	*{see section 5.1.2}*	---- xxxx
05	Modulation Amount	-128..127	-99..99	xxxx xxxx
06	High Frequency Damping *{for all except DIST+CHORUS+VERB}* Distortion Level *{for DIST+CHORUS+VERB only}*	0..15	00..99	xxxx ----
06	Level/Mix	0..15	00..99	---- xxxx
07	Center	0..127	00..99	-xxx xxxx
08	FX1 Mix	0..127	00..99	-xxx xxxx
09	FX2 Mix	0..127	00..99	-xxx xxxx
10	Effect Number	0..32	*{see section 5.1.1}*	---x xxxx
10	- reserved -			xxx- ----

5.2.3 Multi-Voice Chorus

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	- unused -			
01	Feedback	-128..127	-99..99	xxxx xxxx
02	Chorus Rate	0..99	00..99	-xxx xxxx
03	Chorus Depth	0..127	00..99	-xxx xxxx
04	Modulation Destination	0..7	FX1-MIX, FX2-MIX, RATE, DEPTH, LEVEL, FDBACK, CENTER, NOTHING	xxxx ----
04	Modulation Source	0..15	*{see section 5.1.2}*	---- xxxx
05	Modulation Amount	-128..127	-99..99	xxxx xxxx
06	- unused -			
07	Center	0..127	00..99	-xxx xxxx
08	FX1 Mix	0..127	00..99	-xxx xxxx
09	FX2 Mix	0..127	00..99	-xxx xxxx
10	Effect Number	0..32	*{see section 5.1.1}*	---x xxxx
10	- reserved -			xxx- ----

5.2.4 Phaser

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Stereo Cross Feedback	-128..127	-99..99	xxxx xxxx
01	Feedback	-128..127	-99..99	xxxx xxxx
02	Phaser Rate	0..99	00..99	-xxx xxxx
02	Invert	0,1	OFF, ON	x--- ----
03	Phaser Depth	0..127	00..99	-xxx xxxx
04	Modulation Destination	0..7	FX1-MIX, FX2-MIX, RATE, DEPTH, LEVEL, FDBACK, CENTER, NOTHING	xxxx ----
04	Modulation Source	0..15	*{see section 5.1.2}*	---- xxxx
05	Modulation Amount	-128..127	-99..99	xxxx xxxx
06	Level/Mix	0..15	00..99	---- xxxx
07	Center	0..127	00..99	-xxx xxxx
08	FX1 Mix	0..127	00..99	-xxx xxxx
09	FX2 Mix	0..127	00..99	-xxx xxxx
10	Effect Number	0..32	*{see section 5.1.1}*	---x xxxx
10	- reserved -			xxx- ----

5.2.5 Rotary Speaker Simulator

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Decay Time	0..127	00..99	-xxx xxxx
01	- unused -			
02	High Rotor Speed	0..99	00..99	-xxx xxxx
03	Rotor Depth	0..127	00..99	-xxx xxxx
04	Rotor Mode	0..4	CONTIN, SWITCH, TOGGLE	xxxx ----
04	Modulation Source	0..15	*{see section 5.1.2}*	---- xxxx
05	Low Rotor Speed	0..99	00..99	-xxx xxxx
06	High Frequency Damping	0..15	00..99	xxxx ----
07	Rotor Center	0..127	00..99	-xxx xxxx
08	FX1 Mix	0..127	00..99	-xxx xxxx
09	FX2 Mix	0..127	00..99	-xxx xxxx
10	Effect Number	0..32	*{see section 5.1.1}*	---x xxxx
10	- reserved -			xxx- ----

5.2.6 Guitar Effects

Offset	Parameter Name	Parameter Range Internal	Displayed	Bit Mask
00	Decay Time	0..127	00..99	-xxx xxxx
01	Feedback	-128..127	-99..99	xxxx xxxx
02	Flanger Rate	0..99	00..99	-xxx xxxx
03	Compression Threshold	0..15	00..99	xxxx ----
03	Input Level	0..11	00..11	---- xxxx
04	Modulation Destination	0..5	DECAY, DAMPING, FX1-MIX, FX2-MIX, FDBACK, NOTHING	xxxx ----
04	Modulation Source	0..15	*{see section 5.1.2}*	---- xxxx
05	Modulation Amount	-128..127	-99..99	xxxx xxxx
06	High Frequency Damping	0..15	00..99	xxxx ----
06	Output Level	0..15	00..99	---- xxxx
07	Highpass Cutoff	0..15	00..99	xxxx ----
07	Lowpass Cutoff	0..15	00..99	---- xxxx
08	FX1 Mix	0..127	00..99	-xxx xxxx
09	FX2 Mix	0..127	00..99	-xxx xxxx
10	Effect Number	0..32	*{see section 5.1.1}*	---x xxxx
10	- reserved -			xxx- ----