Contents Authoring Guideline For MA-3 Authoring Tool
< SMAF/Phrase Edition >

Version 3.2.4

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Contents

Revision History

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Ver.	Date	Description
3.2.4	2004/12/17	New released

1.Outline of this document

    This document stipulates a guideline in order to create a SMF (Standard MIDI File) that can pull out the performance of Yamaha's synthesizer LSI, MA-3 to the maximum extent when authoring the contents (SMAF/Phrase L1) for terminals equipped with MA-3 by using MA-3 Authoring Tool. Moreover, this document describes the point which should be careful.

    MA-3 Authoring Tool guarantees a normal operation in confirming a playback and conversion to career format in case of using SMF only with a MIDI event described in this document. (In case of reading SMF containing a MIDI event which is not described in this document, the operations are not guaranteed.) Although MIDI sequencer application software for authoring SMF in accordance with this document is not designated, the requirements include the capability of entry of events described here.

[Note]   About the numerical notations

        In this documentation, the data values are described using decimal numbers and hexadecimal numbers. In case of using hexadecimal numbers, a letter "H" (Hexadecimal) follows the numerical values. Moreover, "n" expresses the arbitrary integers. When you input a data value, refer to the following table 1.

Table 1 Comparison between Decimal numbers and Hexadecimal numbers

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
0	00H	32	20H	64	40H	96	60H
1	01H	33	21H	65	41H	97	61H
2	02H	34	22H	66	42H	98	62H
3	03H	35	23H	67	43H	99	63H
4	04H	36	24H	68	44H	100	64H
5	05H	37	25H	69	45H	101	65H
6	06H	38	26H	70	46H	102	66H
7	07H	39	27H	71	47H	103	67H
8	08H	40	28H	72	48H	104	68H
9	09H	41	29H	73	49H	105	69H
10	0AH	42	2AH	74	4AH	106	6AH
11	0BH	43	2BH	75	4BH	107	6BH
12	0CH	44	2CH	76	4CH	108	6CH
13	0DH	45	2DH	77	4DH	109	6DH
14	0EH	46	2EH	78	4EH	110	6EH
15	0FH	47	2FH	79	4FH	111	6FH
16	10H	48	30H	80	50H	112	70H
17	11H	49	31H	81	51H	113	71H
18	12H	50	32H	82	52H	114	72H
19	13H	51	33H	83	53H	115	73H
20	14H	52	34H	84	54H	116	74H
21	15H	53	35H	85	55H	117	75H
22	16H	54	36H	86	56H	118	76H
23	17H	55	37H	87	57H	119	77H
24	18H	56	38H	88	58H	120	78H
25	19H	57	39H	89	59H	121	79H
26	1AH	58	3AH	90	5AH	122	7AH
27	1BH	59	3BH	91	5BH	123	7BH
28	1CH	60	3CH	92	5CH	124	7CH
29	1DH	61	3DH	93	5DH	125	7DH
30	1EH	62	3EH	94	5EH	126	7EH
31	1FH	63	3FH	95	5FH	127	7FH

2. Notes on Authoring SMF

2.1. SMF format

Use Standard MIDI File Format 0 or Format 1.

2.2. MIDI channels

MIDI channels 1 to 16 are available.

2.3. Synthesizer mode and No. of tones generated

MA-3 Authoring Tool has two modes, FM32 tone mode and FM16 tone mode. The mode can be designated in preference of Authoring Tool.

When FM16 tone mode was designated in MA-3 Authoring Tool, and MSB was specified as 124 or 125, it prepares all four-operator voices as default FM voices. When FM32 tone mode was designated and MSB was specified as 124 or 125, it prepares all two-operator voices as default FM voices. Refer to another data for details about voice map.

SMAF/Phrase can include the maximum of four channels in one file; in addition, the number of sound generation for each channel is 1 tone (monophonic), and the total becomes 4 tones. For that reason, we recommend you to use monophonic notation to describe note messages.

Moreover, in SMAF/Phrase, up to 4 files are playable at a time, so the maximum number of simultaneous pronunciation of all 4 files becomes 16 tones.

In MA-3 Authoring Tool, it is possible to output 4 files for every 4 channels from a SMF made by16 channels.

2.4. TEMPO

Only the range of 5BH 8DH 80H (quarter notes = 10) to 00H EAH 60H (quarter notes = 1000) becomes valid for Set Tempo value.

MA-3 Authoring Tool supports tempo change during the music. But it is not possible to change tempo after loading SMF into MA-3 Authoring Tool.

MA-3 Authoring Tool treats quarter notes as 120, when tempo is not specified.

2.5. Time Base

MA-3 Authoring Tool converts data into SMAF/Phrase by using SMF time base and tempo information, as 1Tick = 20msec (Fixed).

2.6. Channel attribution

As the Channel attributions, normal channel and drum channel are provided. These attributes can be changed by bank select. (Refer to MA-3 Voice MAP/ MA-3 Drum Instrument MAP.)

When designation in bank select is not provided specifically, channel 10 is treated as a drum channel, and other channels are treated as a normal channel.

In addition, all channels are treated as Normal channels, after converting into SMAF/Phrase L1.

3. Applicable MIDI events

MA-3 Authoring Tool covers the following MIDI events, and ignores other events. However, be sure to input a note event. The initial setting values described below are default values that MA-3 Authoring Tool handles when no events are designated in SMF.

The MIDI events to be used are shown in the following table 2.

Table 2 List of used MIDI Events

Name of MIDI Event	Format Type
Note On	9nH kkH vvH
Note Off	8nH kkH vvH
Program Change	CnH ppH
Bank Select	BnH 00H mmH (MSB) BnH 20H llH (LSB)
Modulation Depth	BnH 01H vvH
Panpot	BnH 0Ah vvH
Expression	BnH 0BH vvH
Data Entry	BnH 06H mmH (MSB) BnH 26H llH (LSB)
RPN	BnH 64H aaH (LSB) BnH 65H bbH (MSB)
Channel Reserve	BnH 37H vvH
Pitch Bend	EnH llH mmH
Tempo	FFH 51H 03H ttH ddH…ttH
Text	FFH 01H llH ddH…ddH
Copyright	FFH 02H llH ddH
User Event	F0H 43H 79H 06H 7FH 10H ddH F7H

3.1. NoteOn

9nH   kkH   vvH

- n: channel number 0 to 15 (0H to FH)
- kk: note number0 to 114 (0H to 72H) A of 440 Hz=69 (45H)
- vv: key velocity is ignored.

In an applicable channel, sound generation on a key of designated note number is started.

It is desirable to describe NoteOn and NoteOff with monophonic notation rules. For more information about slur/tie process of MA-3 Authoring Tool, please refer to "4.1Process of Slur/Tie."

[Note]   SMF which does not include any note event can not be converted into an internal data; in addition, Authoring Tool may not operate correctly. So be sure to an insert note event.

[Note]   According to the number of program change, the rhythm may differ. For more information about applicable program change number, refer to "Voice List" in Users Manual.

[Note]   With MA-3, when two or more notes are performed at a same timing, the later output sound comes out 115μs behind of the previous sound comes out.

[Note]   With MA-3 Authoring Tool, multiple pronunciations at the same note number on the same channel are not guaranteed. Locate pronunciations not to overlap to each other at the same note number on the same channel.

3.2. NoteOff

8nH   kkH   vvH

- n: Channel number 0 to 15 (0H to FH)
- kk: Note number 0 to 114 (00H to 72H) A of 440 Hz=69(45H)
- vv: Key velocity is ignored.

In an applicable channel, pronunciation is ended by the key of a specification note number.

[Note]   According to the specification of Phrase, it performs NoteOff over all pronouncing notes, at the end of music. If release rate is too long, it leaves pronunciation after music ends, so adjust release rate to applicable length. In addition, cancel "repeat" playback setting when checking. (If "repeat" is set, it makes mute process at the end of music.)

3.3. Program Change

__CnH   ppH__

n: Channel number 0 to 15 (0H to FH)
pp: Program number 0 to 127 (0H to 7FH)

Initial setting value: 0

A voice of designated channels is setup.

When an applicable channel is set for normal channel, a voice from designated banks by bank select is chosen. When an applicable channel is set as a drum channel, drum set is selected. With SMAF/Phrase, only FM voices are applicable for the default voice of Drum Bank.

In addition, only 4 voices can be set into one music for SMAF/Phrase. When it exceeds 4 voices, set the voice to be selected, on MA-3 Authoring Tool.

Insert Program Change at the top ("0" tick) of Bank select of each channels.

[Note]   When program change is performed in music, insert the program change at the point of time in which no pronunciation is performed, on an applicable channel.

3.4. Control Change

3.4.1. Bank Select

BnH	**00H**	**mmH (MSB)**
BnH	**20H**	**llH (LSB)**

n:　　Channel number 0 to 15 (0H to FH)

mm:　MSB value of bank number 0 to 127 (0H to 7FH)

ll:　　LSB value of bank number　0 to 127(0H to 7FH)

Initial setting value:　　　　0/0

A designated channel is setup. It is recommended to use bank select MSB and bank select LSB as a set.

Table 3 shows bank selects that is handled by MA-3 Authoring Tool.

Table 3 Bank Select Conversion Table

MSB	LSB										
	0	1	3	4	5	6	7	8	9	10	11 to 127 Unspecified
0 to 121, 126, 127 Unspecified	When 10ch, it is replaced to MSB:125/LSB:0/Pch:2 When except 10ch, it is replaced to MAB:124/LSB:1										
122, 124 (Normal)	Preset Voice	User Voices								Replace LSB to 1	
123, 125 (Drum/StreamPCM)	See the following table										

MSB	LSB	Pch										
		0	1	2	3	4	5	6	7	8	9	10	11 to 127 Unspecified
123, 125 (Drum/StreamPCM)	0	Preset Voice	User Voices									Replace Pch to 2

[Note]　　When MSB is 122, it is replaced with 124, or when MSB is 123, it is replaced with 125, so that SMF made for MA-2 can be used in MA-3 Authoring Tool.

MSB	LSB	14 bit value
124	0	15872
	1	15873
	2	15874
	3	15875
	4	15876
	5	15877
	6	15878
	7	15879
	8	15880
	9	15881
125	0	16000

Table 4 Bank Select 14-bit notation value

Even new Bank Select was received, the voice of previously program change is valid until the next program change. Designate Drum Bank with each channels, then designate program change, to make Drum Channel. Also, designate Normal Bank and then designate program change makes FM Normal channel.
When multiple bank selects are existed, the latest message (last one on the time axis) is processed preferentially.

[Note]   With MA-3 Authoring Tool, it replaces MSB with 124 when MSB is 122, and with 125 when MSB is 123, to use SMF which was created for MA-2. In addition, when MSB is other than 124 or 125, channel 10 replaces it with 125.

By designating Bank Select MSB 125, an applicable channel becomes Drum channel. If changing Drum set at program change, Drum instrument changes an instrument which is applicable to voice map.
Although multiple Drum voices can be held in one channel, since one channel can hold only one voice with SMAF/Phrase, only one of multiple Note# can be converted to SMAF/Phrase. Key Number set to Drum voice is used for the Note # of Note message of SMAF/Phrase.

[Note]   When read in with MA-3 Authoring Tool after saving as SMAF/Phrase, it replaces Bank Select MSB with 124, Bank Select LSB with 10 for the default voice, and Bank Select MSB with 124, Bank Select LSB with 1 for the user voice. In addition, about user voice the number of program change is assigned from 0 in order of channel number.

3.4.2. Modulation Depth

BnH　01H　vvH

n:　Channel number 0 to 15 (0H to FH)
vv:　Depth of vibrato 0 to 127 (00H to 7FH)

Initial setting value:　　　　0

　The depth of the vibrato (LFO pitch abnormal conditions) of a designated channel is specified.
　The relationship between the value and depth of vibrato is shown in **Table 5**. The depth of vibrato here shows the multiple for vibrato depth that is set for each voice.

Table 5 Relationship between Vibrato Value and Depth

Vibrato value	Depth of vibrato
0 to7	OFF
8 to 31	x 1
32 to 63	x 2
64 to 95	x 4
96 to 127	x 8

3.4.3. Panpot

BnH　0AH　vvH

n:　Channel number 0 to 15 (0H to FH)
vv:　Control value 0 to 127 (00H to 7FH)

Initial setting value:　　　　64 (40H) [center]

　The stereo sound place position of a designated channel is specified. The positioning is made between the left end (vv = 0) and right end (vv = 127) of the stereophonic sound field by using the following formulas.

Recommended formulas:　　　Left　　Channel Gain[dB] = $20*\log(\cos(\pi/2*(vv)/127)$
　　　　　　　　　　　　　　Right　Channel Gain[dB] = $20*\log(\sin(\pi/2*(vv)/127)$

3.4.4. Expression

BnH 0BH vvH

n: Channel number 0 to 15 (0H to FH)
vv: Control value 0 to 127 (00H to 7FH)

Initial setting value: 127 (7FH)

A volume change of an applicable channel is specified.

Formula : $Gain[dB] = 20*\log((vv)^2/127^2)$

[Note]   Only this event is the volume controllable event with SMAF/Phrase. By setting this event as the maximum value of 127, it becomes possible to make a voice the maximum volume (0dB).

[Note]   When inserting it at the same timing with the NoteOne time, it may make noise by the interpolating time of the volume.

3.4.5. Data Entry

BnH 06H mmH (MSB)
BnH 26H llH (LSB)

n: Channel number 0 to 15 (0H to FH)
mm: MSB of data value 0 to 127 (00H to 7FH)
ll: LSB of data value 0 to 127 (00H to 7FH)

Initial setting value: 0/0

It is used for entering a value of RPN (MSB/LSB). For the details, refer to the section of RPN.

3.4.6. RPN

BnH 64H llH (LSB)
BnH 65H mmH (MSB)

n: Channel number   0 to 15 (0H to FH)
ll: LSB of parameter number 0 to 127 (00H to 7FH)
mm: MSB of parameter number 0 to 127 (00H to 7FH)

Initial setting value: 127/127 (7FH/7FH)

It is used for designating a parameter number of RPN.

3.4.6.1. 00H/00H Pitch Bend Sensitivity

BnH 64H 00H / BnH 65H 00H (RPN parameter designation)
BnH 06H mmH   / BnH 26H llH   (data entry)

n:	Channel number 0 to 15 (0H to FH)
mm:	MSB of data value 1 to 24 (01H to 18H)
ll:	LSB of data value (fixed to 0)

Initial setting value: 2/0   (2 halftones)

   Setting of sensitivity of pitch bend is performed. MSB of data entry shows the sensitivity in halftones, and LSB of data entry shows the sensitivity in cents. For example, when MSB=1 and LSB=0, the sensitivity becomes ± 1 halftones. (Overall ranges of change are 2 halftones.)
   As for a setup of data value MSB except 1 to 24, it is disregarded.

3.4.7. Channel reserve

BnH   37H   vvH

n:	Channel number 0 to 15 (0H to FH)
vv:	number of reserve 0 to 16 (00H to 10H)

Initial setting value: 1

   The pronunciation of the number of reserve is guaranteed with the channel reserve specified channel, by keeping the channel for the number of reserve and distributing note events into these channels. (instead, pronunciations of other channels are deterred.)
   With the normal channel, when it exceeded the reserved number, the first note event is muted, and the latest event is pronounced.
   With the drum channel, it prioritizes the first arrival and secures the note number for the amount of reserved number, and pick up only note events of applicable note number.
   Place this message at the head of each channel (0 Tick). It effects only when this message is placed on the top.

  [Note]   When note event was distributed into channel 10 by channel reserve, drum voice is designated if any channel attributes (normal channel / drum channel) are not specified by bank select or program change. When normal channel is required, be sure to specify the channel attribute by bank select and program change.

3.5. Pitch Bend

EnH llH mmH	
n:	channel number 0 to 15 (0H to FH)
ll:	LSB of bend value 0 to 127 (00H to 7FH)
mm:	MSB of bend value 0 to 127 (00H to 7FH)

Initial setting value: 0/64 (00H/40H) (center)

Changes the pitch of applicable channel up or down. The initial value of change width (pitch bend range) is ± 2 halftones. 0/0 makes the downward pitch bend maximum. 127/127 makes the upward pitch bend maximum. Pitch bend range can be set with 00H/00H of RPN.

3.6. Meta Events

3.6.1. Tempo

FFH 51H 03H ttH ttH ttH	
tt tt tt:	length of quarter notes (μ sec)

MA-3 Authoring Tool allows designation of tempo in any location because it accommodates to temp change in the music.

3.6.2. Text

FFH 01H llH ddH…ddH	
ll :	number of bytes of text (variable length presentation)
dd:	text data

Tile, composer, writer, arranger, player and singer can be inputted by describing XF information header (refer to <APPENDIX>) using this meta-event.
MA-3 Authoring Tool converts this event to each information of Optional Data Chunk of SMAF/Phrase.
Normally, control codes for characters such as ”(“, “[“ and “/” that are defined with XF information header for portable terminals are displayed as they are on the MA-3 Authoring Tool.

3.6.3. Display of Copyright

FFH 02H llH ttH…ttH	
ll:	number of bytes of text (variable length presentation)
dd:	text data

By describing copyright information, copyright can be inputted.
MA-3 Authoring Tool converts this event to Copyright of Optional Data Chunk of SMAF/Phrase.

3.7. Classified System Exclusive Message

A voice setting, a waveform setting, etc peculiar to device are defined exclusively.

3.7.1. MA-3 User Event

F0H   43H   79H   06H   7FH   10H   IDH   F7H
ID: Interrupt classification 0 to 15 (00H to 0FH)

Specifies the setting position of the user event on sequence.
User can set up 16 kinds of events by this event and it is used in applications, such as JAVA and game.
This event does not affect the music play.

[Note]   When designates user event, designate after interval more than 100 msec surely from the front user event. If don't do it, it may not operate normally.
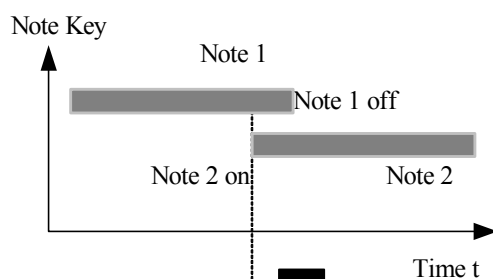
4. Notes
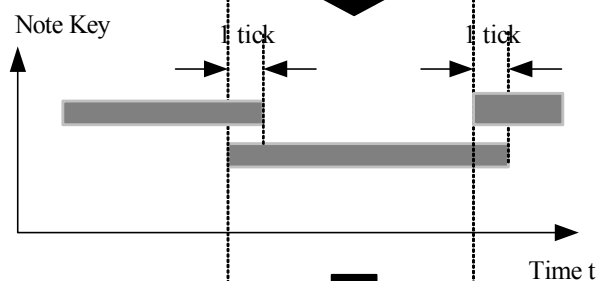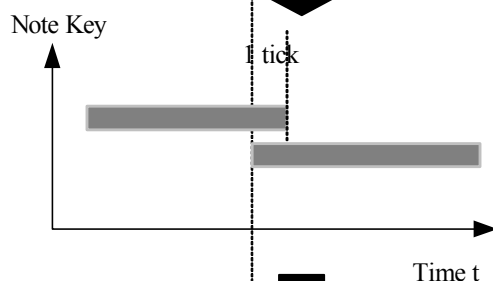
4.1. Process of Slur/Tie

4.1.1. Slur

When creating a slur phrase, describe the second note to start before the first note ends (refer to Fig. 1 Process of Slur **expression**). MA-3 Authoring Tool adjusts the pronunciation end time of the first note, and makes overlapping part "1 tick". With MA-3 board, it pronounces these 2 note as Slur (connect notes as legato).
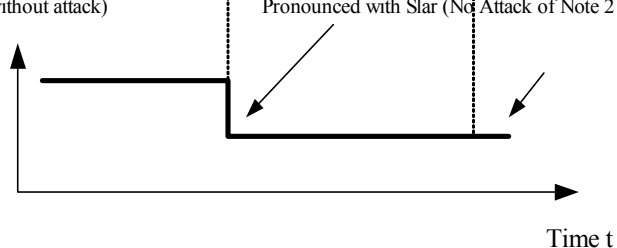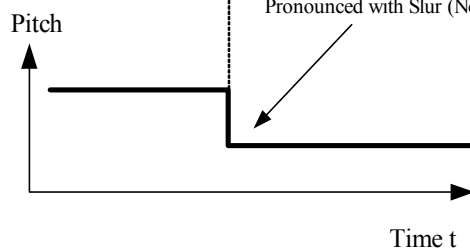
Fig. 1 Process of Slur expression

Right figures of
Fig. 1 show the process of the case in which the tone length of the note is completely included in the other tone length on one channel. Basically, do not create such data in the stage of SMF.

4.1.2. Tie

When same notes overlap in SMF, MA-3 Authoring Tool converts two notes into one note. Basically, do not create such data in the step of SMF.
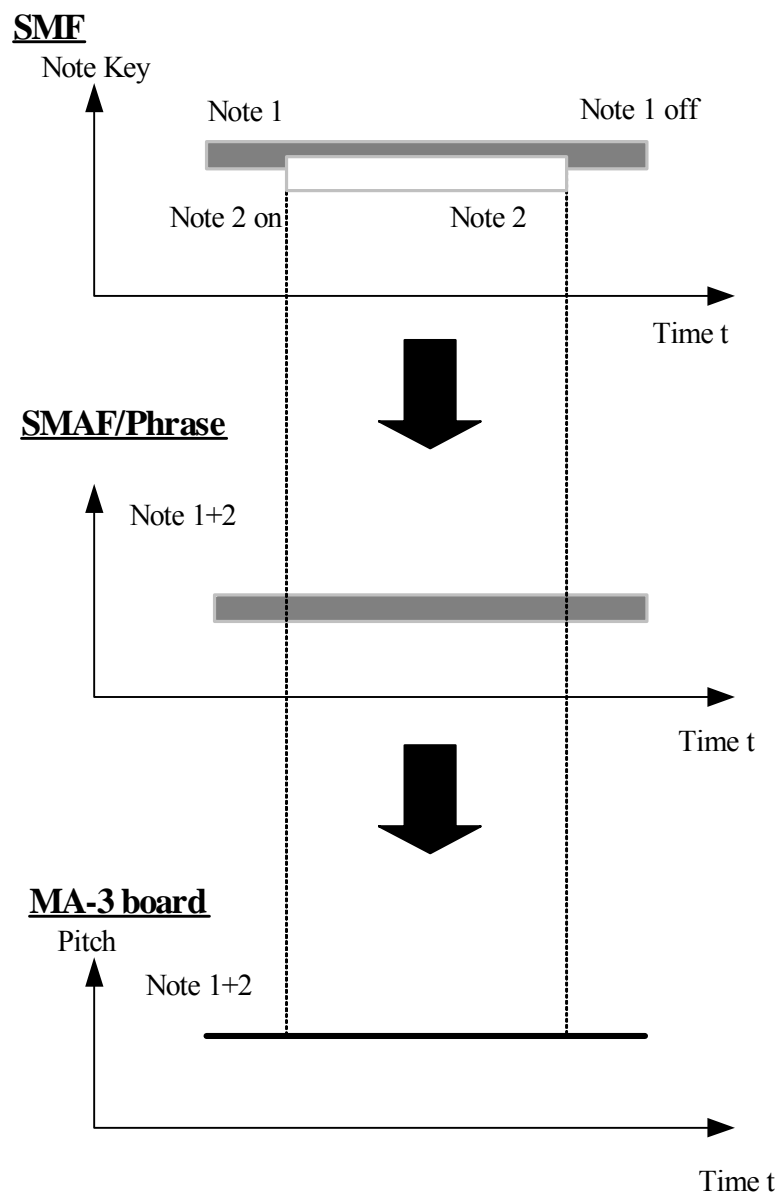
SMF

Note Key

Note 1   Note 1 off

Note 2 on   Note 2

Time t

SMAF/Phrase

Note 1+2

Time t

MA-3 board

Pitch

Note 1+2

Time t

Fig. 2 Process of Tie expression

4.2. Volume specification and Note message

   With MA-3 Authoring Tool, do not insert note message at the same time as the volume specification. It may make noise, or attack of tone may be missed. To avoid these problems, insert a note message more than 22msec later than the volume specification.
   The target volume messages are pan pot and expression. Especially when the volume shift is larger, this problem easily occurs.

4.3. Note of playback repetition

   With MA-3 SMAF/Phrase, the playback timing may be delayed a little at the beginning of the music, during the playback repetition.
   The maximum delay during the repetition playback is 20msec.
   According to the above mentioned reasons, when the music, which is expected to return from the terminus of the music to the beginning of music at the exact tempo, is created, be sure to check the playback timing of repetition.

4.4. NoteOn at the same timing with Mono-mode-On.

   With the channel using Mono-mode-On, do not insert multiple NoteOn at the same timing (duration=0).
   With the channel using Mono-mode-On, when multiple NoteOn are existing at the same timing, the latest note is pronounced, but the volume may not be increased to the total level (the volume becomes smaller).

4.5. Total size after conversion

When total size exceeds 256000byte, it is considered as an error, and not converted.
Be sure to create SMF so that total size becomes less than 256000byte.

5. Appendix

5.1. XF information Header (by language)

Sets information of features and attributes of music by using the form of text meta-event in the format of SMF.

FF 01H len <text>

The information items are divided by an 8 bit colon, ":", and listed.
No data is placed in the information items that are not described.
New items are to be added after the last item. When no text exists, the processing system places blanks in the following information items even when an 8 bit colon is not found.
The first two items in information item section and various control codes are described with ASCII.

5.1.1. Information Items

5.1.1.1. XF Information Header -Language Specific- ID

XF Information Header -- ID indicating Language Specific (characters)   "XFln"

5.1.1.2. Language

Information that designate the code system of characters that are used for XF information header (by language).
It does not designate the character code system that is used for words. The character code system for words is designated with XF words header. It does not show the place of composition.
The Authoring Tool only the following languages.

Symbol	Character code	Applicable languages
L1	Latin 1(ASCII(7bit) + ISO 8859-1)	English, French, German, Italian, Spanish, Portuguese, etc.
JP	Shift-JIS	Japanese
KR	ISO-2022-KR	Korean

5.1.1.3. Song Name

Expression of time by language
When using two or more lines to express a title, place an 8 bit slush, "/", in the place a linefeed is to be made.

5.1.1.4. Composer

Name of composer of original music
Divide the family name and given name with an 8 bit space, " ".
When two or more composers are written, divide them with an 8 bit slush, "/".

5.1.1.5. Lyricist

Name of writer when words are given to the original music.
The format is the same as the one for the composer.

5.1.1.6. Arranger

Name of a person who arranged original music or music data.
The format is the same as the one for the composer.

5.1.1.7. Performer

Name of a person or a group of persons who plays or sings original music.
The format is the same as the one for the composer.

5.1.1.8. Programmer

Name of a person who authored music data.
The format is the same as the one for the composer.