

Guidelines for SMF Creation

SMF to SMAF Converter for MA-3

Version 1.0.2

2002/4/16

YAMAHA CORPORAION

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1 Overview

This document provides guidelines for how to use "SMF to SMAF/MA-3 converter", herein SscMA3, to create SMF(Standard MIDI File) data for computer contents aimed at MA-3-embedded mobile phone. MA-3 is a YAMAHA sound LSI designed for mobile device.

SscMA3 reads SMF data created as described in this document, confirms the playback, and converts it to the carrier format. SscMA3 does not guarantee the behavior of SMF created beyond the description in this document. There are no specifications for which MIDI sequencer software applications you should use for creating SMF, however, it is required to use a MIDI sequencer that allows input described events.

2. Regulations for SMF Creation

2.1. SMF Format

Must use Standard MIDI File Format 0.

2.2. MIDI Channel

Use MIDI channel from 1 to 16.

2.3. Sound Mode and Number of Voices

SscMA3 supports 2 sound modes of FM32 mode and FM16 mode. In FM32 mode, it supports maximum 32 voices, when all are 2 operators, for FM synthesizer and maximum 8 voices for PCM. In FM16 mode, it supports maximum 16 voices, when all are 4 operators, for FM synthesizer. Although each MIDI channel can be specified with poly notes, the total number of voices for all MIDI channels should be kept under the maximum number of voices that can be produced at one time. If the total number of voices for all MIDI channels exceeds the number of maximum voices producible at one time, the note produced before will be muted for the MA-3 Authoring system takes last came in note with higher priority.

To switch mode, use Preference in the Authoring tool.

If SscMA3 is set to FM16 mode and the bank select MSB is set to 124 or 125, FM synthesizer is supported all with 4-operator sound by default.

If SscMA3 is set to FM32 mode and the bank select MSB is 124 or 125, FM synthesizer is supported with 2-operators sound.

Refer to other attached document for voice map.

2.4. Tempo

No limitations for tempo.

Be aware that tempo cannot be changed after SMF is read into SscMA3. SscMA3 assumes that a quarter note is "120" if no temps are specified. Tempo change is supported in the middle of a song.

2.5. TimeBase

No particular limitations for timebase. SscMA3 converts the time information of timebase and tempo of SMF to an event that designates 1 tick = 20msec(fixed).

2.6. Channel Attribute

2 channel attributes are supported. One is normal channel and the other is drum channel. The channel attribute can be changed via bank select.

If no bank select is specified, it assumes that channel 10 is drum channel and channels other than 10 are normal channel.

3. Support MIDI Events

The MIDI events supported by SscMA3 are described in this section. Events not described here will be ignored. None events are MUST DEFINE event. The initial values described in this document are also the defaults for SscMA3 when there are no specifications in SMF.

3.1. Note-On

0x9n kk vv

n: channel number (0x0 ~ 0xF)

kk: note number (0x00~0x7F) of A=69 at 440Hz

vv: key velocity. It will be considered as a note-off event when the value is 00.

This event will start producing sound on the specified channel using the key of the specified note. If the channel is specified to drum/stream PCM channel, note numbers from 0 to 12 and keys from 92 to 110 indicate to start producing Stream PCM.

[Note]: Tune may vary with different program change number. Refer to the Voice List in the SscMA2 Users' Manual for the details of support program change number.

In MA-3, if more than 2 notes are produced at the same time, the note produced latter is about 115μs delayed than the note produced former. Therefore, even the same note is produced at the same time the output level may be reduced due to different playback sampling rate.

3.2. Note-Off

0x8n kk vv

n: channel number (0x0~0xF)

kk: note number (0x00~0x7F) of A=69 at 440Hz

vv: key velocity is ignored.

This event will stop sound on the specified channel using the key of the specified note. If the channel is specified to drum/stream PCM channel, note numbers from 0 to 12 and keys from 92 to 110 indicate to stop the sound of Stream PCM.

3.3. Program Change

0xCn pp

n: channel number (0x0~0xF)

kk: program number (0x00~0x7F)

Initial value: 0x00

Set up sound for the specified channel.

If the specified channel is set up with normal channel, sound is selected based on the bank selected by bank select. The drum sound will be set if the specified channel is set up with drum channel.

The default of drum bank consists of mixture of both PCM and FM.

You can assign either PCM or FM as the user sound by using SSCMA3.

Program change must be inserted after the bank select located at the beginning of each channel. As program change in the middle of a song is not accepted when the specified channel is currently producing sound, you should insert program change to the point when the sound is not being produced.

[Note]: Refer to SscMA3 Users' Manual for the details of what sound can be set up in program change.

3.4. Control Change

3.4.1. Bank Select

0xBn 0x00 aa (MSB)

0xBn 0x20 bb (LSB)

n: channel number (0x0~0xF)

aa: bank number MSB value (0x00~0x7F)

bb: bank number LSB value (0x00~0x7F)

Initial value: 0x00/0x00

Set up bank for the specified channel. Bank select MSB and bank select LSB must be used as a pair.

List 1 shows the bank selects supported by SscMA3.

MSB	Format	Category	LSB										
			0	1	2	3	4	5	6	7	8	9	10
0~121	Not supported	---	Default sound (channel 10 is drum and others are normal)										
124	MA-3 Native	Normal	Preset sound parameter										
125	MA-3 Native	Drum/ Stream PCM	Preset sound parameter										
126, 127	Not supported	---	Default sound (channel 10 is drum and others are normal)										

List 1 Support Bank Select

Even a bank select event is received; the sound of previous program change remains effective until the next program change is received. Therefore, if you set up a channel with drum bank, the channel will not be set to drum channel until the program change is specified. Same for the setup to FM normal channel, you must first set the channel with normal bank and then specify program change.

When multiple bank selects exist, the latest message, the one came in last on the time axis, will be processed first.

A channel will become drum/stream PCM channel if the channel is set with bank MSB 125. When drum set is changed in program change, the drum instrument is changed to the instrument corresponding to the voice map. For Stream PCM, note number and Stream Wave ID will be processed as described in List 2 regardless of what program change is received. Up to 10 Stream Wave IDs can be specified with this format.

Note #	Definition	Assign
0	Stream PCM	Stream Wave ID : 1
1		Stream Wave ID : 2
2		Stream Wave ID : 3
:		:
9		Stream Wave ID : 10

List 2 Support notes for Drum/Stream PCM

[Note]: Refer to the Voice List in the SscMA3 Users' Manual for sounds that can be specified in bank select and program change.

3.4.2. Modulation Depth

0xBn 0x01 vv

n: channel number (0x0~0xF)

vv: depth of vibrato (0x00~0x7F)

Initial value: 0x00

Specify the depth of the vibrato (LFO pitch modulation) of the specified channel.

List 3 shows the relationships between vibrato value and depth. The depth of vibrato here indicates multiplication of the depth of the vibrato set to each voice.

Vibrato value	Depth of Vibrato
0x00	OFF
0x01~0x1F	x1
0x20~0x3F	Double
0x40~0x5F	Quad
0x60~0x7F	X8

List 3 Relationships between vibrato value and the depth

If the channel is a drum/Stream PCM channel, this message becomes ineffective for note numbers from 0 to 9. (fixed to 0x00)

3.4.3. Channel Volume

0xBn 0x07 vv

n: channel number (0x0~0xF)

vv: control value (0x00~0x7F)

Initial value: 0x64

This event sets up volume of a channel and is used for setting volume balance between channels.

$$\text{Formula : Gain[dB]} = 20 \cdot \log((cc\#7)^2 / 127^2)$$

If the channel is a drum/Stream PCM channel, this event becomes ineffective for note numbers from 0 to 9.

[Note]: Use velocity to set up the individual wave volume to be assigned to Stream PCM. If you want to control drum and Stream PCM respectively, separate them to different channels and set up their respective volumes.

3.4.4. Panpot

0xBn 0x0A vv

n: channel number (0x0~0xF)

vv: control value (0x00~0x7F)

Initial value: 0x40(center)

Specify the position of stereophonic sound field for a channel. The position between left end (0) and right end (127) of stereophonic sound field is calculated based on the formula below.

The message remains effective for note numbers from 0 to 9 even when the channel is a drum/Stream PCM channel.

Recommended formula: Left Channel Gain[dB] = $20 \cdot \log(\cos(\pi/2 \cdot (cc\#10)/127))$

Right Channel Gain[dB] = $20 \cdot \log(\sin(\pi/2 \cdot (cc\#10)/127))$

3.4.5. Expression

0xBn 0x0B vv

n: channel number (0x0~0xF)

vv: control value (0x00~0x7F)

Initial value: 0x7F

Specify volume change for the channel volume of a channel.

If the channel is a drum/Stream PCM channel, the message becomes ineffective for note numbers from 0 to 9.

[Note]: cc#7 and cc#11 are both used for volume control but have different purposes. cc#7 is used for setting up the overall volume for a song and for mix-down by fader that are set before playback; while cc#11 is used for adjusting channel volume.

Formula: Gain[dB] = $20 \cdot \log((cc\#11)^2/127^2)$

3.4.6. Hold1 (Damper)

0xBn 0x40 vv

n: channel number (0x0~0xF)

vv: control value (0x00~0x7F)

Initial value: 0x7F

This event defines ON and OFF of damper, sustain pedal, for a channel. Set OFF when the value is between 0x00~0x3F and ON when the value is between 0x40~7F.

If the channel is a drum/Stream PCM channel, this message becomes ineffective for note numbers from 0 to 9. (fixed to 0x00)

[Note] The NoteOff event will be retained if it is received with damper on. The retained NoteOff is executed when damper switches from ON to OFF and the volume envelope shifts to release.

3.4.7. Data Entry

0xBn 0x06 aa (MSB)

0xBn 0x26 bb (LSB)

n: channel number (0x0~0xF)

aa: data value MSB (0x00~0x7F)

bb: data value LSB (0x00~0x7F)

Initial value: 0x00/0x00

This event is used to input the RPN value. Refer to the description for RPN.

3.4.8. RPN

0xBn 0x64 aa (LSB)

0xBn 0x65 bb (MSB)

n: channel number (0x0~0xF)

aa: parameter number MSB (0x00~0x7F)

bb: parameter number MSB (0x00~0x7F)

Initial value: 0x7F/0x7F

Specify the parameter number of RPN.

3.4.8.1. 00H/00H: pitch bend sensitivity

0xBn 0x64 0x00 / 0xBn 0x65 0x00 (RPN parameter)**0xBn 0x06 aa / 0xBn 0x26 bb (Data Entry)**

n: channel number (0x0~0xF)
 aa: data value MSB (0x00~0x18)
 bb: data value LSB (fixed at 0x0)

Initial value: 02H/00H (2) half notes

Set up the sensitivity of pitch bend. Data entry MSB shows the sensitivity in half-note increment and LSB shows the sensitivity in cent increment. For example, if MSB is 01 and LSB is 00, the sensitivity is ± 1 half note. (The overall range of change is 2 half notes.)

3.4.9. All Sound Off

0xBn 0x78 0x00

n: channel number (0x0~0xF)

Right after this message is received, all voices being produced in the specified channel will be muted.

This message remains effective for note numbers from 0 to 9 even if the channel is a drum/Stream PCM channel.

3.4.10. Reset All Controllers

0xBn 0x79 0x00

n: channel number (0x0~0xF)

After this event is received, the next controller will be reset to the initial value.

Controller	Name	Value
0x01	Modulation	0x00 (OFF)
0x0B	Expression	0x7F (MAX)
0x40	Hold1	0x00 (OFF)
0x64	RPN LSB	0x7F (NULL)
0x65	RPN MSB	0x7F (NULL)
-	Pitch Bend	0x00/0x40 (Center)

Program change, bank select, and channel volume do not need to reset the controller.

3.4.11. All Note Off

0xBn 0x7B 0x00

n: channel number (0x0~0xF)

Turn off all voices being produced in a channel.

This message remains effective for note numbers from 0 to 9 even if the channel is a drum/Stream PCM channel,

3.4.12. Mono Mode On

0xBn 0x7E 0x01

n: channel number (0x0~0xF)

Switch a channel to the monophonic mode.

Note numbers from 13 to 91 will ignore this message if the channel is a drum/Stream PCM channel. If the channel is a drum/Stream PCM channel, this message becomes ineffective for note numbers from 0 to 9.

Mode change in the middle of a song is not allowed.

When a channel is in the monophonic mode, it processes polyphonic note with slur.

If voice is muted by DVA while the note of the first voice in the slur is being produced, the note of the second voice will be attached with attack (re-triggered).

3.4.13. Ploy Mode On

0xBn 0x7F 0x00

n: channel number (0x0~0xF)

Switch a channel to the polyphonic mode.

Mode change in the middle of a song is not allowed.

If the channel is a drum/Stream PCM channel, this message becomes ineffective for note numbers from 0 to 9.

3.5. Pitch Bend

0xEn ll mm

n: channel number (0x0~0xF)
ll: bend value LSB (0x00~0x7F)
mm: bend value MSB (0x00~0x7F)

Initial value: 0x00/0x40 (center)

Turn the pitch up and down for a channel. The initial value of the pitch bend range is ± 2 half notes.

0x00/0x00 is the maximal pitch bend for downward pitch and 0x7F/0x7F is the maximal pitch bend for upward pitch.

If the channel is a drum/Stream PCM channel, this message becomes ineffective for note numbers from 0 to 9.

3.6. Meta Events

3.6.1. Tempo

0xFF 0x51 0x03 aa bb cc

aa bb cc: length of a quarter note (μ sec)

As SscMA3 supports tempo change in the middle of a song, tempo can be specified in any position.

3.6.2. Text

0xFF 0x01 len text

len : the number of bytes of text (changeable experssion)

text: text data

Describing the XF information header in this meta event allows to input information of music title, composer, lyricist, music arranger, music performer, and singer. Refer to APPENDIX for "XF information header".

SscMA3 will convert this event to the corresponding information in the Optional Data Chunk of SMAF/MA-3.

Most mobile devices will display the control symbols such as "(", "[", and "/" defined in the XF information header as plain characters.

3.6.3. Copyright Disaply

0xFF 0x02 len text

len : bytes of text (changeable)

text: text data

This event allows to input copyright information.

SscMA3 will convert this event to the copyright information in the Optional Data Chunk of SMAF/MA-3.

3.6.4. Cue Point

0xFF 0x07 0x05 0x53 0x54 0x41 0x52 0x54 (START)

0xFF 0x07 0x04 0x53 0x54 0x4F 0x50 (STOP)

These messages work as meta events of Cue Point and are used to specify the start position and the end position of a playback.

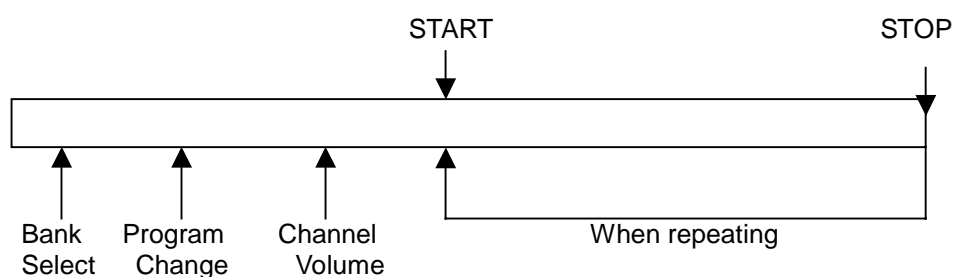
SscMA3 will convert these events to the Start Point and Stop Point of SMAF/MA-3.

Byte 4 to byte 8 of START (0x53 0x54 0x 41 0x52 0x54) is ASCII code, which indicates START in capital letters.

Byte 4 to byte 7 of STOP (0x53 0x54 0x 4F 0x50) is ASCII code, which indicates STOP in capital letters.

“START” must be inserted before or to the same position of the first note-on, and “STOP” must be inserted after or to the same position of the last note-off.

START and STOP must be inserted as a pair during a song.



Even when START is sent after the control messages as the figure shown above the control messages are read during repeating as well.

3.6.5. XF CuePoint

0xFF 0x7F 0x04 0x43 0x7B 0x02 rr

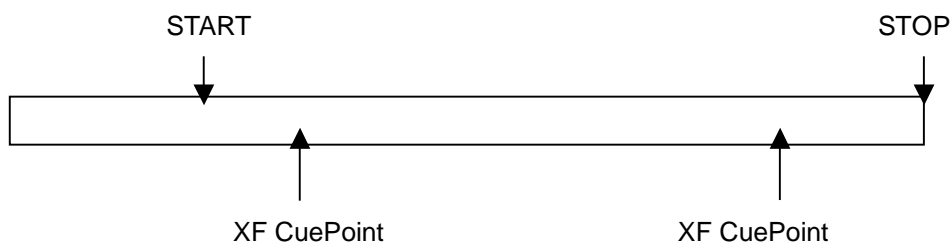
rr : Rehearsal Mark

The looping point can be set up by specifying a rehearsal mark after changing the format to XF format.

SscMA3 will convert this event to the Phrase List of SMAF/MA-3. Below is the support conversion list.

XF Rehearsal Mark	Loop
Intro	Introduction (PI)
Ending	Ending (PE)
A	A melody (PA)
B	B melody (PB)
C	Sabi (PS)
D	Interlude (PK)
E	Refrain (PR)

This meta event must be inserted between START and STOP of Cue Point described in 3.6.4.



3.7. Universal System Exclusive Message

3.7.1. Master Volume

Message	Description
0xF0 0x7F	Universal real-time exclusive header
<device ID>	ID for target device (7F:ALL)
0x04	Sub ID #1
0x01	Sub ID #2
ll	Master Volume LSB
mm	Master Volume MSB
0xF7	EOX

Initial value: 0x64(100)

Set up the volume of the final sound output. The ll item is ignored.

Formula: $\text{Gain[dB]} = 20 \cdot \log((\text{Data})^2 / 127^2)$

[Note]: The initial value is adjusted to the value that causes no clipping sound throughout the playback of a song even when receiving a SMF excluding master volume. (-4dB: one eighth of the maximum volume)

When creating a content of fewer voices, it would be proper to increase the value in advance. For final adjustment on the content volume, it is recommended that you watch the level indicator to increase the volume to the possible maximum level that cause no digital clipping.

4. Regulations for Setting up Stream PCM

4.1. Maximum number of Voices

SscMA3 supports maximum 2 voices for Stream PCM. The capacity of MA-3 RAM is 8 KB and each voice would consume 1 KB. When 2 voices are specified, 2 KB will be consumed.

5. Appendix

5.1. XF Information Header (Language Specific)

This XF information header can set up information for characteristics or attributes of a song by using the text meta event of the SMF format.

FF 01 len <text>

Separate each information item using single-byte colon ":" and enumerate them.

Do not put information to the item that you do not want to specify.

Add new items to the last item. When no further texts are found, it assumes that the information items are all blank even if no colons are found.

Use ASCII code to specify information item 1) and 2) and various control symbols.

The XF Information Header (language specific) for Japanese is described hereafter.

5.1.1. Information Item

5.1.1.1. XF Information Header -- Language Specific -- ID XF Information Header (Language Specific) ID

4-character ID for indicating XF Information Header -- Language Specific "XFIn"

5.1.1.2. Language

This information is for specifying character code system to be used in the XF information header (language Specific).

Notice that this information is not used for specifying character code system for words.

The character code system for words must be specified in the XF word header. Neither this information is for displaying the place where the music is created.

Authoring Tool supports languages listed below.

Symbol	Character Code	Support Language
JP	Shift-JIS	Japanese

5.1.1.3. Song Name: Music Title

Music title by language

Double-byte character must be used when alphabet is used.

For search purpose, reading attachment based on double-byte Japanese Hiragana must be enclosed with "()".

Do not use Katakana, phonetic Japanese syllable, for reading attachment.

Single-byte braces "[" and "]" can be used with a phonetic symbolic written.

Phonetic symbolic written must be correctly attached to the corresponding characters.

To display a music title in multiple lines, put "/" to the position you want to the line to change.

Example: それいけ！Y[わい]マン/元[げん]気[き]いっぱい(それいけわいまん げんきいっぱい)

Display:

わい
それいけ！Yマン
げんき
元気いっぱい

The control symbols must be processed like example when music title is displayed.

5.1.1.4. Composer

Composer of the original music

Use single-byte space to separate last name and first name.

To input multiple composers, use single-byte slash "/" to separate each individual.

Double-byte character must be used when alphabet is used.

For search purpose, reading attachment based on double-byte Japanese Hiragana must be enclosed with "(" and ")".

Do not use Katakana, phonetic Japanese syllable, for reading attachment.

To input multiple composers, attach respective reading to each composer.

Example:

山作 太郎(きょくづくり たらう) 山作 次郎(きょくづくり じろう)

5.1.1.5. Lyricist

Name of the lyricist when there are words given to the original song

The format is the same as composer's format.

5.1.1.6. Arranger: Music Arranger

Name of the person who makes music arrangement

The format is the same as composer's format.

5.1.1.7. Performer: Music Player or Singer

Name or group name of the singer or performer of the original music

The format is the same as composer's format.

5.1.1.8. Programmer: Music Producer

Name of the music producer

The format is the same as composer's format.

Example:

"楽しい日曜日" of the music title, released September 28, 1994.

A genre is pop and a beat is eight beats.

Sax Melody, Female Solo Voice.

Writer's 山瀬太郎, Lyricist's 浜松花子, No Arranger, Player/Singer's 中沢町子,
music data producer's 豊岡次郎.

XF Information Header(Language Specific) Example of Japanese Language:

FF 01 len <XFIn: JP: 楽しい日曜日 (たのしいやちようび) 山瀬太郎 (やまはたろう)

浜松花子 (はまつはなこ) 中沢町子 (なかざわまちこ) 豊岡次郎 (とよおかじろう) >

5.2. XF Rehearsal Mark

In XF format, a rehearsal mark is defined as below as a style message.

FF 7F 04 43 7B 02 rr Rehearsal Mark

rr Rehearsal Mark 0yyyyxxx

Lower 4 bits(xxxx)

0: Intro

1: Ending

2: Fill-in

3: A

4: B

:

15: M

Upper 3 bits (yyy)

0-7: variation for each

1 :so called ' A', B' etc

2 :so called " A", B" etc

This is used for separating each so-called section.

Insert this mark in between measures.

It is possible that some music may not include all rehearsal marks.

The number of measures between rehearsal marks could be any.