

# MA-3 Sound Format Specification

## – SMAF/Phrase L1 Extended –

Version 1.4.0

January 29, 2002

Yamaha Corporation

<p>[Notes]</p>
<p>This document is the installation guide of MA-3 Sound Middleware as sample source code. This document specifies operation expected to middleware, but doesn't guarantee operation of sample middleware.</p>
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Note:

For explanation of definition of functions, the following formats are defined for use.

Definition format	Meaning	Definition format	Meaning
UINT8	8 bits without code	SINT8	8 bits with code
UINT16	16 bits without code	SINT16	16 bits with code
UINT32	32 bits without code	SINT32	32 bits with code

History

Version	Date	Description
1.0	May 18, 2001	Initial edition
1.1	June 18, 2001	Explanation of tones was added.
1.2	June 18, 2001	Tones of MA-3 were changed.
1.2.1	August 8, 2001	The version was changed so that it coincides with the source.
1.3.0	November 26, 2001	The limit was added to MA-3 FM wave setup.
1.4.0	January 29, 2002	User assignment voice BO bit 1 fixed was added. Gatetime=0 prohibition of NoteMessage was added. Chapter 6 SMAF/Phrase L1 Non-corresponding item was added.

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## 1 Outline

This document shows non-standard parts of SMAF/Phrase L1 that is supported by MA-3. SMAF/Phrase L1 spec. of MA-3 uses only FM synthesizer, and the support of WT synthesizer is not performed. All of MA-2 extension is supported for securing compatibility. However, since the default tones are different between MA-2 and MA-3, generation of default tones is not always compatible perfectly. For the non-standard parts of SMAF/Phrase L1, refer to specification for SMAF/Phrase L1.

## 2 User designated tones

Definition of user defined tones for ExVoice chunk is dealt with the following format.

MA-3 FM Waveform setting 0xff, 0xf0, LL, 0x43, 0x04, 0x01, ..., 0xf7

Description

Registration of FM tones of MA-3

Argument

LL (20/34)  
To be 20 up to data #16 for 2-OP tones. 34 for 4-OP tones.  
... Defines MA-3 FM waveform data shown below.  
(For the details of parameters, refer to MA-3 HW documents.)  
XOF bit must be 0.  
BO should be set to 1.

	MSB										LSB																											
#1	PANPOT										BO																											
#2	LFO		PE	0	0						ALG																											
#3	SR				XOF	0	SUS	KSR																														
#4	RR				DR																																	
#5	AR				SL																																	
#6	TL				KSL					OP1																												
#7	0	DAM	EAM	0	DVB	EVB																																
#8	MULTI				0	DT																																
#9	WS				FB																																	
#10	SR				XOF	0	SUS	KSR																														
#11	RR				DR																																	
#12	AR				SL																																	
#13	TL				KSL					OP2																												
#14	0	DAM	EAM	0	DVB	EVB																																
#15	MULTI				0	DT																																
#16	WS				0																																	
#17	SR				XOF	0	SUS	KSR																														
#18	RR				DR																																	
#19	AR				SL																																	
#20	TL				KSL					OP3																												
#21	0	DAM	EAM	0	DVB	EVB																																
#22	MULTI				0	DT																																
#23	WS				FB																																	
#24	SR				XOF	0	SUS	KSR																														
#25	RR				DR																																	
#26	AR				SL																																	
#27	TL				KSL					OP4																												
#28	0	DAM	EAM	0	DVB	EVB																																
#29	MULTI				0	DT																																
#30	WS				0																																	

OP1

OP2

OP3

OP4

## MA-2 Waveform setting

0xff, 0xf0, LL, 0x43, 0x03, ..., 0xf7

## Description

Registers FM tones for MA-2. This is used for compatible reproduction of data for MA-2. Since HW is not capable of processing MA-2 format directly, it is converted to MA-3 format before using.

However, although physical amount of parameter is different a little between MA-2 and MA-3 even though their set values are the same, the values of parameters such as ADSR of which adaptation is difficult are used as they are. (Some difference is produced because  $F_s$  is 49.7KHz which is different from 48KHz.)

## Argument

LL (18/28)  
To be 18 up to data #15 for 2-OP tones. 28 for 4-OP tones.  
... Defines MA-2 FM wave for data shown below.  
(For the details of parameters, refer to MA-2 HW documents.)  
BO should be set to 1.

	MSB																												LSB
#1	0	0	0	0																									#Voice
#2																													#Bank Select
#3	0																												#Program Change
#4																													
#5	0	0	0	0	0	0	0																						BO
#6																													
#7																													
#8																													
#9																													
#10																													
#11																													
#12																													
#13																													
#14																													
#15																													
#16																													
#17																													
#18																													
#19																													
#20																													
#21																													
#22																													
#23																													
#24																													
#25																													

Voice : Fixed to "0"  
BankSelect : Fixed to "0"  
ProgramChange: Fixed to "0"  
Other than the above: To comply with Specification for MA-2 HW

### 3 Processing of necessary messages

Naturally, all of the necessary messages are dealt with, the accuracy of Volume/Panpot is limited to 5 bits which is the accuracy of HW. For MA-3, the switch over is made by applying 20 ms at the tone change.

<b>Volume</b>		0x00, 0x3B+ (NN<<6), XX
<hr/>		
Description	Changes volume of designated channel.	
Argument		
	NN	#channel (0..3)
	XX	Volume setting (0..127)
		$\text{Vol[dB]} = 20 * \log (XX^2/127^2)$
		default: 100
<b>Shortened type Volume</b>		0x00, 0x00+ (NN<<6)+XX
<hr/>		
Description	Changes volume of designated channel.	
Argument		
	NN	#channel (0..3)
	XX	Shortened format of Volume setting (1..14)
	0x1	Mute
	0x2	$20 * \log (31^2/127^2)$
	0x3	$20 * \log (39^2/127^2)$
	0x4	$20 * \log (47^2/127^2)$
	0x5	$20 * \log (55^2/127^2)$
	0x6	$20 * \log (63^2/127^2)$
	0x7	$20 * \log (71^2/127^2)$
	0x8	$20 * \log (79^2/127^2)$
	0x9	$20 * \log (87^2/127^2)$
	0xA	$20 * \log (95^2/127^2)$
	0xB	$20 * \log (103^2/127^2)$
	0xC	$20 * \log (111^2/127^2)$
	0xD	$20 * \log (119^2/127^2)$
	0xE	0dB
<b>Panpot</b>		00, 0x3A+ (NN<<6), XX
<hr/>		
Description	Changes pan value of designated channel.	
Argument		
	N	#channel (0..3)
	N	
	X	Pan setting (0..127)
	X	$\text{Lch[dB]} = 20 * \log (\text{Cos} (\text{PAI}/2 * \text{XX}/127))$ , < Lch = MUTE if vv = 127>
		$\text{Rch[dB]} = 20 * \log (\text{Sin} (\text{PAI}/2 * \text{XX}/127))$ , < Rch = MUTE if vv = 0>
		default: 64

NOP	0xff, 0x00
Description	Nothing occurs. This is used for extension of blank period.
Argument	none
UserEvent	0xff, 0x1n
Description	Performs call back for the system.
Argument	n                      Event number (0x0..0xF)
Program change	0x00, 0x30+ (NN<<6), XX
Description	Changes tones of designated channel. The tones are selected from four tones that can be set. The relationship between the #VoiceID and actual tones are set by the tone setting side. When the program is changed during NoteOn, the tone is changed at the next KeyOn.
Argument	NN                      #channel (0..3) XX                      #voice (0..3) default: 0
Octave shift	0x00, 0x32+ (NN<<6), XX
Description	Changes interval of tones of designated channel. Changes tone generation key range that is designated by Note message. The issue of Note message after this message becomes valid.
Argument	NN                      #channel (0..3) XX                      Octave (0x81..0x84) 0x00        Normal 0x01        +1oct 0x02        +2oct 0x03        +3oct 0x04        +4oct 0x81        -1oct 0x82        -2oct 0x83        -3oct 0x84        -4oct default: 0

Note message KEY+ (OCT<<4)+ (NN<<6), G1, <G2>

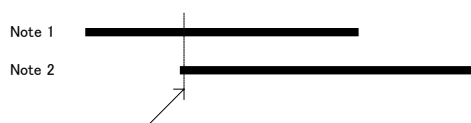
#### Description

Performs tone generation at designated channel.

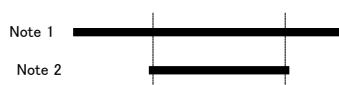
Designates NoteOn/NoteOff. The tone generation is performed according to mono-phonetic rule. When OCT = 2 / KEY = 9 A4 is to be 440Hz. Actual tone generation key is affected by Octave shift message. However, when tone generation period overlaps for 1 or longer, the tone is judged as sustained tone, and thus, becomes tie / slur tone at the time the tone overlaps.

The result of tone generation when Note that is included perfectly in the tone generation time of previous Note is issued is not guaranteed.

Note: When MIDI\_Key exceeds 13..108, which is the limit of MA-3 HW, it is to be deemed as tone generation that is different by an octave.



Interval of Note 1 changes to that of Note 2 at this point. Tone generation is sustained.



Unacceptable pattern, where Note 2 is included perfectly in Note 1.

#### Argument

NN	#channel (0..3)		
KEY	Setting height of key (1..12)		
	1 C#	8 G#	
	2 D	9 A	
	3 D#	10 A#	
	4 E	11 B	
	5 F	12 C	
	6 F#		
	7 G		
OCT	Setting octave (0..3)		
	0 0 oct		
	1 +1 oct		
	2 +2 oct		
	3 +3 oct		
G1,[G2]	GateTime		
	G2 is not present when MSB of G2 is equal to "0".		
	When MSB of G1 is equal to "1", lower 7 bits of G1 and that of G2 are coupled in the upper part of G1, and 128 is added to obtain Gate Time.		
	Gate Time=0 is forbidden.		

## 4 Applicable optional messages

Shortened type Modulation 0x00, 0x20+ (NN<<6)+XX

---

### Description

Changes amount of vibrato in designated channel.

The amount of vibrato varies among tones. When the set value exceeds 26.8[cents], it is fixed to 26.8[cents].

### Argument

NN #channel (0..3)

XX Set value of vibrato (0x01..0x0e)

0x01 Vibrato is off.

0x02 Standard setting x 1 [cents]

0x03 Standard setting x 1 [cents]

0x04 Standard setting x 2 [cents]

0x05 Standard setting x 2 [cents]

0x06 Standard setting x 2 [cents]

0x07 Standard setting x 2 [cents]

0x08 Standard setting x 4 [cents]

0x09 Standard setting x 4 [cents]

0x0a Standard setting x 4 [cents]

0x0b Standard setting x 4 [cents]

0x0c Standard setting x 8 [cents]

0x0d Standard setting x 8 [cents]

0x0e Standard setting x 8 [cents]

default: 0x01 (OFF)

However, total amount of Vibrato will not exceed 26.8[cents].

PitchBend0x00, 0x34+ (NN<<6), XX

---

### Description

Sets the amount of change of pitch for reproduction in designated channel.

### Argument

NN #channel (0..3)

XX Amount of bend (0x00..0x40..0x7f)

0x00 (-Max[cents])..0x40 (0[cents])..0x7f (+Max[cents])

The change curve is cent-linear. Maximum initial value is 200.

default: 0x40

#### 4.1 Extended SysEx message

PitchBend range 0xff, 0xf0, 0x06, 0x43, 0x04, 0x02, NN, XX, 0xf7

---

##### Description

Sets the maximum width of change of pitch for reproduction in designated channel.

##### Argument

NN #channel (0..3)  
 XX Maximum amount of bend (1..24[100cent])  
 default: 2

Extended Note (lower) 0xff, 0xf0, 0x06, 0x43, 0x03, 0x90, 0xBn, XX, 0xf7

---

##### Description

Changes #BLOCK/upper 2 bits of #FNUM/KeyOn of synthesizer directly.  
 This is a function for MA-2 compatible reproduction.  
 For MA-3, (upper) and (lower) that are issued at time "0" must be processed as a pair, and  
 BLOCK&FNUM and KeyOn/Off information are set simultaneously.

##### Argument

n MA-2 register index (0..3)  
 XX Set data (0x00..0xff)  

$$\text{FNUM} = (\text{FNUM} \& 0x300) | \text{XX}$$

$$\text{Fout}[\text{Hz}] = \text{FNUM} * (2^{\text{BLOCK}} / 2^{20}) * \text{F0} (49700)$$

Extended Note (upper) 0xff, 0xf0, 0x06, 0x43, 0x03, 0x90, 0xCn, XX, 0xf7

---

##### Description

Changes #BLOCK/upper 2 bits of #FNUM/KeyOn of synthesizer directly.  
 This is a function for MA-2 compatible reproduction.  
 For MA-3, (upper) and (lower) that are issued at time "0" must be processed as a pair, and  
 BLOCK&FNUM and KeyOn/Off information are set simultaneously.

##### Argument

NN MA-2 register index (0..3)  
 XX Set data (0x00..0xff)  

$$\text{KeyOn} (0:\text{Off}, 1:\text{On}) = \text{XX} \gg 5$$

$$\text{BLOCK} (0..7) = (\text{XX} \gg 2) \& 0x07$$

$$\text{FNUM} = (\text{FNUM} \& 0x0ff) | ((\text{XX} \& 0x03) \ll 8)$$

$$\text{Fout}[\text{Hz}] = \text{FNUM} * (2^{\text{BLOCK}} / 2^{20}) * \text{F0} (49700)$$

## 5 Default sound set

Default tones are to be FM tones that are built in MA-3.

PC#	Instrument	Key Range	PC#	Instrument	Key Range
0	GrandPno	21-108	32	AcoBass	28-55
1	BritePno	21-108	33	FngrBass	28-55
2	E.GrandP	21-108	34	PickBass	28-55
3	HnkyTonk	21-108	35	Fretless	28-55
4	E.Piano1	28-103	36	SlapBas1	28-55
5	E.Piano2	28-103	37	SlapBas2	28-55
6	Harpsi	41-89	38	SynBass1	28-55
7	Clavi	36-96	39	SynBass2	28-55
8	Celesta	60-108	40	Violin	55-96
9	Glocken	72-108	41	Viola	48-84
10	MusicBox	60-84	42	Cello	36-72
11	Vibes	53-89	43	Contrabs	28-55
12	Marimba	48-84	44	TremStr	28-96
13	Xylophon	65-96	45	PizzStr	28-96
14	TubulBel	60-77	46	Harp	23-103
15	Dulcimar	60-84	47	Timpani	36-57
16	DrawOrgn	36-96	48	Strings1	28-96
17	PercOrgn	36-96	49	Strings2	28-96
18	RockOrgn	36-96	50	Syn.Str1	36-96
19	ChrchOrg	21-108	51	Syn.Str2	36-96
20	ReedOrgn		52	ChoirAah	48-79
21	Acordion	53-89	53	VoiceOoh	48-79
22	Harmnica	60-84	54	SynVoice	48-84
23	TangoAcd	53-89	55	Orch.Hit	48-72
24	NylonGtr	40-84	56	Trumpet	58-94
25	SteelGtr	40-84	57	Trombone	34-75
26	JazzGtr	40-86	58	Tuba	29-55
27	CleanGtr	40-86	59	Mute.Trp	58-82
28	Mute.G.tr	40-86	60	Fr.Horn	41-77
29	Ovrdrive	40-86	61	BrasSect	36-96
30	Dist.Gtr	40-86	62	SynBras1	36-96
31	GtrHarmo	40-86	63	SynBras2	36-96

PC#	Instrument	Key Range	PC#	Instrument	Key Range
64	SprnoSax	54-87	96	Rain	36-96
65	AltoSax	49-80	97	SoundTrk	36-96
66	TenorSax	42-75	98	Crystal	36-96
67	Bari.Sax	37-68	99	Atmosphr	36-96
68	Oboe	58-91	100	Bright	36-96
69	Eng.Horn	52-81	101	Goblins	36-96
70	Bassoon	34-72	102	Echoes	36-96
71	Clarinet	50-91	103	Sci-Fi	36-96
72	Piccolo	74-108	104	Sitar	48-77
73	Flute	60-96	105	Banjo	48-84
74	Recorder	60-96	106	Shamisen	50-79
75	PanFlute	60-96	107	Koto	55-84
76	Bottle	60-96	108	Kalimba	48-79
77	Shakhchi	55-84	109	Bagpipe	36-77
78	Whistle	60-96	110	Fiddle	55-96
79	Ocarina	60-84	111	Shanai	48-72
80	SquareLd	21-108	112	TnklBell	72-84
81	SawLead	21-108	113	Agogo	60-72
82	CaliopLd	36-96	114	SteelDrm	52-76
83	ChiffLd	36-96	115	WoodBlk	60-72 (*1)
84	CharanLd	36-96	116	TaikoDrm	60-72 (*2)
85	VoiceLd	36-96	117	MelodTom	60-72 (*3)
86	FifthLd	36-96	118	Syn.Drum	60-72 (*4)
87	Bass&Ld	21-108	119	RevCymb1	60-72 (*4)
88	NewAgePd	36-96	120	FretNoiz	60-72
89	WarmPad	36-96	121	BrthNoiz	60-72
90	PolySyPd	36-96	122	SeaShore	60-72 (*5)
91	ChoirPad	36-96	123	Tweet	60-72 (*6)
92	BowedPad	36-96	124	Telephone	60-72 (*7)
93	MetalPad	36-96	125	Helicptr	60-72 (*7)
94	HaloPad	36-96	126	Applause	60-72 (*6)
95	SweepPad	36-96	127	Gunshot	60-72 (*5)

The tone generation is to be an even temperament in principle, except that those with (\*) are to be as follows.

\*1 : 50 cents / halfnote, #69 = F#4

\*3 : 50 cents / halfnote, #69 = C#4

\*5 : 20 cents / halfnote

\*7 : 10 cents / halfnote

\*2 : 50 cents / halfnote, #69 = A2

\*4 : 50 cents / halfnote

\*6 : 5 cents / halfnote

## **6 SMAF/Phrase L1 Non-corresponding item**

### **6.1 Sequence chunk**

In MA-3, when Sequence chunk does not exist, or when playback time length does not fulfill 20ms, it becomes an error.