YAMAHA®

XG Format

Music Data Production Recommendations

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Introduction

This document provides recommendations for creating music data compatible with instruments utilizing the Yamaha “XG” format.

In order to create music data that takes the fullest advantage of the XG format, you’ll need to have a complete understanding of the XG Specifications. We therefore urge you to refer both to this document and to the XG Specifications as you are creating your data.

Note that the XG Specifications includes a number of new features which are not defined in the “GM System Level 1 Recommendations” (MIDI 1.0 Recommended Practice RP-003) of the JMSC (Japanese MIDI Standards Committee, now AMEI—the Association of Musical Electronics Industry). These new features are marked “***Non-GM1***” in this document.

Models currently compatible with the XG Specifications include:

Yamaha MU50 (Mid-range reference module, utilizing XG Level 1)
Yamaha DB50XG (Sound card daughterboard, utilizing XG Level 1)
Yamaha MU80 (High-end reference module, utilizing XG Level 2)

CONTENTS

1. XG implementation levels

There are currently two levels of XG implementation: Level 1, as utilized by the Yamaha MU50 and DB50XG; and Level 2, as utilized by the Yamaha MU80. There are also plans for a future XG Level 3, with details to be announced.

While most aspects of XG Levels 1 and 2 are the same, there are a number of important differences between the two, as follows:

	XG Level 1 (MU50 / DB50XG)	XG Level 2 (MU80)
Number of drums setups	Two	Four
Number of onboard effects	Three (Reverb, Chorus, Variation)	Five (Reverb, Chorus, Variation, Distortion, Graphic EQ)
Number of SFX voices*	42	49

Unless otherwise noted, all references in this document apply to both XG Level 1 and Level 2.

** For a complete listing of all Level 1 and Level 2 SFX voices, see section 6-3 in this document.*

2. Data format

2-1. Format

We recommend the use of Standard MIDI File format 0 (where the file contains a single multi-channel track), as opposed to format 1 (where the file contains multiple tracks).

2-2. Tempo

We recommend using tempo settings in the range of 32 - 250 bpm.

2-3. Resolution

Any resolution (such as 96 ppq or 480 ppq) may be used. For the MIDI events listed below, be sure to allow appropriate spacing between each event (as described below) in order to ensure correct processing by the sequencer:

- *Continuous Control Change data such as Pitchbend, Expression, Volume, and Modulation* - If these messages occur in dense succession, tempo can sometimes become unstable, so use the Thin Out (or equivalent) function on your sequencer to reduce the data stream as much as possible. Wherever possible, leave intervals of at least 1/96 (=5/480) between these events.

- *Between Bank Select MSB/LSB and Program Change* - If these three events are placed at the same time clock, the sequencer may produce unexpected results. Always leave intervals of at least 1/96 (=5/480) between these events, and always send the Bank Select MSB first, the Bank Select LSB second, and the Program Change last.

- *Between events such as RPN/NRPN Parameter Select, Data Entry MSB/LSB, and Reset* - Always leave intervals of at least 1/96 (=5/480) between these events.

- *After a System Exclusive message* - Always leave an interval of at least 1/96 (=5/480). We recommend the use of System Exclusive messages only within the setup data (see section 2-4 below), and not within the song data itself.

2-4. Setup Data

Reserve one or more measures for tone generator setup data at the beginning of the song, and do not place any music data in this "setup" measure or measures. Use the minimum number of setup measures that are required, as dictated by the time signature and the amount of MIDI events necessary. Always observe the required spacing between each event as given in section 1-3, above.

- Taking into account the possibility that XG music data may be played back on a GM tone generator, be sure to include a GM System On message in the setup data. The GM System On message must be transmitted **before** the XG System On message.

- Allow empty intervals of at least 200 msec after the GM System On, and at least 50 msec after XG System On.

- Note that the reception of an XG System On message by an XG-compatible instrument causes all parameters to initialize to their factory defaults (see the instrument's owners manual for details). Therefore, **you need include in the setup data only those messages required to set parameters to values other than their factory defaults**.

- Allow an empty interval of at least 200 msec after the setup data before the song data begins.

- We recommend the general order of events in the setup measure to be as follows:
    1. SMF header chunk
    2. SMF track chunk
    3. SMF Meta-Events such as tempo, time signature, text events, copyright notice, sequence name, lyric, etc.
    4. GM System On message
    5. XG System On message
    6. All required System Exclusive parameter changes (Effects selection, followed by Effects customization, followed by voice parameter customization)

    7a. Bank Select messages (Control Change #0, followed by Control Change #32) for channel 1

    7b. Program Change message for channel 1

    7c. All required Control Change messages for channel 1 (except Control Change #0 and #32)

    7d. All required RPN messages for channel 1

    7e. All required NRPN messages for channel 1

    8. Repeat 7a - 7e for channel 2, then channels 3 ... 16

You can utilize the setup data templates provided on the enclosed floppy disk. Be careful to observe the spacing requirements between MIDI events as given in section 2-3 above.

3. Channels

3-1. Number of Parts

A maximum of 16 parts (16-way multitimbral) should be used, since this is the minimum requirement for Level 1 XG instruments (Level 2 XG instruments may have up to 32-way multitimbral capability).

3-2. Channel Assignment for Each Part

Depending on the character of the song, assign channels 1 - 5 and channel 10 as follows:

Minus-one music:

Part	MIDI Ch.	Note
Rhythm	10	dedicated rhythm part
Melody	1	main part to be muted during minus-one play
Sub-melody/ solo/ accompaniment	2	secondary part to be muted during minus-one play
Bass	3	bass part
Pad	4	backing part with mostly sustained notes
Riff	5	rhythmic backing part

Band music:

Part	MIDI Ch.	Note
Rhythm	10	dedicated rhythm part
Melody	1	lead part
Sub-melody/ solo/ accompaniment	2	solo part or important backing part
Bass	3	bass part
Pad	4	backing part with mostly sustained notes
Riff	5	rhythmic backing part

Piano practice piece:

Part	MIDI Ch.	
Rhythm	10	dedicated rhythm part
Melody	1	right hand (1st) part
Sub-melody/ solo/ accompaniment	2	left hand (2nd) part
Bass	3	bass part
Pad	4	backing part with mostly sustained notes
Riff	5	rhythmic backing part

Remaining musical parts should be allocated to channels 6 - 9 and 11 - 16, with parts of greater musical importance assigned to lower-numbered channels.

3-3. Rhythm Channel Settings

As specified in 3-2 above (and as per General MIDI), channel 10 is always dedicated to the rhythm part. ***Non-GM1*** If you wish to specify a secondary rhythm part (in addition to channel 10), use either the Bank Select MSB and LSB* or the SysEx parameter change Part Mode** to designate another channel as a rhythm sound.

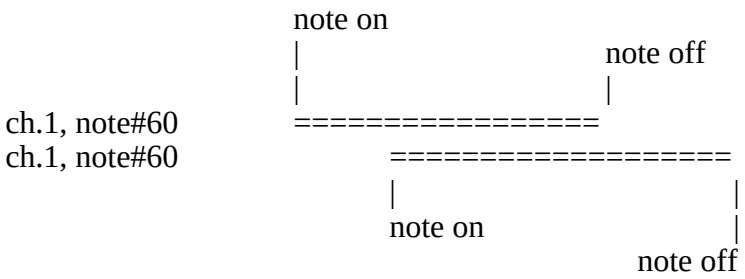
- SysEx parameter changes can be used to create drum setup settings for a maximum of two parts, including channel 10.
- By default, ch.10 is “DRUMS 1.” (In SysEx parameter change multi-part Part Mode F0H, 43H, 10H, 4CH, 08H, nnH, 07H, ddH, F7H, Part Number nnH=09H, and Data ddH=02H.)
- For one drum part other than ch.10, use “DRUMS 2.” (F0H, 43H, 10H, 4CH, 08H, 08H, nnH, 07H, 03H, F7H.)
- DRUMS 3 and DRUMS 4 are provided by Level 2 XG instruments only, and should not be used.
- If you do not need to use drum setup to modify the contents of the kit, you can use the SysEx parameter change F0H, 43H, 10H, 4CH, 08H, nnH, 07H, 01H, F7H to set the Part Mode to “DRUM.” This allows you to specify three or more parts as rhythm sounds.

** See the XG Specifications, #4. Control Change / Bank Select MSB/LSB*
*** See the XG Specifications, #7. System Exclusive Messages / Parameter Change, and Table 1-8*

4. Simultaneous polyphony

Always keep the song within 16 - 32 notes of simultaneous polyphony. Since some voices use two notes of the total polyphony (because they contain two elements), the maximum available number of simultaneous notes will depend on the type and combination of voices used.

Avoid overlapping note on/offs of the same channel and note number. For example, in the following case, it cannot be definitely stated how note-on processing will take place:



5. Timing distribution

Do not place messages such as Pitch Bend Change and Control Change, etc., in the same time clock. Since some sequencers rearrange the order of MIDI events that occur in a single time clock, the results may be unpredictable. Also, dense successions of events (even if they do not occur in the same time clock) can cause the tempo to be disrupted, or the hardware to respond in unexpected ways.

Non-GM1 Regarding Bank Select, the XG Specification says that "As given in the MIDI specification, MSB + LSB + Program Change must be sent as a unit." Here, "as a unit" should not be understood to mean "at the same time," but rather that "other MIDI events may not occur between the MSB, LSB and program change." Hypothetically speaking, if these three messages were sent at the same time and the sequencer read the Program Change first and the MSB and LSB later, the voice would be selected from the previously-specified bank. For more information, refer to XG Specifications #4. Control Changes / Bank Select MSB/LSB.

Note that the reception of Bank Select MSB/LSB does not immediately change the tone generator voice. The channel stores the received Bank Select MSB/LSB setting, but does not apply it until receipt of the next Program Change.

6. Voice selection **Non-GM1**

6-1. Voice Selection Procedure

The XG voice selection procedure is as follows.

- Melody voice — Bank Select MSB = 00H,
  use Bank Select LSB to specify the bank,
  then use Program Change to select the voice
- SFX voice — Bank Select MSB = 40H,
  Bank Select LSB = 00H (fixed),
  then use Program Change to select the voice
- SFX kit — Bank Select MSB = 7EH,
  Bank Select LSB = 00H (fixed),
  then use Program Change to select the kit,
  finally, use Note Number to select the voice
- Rhythm Kit — Bank Select MSB = 7FH,
  Bank Select LSB = 00H (fixed),
  then use Program Change to select the kit,
  finally, use Note Number to select the voice

For Kit and Voice mapping, refer to the “XG Voice List” and “XG Drum List” that are attached to the XG Specifications. In the SFX kit, there are some notes within the valid range of notes that produce no sound (that is, keys to which no voice is assigned).

6-2. Melody Voice Substitution

Tone generators that do not have the specified bank when a new melody voice is selected will automatically substitute the sound of the previously selected bank. (By default, this will be the GM basic sound set in Bank 0.)

As an example:

If you want Bank Select
MSB = 00H, LSB = 2DH, Program Change #29 Jazz Man
but a substitution of
MSB = 00H, LSB = 2BH, Program Change #29 Funk Gtr 2
is possible, first transmit
MSB = 00H, LSB = 2BH, Program Change #29
and then transmit
MSB = 00H, LSB = 2DH, Program Change #29

This slight detour will minimize the chances of an undesired replacement by the GM basic sound set.

6-3. SFX Voice Substitution

Be aware that Level 1 XG instruments (such as the MU50 and DB50XG) do not contain all the Level 2 SFX voices (as provided by the MU80) . Level 1 tone generators that do not have the specified SFX voice when a new SFX voice is selected will play silence, so avoid using any SFX voices that are not common to both Level 1 and Level 2 XG instruments. The table below compares the Level 1 (MU50/DB50XG) SFX voice list with the Level 2 (MU80) voice list:

Level 1 (MU50/DB50XG) SFX Voice List

Pch#	Bank 0	# of Elements
1	CuttngNz	1
2	CttngNz2	2
3		
4	Str Slap	1
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17	Fl.KClik	1
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33	Rain	1
34	Thunder	1
35	Wind	1
36	Stream	2
37	Bubble	2
38	Feed	2
39		
40		
41		
42		
43		
44		
45		

Level 2 (MU80) SFX Voice List

Pch#	Bank 0	# of Elements
1	CuttngNz	1
2	CttngNz2	2
3	DstCutNz	2
4	Str Slap	1
5	B.Slide	2
6	P.Scrape	1
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17	Fl.KClik	1
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33	Rain	1
34	Thunder	1
35	Wind	1
36	Stream	2
37	Bubble	2
38	Feed	2
39		
40		
41		
42		
43		
44		
45		

Level 1 (MU50/DB50XG) SFX Voice List

Pch#	Bank 0	# of Elements
46		
47		
48		
49	Dog	1
50	Horse	1
51	Bird 2	1
52		
53		
54		
55	Ghost	2
56	Maou	2
57		
58		
59		
60		
61		
62		
63		
64		
65	Tel.Dial	1
66	DoorSqek	1
67	Door Slam	1
68	Scratch	1
69	Scratch 2	2
70	WindChm	1
71	Telphon2	1
72		
73		
74		
75		
76		
77		
78		
79		
80		
81	CarEngin	1
82	Car Stop	1
83	Car Pass	1
84	CarCrash	1
85	Siren	2
86	Train	1
87	Jetplane	2
88	Starship	2
89	Burst	2
90	Coaster	2
91	SbMarine	2
92		
93		
94		
95		

Level 2 (MU80) SFX Voice List

Pch#	Bank 0	# of Elements
46		
47		
48		
49	Dog	1
50	Horse	1
51	Bird 2	1
52	Kitty	1
53	Growl	1
54	Haunted	2
55	Ghost	2
56	Maou	2
57		
58		
59		
60		
61		
62		
63		
64		
65	Tel.Dial	1
66	DoorSqek	1
67	Door Slam	1
68	Scratch	1
69	Scratch 2	2
70	WindChm	1
71	Telphon2	1
72		
73		
74		
75		
76		
77		
78		
79		
80		
81	CarEngin	1
82	Car Stop	1
83	Car Pass	1
84	CarCrash	1
85	Siren	2
86	Train	1
87	Jetplane	2
88	Starship	2
89	Burst	2
90	Coaster	2
91	SbMarine	2
92		
93		
94		
95		

Level 1 (MU50/DB50XG) SFX Voice List

Pch#	Bank 0	# of Elements
96		
97	Laughing	1
98	Scream	1
99	Punch	1
100	Heart	1
101	FootStep	1
102		
103		
104		
105		
106		
107		
108		
109		
110		
111		
112		
113	MchinGun	1
114	LaserGun	2
115	Xplosion	2
116	FireWork	2
117		
118		
119		
120		
121		
122		
123		
124		
125		
126		
127		
128		

Level 2 (MU80) SFX Voice List

Pch#	Bank 0	# of Elements
96		
97	Laughing	1
98	Scream	1
99	Punch	1
100	Heart	1
101	FootStep	1
102	Applaus2	1
103		
104		
105		
106		
107		
108		
109		
110		
111		
112		
113	MchinGun	1
114	LaserGun	2
115	Xplosion	2
116	FireWork	2
117		
118		
119		
120		
121		
122		
123		
124		
125		
126		
127		
128		

7. Effects **Non-GM1**

The following three effect blocks are available for use by both Level 1 and Level 2 XG instruments:

Reverb
Chorus
Variation

The types available in each block are listed in the "XG Basic (Required) Effect List" included with the XG Specifications.

- There is a risk of losing song data compatibility if you use optional types, optional parameters, or optional effects. Avoid using, for example, "White Room" or "Pitch Change."

- If your data requires a distortion effect and is intended for playback on a Level 2 XG instrument such as the Yamaha MU80, use a distortion program within the Variation block rather than a distortion program contained within the Distortion (Insertion Effect 1) block.

- If you use SysEx parameter change effect parameters, do not modify parameters 11 and higher. (Use only parameters 1 - 10.) Details of the parameters are given in the "XG Effect Parameter List" in the XG Specifications.

- In the Variation block, Variation Connection is initially set to INS (that is, in F0H, 43H, 10H, 4CH, 02H, 01H, 5AH, ddH, F7H, the default setting is ddH=00H.) In this state, a Variation effect can be used for only one part, so specify Variation Part as needed. (In F0H, 43H, 10H, 4CH, 02H, 01H, 5BH, ddH, F7H, specify ddH. By default, ddH=7FH i.e., OFF)

- When Variation Connection = INS, Control Change #94 Effect 4 Depth (Variation send) is ignored.

- By setting Variation Connection to SYS, you can apply Variation effects to two or more parts. (In F0H, 43H, 10H, 4CH, 02H, 01H, 5AH, ddH, F7H, set ddH=01H.) In this case, Control Change #94 (Variation Send) will specify the send levels of each part. Always set Variation Connection to SYS *before* setting values for Control Change #94.

8. System Exclusive parameter changes **Non-GM1**

Avoid using System Exclusive parameter changes that are designated as optional in the “XG Specifications.” As exceptions, the following three may be used even though they are listed as optional:

*Multi EQ Data parameter change**
Display Data parameter change
A/D Part Data parameter change

Because Multi EQ parameters are used only by Level 2 XG instruments (and are ignored by Level 1 XG instruments, which always provide a flat EQ response), EQ may be used only as long as a flat response would not cause the character of the song to be lost.

Note that **later-received SysEx messages always take priority**, so when transmitting messages that reset the entire block of parameters (such as Effect Type), give consideration to the appropriate order and spacing. For example:

- *Multi Effect Data parameter change* - Send parameters **after** specifying the effect type.
- *Multi EQ Data parameter change** - Send parameters **after** specifying the EQ type.
- *Drums Setup parameter change* - Use a Program Change message to select a Rhythm Kit, **then** (if necessary) use Multi Part Data parameter change Part Mode to select Drums Setup. **Finally**, send parameters.

9. Fade in/out **Non-GM1**

To fade a song in or out, use Control Change #11 (Expression) or the universal system exclusive message MIDI Master Volume (F0H, 7FH, 7FH, 04H, 01H, llH, mmH, F7H). Note that MIDI Master Volume changes the relative values of *all* parts simultaneously.

Also, when Variation Connection is SYS, parts which use a Variation effect may not fade correctly. In this case, use the effect parameter change Variation Return (F0H, 43H, 10H, 4CH, 02H, 01H, 56H, ddH, F7H) in conjunction with the MIDI Master Volume message.

10. Miscellaneous

10-1. When a Program Change message is received, the values of Control Change messages such as Volume or RPN/NRPN are not reset. Be aware of this when you use Program Change messages within a song.

10-2. Use Control Change #7 (volume) to adjust the volume balance between parts. If, when inputting song data, you use a pedal-type volume controller for performance expression, the data will be recorded as Control Change #7 data, but you should replace this with Control Change #11 (expression) data.

10-3. For performance expression within a song (such as crescendos and diminuendos), use Control Change #11 (expression).

10-4. ***Non-GM1*** Control Change #10 (panpot) may be used while a note is sounding.

10-5. For the following four messages, use only values of either 0 or 127 (i.e., on/off switch values)—do not use half-pedal data values:

Control Change #64 (Sustain)
Control Change #65 (Portamento)
Control Change #66 (Sostenuto)
Control Change #67 (Soft Pedal)

10-6. ***Non-GM1*** Some parameters (such as Filter Cutoff Frequency, Filter Resonance, EG Attack Rate, and EG Release Rate) can be altered with Control Change messages as well as with NRPNs and/or System Exclusive parameter messages. ***We recommend that such parameters always be altered with Control Changes rather than with NRPNs or System Exclusive messages.***

10-7. Do not use Control Change #84 (Portamento Control).

10-8. Do not use Control Change #120 (All Sound Off) or #123 (All Note Off).

10-9. Do not use AnH (Polyphonic Aftertouch) or DnH (Channel Aftertouch).

When inputting data from a keyboard or other controller in realtime, keep Aftertouch out of the music data with the use of a MIDI input filter.