MA-3 Authoring Tool
User's Manual
(ATS-MA3-L Edition)

Ver.1.0.0

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⊛YAMAHA

Introduction

   MA-3 Authoring Tool is application software for authoring, correcting, and verifying the contents for mobile phones, and the operating systems for running this software includes Windows®2000 and Windows®XP.

   By using this application, conversion from SMF (*Standard MIDI File*) to MLD format (*.mld*), editing of voices, editing of management information, and confirmation of sound generation on emulator can be implemented.

Recommended Operating Environment

The recommended operating environment of this authoring tool is as follows.

Compatible Operation System	Microsoft® Windows® XP Microsoft® Windows® 2000
CPU / Clock	Pentium®, Celeron™, or compatible processor/ more than 400MHz
Memory	64MB or more
Required hard disk space	40MB or more

【**Note**】 All names of products that are presented in this manual are trademarks and registered trademarks of their companies respectively.

Contents

Revision History

Ver.	Date	Description
1.0.0	2004/09/30	Newly Released

1. About MA-3 Authoring Tool

Independence of MA-3 Authoring Tool and Sequencer

MA-3 Authoring Tool is the independent application software that is used together with general-purpose MIDI sequencers. Therefore, user is allowed to select the most familiar sequencer. All operations up to conversion to MLD (*.mld*) can be made by performing a sequence editing with your sequence software, and then performing a voice editing and management information editing using MA-3 Authoring Tool.

Sequencer Direct MIDI Playback

By directly playing back with your sequence software, data, voices, and etc. can be confirmed.

Stream PCM Pasting Function

By reading a Stream PCM file for synchronized-play with channel sequence, it can be assigned.

Real Time Voice Editing

The read SMF data can be confirmed on event viewer. In a voice change, voice change in real time is possible.

Event Viewer Function

It can confirm the event information using event viewer by reading SMF data. SMF data can be confirmed on an event list or piano-roll. In addition, Piano roll window advances synchronously during a confirmation of playback. Also, it can perform an edit of music information.

Allow to Make Various Voices

MA-3 adopts the following two synthesizer systems, FM synthesizer and PCM synthesizer.
(For details about FM synthesizer and PCM synthesizer, refer to "*5.1 About FM Synthesizer / Examine it for a moment.*")
By using these two synthesizer methods, it becomes possible to make voices which each special feature were employed efficiently.

Realize the Various Sounds Easily by Using Voice Library

Voice Libraries (***VLF-MA3/VLP-MA3/VLW-MA3***) which are recorded various sounds are attached in this application.

"VLF-MA3" is an extended voice library of FM voice, and it is able to extend voices which differ from default voices, easily.

"VLP-MA3" is the PCM voice library, and it can easily realize real sounds that differ from FM.

"VLW-MA3" is the Ethnic Library; in addition, it can expand the sounds for the folk instruments.

By using these three voice libraries, the various sounds are easily realizable.
For details about the registration method of each voice libraries etc., see the manual attached with library.
(***VLF-MA3_v***.pdf, VLP-MA3_v***.pdf, VLW-MA3_v***.pdf***)

2. Preparation before Use

2.1. Installation of MA-3 Authoring Tool

The installation procedure for MA-3 Authoring Tool is explained in this chapter.

2.1.1. Installation of MA-3 Authoring Tool

1. Double-click the "*setup.exe*" icon.

2. Then, "*Setup Wizard*" dialog is displayed.

3. Click "*Next*" on "*Setup Wizard*" dialog.

4. Then, "*Select Installation Folder*" dialog appears.

5. Select the folder in which the application will be installed, and then click "*Next*" button.

6. Then, "*Confirm Installation*" dialog appears.

7. Installation is started. When the installation is completed, "*Installation Complete*" dialog is displayed.

8. Click "*Close*" on "*Installation Complete*" dialog.

9. Installation is now completed; in addition, a shortcut icon, "*ATS-MA3-L*", is also created on your desktop.
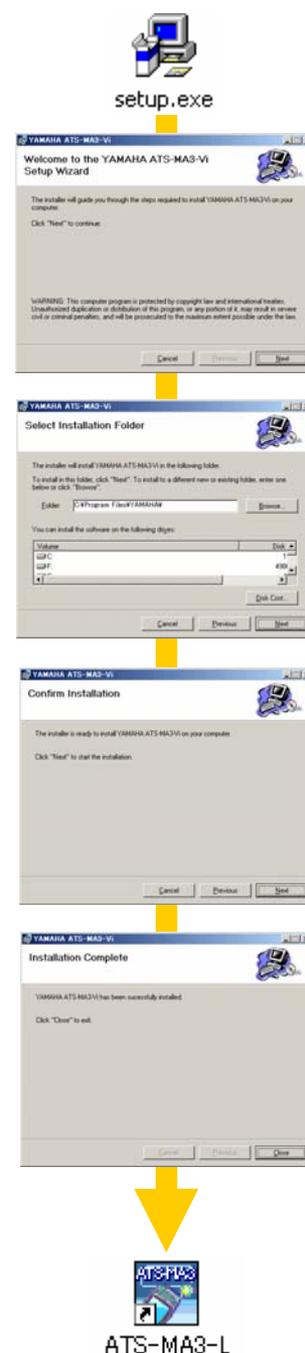
3. Let's Use MA-3 Authoring Tool

This chapter describes a flow of steps in which reading a standard MIDI file (*.mid*), and then confirming the playback; in addition, editing a voice of music, and saving it as a MLD file (*.mld*).

3.1. Start-up of Authoring Tool

After both installation of MA-3 Authoring tool and necessary connections are completed, MA-3 Authoring Tool is started up with the following procedure.

1.   Double-click the short-cut icon called "***ATS-MA3-L***" that is located on your desktop.

Figure. 3-1   ATS-MA3L

2.   Then, MA-3 Authoring Tool is started up in the following order.
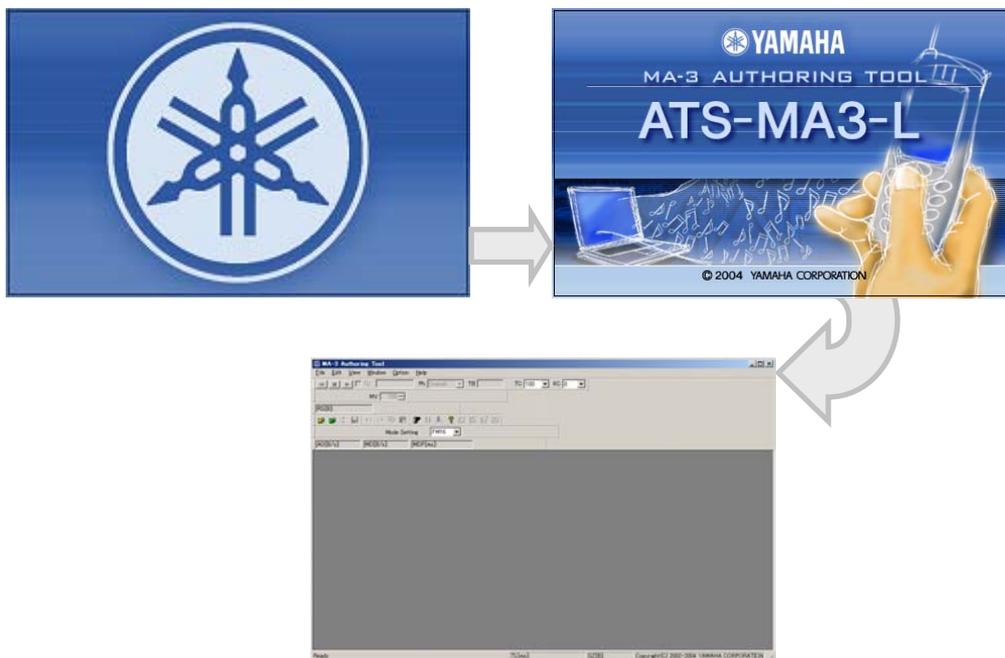
Figure. 3-2   Start Up Screen

3.2. Let's Read SMF

First of all, be sure to prepare a MIDI file to edit with MA-3 Authoring Tool, and create using your sequence software by reference to the "**Contents Authoring Guideline**."

These files become editable with MA-3 Authoring Tool by "**Import from SMF**" function from "**Fil**e" menu which is described later in this document.

1.   Click "**Import from SMF**" on Application Window or select "**Import from SMF**" from the "**File**" menu in Menu-Bar.

2.   Then, "**Open**" dialog appears.

3.   Select SMF (*.**mid**), and then click "**Open**".

4.   Then, the file is converted.

5.   SMF file is read into "**Score Window**."

6.   After SMF file is read into Authoring Tool completely, "**Score Window**" is displayed.
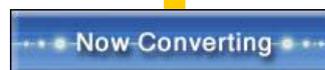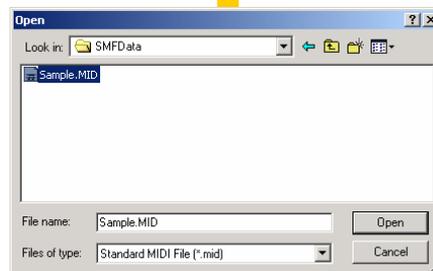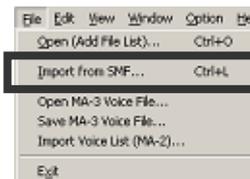
When music data is opened, voices in the Voice List is read and assigned into "**Score Window**."

3.3. Play and Stop of Read Music

This section describes the procedure how to "*Start*" and "*Stop*" music.

Stop

Playback

1.   Click "*Play*" button on "*Control Bar*" in "*Application Window*."

2.   Then, music is read into "*Score Window*."

Now Importing

3.   The music is checked.

4.   Music is converted.

Now Checking

5.   Music is transmitted into MA-3 emulator.

Now Converting

6.   The read music is played back, and then Control bar which shows a playback position is displayed on "*Score Window*."

7.   Click "*Stop*" button on Control Bar in Application Window.

Now Sending

8.   Music is stopped.
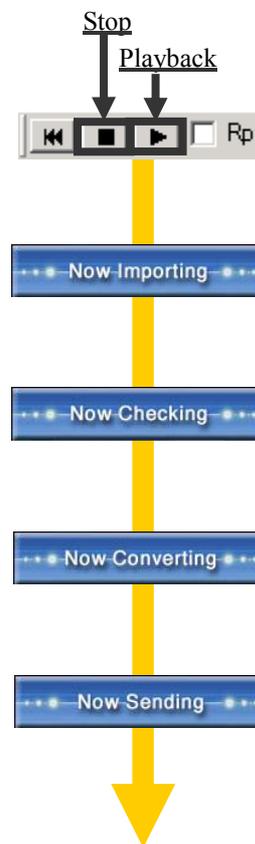
【Note】 "*Start*" and "*Stop*" functions also can be controlled by "*Space Key*" on your keyboard.

3.4. Let's Edit FM Voices

Let's change the depth of modulation for FM voices here.

【Note】 For the voices to edit, it is necessary to set voices except pre-set voices beforehand. For details about the method for setting voices except the pre-set voice, see "*4.12.1 About Voice Bank*."

【Note】 Copy & Paste operations of voices can be redone by using "*Undo/Redo*" functions.

【Note】 Copy & Paste operations of voices can be performed from "*Paste Voice List*" of "*Voice Assign Map*." For details, refer to *"4.11.5.1Voice Copy/Paste Function."*

Read a voice data to edit and select "*Voice List*" from "*Window*" menu, and then open it.

1. Move a mouse pointer to the top of pre-set voice which will be used and select "*Copy*" by right-click.

2. Select "*Voice Assign Map*" from "*Window*" menu and open it.

3. Right-click a voice name which you want to change to a copied voice, and select "*Paste*" to paste it.
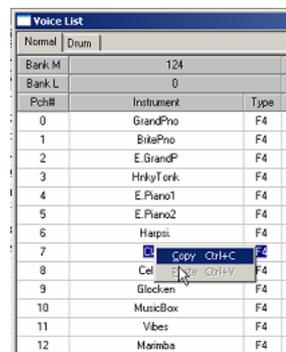
4. Double-click the area of "*Name*" where voice is pasted in step "3."

5. Then, "*Voice Edit Window*" is opened.
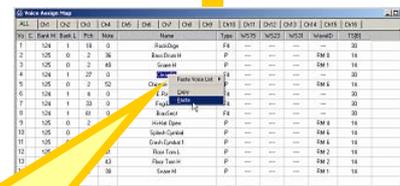
6. Click "*Operator4*" tab, and place a check in the check box "*EVB*". (For details about EVB, refer to "*4.12.5 FM Voice Edit Parameters.*")

7. Move the slider of "*DVB*" to change the value. When the value becomes bigger, the effects may also increase that impact. (For details about DVB, refer to "*4.12.5 FM Voice Edit Parameters*".)

Double-click "*Name*"
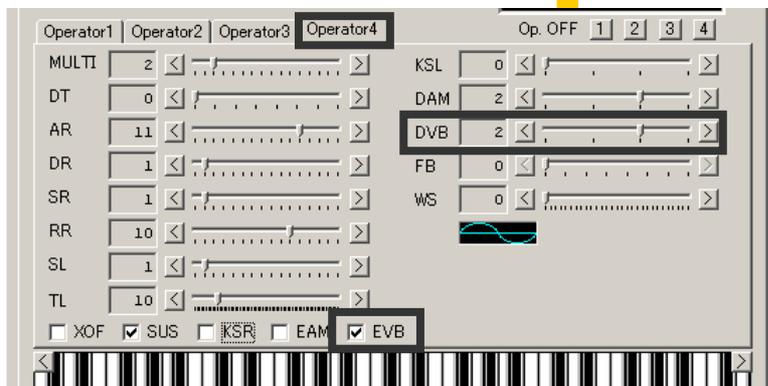
3.5. Procedure to Stream PCM Playback

    MA-3 has "**Stream PCM Playback**" function which can play back a digitally recorded voice. StreamPCM function makes a playback of digitally recorded natural sounds possible, such as human voices, animal voices, bird cries, sound of the waves, and sound of the winds, with mobile-phones.
    Since voices by StreamPCM playback can be precisely synchronized with a performance by FM synthesizer, it is possible to attach a back chorus to melody.
     In this section, a method of loop-play of digitally recorded animals or drum voices is explained.

【Note】 As for the sound file to register, be sure to use the sound file saved by 16bits. For details, see "*4.11.6.2 Sound File which can be registered as Stream PCM*."

1.   Select "**Stream PCM Assign Map**" from "**Window**" menu in menu-bar.

2.   Right-click under the area represented as "**WaveID**" or "**FS**" and select "**New**", and then "**Open**" dialog is opened.

3.   Select WaveFile and click "**Open.**" Then, WaveFile read into Stream PCM assign map is displayed.
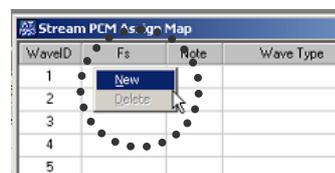
【Note】 When there is no Stream PCM event corresponding to WaveID, it is displayed in gray.
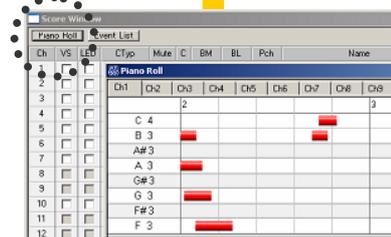
4.   "**Piano Roll**" Window is opened by clicking "**Piano Roll**" button on "**Score Window**."

5.   Drag & Drop from "**Stream PCM Assign Map**" to Stream PCM Edit View of "**Piano Roll Window**."

6.   Stream PCM event is created at the dropped point.
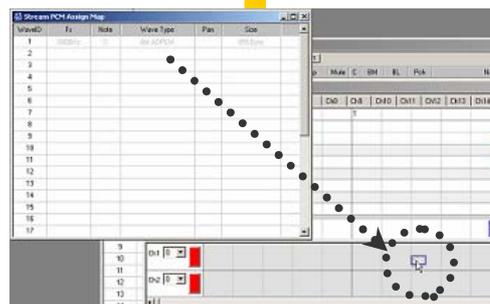
【Note】 For details about Stream PCM Edit View, see "*4.11.2.1 Piano Roll Window*".
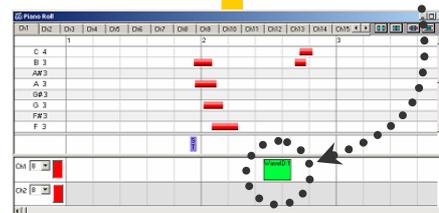
3.6. Saving Procedure by Mobile File Format (MLD)

1. Select "*SaveAs*" from "*File*" menu of menu-bar.

2. Then, "*Save as*" dialog appears.

3. Type a desired file name and click "*Save*" button.

4. Then, the file is saved with "*MLD format* (*.mld*)."
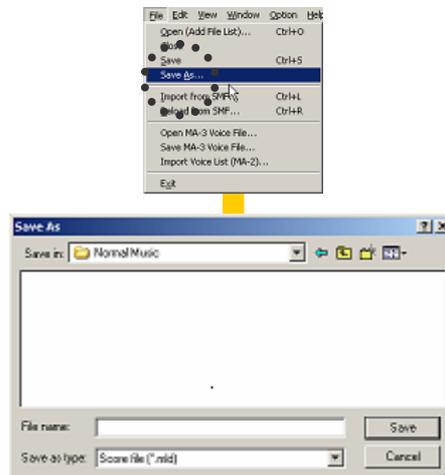
3.7. Let's Use Sequencer and MA-3 Authoring Tool Simultaneously

By starting up your sequencer and MA-3 Authoring Tool simultaneously, the edited data quickly can be played back and confirmed by authoring tool.

1. Start up MA-3 Authoring Tool and sequencer.

2. Read the same data into MA-3 Authoring Tool and sequencer.

3. Edit the data with sequencer.

4. Save the edited data by "*SMF Format 0/ SMF Format 1*" using sequencer.

【**Note**】 At this time, do not change both saving directions and file names.

5. Click "*SMF Reload Button*" on Application Window or select "*Reload from SMF*" from "*File*" menu of menu-bar.

6. Play and confirm the data by clicking "*Play*" button of MA-3 Authoring Tool.

4. Reference

4.1. Application Window

Each edit windows are opened on this "***Application Window***." This window provides "***Menu bar***", "***Control bar***", "***Volume bar***", "***Report bar***", "***Tool bar***", "***Preference Bar***", "***Density Reprot Bar***", and "***Status bar***" that are applicable commonly to all edit windows. The Menu bar, Volume bar, Tool bar, Preference Bar, and Control Bar are used to select or execute various functions by clicking or dragging. In addition, Report Bar, Event Density Bar, and Status Bar show the present status.
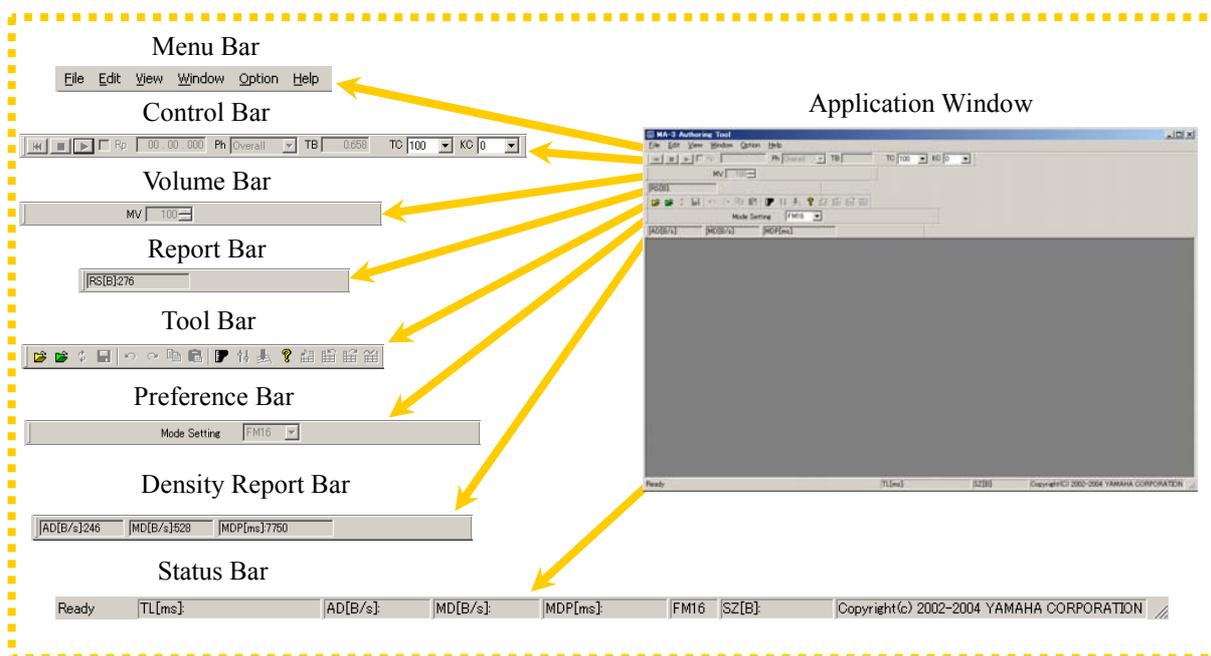
Figure. 4-1   Application Window

【**Note**】 The Control bar, Volume bar, Report bar, Tool bar, Preference Bar, Density Report Bar, and Status Bar can be displayed or hidden as necessary.

【**Note**】 By clicking "***View***" menu on Menu bar, a pull-down menu is displayed. By clicking a name of Tool bar, Status Bar, Report Bar, Volume Bar, Preference Bar, Density Report Bar, and/or Control Bar and placing a check, Tool bar, Status Bar, Report bar, Volume bar, Preference Bar, Density Report and Control Bar are displayed on Application menu. Conversely, by clicking the name of Control bar, Volume bar, Report bar, Toolbar, Preference Bar, Density Reprot Bar, and/or Status Bar once again, these windows are hidden from Application menu.

4.2. Title Bar

"*Title Bar*" on the "*Application Window*" displays the name and the location of a file which is presently opened in MA-3 Authoring Tool. The Title Bar of each "*Edit Window*" displays the name of each window.

Figure. 4-2   Title Bar

No.	Name	Description
1	Application icon	By clicking this icon, System menu is opened.
2	Minimize button	By clicking this button, windows are minimized (to make it an icon).
3	Maximize button/Undo (Minimize) button	By clicking this button, windows are maximized. Window is restored to the original size by clicking this button once again.
4	Close button	By clicking this button, windows are closed. In case of "*Application Window*", windows are closed and application is also ended. In case of "*Edit Windows*", each window is closed one by one.

4.2.1. System Menu

By clicking the "*Application Icon*" located on the left end on the title bar, this System Menu is opened.
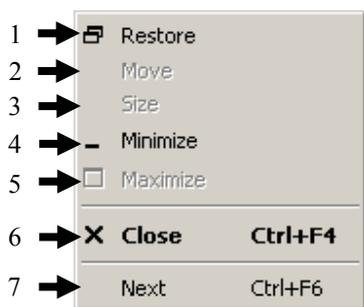
Figure. 4-3   System Menu

No.	Name	Description
1	Restore	When the size of window has been changed by size change etc., the window is restored to original size by clicking this function.
2	Move	Mouse pointer is changed to the moving tool by clicking this function. Use this pointer to move the windows by clicking & dragging the title bar of windows. The maximized windows cannot be moved.
3	Size	Mouse pointer is changed to the size-change tool. Put this pointer on the upper, lower, left and right side lines of the window, and clicks and drugs the line to change the size of the window. The maximized window cannot be changed.
4	Minimize	Windows are minimized (to make it an icon)
5	Maximize	Windows are maximized. If the window is already maximized, this function cannot be selected.
6	Close (Alt+F4) (Ctrl+F4)	Windows are closed by clicking this function. In case of "*Application Window*", all windows are closed and application is also ended. In case of "*Edit Window*", each window is closed one by one.
7	Next (Ctrl+F6)	If multi-Edit Windows are opened on Application Window, a Window in active can be changed by clicking this button. This function is only available on the System menu of Edit Window.

4.3. Menu Bar

In Manu Bar, the following menus are provided to execute and control various functions.
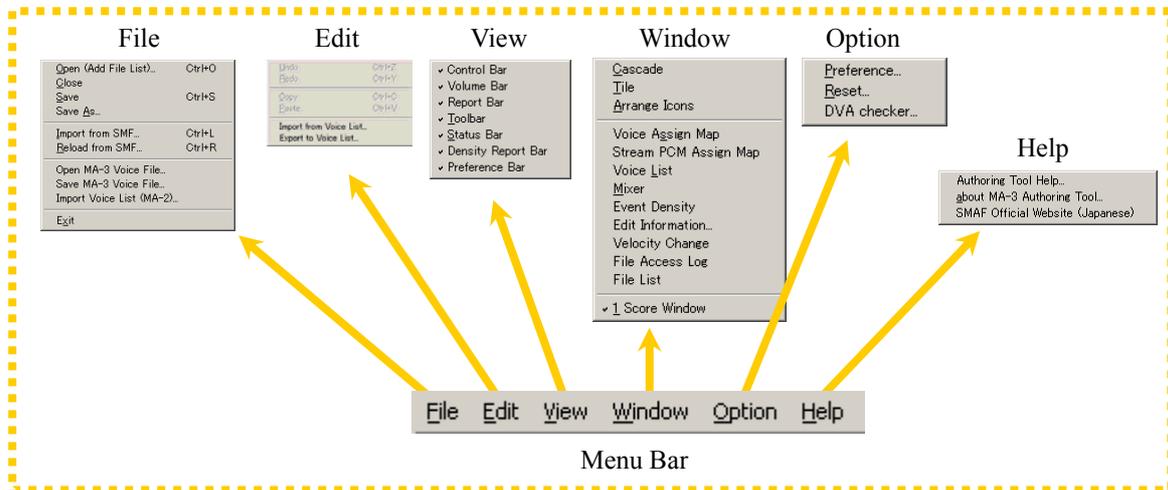
Figure. 4-4   Application Window

4.3.1. File

A series of operation such as open, close, save, and end of files can be performed with this menu.
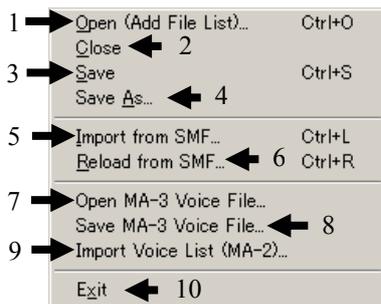
Figure. 4-5   File Menu

No.	Function Name	Contents
1	Open (Add File List)…	Opens MLD file list. (*.*mld*)
2	Close	Closes SMF file. (*.*mid*)
3	Save	Saves MLD file. *(*.*mld*)*
4	Save As	Saves MLD file with another name. (*.*mld*)
5	Import From SMF	Reads SMF. (*.*mid*)
6	Reload from SMF	Reloads SMF. (*.*mid*)
7	Open MA-3 Voice File	Opens MA-3 voice file. (*.*vm3*)
8	Save MA-3 Voice File	Saves MA-3 voice file. (*.*vm3*)
9	Import Voice List (MA-2)	Reads the voice list of MA-2 (*.*vma*)
10	Exit	Exists from MA-3 Authoring Tool

4.3.1.1. Import Voice List (MA-2)

The voice list created by MA-2 Authoring Tool can be read and registered into the voice list of MA-3 Authoring Tool.

1.   When selects "*Import Voice List (MA-2)*" from "*File*" menu on menu bar, "*Open*" dialog is displayed.

2.   Select a file, and then select a voice bank to register and place a check into the box in Option.
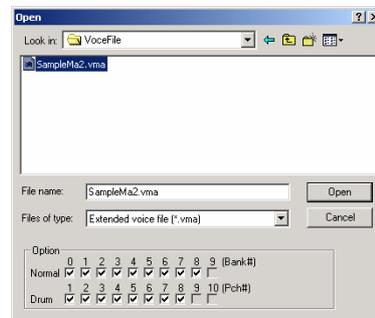
The voice list created by MA-2 Authoring Tool is registered into the user bank of the voice list of MA-3 Authoring Tool.
▪ The voice of Normal Bank is registered into the user normal banks 1-9 (up to 9 banks).
▪ The voice of Drum Bank is registered into the user drum banks 1-8 (up to 8 banks).
When you want to select grayout bank, set it up once again after removing all checks from the bank which are already set up.

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3.   By clicking "*Open*", the voice list is registered.

【**Note**】 Since the type of voice parameter differs between MA-2 and MA-3 slightly, make sure to set the voice parameter once again as necessary after "*Import Voice List*" is performed.

4.3.2. Edit

Figure. 4-6   Edit Menu

No.	Function Name	Contents
1	Undo	Disable the last performed copy-operation, and undo to the previous state.
2	Redo	Repeats a same process as one performed immediately before and executes.
3	Copy	Copies the selected contents. When nothing is selected, it is displayed by gray color.
4	Paste	Pastes the copied contents.
5	Import from Voice List…	Imports voices from Voice List to Voice Assign Map in block.
6	Export to Voice List…	Exports voices from Voice Assign Map to Voice List in block.

4.3.3. View

Each bar is displayed and/or hidden from Application Window by left clicking on the name of each bar to place/replace a check mark.
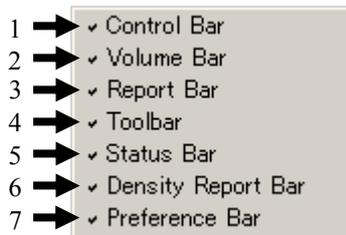
Figure. 4-7   View Menu

No.	Function Name	Contents
1	Control Bar	Switches a display/non-display of Control Bar. (For details, see "4.4Control Bar")
2	Volume Bar	Switches a display/non-display of Volume Bar. (For details, see "4.5Volume Bar")
3	Report Bar	Switches a display/non-display of Report Bar. (For details, see "4.6Report Bar")
4	Tool Bar	Switches a display/non-display of Toolbar. (For details, see "4.7Tool Bar")
5	Status Bar	Switches a display/non-display of Status Bar. (For details, see "4.10Status Bar")
6	Density Report Bar	Switches a display/non-display of Density Report Bar. (For details, see "4.9Density Report Bar")
7	Preference Bar	Switches a display/non-display of Preference Bar. (For details, see "4.8Preference Bar")

4.3.4. Window

In Window menu, display/non-display arrangement of each window can be controlled. By placing a check on the name of each window, windows are opened on Application Window.
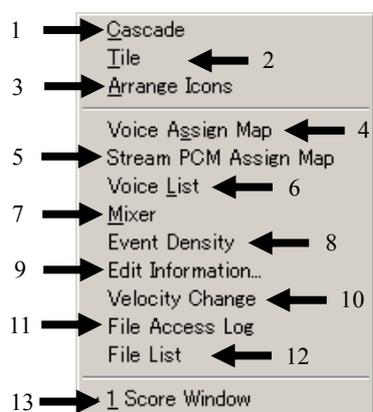
Figure. 4-8   Window Menu

No.	Function Name	Contents
1	Cascade	Displays windows in piles.
2	Title	Displays windows in a line.
3	Arrange Icons	Arranges the minimized windows on the bottom of "Application Window."
4	Voice Assign Map	Displays Voice Assign Map. (For details, see "4.11.5Voice Assign Map.")
5	Stream PCM Assign Map	Displays Stream PCM assign map. (For details, see"0 Stream PCM Assign Map.")
6	Voice List	Displays Voice list. (For details, see "4.11.4Voice List Window.")
7	Mixer	Displays Mixer Window. (For details, see "4.11.7Mixer.")
8	Event Density	Displays Event Density window (For details, see "4.11.8Event Density.")
9	Edit Information	Displays management information dialog. (For details, see "4.11.10Edit Information.")
10	Velocity Change	Displays Velocity Change dialog. (For details, see "4.11.9Velocity Change.")
11	File Access Log	Displays File Access Log window. (For details, see "4.11.11File Access Log.")
12	File List	Displays MLD File List window. (For details, see "4.11.1File List Window.")
13	List of Windows	Lists the windows currently opened in Application Window. In addition, a window currently active is shown with checked mark as shown like in figure. Moreover, the selected window will become an active condition if optional windows are chosen from a list.

4.3.5. Option

This is a menu which can check and set up the environment of basic operation or the contents data information on an Authoring Tool.
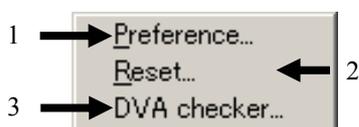
Figure. 4-9 Option Menu

No.	Function Name	Contents
1	Preference	Opens preference dialog. (For details, see "4.11.12Preference Window.")
2	Reset	This function is not available.
3	DVA Checker	DVA checker window is opened, and then the maximum number of the pronunciation in the data can be checked. (For details, see "4.11.13DVA Checker.")

4.3.6. Help

This is a menu for supporting a user.

Figure. 4-10 Help Menu

No.	Function Name	Contents
1	Authoring Tool Help…	Displays "*MA-3 Authoring Tool User's Manual.*"
2	about MA-3 Authoring Tool	Displays "*about MA-3 Authoring Tool.*" (For details, see "4.11.14about Authoring Tool.")
3	MLD Official Website (Japanese)	URL *http://smaf-yamaha.com/what/other4.html*

4.4. Control Bar

Control Bar is a functional group to display or control the contents of data. A series of operation from playback to stop of data can be performed by checking the musical piece data. Descriptions about each functions, see the following table.
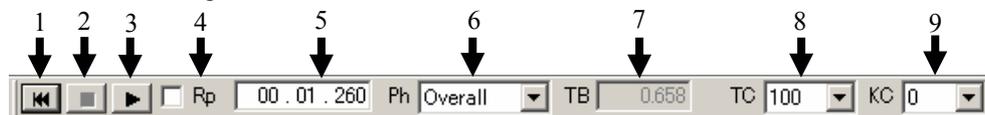
Figure. 4-11   Control bar

No.	Function Name	Contents
1	Rewind	Playback bar is moved to the head of music.
2	Stop	Playback of music is stopped.
3	Play	Playback of music is started.
4	Repeat (Rp)	Repeat is specified.
5	Playback Position Indicator	Playback position is displayed. Arbitrary values can be input directly. Display unit is "*ms.*"
6	Phrase List (PL)	Select a phrase list to be an object for playback. Change of playback mode is available. When "*Overall*" is selected, a music is played from head to end, and if Partial is selected, a music only a section specified by marker is played. For details about the specification of marker, see "***Contents Authoring Guideline For MA-3 Authoring System***."
7	TimeBase (TB)	Time base is displayed.
8	Tempo Control (TC)	Tempo control is displayed. Tempo value set in the read data is possible to be changed and played back by 70% - 130% of a rate.
9	Key Control (KC)	Displays the key control, which can be changed from +12 to -12. Only the channel which uses the tone of a normal bank receives key control. The channel which uses the tone of a drum bank does not receive key control.

【Note】 The Repeat setup, Playback mode change of Phrase List, Tempo Control Setup, and Key Control setup becomes valid only when Authoring tool is used, and does not reflect to MLD files. Time base is displayed per 1Tick in (*ms*) unit.

4.5. Volume Bar

Volume bar is a function to set the playback volume, speed, height of key, etc. of musical pieces in MA-3 Authoring Tool.

Figure. 4-12   Volume Bar

No.	Function Name	Contents
1	MV (Master Volume)	Displays the maximum value of Master volume which was input in music. When the master volume of data to input is not defined, the master volume is automatically set to "100."

【Note】 Be sure to set up the Master volume to SMF. If Master volume is not defined, a playback volume by sequencer and a playback volume by Authoring Tool may differ.

4.6. Report Bar

This bar displays the total RAM size in music which was provisionally calculated by Native Format Level. The unit is "***Byte***."

1

RS[B]:

Figure. 4-13   Report Bar

No.	Function Name	Contents
1	RS (RAM Size)	Total RAM Size in music is displayed by byte unit.

RAM Size Check Timing
When "***OK***" button of VoiceEdit dialog is clicked.
In case of SMF Import
In case of SMF Reload
In case of Voice Paste to VoiceAssignMap
In case of import from Voice List
When "***OK***" of Preference is selected.
When Reserve setting in Piano Roll/Stream PCM Edit View are changed.

4.6.1. About RAM Size

Since MA-3 RAM size is 8176 bytes, musical pieces of which data size exceeds the capacity cannot be played back. MA-3 Authoring Tool calculates the RAM size used as the musical pieces, and if the value exceeds 8176 bytes, an error message is output. The size calculation is found by summing the followings.

Size List	
Voice Parameter Registration	FM2op : 16 byte / 1 tone FM4op: 30 byte / 1 tone PCM : 14 byte / 1 tone
PCM Voice Waveform Registration	Byte size of data section (1 byte will be added if it is odd number.) / 1 Waveform
FM Basic Waveform Registration	2048 bytes / 1 Waveform
Stream PCM Waveform Registration	• When not used (No Reserved) / 0 byte • When max. number of pronunciation is "1" (1 Voice Reserved) /1024 bytes • When max. number of pronunciation is "2" (2 Voices Reserved) /2048 bytes

4.7. Tool Bar

This bar contains a series of functions which are provided in File Menu, Edit Menu, etc.
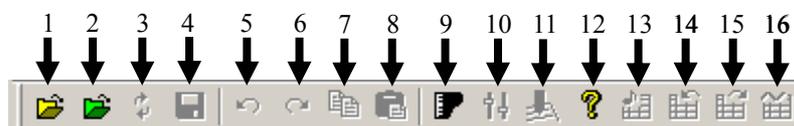
Figure. 4-14   Tool Bar

No.	Function Name	Contents
1	Open (Add File List)	Registers a MLD file into file list. Opens the MLD file *(*.mld)*
2	Import from SMF	Imports a SMF *(*.mid)*. Refer to the following "*Note*."
3	Reload from SMF	Reloads a SMF *(*.mid)*.
4	Save	Saves a MLD file *(*.mld)*.
5	Undo	Voice data paste is undone.
6	Redo	Voice data paste is redone.
7	Copy	Copies a voice data.
8	Paste	Pastes a voice data.
9	Voice List	Displays the Voice List Window. (For details, see "4.11.4Voice List Window.")
10	Mixer	Displays the Mixer Window. (For details, see "4.11.7Mixer.")
11	Information	Displays the Information Window. (For details, see "4.11.10Edit Information.")
12	Help	Opens the "*MA-3 Authoring Tool User's Manual*."
13	Voice Assign Map	Displays the Voice Assign Map. For details, see "4.11.5Voice Assign Map.")
14	Import from Voice List	Imports voices with the same bank number and the same voice number to the voice list in the Voice Assign Map.
15	Export to Voice list	Exports voices with the same bank number and the same voice number from the voice list in the Voice Assign Map.
16	Stream PCM Assign Map	Displays Stream PCM Assign Map. (For details, see "0 Stream PCM Assign Map.")

【Note】 It supports to the reading of "*SMF Format 0*" and "*SMF Format 1*."

4.8. Preference Bar

This is a dialog bar to set the MA-3 Authoring Tool operational environment.
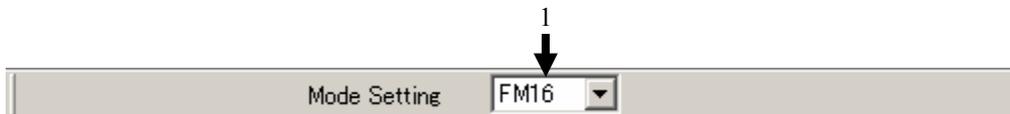
Figure. 4-15   Preference Bar

No.	Name	Description	
1	Mode	Change FM-mode When music is read into Authoring Tool, FM mode can not be changed. In the case, be sure to close the music data once, and then set FM mode.	
		FM16 Mode	This is a mode which can use 2-operator mode/4-operator mode voice and PCM voice.
		FM32 Mode	This is a mode which can use 2-operator mode voice and PCM voice.

4.9. Density Report Bar

This bar shows the event density information in music data.

Figure. 4-16   Event Density Report Bar

No.	Name	Description
1	AD (Average Density)	Converts the event density in the read music, which put through one music, to MIDI byte numbers; and then, it is displayed. The unit is "*Byte/sec*." (One musical note is counted as 6-Byte.)
2	MD (Max Density)	Displays the event density per unit, which is the highest in one music. The unit is "*Byte/sec*."
3	MDP (Max Density Position)	Displays the position which has the highest event density in music. The unit is "*ms*."

4.9.1. Calculation Method of Evnet Density

The size consumed by MIDI event is differed. When an error comes out by event density, it is necessary to cut the event in reference to "*4.11.8Event Density"*).

The number of consumption bytes of a MIDI event	
Note Event	6Byte
Control Chan	3Byte
Program Change	2Byte
Pitch bend	3Byte
Exclusive Message	Bytes number in Data Section + 2 (F0, F7)Byte

4.10. Status Bar

This bar shows the status information of contents.

Figure. 4-17   Status Bar

No.	Name	Description
1	Status Display	Displays the simple explanation about each buttons and functions in the position where the mouse is pointing. When nothing is pointed out, it shows "*Ready*."
2	TL (Total Length)	Displays the "*Actual Playing Total Time (end position)*" in the read music. The unit is "*ms.*" The actual playing total time is the time from Start Point to Stop Point. The end position is displayed with Tick count from the head.
3	SZ (Size)	Displays the size of MLD when file is saved in MLD format (*.mld*), or when MLD is read.

4.11. Description of each Windows

This chapter describes the names and functions of each window provided in MA-3 Authoring Tool.

4.11.1. File List Window

MLD files are displayed as a list.
MLD files are read into "*File List Window*."
Simple playback will be performed if "*Play*" button is pressed in the state which the list is selected.
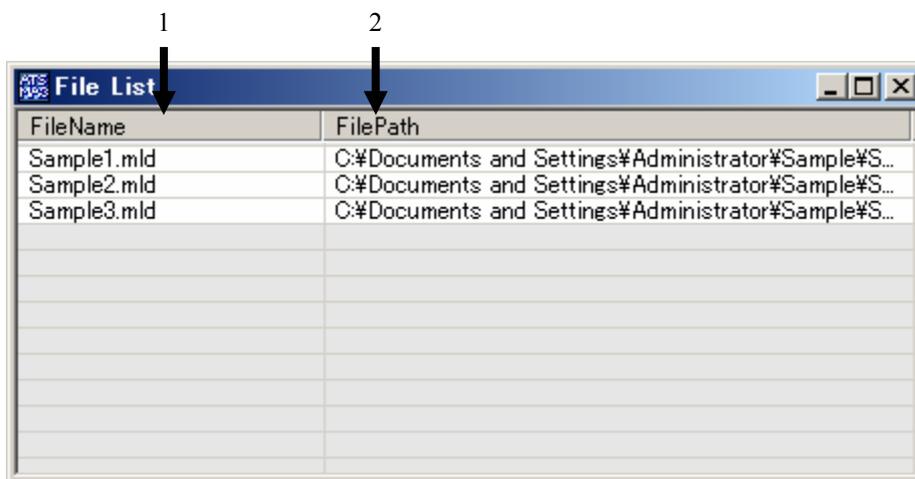
Figure. 4-18   File List Window

No.	Function Name	Contents
1	File Name	Displays the file name of loaded MLD file.
2	File Path	Displays the file pass of loaded MLD file.

4.11.2. Score Window

Score Window is a window to display the data content of read SMF (*.mid*) or MLD File (*.mld*).
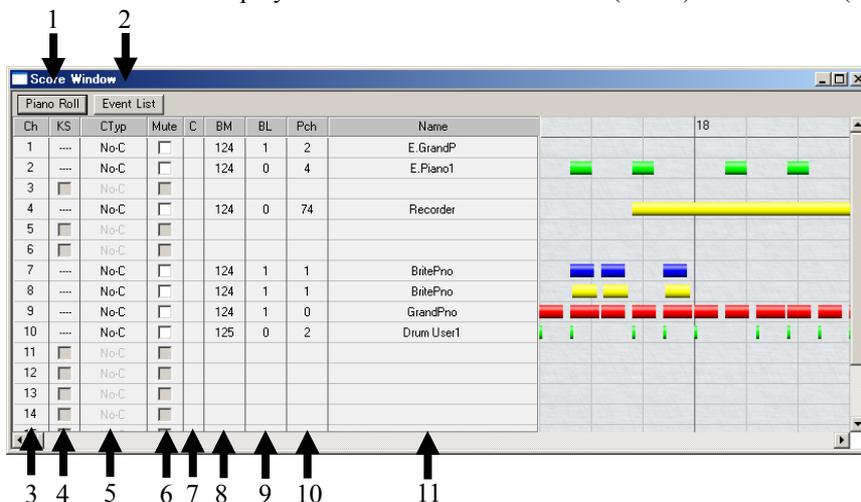
Figure. 4-19   Score Window

No.	Function Name	Contents
1	Piano Roll	Displays the contents read into the Score Window on Piano Roll Window.
2	Event List	Displays the data read into the Score Window on Event List Window.
3	CH	Shows channel numbers.
4	KS (Key Control Status)	When Key Control is set up, specification of whether KeyControl is performed or not to the applicable channel is determined. By placing a check in the box, KeyControl becomes effective. In addition, in channels which use a voice of Normal bank (KS box is marked as "--"(default")), KeyControl is valid. Conversely, in channels which use a voice of Drum bank, KeyControl is invalid.
5	Ctyp (Channel Type)	Designates Channel Type for applicable channel. Clicking on the column of Ctyp of each channel changes the content as No-C, Melo, No-M and Ryh in this order.
6	Mute	Mutes the channel by placing a check in the relevant channel. It is not reflected to MLD file.
7	C (Change Flag)	If the result shows difference when compared with voices that has the same bank number and voice number in the Voice List, a blue circle is displayed. When any of voices, which are different from the voice list in the relevant channel, exists, a blue circle is displayed.
8	BM (Bank Select MSB)	Displays BankSelect MSB at the top of voice.
9	BL (Bank Select LSB)	Displays BankSelect LSB at the top of voice.
10	Pch (Program Change)	Displays program change number at the top of voice.
11	Name	Displays name of voice at the top of voice. When a voice name is double-clicked, Voice Edit window will open. (Voice Edit window of built-in ROM voices cannot be opened.)

4.11.2.1.Piano Roll Window

Displays the contents read into the Score Window on Piano Roll Window.
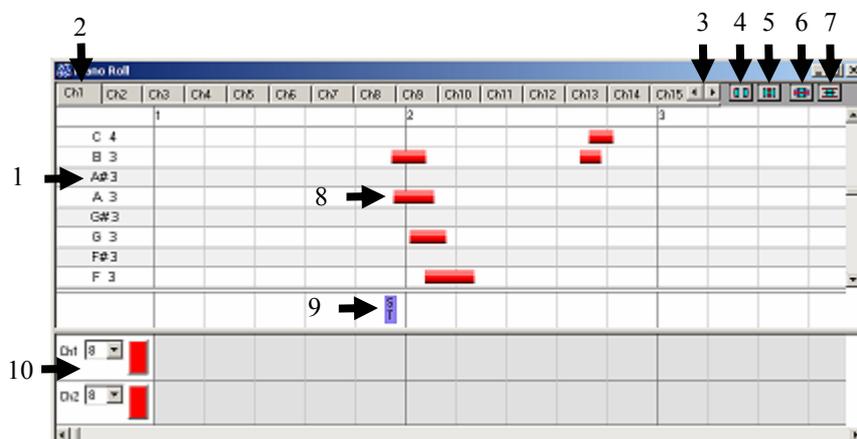
Figure. 4-20   Piano Roll Window

No.	Function Name	Contents
1	Interval Display	Displays the intervals of Piano Roll window.
2	[Ch1~16] and [All] part tabs	By clicking each tab, a part to display on Piano Roll window can be changed.
3	Scroll buttons	A part tab scrolls from side to side. Un-displayed part tab can be displayed.
4	Horizontal zoom-in button	By clicking, the display size of window can be enlarged horizontally.
5	Horizontal zoom-out button	By clicking, the display size of window can be decreased horizontally.
6	Vertical zoom-in button	By clicking, the display size of window can be enlarged vertically.
7	Vertical zoom-out button	By clicking, the display size of window can be decreased vertically.
8	Note bar	Displays intervals and gate time of each MIDI note.
9	Controller display	Displays control change or pitch bend that are inputted in each part.
10	Stream PCM Edit View	Assign of Stream PCM can be performed.

StreamPCM (WAVE → MLD) Conversion Procedure

1. Load a SMF which has no Midi-event or includes a note for Stream.
   *note for Stream (BANK/MSB125-Note Number 0 to 12, 92 to 110)
2. Open the PianoRoll Window. The following windows are opened.
   *When note for Stream is contained in SMF, WAVEID which corresponds to the note number is automatically displayed.
3. Register the WAVE Data of which a sampling frequency was optimized beforehand into StreamPCM Assign Map. Or load the existing StreamPCM File (*.sm3).
   *When a note for Stream is attached to SMF, be sure to register a WAVE corresponding to note number/WAVEID.
4. If Stream is newly added into music, Drag&Drop method shown blow can be used to assign.

Stream PCM Edit View is a window to assign a Stream PCM to MLD.
Since the maximum pronunciation of Stream PCM is two tones, it is divided into two levels (Upper/Lower).
By dragging and dropping from Stream PCM Map to here, it becomes assignable.
For details about how to assign the Stream PCM, see "0
Stream PCM Assign Map."
By double-clicking the Stream truck, velocity conversion of Stream truck is possible; in addition, by right-clicking, Stream truck can be deleted. Moreover, displacement of position (***Drag***) and change of length (***Drag adjustment***) can be executable.

StreamPCM Assign Map

Drag & Drop

Piano Roll Window
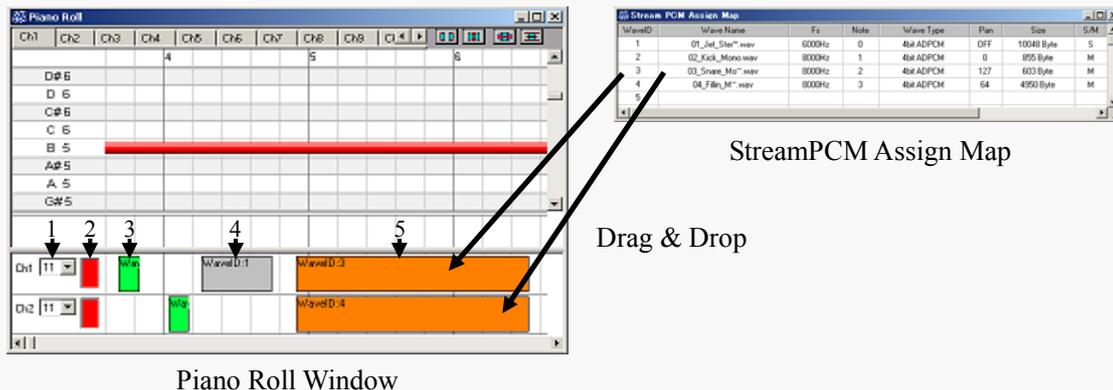
No.	Name	Description
1	Ch	The channel which inserts a Stream PCM event is selected. From newer to older, the number in channel without events is initial-displayed.
2	Stream PCM Reserve Button	Sets the reserved number of Stream PCM. According to the reserved numbers, the amount of RAM consumption will be changed. Please refer to "4.6.1 About RAM Size" for details.
3	Stream PCM Track (Mono)	It is the Stream PCM track of monophonic pronunciation. It is displayed in yellow-green.
4	Stream PCM Track (Not Assigned)	It is the Stream PCM track with which only the stream event exists and a voice is not assigned. It is indicated in gray.
5	Audio Bar	WaveID of a StreamPCM event is shown. In the case of a monophonic, it is displayed in yellow-green; in addition, in the case of stereo, it is displayed in orange.

4.11.3. Event List Window

Displays the contents read into Score window to Event List window.
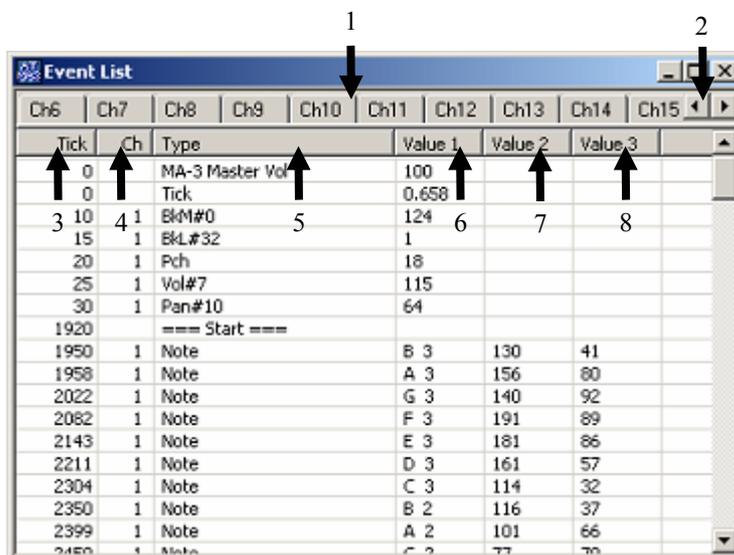
Figure. 4-21   Event List Window

No.	Function Name	Contents
1	[Ch1~16], [Stream PCM] and [All] part tabs	By clicking each tab, a part displayed on the "*Event List Window*" can be changed.
2	Scroll buttons	Part tab is scrolled left or right by pressing this button. Part tab that is not displayed can be displayed.
3	Tick (Location)	Displays a location of each event by using the unit of Tick.
4	Ch (Channel)	Displays a channel of each event.
5	Type	Displays the type of each event.
6	Value1	"*Control Change*"…Displays a data value. "*Pitch Bend*"…Displays a pitch bend value. "*Note*"…Displays a note number. "*Stream PCM*"…Displays a WaveID.
7	Value2	"*Note*"…Displays game time of note. "*Stream PCM*"…Displays gate time of Stream PCM.
8	Value3	"*Note*"…Displays velocity of note. "*Stream PCM*"…Displays velocity of Stream PCM.

4.11.4. Voice List Window

Display the voice map.
When SMF is loaded, relevant voices of Voice List are assigned as MLD voice.
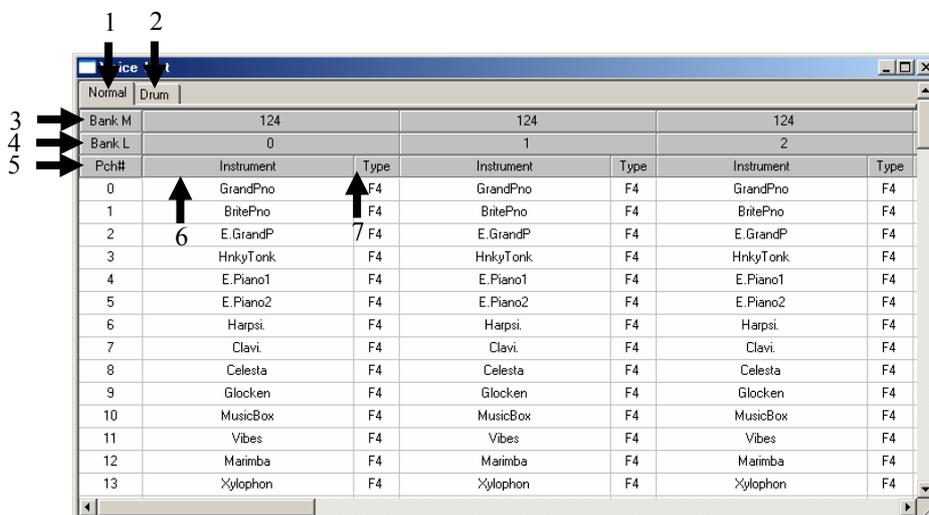
Figure. 4-22   Voice List Window

No.	Function Name	Contents
1	Normal	Displays normal voices.
2	Drum	Displays drum voices.
3	Bank M	Displays BankSelect MSB.
4	BankL	Displays the types of used voices. In case of drum voice, it becomes "***Pch#***" display.
5	Pch#	Displays voice numbers. In case of drum voice, it becomes "***Note#***" display.
6	Instrument	Displays voice names. When voice name is double-clicked, Voice Edit window is opened.
7	Type	Displays operator that is used. F4: 4 operators setting / F2: 2 operators setting / P: PCM setting

【Note】 By "***Import from Voice***" button in tool bar, import of voice from Voice list to Voice Assign Map is possible, in addition, by "***Export from Voice***" button, export of voice from Voice Assign Map to Voice list is possible.

【Note】 In normal voice list, voice names and voice types corresponding to program numbers of each Bank are displayed, and in drum voice list, voice names and voice types corresponding to note numbers of each program are displayed.

【Note】 Each voice can be changed and be saved by Bank unit. For details about the save of voice list, see "***4.12.3   Save of Voice List***."

4.11.4.1. Voice List Right Click Menu

By right-clicking the "***Bank M***", a pop-up menu is displayed.
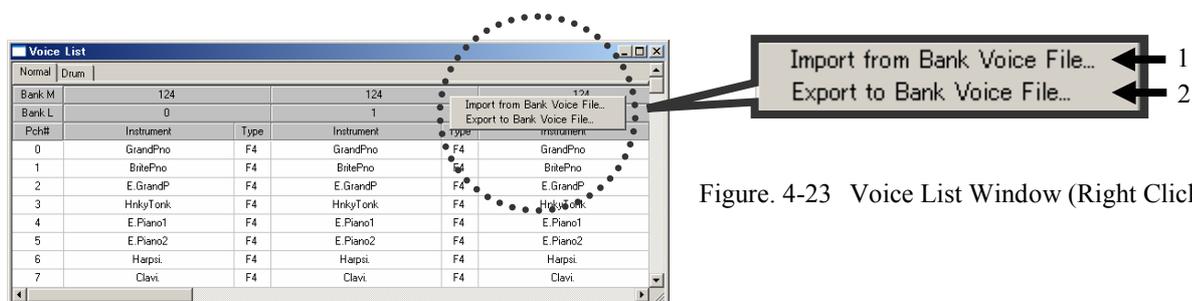
Figure. 4-23   Voice List Window (Right Click Menu)

No.	Function Name	Contents
1	Import from Bank Voice…	Saves voice by Bank unit. For details, see "4.12.3.2 Saving by Bank."
2	Export from Bank Voice	Loads voice by Bank unit. For detail, see "4.12.4.2 Load of bank unit."

4.11.5. Voice Assign Map

Display voices which are used by each channel per channels.
Voices up to 128 including all channels can be displayed. (Data which uses more than 128 voices cannot be read.)

【Note】 Voices that use voices of built-in ROM are displayed in blue. (For details about build-in ROM voices, see "*5.2.7 MA-3GM Level1 Normal Voice MAP (built-in ROM Mode)* and "*5.2.8 MA-3 GM level Drum Instrument (built-in ROM mode)*".
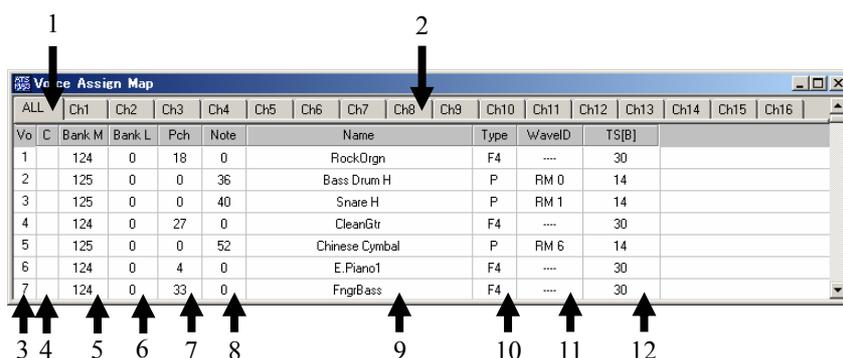
Figure. 4-24   Voice Assign Map Window

No.	Function name	Contents
1	ALL	Displays all used voices.
2	Ch1~Ch16	Displays the used voices per channels.
3	Vo.	Displays the number of used voices.
4	C (Change Flag)	When comparing the bank number of same voice list and voice of same voice number, and if the result is different, a blue circle is displayed.
5	Bank M (Bank Select MSB)	Displays BankSelect MSB.
6	Bank L (Bank Select LSB)	Displays BankSelect LSB.
7	Pch	Displays program change number.
8	Note	Displays note number.
9	Name	Displays voice name. When a voice name is double-clicked, Voice Edit window will be opened. (Voice Edit window of built-in ROM voices cannot be opened.)
10	Type	Displays voice type to use. F4: 4 operators setting, F2: 2 operators setting, P: PCM setting.
11	WaveID	When used voice PCM and RAM voice is used, its WaveID is displayed. When using Drum voice "*RM*" of ROM, "*RM0~6*" is displayed.
12	TS[B] (Total Size)	RAM size for used voice is displayed. The unit is "*Byte*." For details about RAM size, see "4.6.1 About RAM Size"

4.11.5.1. Voice Copy/Paste Function

By right-clicking the voice name of Voice Assign Map, "***Voice data Copy/Paste***" function menu is displayed.

【Note】 For details about the explanations of voice data Copy/Paste, see "Individual Assignment of Voice Data."

Figure. 4-25 Copy & Paste Function
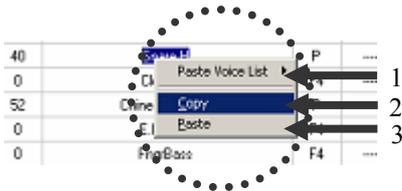
No.	Function name	Contents
1	Paste Voice List	Displays the contents of Voice List. For details, see the following figure.
2	Copy	Voices can be copied.
3	Paste	Voice can be pasted.

The voice assignment method to MLD can also select and assign a voice from "***Paste Voice List***" of Voice Assign Map besides copy & paste of Voice List to Voice Assign Map.

It is possible to change a voice by choosing Paste Voice List, and following and choosing a voice from the menu displayed by carrying out the right click of the voice name changing.
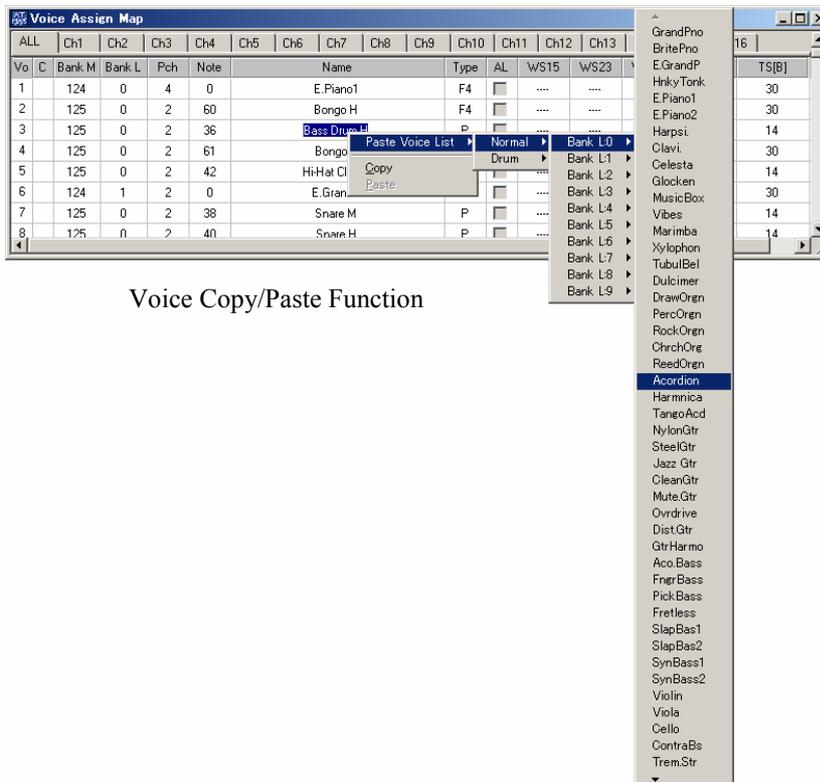
Voice Copy/Paste Function

4.11.5.2. Voice Assign Map Right-click Menu

By right-clicking on a status such as "***Bank M***", the Voice Assign Map right-click menu will appear.
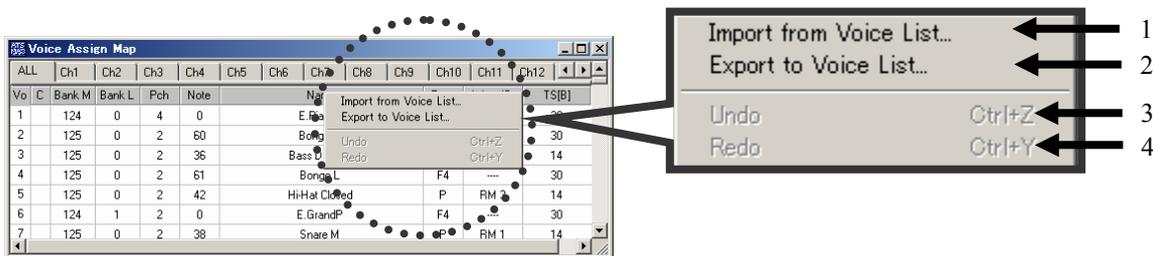
Figure. 4-26   Voice Assign Map (Right Click Menu)

No.	Function Name	Contents
1	Import from Voice List	Voice, which has the same voice number and same bank number in the Voice List, is imported into Voice Assign Map. In addition, the same operation can be performed same operation with "***Import from Voice List***" in a tool bar. For details, see "4.12.2.1 Simultaneous Assignment of Voice Data."
2	Export to Voice List	Voice, which has the same voice number and the same bank number in the Voice List, is exported from Voice Assign Map. In addition, the same operation can be performed with "***Export to Voice List***" in a tool bar. For details, see "4.12.2.1 Simultaneous Assignment of Voice Data".
3	Undo	Makes the last copy operation for voice invalid and returns it into the previous state.
4	Redo	Repeats the same process as the last performed process.

4.11.6. Stream PCM Assign Map

Stream PCM is assignable.
Stream PCM can be registered the maximum of 32 waves, and can be simultaneously pronounced to two sound.
(The number of simultaneous pronunciation at the time of use is one tone about a Stereo wave.)
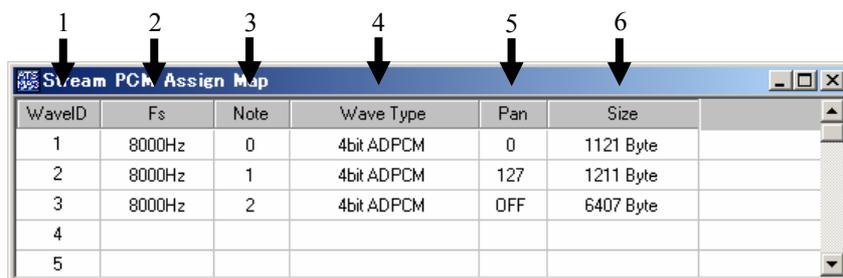
Figure. 4-27   StreamPCM Assign Map

No.	Function Name	Contents
1	WaveID	Displays wave ID. Corresponds to Note number. Up to 32 waves can be registered.
2	Fs	Displays the frequency of wave.
3	Note	Displays note numbers. (0 to 12 and 92 to 110)
4	Wave Type	Displays wave type.
5	Pan	Displays pan of Wave.
6	Size	Displays the size of the read wave data.

4.11.6.1. About Note to which a Stream PCM can be assigned

In order to register a Stream PCM event into SMF, it is necessary to set up by Bank Select, Program Change, or Note number beforehand, in other words, assigns by Stream PCM Edit Window of Piano Roll.

The bank selection of the note which can be used as a Stream PCM, a program change (an arbitrary value needs to be program changed for decision of a bank selection), and the note number are as follows.

Bank MSB	Note number	Definition	
125	0	Stream PCM	WaveID:1
	1		WaveID:2
	:		WaveID:X
	12		WaveID:13
	13	Drum Channel	
	14		
	:		
	91		
	92	Stream PCM	WaveID:14
	93		WaveID:15
	:		WaveID:X
	110		WaveID:17

【Note】　For details, see "*Contents Authoring Guideline*."

4.11.6.2. Sound File which can be registered as Stream PCM

In MA-3 authoring tool, it is possible to convert a sound file as an encoding-processed (*compressed*) StreamPCM and to register it to MLD, so that a channel sequence and a sound file (*AIFF/WAVE*) can be played synchronously on MLD. Stream PCM can be registered up to 32 kinds and can pronounce up to 2 sounds simultaneously.

Sound file to load			Stream PCM
Bit rate	Sampling frequency	Format	Compressing method
16Bit	4KHz to 16KHz	AIFF/WAVE Monophonic	4Bit ADPCM

【Note】　Stereophonic sound file can not be registered.

4.11.6.3.Stream PCM Assign Map New／Delete Menu

By right-clicking the Stream PCM Assign Map window, "***New/Delete***" menu is displayed. In addition, it makes possible to perform the registration and delete of sound files.
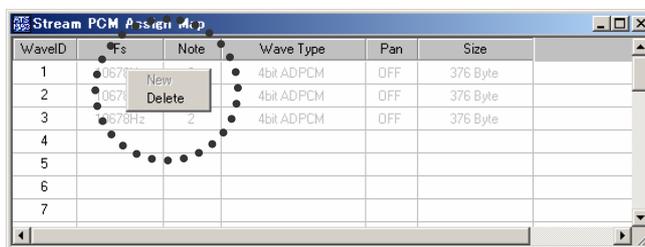
Figure. 4-28   StreamPCM Assign Map   (New/Delete)

【Note】 For details about the Fs of a file which can be loaded as Stream PCM and encoding system which can be selected, refer to "***4.11.6.2 Sound File which can be registered as Stream PCM***."

4.11.6.4.Stream PCM Wave Panpot

By double-clicking the pan-display column, "***Stream PCM Wave Panpot***" dialog opens and the panpot can be set.
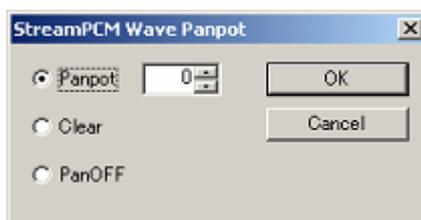
Figure. 4-29   Stream PCM Wave Panpot

【Note】 For details about the "***StreamPCM Wave PanpotClear***" and "***StreamPCM Wave Panpot PanOFF***", refer to "***Contents Authoring Guideline***."

4.11.6.5.Stream PCM Assign Map Right-click menu

By right-clicking on the status such as "**WaveID**" or "**Fs**", a pop-up menu is displayed.
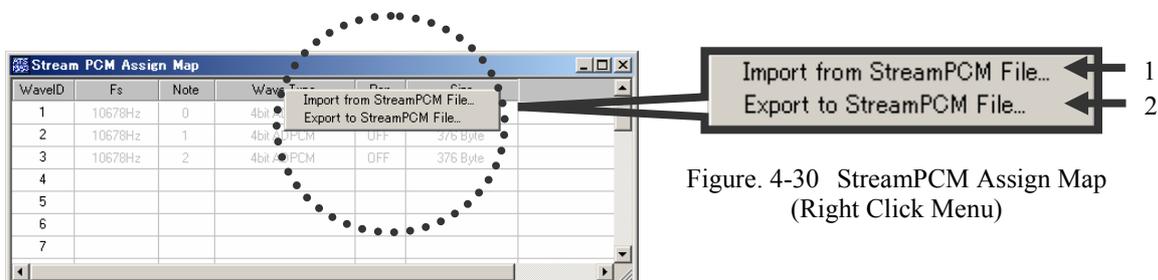
Figure. 4-30   StreamPCM Assign Map
(Right Click Menu)

No.	Function name	Contents
1	Import from Stream PCM File	Waveform data can be read from Stream PCM File that has been saved in Export to Stream PCM File.
2	Export to Stream PCM File	All waveform data registered in Stream PCM Assign Map can be saved in StreamPCM File. (extension is "*.sm3*")

4.11.7. Mixer

The playback balance of each channel can be kept. (The balance cannot be changed during a playback of data.)
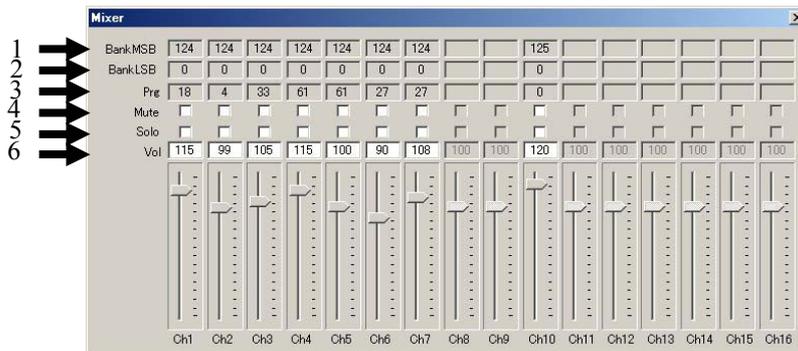
Figure. 4-31 Mixer Window

No.	Function name	Contents
1	Bank MSB (Bank Select MSB)	Displays BankSelect MSB.
2	Bank LSB (Bank Select LSB)	Displays BankSelect LSB.
3	Prg (Program)	Displays program number.
4	Mute	Mutes a relevant channel. This is not reflected on the music data (***MLD***).
5	Solo	Plays a relevant channel with solo. This is not reflected on the music data (***MLD***).
6	Vol	Displays a volume value.

4.11.8. Event Density

Converts the event density to the MIDI byte counts in the read music and displays it.
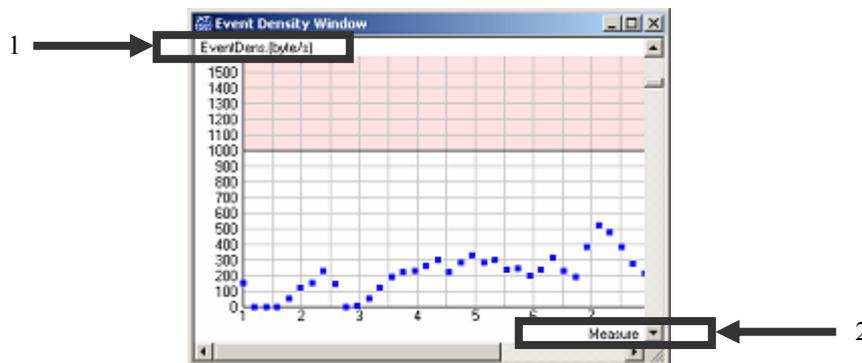
Figure. 4-32   Event Density

No.	Function name	Contents
1	Event Density [byte/s]	Displays event density. The unit time used as criteria when converting an event density can be set up by preference.
2	Measure/Time [Sec]	Displays time. •·In case of SMF import : Measure (*beat unit*) is displayed. • In case of MLD Open : Time "*sec*" is displayed.

4.11.9. Velocity Change

Velocity of Note event in read music can be changed.
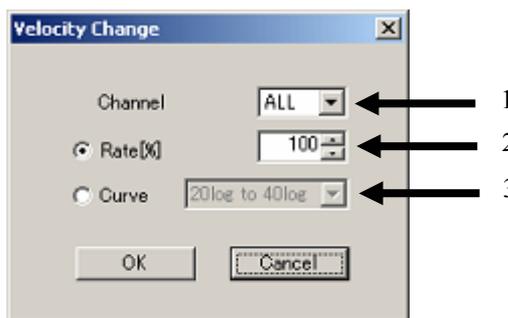
Figure. 4-33   Velocity Change Dialog

No.	Function name	Contents
1	Channel	Designates the channel to change its velocity. 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16 channel, STM) can be designated.
2	Rate [%]	Designates the change rate of velocity value 50 ~ 200%. When you input a value directly, be sure to push "*Enter*" key after input.
3	Curve	Designates the curve which changes a velocity. There are 2 kinds of curves "*20logto40log*" and "*40logto20log.*"

4.11.10. Edit Information

Information can be input / edited.
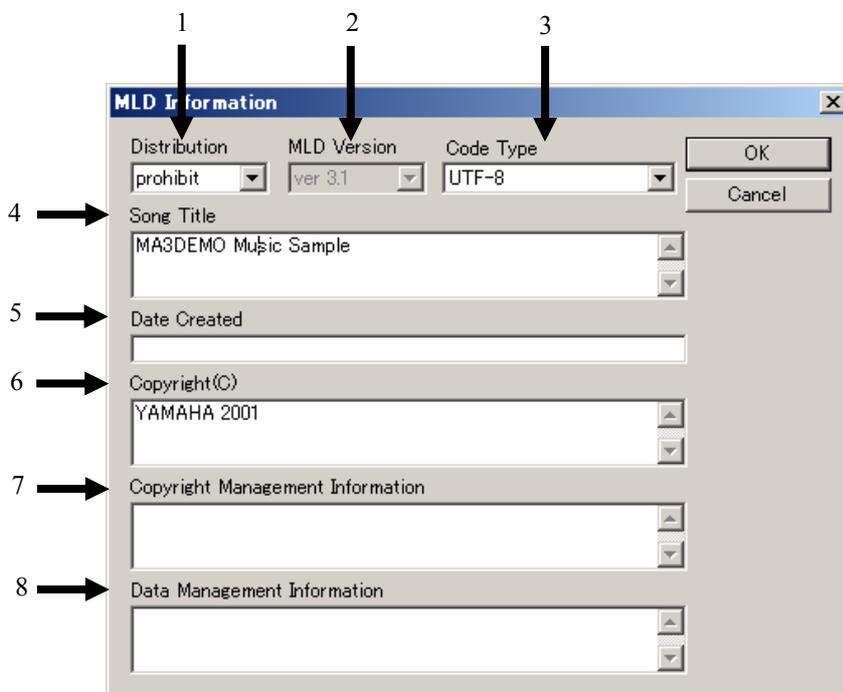
Figure. 4-34   Edit Information

No.	Function name	Contents
1	Distribute	Sets up allow/prohibit of re-distribution.
2	MLD Version	Displays the version information.
3	Code Type	Sets up the code type. UTF-8… Convert to UTF-8 and output it. ANSI… Output without a conversion.
4	Song Title	You can enter the song name here. The available character numbers are up to 50 by half size character.
5	Date Created	You can enter the creation date and time here. Be sure to type 8 half size characters here. E.g. January/15/2004 → 20040115
6	Copyright ©	Copyright can be input. The number of character which can be input is up to 255 in half-size.
7	Copyright Management Information	Copyright management information can be input. The number of character which can be input is up to 255 in half-size.
8	Data Management Information	Data management information can be input. The number of character which can be input is up to 255 in half-size. In addition, name of lyric writer can be input here.

4.11.11. File Access Log

Figure. 4-35 File Access Log

Log is displayed when operation related to the file is performed.
The performed operation and path of file are displayed.
The contents of display do not disappear until application ends.

4.11.12. Preference Window
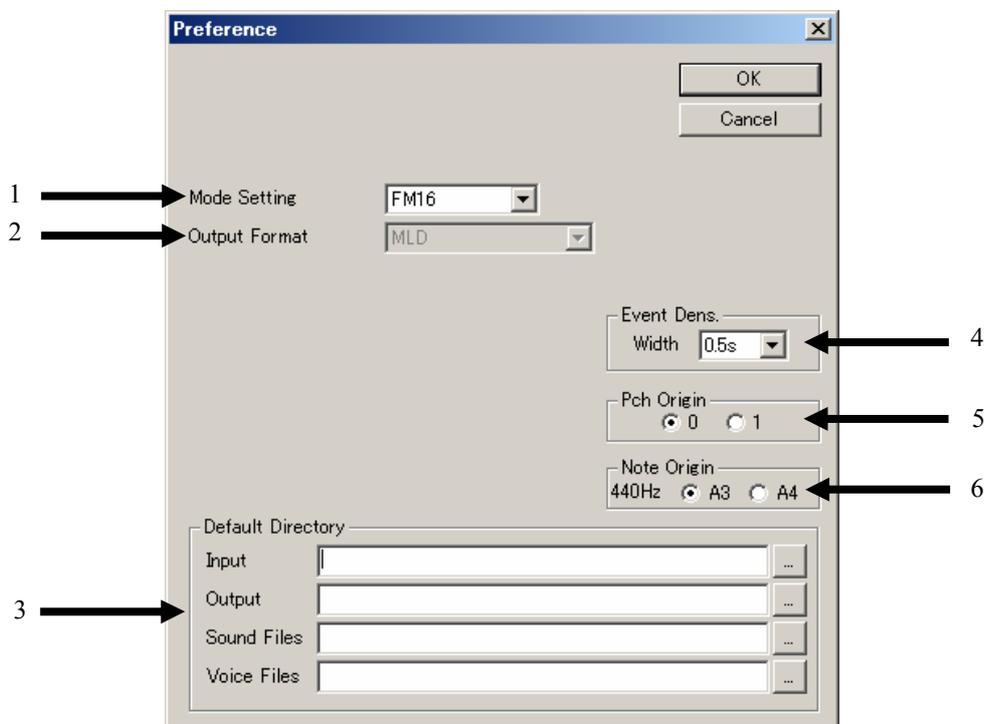
Figure. 4-36   Preference Window

No.	Function name	Contents
1	Mode Setting	Switches FM mode. When music data is read in Authoring Tool, FM mode can not be switched. So, be sure to switch to FM mode after close music data.
		FM16 Mode
		This is a mode in which can use 2-operator voice, 4-operator voice, and PCM voice.
		FM32 Mode
		This is a mode in which can use 2-oerator voice and PCM voice.
2	Output Format	Displays an output format.
3	Event Dens. Width	The unit time used as the reference at converting event density can be set up. 0. 1 Sec, 0.2 Sec, 0.5 Sec, 1.0 Sec, 1.5 Sec, or 2.0 Sec can be chosen. (Density unit is Byte/Sec=Density/Width.)
4	Pch Origin	Whether program change number starts from "0" or from "1" can be selected by selecting Pch Origin.
5	Note Origin	It can set to display Note of 440Hz as A3 or A4. The Note display of EventList and PianoRoll change, but the tone of the voice to generate does not change.
6	Default Directory	It can be set as the default directory at the time reading various files by clicking the right side button and choosing arbitrary folders.

4.11.12.1. Mode Setting & Stream PCM Reserve

There are two kinds of mode setting, "*FM16*" and "*FM32*", in addition, the maximum simultaneous pronunciation numbers in these two modes are differed.

	FM Synthesizer	PCM Synthesizer	Stream PCM
FM16 mode	16	8	2
FM32 mode	32	8	2

4.11.13. DVA Checker

This is a window to check the maximum simultaneous pronunciation numbers.
When an error occurred in the maximum simultaneous pronunciation number, it is used to pinpoint the error parts.

Figure. 4-37   DVA Checker

No.	Function name	Contents
1	Mode (Check over the Max voice)	By clicking the Check button, the position of which it exceeded the number of maximum simultaneous pronunciation in each mode (***FM32, FM16***) and its pronunciation number are checked. The value of "***Time***", "***FM***" and "***PCM***" are displayed when the result is "***Over***."
	(Check the Max Voice Number of Sequence)	By clicking the Check button, the position of the maximum simultaneous pronunciation number in data and the number of pronunciation are checked. The value of "***Time***", "***FM***" and "***PCM***" are surely displayed, it is not concerned with Result.
2	Output file	By placing a check in a box, time of which it exceeded the number of maximum simultaneous pronunciation in each mode (***FM32, FM16***) and its pronunciation number can be saved by text-file format. (***DVAChecker_result.txt***) The text file is saved in the folder which is installed in MA-3 Authoring Tool.
3	Result	Displays the result which checked the simultaneous pronunciation number. If it is not over the number of maximum simultaneous pronunciation in each mode, "***O.K.***" will be displayed. If it is over, "***Over***" will be displayed. And if the result is "***Over***", open the above text file and confirm the details, please.
4	Time	Displays the object time in "***ms***" unit.
5	FM	Displays the number of simultaneous pronunciation of FM voice.
6	PCM	Displays the number of simultaneous pronunciation of PCM voice.

4.11.14. about Authoring Tool
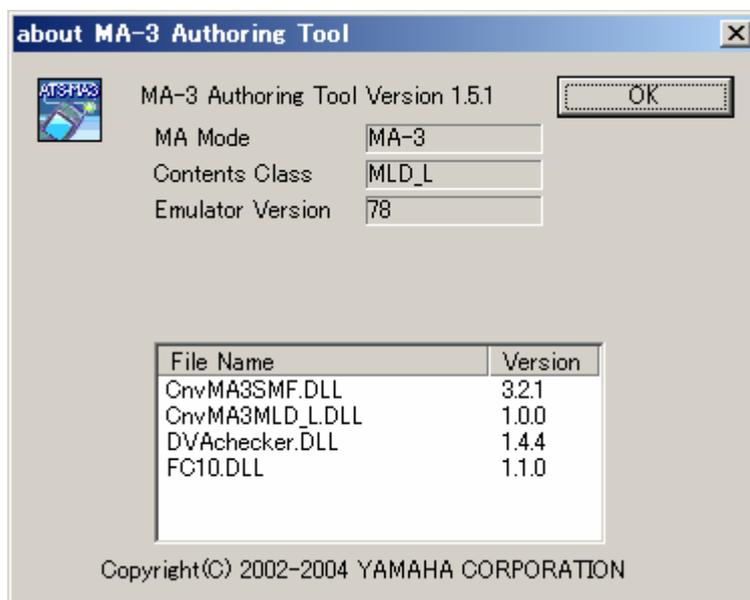
Figure. 4-38   about Authoring Tool

4.12. Voice Edit

4.12.1. About Voice Bank

This is a list of voice banks which can be used by MLD. Assigned area differs depending on a bank specified in SMF. Voice edit possible or impossible, voice, etc. differs depending on an assigned bank.

Normal Voice

Kinds of voice	Preset	User
Bank MSB	124	124
Bank LSB	0	1 to 9
Program Change	0 to 127	0 to 127
Voice Edit	Impossible	Possible

Drum Voice

Kinds of voice	Preset	Preset	User
Bank MSB	125	125	125
Bank LSB	0	1	2 to 9
Program Change	13 to 91	13 to 91	13 to 91
Voice Edit	Impossible	Impossible	Possible
Others	Mixed with PCM voice	Only FM	―

【**Note**】 For details, see "***Contents Authoring Guideline***."

4.12.2. Assignment of Voice Data

4.12.2.1.Simultaneous Assignment of Voice Data

The voices of Voice List and Voice Assign Map are imported or exported in block.

Import from Voice List

Export to Voice List
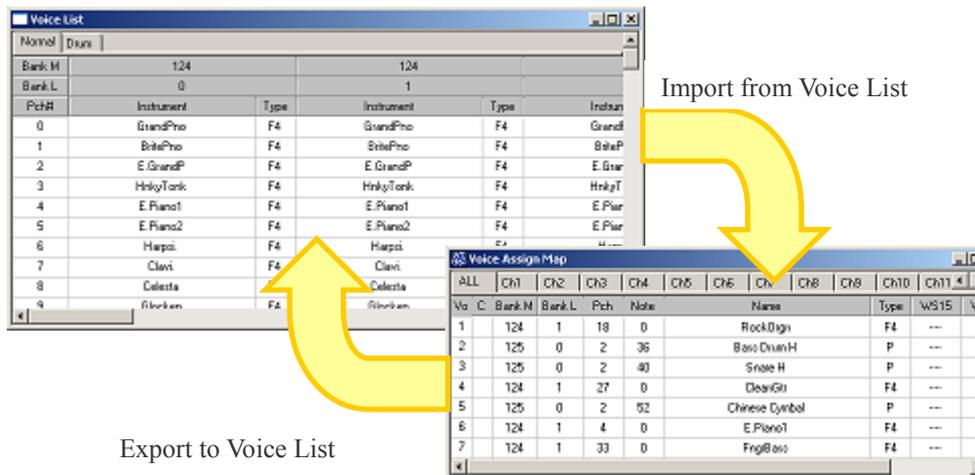
Function name	Contents
Import From Voice List	This is a Right-click menu of Voice Assign Map. Voices in the same Bank position are imported from Voice List to Voice Assign Map in block. It is effective when loading a Voice file.
Export to Voice List	This is a Right-click menu of Voice Assign Map. Voice Assign Map data is exported as voices whose Bank position is the same in VoiceList. It is effective when taking out voices from a MLD file.

4.12.2.2. Individual Assignment of Voice Data

Copy & Paste is performed between Voice List and Voice Assign Map, and voice is assigned.
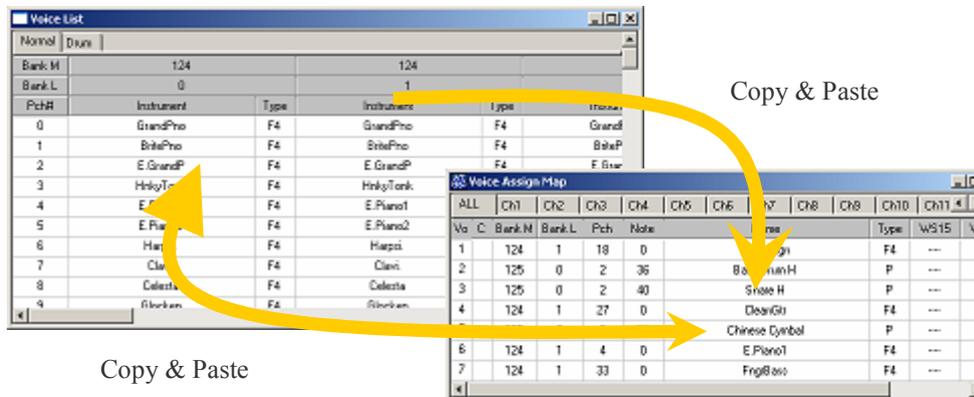
【Note】   It is possible to assign voices from "**Paste Voice List**" of Voice Assign Map. For details, refer to "**4.11.5.1 Voice Copy/Paste Function**."

4.12.3. Save of Voice List

4.12.3.1. Saving all Voices

Select "**Save MA3 Voice File**" from "**File**" menu of the menu-bar on Application Window. "**Save As**" dialog box is displayed. Enter the file name in "**File name**" (extension is "**.vm3**") and click "**Save**" button to save the data.

4.12.3.2. Saving by Bank Unit

Right-click BankMSB column of VoiceList. Select "**Export to Bank Voice**" from the popup window. "**Save As**" dialog box is displayed. Enter the file name in "**File name**" (extension is "**.vm3**") and click "**Save**" button to save the data.
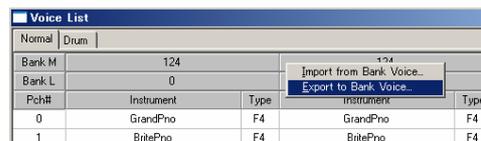
4.12.4. Loading Voice List

4.12.4.1. Loading all voices

Select "**Open MA3 Voice File**" from "**File**" menu of the menu-bar of Application Window. "**Open**" dialog box is displayed. Select the name of extension voice list file to read and click "**Open**" to open the voice list file.

4.12.4.2. Load of bank unit

Right-click BankMSB column of VoiceList. Select "**Import from Bank Voice**" from the popup window. Dialog box is displayed. Select the name of extension voice list file to read and click "**Open**" button to read the voice list file.

4.12.5. FM Voice Edit Parameters

By double clicking the user voice name, Voice Edit window is displayed.
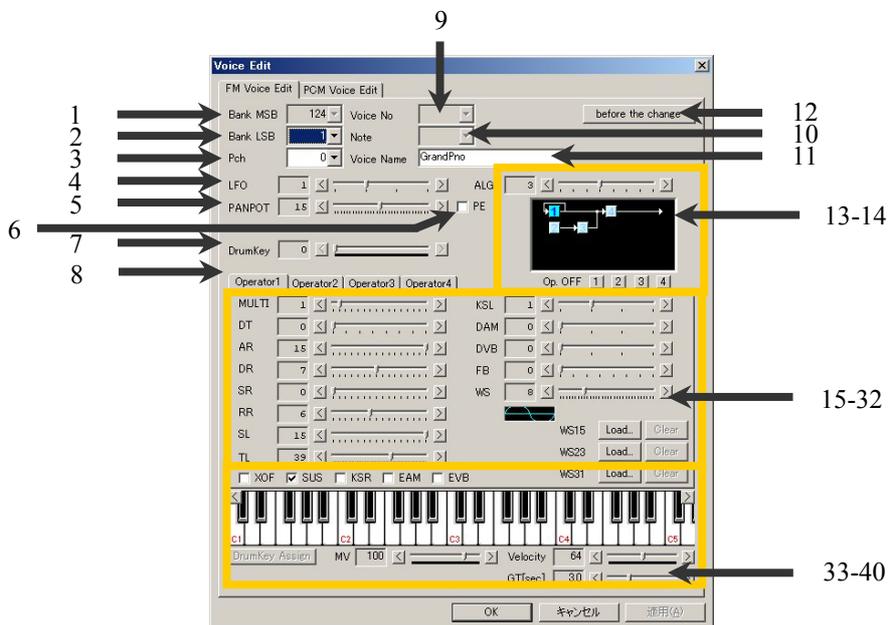
Figure. 4-39   FM Voice Edit Parameter

No. 1- 12

No.	Function name	Contents
1	Bank MSB	Displays Bank MSB in which the voices being edited exist. It cannot be changed here.
2	Bank LSB	Displays Bank LSB in which the voices being edited exist.
3	Pch	Displays/Changes the program change for the voices being edited.
4	LFO	Sets LFO frequency that is used for each voice. LFO= 0 : 1.8 Hz, LFO= 1 : 4.0 Hz, LFO= 2 : 5.9 Hz, LFO= 3 : 7.0 Hz
5	Panpot	Sets right-left balance for each channel. (0…15…31) The smaller value, the further it pans to the left, or the larger value, the further it pans to the right.
6	PE	Place a check in this box to disable the pan setting of the control change and to enable the value of panpot of the voices.
7	DrumKey	Parameter that functions only at edition of the drum voice. It changes the key which the voice being edited actually generates.
8	Operator 1, 2, 3, 4	Changes Operator. The display changes between 1 to 2 and 1 to 4 in accordance with the setting of the algorithm. Right-click on the tab of Operator1 to 4 to display Copy/Paste menu with which the Operator can be copied.
9	Voice No.	Displays the voice number being edited with Voice Assign Map.
10	Note	Displays the note number of Drum voice being edited. It is not displayed at edition of the normal voice.
11	Voice Name	Sets the voice name being edited.
12	Before the Change	Press this switch to listen to the voices before they are edited. Press this switch again to restore the voices being edited.

No.13-14

No.	Function name	Contents
13	ALG (Algorithm)	Sets algorithm. 2 Operator or 4 Operator is set in accordance with the type of algorithm. In FM32 mode, when algorithm of 2op is not selected, it does not pronounce normally. Please set 0 or 1 to ALG. Algorithm 1 Algorithm 2 Algorithm 4 Algorithm 3
14	Op OFF [Operator OFF]	The output of each operator can be turned OFF by selecting the button of 1 to 4.

No.15-32

No.	Function name	Contents
15	MULTI	Designates a multiplier for the frequency. MULTI: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,11, 12,13, 14,15 Multiplier: 1/2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15
16	DT (Detune)	Designates Detune. Detune shifts the pitch delicately to cause the feeling of chorus. DT=1 to 3 shifts the pitch upwards. Difference width becomes large in the order of 1, 2, and 3. DT=5 to 7 shifts the pitch upwards. Difference width becomes large in the order of 5, 6, and 7. DT= 0 and 4, it is standard pitch. The frequency of Detune is affected by the setting of MULTI. When MULTI= 2 times, the values of Detune are doubled.

For item 15, the MULTI table:

MULTI	0	1	2	3	4	5	6	7	8	9	10,11	12,13	14,15
Multiplier	1/2	1	2	3	4	5	6	7	8	9	10	12	15

No.	Function name	Contents
17	AR (Attack Rate)	Attack Rate is the time from the starting of tone generation (-96 dB) to the time of maximum volume (0 dB).
18	DR (Decay Rate)	Decay Rate is the decay time from the moment the maximum volume (0 dB) to the moment Sustain Level (SL).
19	SR (Sustain Rate)	Sustain Rate designates the rate of decay from the moment a Sustain Level is attained. Unlike other rate setting, setting this to "0" causes continuation of the Sustain Level.
20	RR (Release Rate)	Release Rate is the time from key off to the moment the silent state (-96 db) is attained. When a check is placed in the check box of SUS, the setting is ignored.
21	SL (Sustain Level)	The Sustain Level is the one at which Decay Rate changes to Release Rate for decaying tone, or the level at which volume of a continuous tone is sustained.
22	TL (Total Level)	Sets the level of envelope.
23	KSL (Designation of Level Scaling)	For natural instruments, the volume generally decreases and the interval becomes higher. The scaling of level simulates this phenomenon. KSL sets the amount of decay per octave. KSL= 0 : 0, KSL= 1 : 3.0dB / oct KSL= 2 : 1.5dB / oct, KSL= 3 : 6.0dB / oct
24	DAM (Depth of Amplitude Modulation）	Sets the depth of amplitude modulation (AM). DAM= 0 : 1.3 dB, DAM= 1 : 2.8 dB DAM= 2 : 5.8 dB, DAM= 3 : 11.8 dB
25	DVB (Depth of Vibrato Modulation)	DVB= 0 : 3.4 cents, DVB= 1 : 6.7 cents DVB= 2 : 13.5 cents, DVB= 3 : 26.8 cents
26	FB (Amount of Feedback)	This function enables only Modulator side Operator. It designates the degree of feedback modulation. | Setting value	0	1	2	3	4	5	6	7 | |---|---|---|---|---|---|---|---|---|
Degree of modulation	0	$\pi/16$	$\pi/8$	$\pi/4$	$\pi/2$	π	2π	4π	
27	WS (Waveform election)	Designates waveform of each Operator that is used for FM operation. The waveform that is used can be selected from 29 types. About detail, please refer to "4.12.5.1FM Fundamental Wave Form."
28	XOF (Ignore KeyOff)	Sets whether to ignore KeyOff or not. Place a check in the check box to ignore KeyOff. KeyOff does not cause the change of state.
29	SUS (Sustain)	Sets whether to allow the rate change after KeyOff is allowed or not. When check is placed in the check box and Hold 1 (damper) information of MIDI message is received, SR continues after KeyOff. For making effective the hold1 (damper) of MIDI message, be sure to set SUS to ON.
30	KSR （Rate scaling）	Sets rate key scale ON/OFF. Place a check in the check box to enable setting of KSL. Key scale ON/OFF of the rate can be set up by checking this box. By the natural musical instrument, the standup and falling of sound become early as a pitch becomes high in general. The key scale of the rate simulates this phenomenon.
31	EAM (AM modulation)	Sets amplitude modulation ON/OFF. Place a check in the check box to enable setting of DAM.
32	EVB (Vibrato modulation)	Sets vibrato modulation ON/OFF. Place a check in the check box to enable setting of DVB.

4.12.5.1.FM Fundamental Wave Form

FM Fundamental Wave Form

No. 33-36 Keyboard

The voice under editing can be monitored by clicking the keyboard.

Display of normal voice being edited
In the case of normal voice, it pronounces higher musical interval as going the right side of the keyboard, and lower musical interval as going toward the left side.
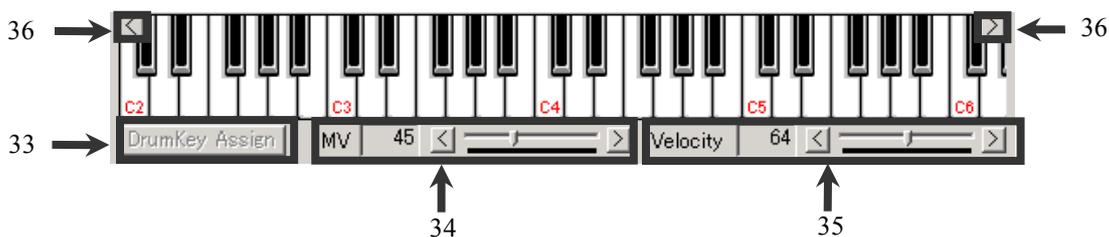
No.	Function name	Contents
33	DrumKey Assign	It is not used when editing normal voice. (It is valid only when editing drum voice)
34	MV (Master Volume)	Master volume value when monitoring by the keyboard can be changed.
35	Velocity (Velocity)	Velocity value when monitoring by the keyboard can be changed.
36	Scrolling button	By pushing this button, the displayable range of keyboard can be changed. ▪ Click of right side button displays higher interval. ▪ Click of left side button displays lower interval.

No. 37-40 Keyboard

<u>Display of drum voice edited</u>
In the case of drum voice, it pronounces only when Note No. under editing is clicked.

No.	Function name	Contents
37	DrumKey Assign	By pushing this switch, it can pronounce the drum voice in higher musical interval as going toward the right side of keyboard, and in lower musical interval as going toward the left side. Please find out your favorite key and set it as a DrumKey. (DrumKey Assign shown in the following figure means the switch is being pushed.) DrumKey Assign → All keys can be pronounced by pushing the DrumKey Assign switch.
38	MV (Master Volume)	Master volume value when monitoring by the keyboard can be changed.
39	Velocity (Velocity)	Velocity value when monitoring by the keyboard can be changed.
40	Key	Displays only the note number under editing.
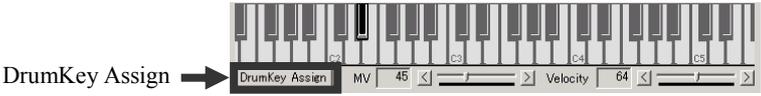
4.12.6. PCM Voice Edit Parameters
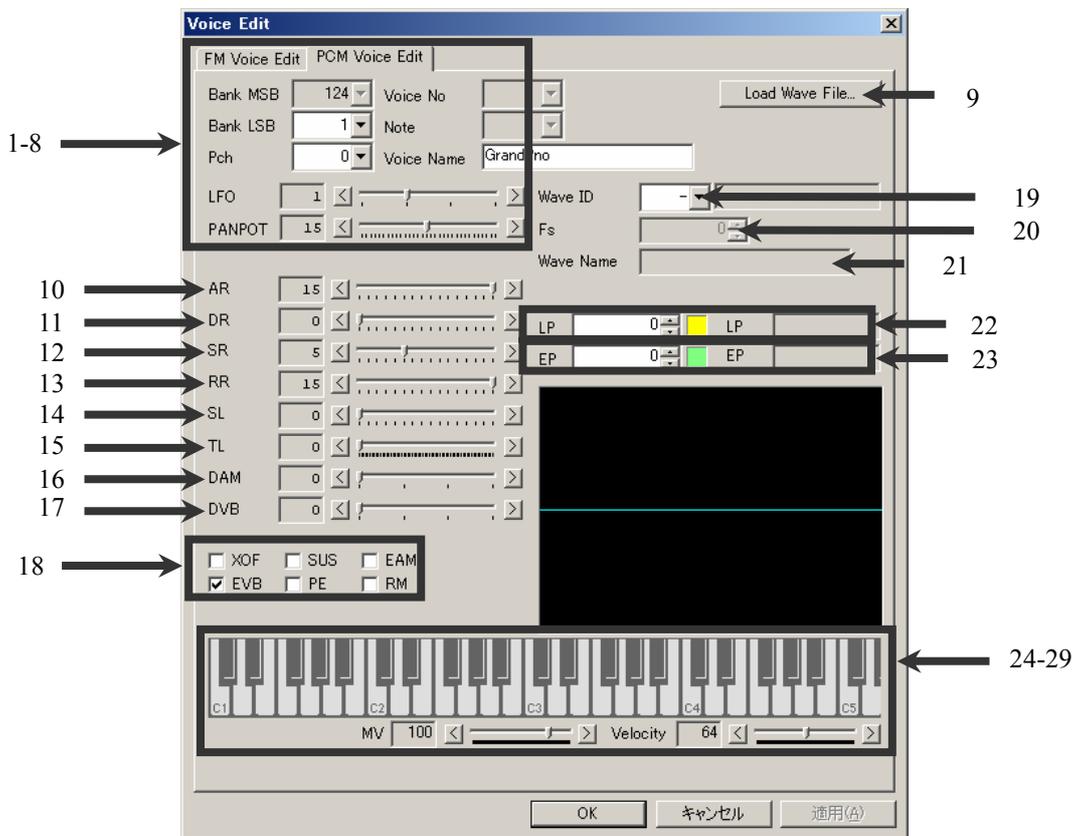
Figure. 4-40   PCM Voice Edit Parameter

No.1-8
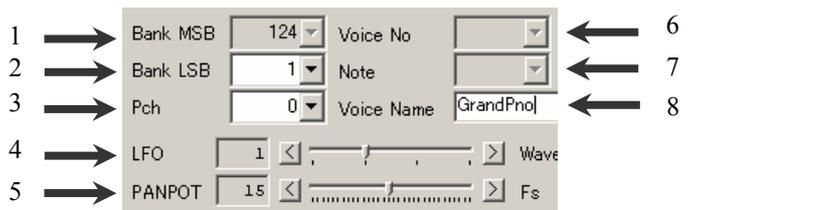
No.	Function name	Contents
1	Bank MSB	Displays BankSelect MSB in which the voices being edited exist. It cannot be changed here.
2	Bank LSB	Displays BankSelect LSB in which the voices being edited exist.
3	Pch	Displays and changes program change for the voices being edited.
4	LFO	Sets LFO frequency that is used for each voice. LFO= 0 : 1.8 Hz, LFO= 1 : 4.0 Hz LFO= 2 : 5.9 Hz, LFO= 3 : 7.0 Hz
5	Panpot	Sets right-left balance for each channel. (0…15…31) The smaller value, the further it pans to the left, or the larger value, the further it pans to the right.
6	Voice No.	Displays the voice number being edited with Voice Assign Map.
7	Note	Displays the note number being edited. It is not displayed during an edition of the normal voice.
8	Voice Name	Sets the voice name being edited.

No.9-23

No.	Function name	Contents
9	Load Wave File	Sound file (*AIFF, WAVE*), which is 16bits mono-sound file (it encodes to 4bitADPCM or 8bits PCM) or 8bits mono-sound file (it encodes to 8bits PCM) and its sampling frequency is less than 48 kHz, can be read. Stereo sound file cannot be read. The read wave is assigned to the key of NoteNo.60 (*C key*) and reproducible to 48kHz. E.g. When a 24000Hz sound file is read Fs become lower when lower key is played, and Fs becomes higher when higher key is played, when taking C key of NoteNo.60 (*24000Hz*) as a center. When a waveform is read, "*Load Wave File*" button changes to "*Detach Wave File*" button.
	Detach Wave File	Press this switch to delete the waveform that has been read with "*Load Wave File*." When a waveform is read, "*Load Wave File*" button changes to "*Detach Wave File*" button.
10	AR (Attack Rate)	Attack Rate is the time from the starting of tone generation (-48dB) to the time of maximum volume (0 dB).
11	DR (Decay Rate)	Decay Rate is the decay time from the moment the maximum volume (0 dB) to the moment Sustain Level (*SL*).
12	SR (Sustain Rate)	Sustain Rate designates the rate of decay from the moment a Sustain Level is attained. Unlike other rate setting, setting this to "0" causes continuation of the Sustain Level.
13	RR (Release Rate)	Release Rate is the time from key off to the moment the silent state (-96 db) is attained. When a check is placed in the check box of SUS, the setting is ignored.
14	SL (Sustain Level)	The Sustain Level is the one at which Decay Rate changes to Release Rate for decaying tone, or the level at which volume of a continuous tone is sustained.
15	TL (Total Level)	Sets the level of envelope.
16	DAM (Depth of AM modulation)	Sets the depth of amplitude modulation (*AM*). DAM= 0 : 1.3 dB, DAM= 1 : 2.8 dB DAM= 2 : 5.8 dB, DAM= 3 : 11.8 dB
17	DVB (Depth of vibrato modulation)	DVB= 0 : 3.4 cents, DVB= 1 : 6.7 cents DVB= 2 : 13.5 cents, DVB= 3 : 26.8 cents
18	XOF (Ignore KeyOff)	Sets whether to ignore KeyOff or not. Place a check in the check box to ignore KeyOff. KeyOff does not cause the change of state.
	SUS (Sustain)	Sets whether to allow the rate change after KeyOff or not. When check is placed in the check box and Hold 1 (*damper*) information of MIDI message is received, SR continues after KeyOff. Be sure to set EVB to on to enable modulation of MIDI message.
	EAM (Amplitude modulation On/Off)	Sets amplitude modulation ON/OFF. Place a check in the check box to enable setting of DAM.

No.	Function name	Contents
	EVB (Vibrato modulation On/Off)	Sets vibrato modulation ON/OFF. Place a check in the check box to enable setting of DVB. Be sure to set EVB to on to enable modulation of MIDI message.
	PE (Pan-enable)	Place a check in the check box to disable pan setting of the control change and to enable the value of panpot of voices.
	RM (Designation of ROM/RAM)	Selects ROM or RAM for waveforms that are used. When ROM is designated, a waveform can be selected from seven waveform list in the ROM at Wave ID. When RAM is designated, arbitrary waveform can be designated from the load wave file.
19	Wave ID	For MA-3, multiple PCM waveforms can be read and stored. The management number can be displayed and selected.
20	Fs	Displays the frequencies of waveforms that have been read. On MA-3 Authoring Tool, displays the frequency when flipping NoteNo.60 (*C key*). Changing the value changes the pitch. Some gap may occur in the pitch by the set point of Fs set value of the waveform to read on account of application. Select and Set up the Fs value with reference to "*Recommend Fs setting value list*" in the following table.
21	Wave Name	Displays the names of waveforms that have been read.
22	LP	Designates a loop point for loop reproduction. In addition, a peak factor at the following point was displayed. 4bits ADPCM :Loop Point 8 bits PCM :Loop Point + 1
23	EP	Designates reproduction end point and loop reproduction loop End Point. In addition, a peak factor at the following points was displayed. 4 bits ADPCM :End Point -1 8 bits PCM :End Loop Point It does not pronounce, if the value is "0".

No.24 to 29

The voice under editing can be monitored by clicking the keyboard.

<u>Display of normal voice being edited</u>
In the case of normal voice, it pronounces higher musical interval as going toward the right side of keyboard, and lower musical interval as going toward the left side.
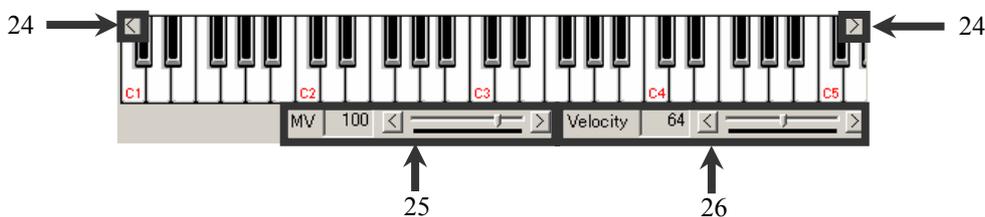
No.	Function name	Contents
24	MV (Master Volume)	Master volume value when monitoring by the keyboard can be changed.
25	Velocity (Velocity)	Velocity value when monitoring by the keyboard can be changed.
26	Scrolling button	By pushing this button, the displayable range of keyboard can be changed. ▪ Click of right side button displays higher interval. ▪ Click of left side button displays lower interval.

Display of drum voice being edited
In the case of drum voice, it pronounces only when the Note number which is being edited is clicked.
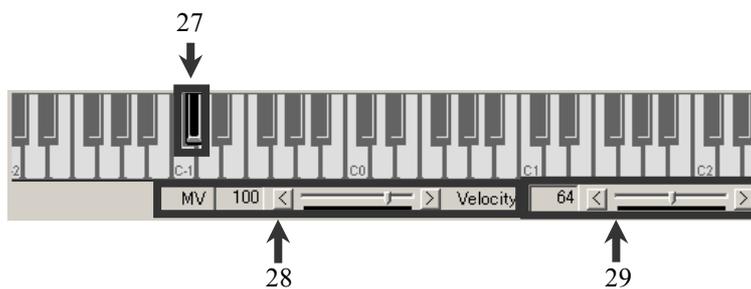
No.	Function name	Contents
27	MV (Master Volume)	Master volume value when monitoring by the keyboard can be changed.
28	Velocity (Velocity)	Velocity value when monitoring by the keyboard can be changed.
29	Key	Only the Note number being edited can be displayed.

4.12.6.1.LP/EP Automatic Control Function

At the time of displaying a Voice Edit of existing PCM voice, if there are any uncorrected values which are set on it, the following confirmation messages will be displayed.
"Automatically operated- Loop and/or End Point adjusted according to PCM mode."
Then, the uncorrected values are rounded to a correct value automatically.

Example of rounding the sampling number "2000",

<with 4bit ADPCM>

In case of the OneShot(LoopPoint=EndPoint)

In case of (LoopPoint $\geq$ Sample number) or (EndPoint $\geq$ Sample number)

LoopPoint = EndPoint = Sample - 1

ex) LP=2000/EP=2000 → LP=1999/EP=1999

LP=2000/EP=2001 → LP=1999/EP=1999

In the case in which only LoopPoint is outside of the range.

LoopPoint = EndPoint

ex) LP=2001/EP=1500 → LP=1500/EP=1500

In the case in which only EndPoint is outside of the range.

EndPoint = Sample - 1

ex) LP=1500/EP=2001 → LP=1500/EP=2000

<with 8bits PCM>

In case of the OneShot(LoopPoint=EndPoint)

In case of (LoopPoint$\geq$Sample -1) or (EndPoint$\geq$Sample -1)

LoopPoint = EndPoint = Sample -2

ex) LP=2000/EP=2000 → LP=1998/EP=1998

In the case in which only LoopPoint is outside of the range.

LoopPoint = EndPoint

ex) LP=2001/EP=1500 → LP=1500/EP=1500

In the case in which only EndPoint is outside of the range.

EndPoint = Sample - 1

ex) LP=1500/EP=2001 → LP=1500/EP=1999

5. Supplement

5.1. About FM Synthesizer / Examine it for a moment

    Most of the persons who attempt to use this Authoring Tool may have knowledge of FM synthesizer sufficiently (or to some extent, even if not sufficiently)
    Therefore, this chapter explains fundamental matters briefly, and describes the techniques for utilization of this Authoring Tool concretely.
    Even if you may find information in this chapter that you already know, read it for confirmation of the matter.

5.1.1. From FM that "Selects" voices to FM that "Creates" voices –Changes of FM Musical Synthesizer

5.1.1.1. Emergence of musical synthesizer

    "*Electronic musical instruments*" have primarily existed since long time ago, longer than the period anybody can imagine.
    However, the most revolutionary matter in the world of the electronic musical instruments may be the emergence of the "*musical synthesizer*." The circuits for authoring three elements of sounds, "*intervals*", "*voices*" and "*volume*" are arranged in the synthesizer so that they can be created very simply and effectively.
    Even before the emergence of the musical synthesizer, the electronic musical instruments provided "*sounds*" which are "*original*" in themselves; they allowed the players only to select the sounds. But, the emergence of the musical synthesizer allowed the players to "*create sounds*".
    The musicians (mainly the keyboard players) have become able to use the electronic instruments as a means for presenting their original (their own) sounds in addition to presentation through playing, allowing to expand their capability of presentation.

5.1.1.2. Epoch making emergence of DX

    Yamaha released DX 7 in 1983 as a model that represents what is call DX series. The fact is, the first digital keyboard that uses FM synthesizer is not DX. Yamaha released GS series in 1981 and CE series in 1982. However, both of these series were keyboards that select "sound" although it allowed making of voices a little.

    It is apparent that the emergence of DX influenced much on the following musical synthesizers because DX is a musical synthesizer which was born to pursue "*creation of sounds*", allowing control of enormous number of parameters, which is unimaginable from its simple appearance, and is given a function that can memorize the created tones internally and externally.

YAMAHA
Digital Programmable Algorithm
Synthesizer
DX7

YAMAHA

CE20

5.1.2. Basic knowledge of FM synthesizer

About 20 years have passed after the release of SX series.
After the release of DX, Yamaha have installed FM synthesizers on various synthesizer
In this period, they have been improved and redesigned in various parts to be more easily operable and excellent musical instruments.

Therefore, the following section describes the basic features of FM synthesizer, though very briefly.

5.1.2.1. "Modification" + "Time" constitute sounds

The musical synthesizers of all digital keyboards that include not only the FM synthesizer but also PCM synthesizer are not given "*oscillator circuits*" that are provided in analog synthesizers although they are electronic musical instruments.
The devices that replace the "*oscillator circuits*" are "memory circuits, and the instruments create the "*sounds*" by controlling the "*oscillator circuits*" through various control signals.

The principal feature of the FM synthesizers is, if it is described briefly by omitting technical and complex expression, that they also read waveform data from the "memory circuits".

When it reads the data,

"*It reads data*" by "*controlling the time*."

Then, how does it "*control the time*"?

"*It gives waveform that controls the time to the memory circuits*."

To make this complex expression simple, it is explained by using a concrete example.
Assume that here is a sawtooth wave that rises from 0 V to 10 V and then returns to 0 V.
The memory circuits are set so that, when the sawtooth wave signal is added to the memory circuits, the memory circuit (a) outputs signal when the voltage of the sawtooth wave reaches 1 V, the memory circuit (b) outputs signal when the voltage of the sawtooth wave reaches 2 V, and so on.
Then, since the voltage level of sawtooth wave increases linearly, memory circuits outputs pure sinusoidal wave as a result.
It is natural that the frequency of the outputted sinusoidal wave is equal to that of the sawtooth wave.
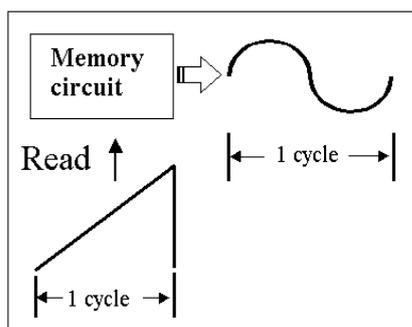
This operation is described in short as follows.

"It gives waveform that controls the time to the memory circuits."

This is the very basic principle of the *"digital musical synthesizer."*

Needless to say, the synthesizer performs its the internal processing not with analog signal but with *"0"* and *"1"* codes. It is a matter of course.

5.1.2.2. Degree of freedom for creation of sounds

Based on the previous description, you may think of an idea to contain waveform of other voices than sinusoidal wave in the memory circuits. Roughly saying, it is the principle of PCM synthesizer.

As described later, the method of making voices with the FM synthesizer is based on the idea of *"hybridization of sinusoidal waves."*

Basically, this method creates any complex waveform by hybridizing sinusoidal waves that are outputted. Isn't it realistic to store various waveforms in the memory circuits to read out them as necessary, at the first thought?

Yes, it is true. But, the number of voices that can be obtained with this method is limited to the number of waveforms stored in the memory circuits.

Moreover, like most of PCM system, *"hybridization"* is impossible for this case, and waveforms that are obtained are only *"subtracted"*.

This method passes roughly formed waveforms through filters to shape them up to desired ones.
On the other hand, FM synthesizer is to provide (*create*) various waveforms.

5.1.2.3. Idea of Operators

The *"Box"* that outputs sinusoidal waves by using the method described above is called *"Operator."*
MA-3 has four *"Operators."*
Theses operators are superimposed to create various waveforms.
MA-3 authors various sounds by combining the *"Operators."*
The resultant Operator that is generated as a voice is called *"Carrier"*, and an Operator that modulates the Carrier is called a *"Modulator."*
This is explained by using an analogy as follows.

There are two persons, standing one behind another. The person who is at the front can only generate voice "*Ah.*"
The person who is behind the front person tickles and surprises the front one when the front one generates the voice.
Then, the front one's "*Ah*" changes to "*Hyaa!*" or "*yell!!*" by being affected by the rear one.
This approximately analogizes the mechanism of the Operator.

Moreover, the number of "*Modulators*" who surprises the "*Carrier* " is not limited to one. It can be three who make the mischief as a group (*parallel type*).

A Modulator does mischief on the second Modulator, the second Modulator does mischief on the third Modulator, and the third Modulator does mischief on the "*Carrier* " (*series type*) in some case.
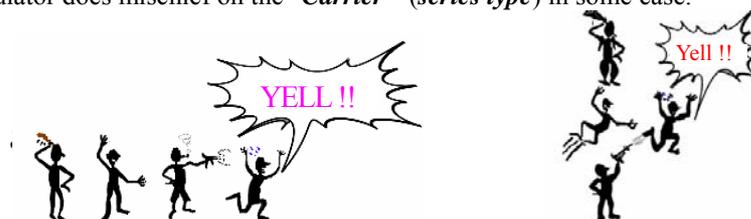
Four Operators are built in, the voices are roughly classified into 2op voices that are constituted with two operators, and 4op voices that are constituted with all of the four operators.
In addition, all of these "*Operator*" of MA-3 are the same, and are not classified into those "*for Carriers*" and those "*for Modulators.*"
Operators are classified according to the purpose of their use.
This feature helps to increase the degree of freedom, and thus, seven types of rows of the Operators are provided (called "*algorithm.*")

5.1.3. Self-feedback, How Wonderful it is!

When you see the algorithm, you will find the part as right figure.
This is called "*self-feedback*."
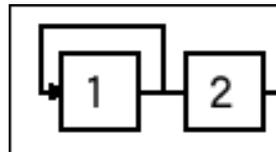
The self-feedback is, as the name describes, able to modulate itself. The level of feedback is increased, an effect that operators having the same pitch comes in a line is obtained.
For some WS that is selected, further increase of the level provides the effect such as a random oscillation, which allows for the use such as a noise generator.

Naturally, since these operators are the same as other operator except that they perform the self-feedback, they are exactly all-round parameters that can add timing changes by using EG.

The following basic formula is shown for those who are interested in understanding the FM synthesizer theoretically.

$$F(t)=A(t) \sin \{w_c t + I(t) \sin w_m t\}$$

F(t) : Output

A(t) : EG data of carrier

w_c : Frequency of carrier

I(t) : EG data of modulator

w_m : Frequency of modulator

Basis of the FM synthesizer have been explained briefly.
We will be happy if the information is useful for your authoring of the voices.

5.2. Voice List

5.2.1. MA-3 Native Normal Voice Map (FM16 mode 0 to 63)

Bank MSB	124		124		124		124	124		124	
Bank LSB	0		1		2		3 to 7	8		9	
	Preset		User Assignable								
Pch#	Inst	Typ	Inst	Typ	Inst	Typ		Inst	Typ	Inst	Typ
0	GrandPno	F4	User	A	User	A	…	User	A	User	A
1	BritePno	F4	User	A	User	A	…	User	A	User	A
2	E.GrandP	F4	User	A	User	A	…	User	A	User	A
3	HnkyTonk	F4	User	A	User	A	…	User	A	User	A
4	E.Piano1	F4	User	A	User	A	…	User	A	User	A
5	E.Piano2	F4	User	A	User	A	…	User	A	User	A
6	Harpsi.	F4	User	A	User	A	…	User	A	User	A
7	Clavi.	F4	User	A	User	A	…	User	A	User	A
8	Celesta	F4	User	A	User	A	…	User	A	User	A
9	Glocken	F4	User	A	User	A	…	User	A	User	A
10	MusicBox	F4	User	A	User	A	…	User	A	User	A
11	Vibes	F4	User	A	User	A	…	User	A	User	A
12	Marimba	F4	User	A	User	A	…	User	A	User	A
13	Xylophon	F4	User	A	User	A	…	User	A	User	A
14	TubulBel	F4	User	A	User	A	…	User	A	User	A
15	Dulcimar	F4	User	A	User	A	…	User	A	User	A
16	DrawOrgn	F4	User	A	User	A	…	User	A	User	A
17	PercOrgn	F4	User	A	User	A	…	User	A	User	A
18	RockOrgn	F4	User	A	User	A	…	User	A	User	A
19	ChrchOrg	F4	User	A	User	A	…	User	A	User	A
20	ReedOrgn	F4	User	A	User	A	…	User	A	User	A
21	Acordion	F4	User	A	User	A	…	User	A	User	A
22	Harmnica	F4	User	A	User	A	…	User	A	User	A
23	TangoAcd	F4	User	A	User	A	…	User	A	User	A
24	NylonGtr	F4	User	A	User	A	…	User	A	User	A
25	SteelGtr	F4	User	A	User	A	…	User	A	User	A
26	Jazz Gtr	F4	User	A	User	A	…	User	A	User	A
27	CleanGtr	F4	User	A	User	A	…	User	A	User	A
28	Mute.Gtr	F4	User	A	User	A	…	User	A	User	A
29	Ovrdrive	F4	User	A	User	A	…	User	A	User	A
30	Dist.Gtr	F4	User	A	User	A	…	User	A	User	A
31	GtrHarmo	F4	User	A	User	A	…	User	A	User	A
32	Aco.Bass	F4	User	A	User	A	…	User	A	User	A
33	FngrBass	F4	User	A	User	A	…	User	A	User	A
34	PickBass	F4	User	A	User	A	…	User	A	User	A
35	Fretless	F4	User	A	User	A	…	User	A	User	A
36	SlapBas1	F4	User	A	User	A	…	User	A	User	A
37	SlapBas2	F4	User	A	User	A	…	User	A	User	A
38	SynBass1	F4	User	A	User	A	…	User	A	User	A
39	SynBass2	F4	User	A	User	A	…	User	A	User	A
40	Violin	F4	User	A	User	A	…	User	A	User	A
41	Viola	F4	User	A	User	A	…	User	A	User	A
42	Cello	F4	User	A	User	A	…	User	A	User	A
43	ContraBs	F4	User	A	User	A	…	User	A	User	A
44	Trem.Str	F4	User	A	User	A	…	User	A	User	A
45	Pizz.Str	F4	User	A	User	A	…	User	A	User	A
46	Harp	F4	User	A	User	A	…	User	A	User	A
47	Timpani	F4	User	A	User	A	…	User	A	User	A
48	Strings1	F4	User	A	User	A	…	User	A	User	A
49	Strings2	F4	User	A	User	A	…	User	A	User	A
50	Syn.Str1	F4	User	A	User	A	…	User	A	User	A
51	Syn.Str2	F4	User	A	User	A	…	User	A	User	A
52	ChoirAah	F4	User	A	User	A	…	User	A	User	A
53	VoiceOoh	F4	User	A	User	A	…	User	A	User	A
54	SynVoice	F4	User	A	User	A	…	User	A	User	A
55	Orch.Hit	F4	User	A	User	A	…	User	A	User	A
56	Trumpet	F4	User	A	User	A	…	User	A	User	A
57	Trombone	F4	User	A	User	A	…	User	A	User	A
58	Tuba	F4	User	A	User	A	…	User	A	User	A
59	Mute.Trp	F4	User	A	User	A	…	User	A	User	A
60	Fr.Horn	F4	User	A	User	A	…	User	A	User	A
61	BrasSect	F4	User	A	User	A	…	User	A	User	A
62	SynBras1	F4	User	A	User	A	…	User	A	User	A
63	SynBras2	F4	User	A	User	A	…	User	A	User	A

5.2.2. MA-3 Native Normal Voice Map (FM16 mode 64 to 127)

Bank MSB	124		124		124		124	124		124	
Bank LSB	0		1		2		3～7	8		9	
	Preset		User Assignable								
Pch#	Inst	Typ	Inst	Typ	Inst	Typ		Inst	Typ	Inst	Typ
64	SprnoSax	F4	User	A	User	A	…	User	A	User	A
65	Alto Sax	F4	User	A	User	A	…	User	A	User	A
66	TenorSax	F4	User	A	User	A	…	User	A	User	A
67	Bari.Sax	F4	User	A	User	A	…	User	A	User	A
68	Oboe	F4	User	A	User	A	…	User	A	User	A
69	Eng.Horn	F4	User	A	User	A	…	User	A	User	A
70	Bassoon	F4	User	A	User	A	…	User	A	User	A
71	Clarinet	F4	User	A	User	A	…	User	A	User	A
72	Piccolo	F4	User	A	User	A	…	User	A	User	A
73	Flute	F4	User	A	User	A	…	User	A	User	A
74	Recorder	F4	User	A	User	A	…	User	A	User	A
75	PanFlute	F4	User	A	User	A	…	User	A	User	A
76	Bottle	F4	User	A	User	A	…	User	A	User	A
77	Shakhchi	F4	User	A	User	A	…	User	A	User	A
78	Whistle	F4	User	A	User	A	…	User	A	User	A
79	Ocarina	F4	User	A	User	A	…	User	A	User	A
80	SquareLd	F4	User	A	User	A	…	User	A	User	A
81	Saw.Lead	F4	User	A	User	A	…	User	A	User	A
82	CaliopLd	F4	User	A	User	A	…	User	A	User	A
83	ChiffLd	F4	User	A	User	A	…	User	A	User	A
84	CharanLd	F4	User	A	User	A	…	User	A	User	A
85	Voice Ld	F4	User	A	User	A	…	User	A	User	A
86	Fifth Ld	F4	User	A	User	A	…	User	A	User	A
87	Bass &Ld	F4	User	A	User	A	…	User	A	User	A
88	NewAgeP	F4	User	A	User	A	…	User	A	User	A
89	Warm Pad	F4	User	A	User	A	…	User	A	User	A
90	PolySyPd	F4	User	A	User	A	…	User	A	User	A
91	ChoirPad	F4	User	A	User	A	…	User	A	User	A
92	BowedPad	F4	User	A	User	A	…	User	A	User	A
93	MetalPad	F4	User	A	User	A	…	User	A	User	A
94	Halo Pad	F4	User	A	User	A	…	User	A	User	A
95	SweepPad	F4	User	A	User	A	…	User	A	User	A
96	Rain	F4	User	A	User	A	…	User	A	User	A
97	SoundTrk	F4	User	A	User	A	…	User	A	User	A
98	Crystal	F4	User	A	User	A	…	User	A	User	A
99	Atmosphr	F4	User	A	User	A	…	User	A	User	A
100	Bright	F4	User	A	User	A	…	User	A	User	A
101	Goblins	F4	User	A	User	A	…	User	A	User	A
102	Echoes	F4	User	A	User	A	…	User	A	User	A
103	Sci-Fi	F4	User	A	User	A	…	User	A	User	A
104	Sitar	F4	User	A	User	A	…	User	A	User	A
105	Banjo	F4	User	A	User	A	…	User	A	User	A
106	Shamisen	F4	User	A	User	A	…	User	A	User	A
107	Koto	F4	User	A	User	A	…	User	A	User	A
108	Kalimba	F4	User	A	User	A	…	User	A	User	A
109	Bagpipe	F4	User	A	User	A	…	User	A	User	A
110	Fiddle	F4	User	A	User	A	…	User	A	User	A
111	Shanai	F4	User	A	User	A	…	User	A	User	A
112	TnklBell	F4	User	A	User	A	…	User	A	User	A
113	Agogo	F4	User	A	User	A	…	User	A	User	A
114	SteelDrm	F4	User	A	User	A	…	User	A	User	A
*1 115	WoodBlo	F4	User	A	User	A	…	User	A	User	A
*2 116	TaikoDrm	F4	User	A	User	A	…	User	A	User	A
*3 117	MelodTor	F4	User	A	User	A	…	User	A	User	A
*4 118	Syn.Drum	F4	User	A	User	A	…	User	A	User	A
*4 119	RevCymb	F4	User	A	User	A	…	User	A	User	A
120	FretNoiz	F4	User	A	User	A	…	User	A	User	A
121	BrthNoiz	F4	User	A	User	A	…	User	A	User	A
*5 122	Seashore	F4	User	A	User	A	…	User	A	User	A
*6 123	Tweet	F4	User	A	User	A	…	User	A	User	A
*7 124	Telphone	F4	User	A	User	A	…	User	A	User	A
*7 125	Helicptr	F4	User	A	User	A	…	User	A	User	A
*6 126	Applause	F4	User	A	User	A	…	User	A	User	A
*5 127	Gunshot	F4	User	A	User	A	…	User	A	User	A

*1 : 50cent/halftpne, #69 = F#4
*2 : 50cent/halftone, #69 = A2
*3 : 50cent/halftone, #69 = C#4
*4 : 50cent/halftone
*5 : 20cent/halftone
*6 : 5cent/halftone
*7 : 10cent/halftone
The voice, which is set to Pch# with "*", is treated as drum voice by key control judging. (User Bank is also.)

(*) Type F2: FM 2 Operator, F4: FM 4 Operator, P: PCM, A: F2/F4/P Assignable

5.2.3. MA-3 Native Normal Voice Map (FM32 mode 0 to 63)

Bank MSB	124		124		124		124	124		124	
Bank LSB	0		1		2		3〜7	8		9	
	Preset		User Assignable								
Pch#	Inst	Typ	Inst	Typ	Inst	Typ		Inst	Typ	Inst	Typ
0	GrandPno	F2	User	A	User	A	…	User	A	User	A
1	BritePno	F2	User	A	User	A	…	User	A	User	A
2	E.GrandP	F2	User	A	User	A	…	User	A	User	A
3	HnkyTon	F2	User	A	User	A	…	User	A	User	A
4	E.Piano1	F2	User	A	User	A	…	User	A	User	A
5	E.Piano2	F2	User	A	User	A	…	User	A	User	A
6	Harpsi.	F2	User	A	User	A	…	User	A	User	A
7	Clavi.	F2	User	A	User	A	…	User	A	User	A
8	Celesta	F2	User	A	User	A	…	User	A	User	A
9	Glocken	F2	User	A	User	A	…	User	A	User	A
10	MusicBox	F2	User	A	User	A	…	User	A	User	A
11	Vibes	F2	User	A	User	A	…	User	A	User	A
12	Marimba	F2	User	A	User	A	…	User	A	User	A
13	Xylophon	F2	User	A	User	A	…	User	A	User	A
14	TubulBel	F2	User	A	User	A	…	User	A	User	A
15	Dulcimar	F2	User	A	User	A	…	User	A	User	A
16	DrawOrgn	F2	User	A	User	A	…	User	A	User	A
17	PercOrgn	F2	User	A	User	A	…	User	A	User	A
18	RockOrgn	F2	User	A	User	A	…	User	A	User	A
19	ChrchOrg	F2	User	A	User	A	…	User	A	User	A
20	ReedOrgn	F2	User	A	User	A	…	User	A	User	A
21	Acordion	F2	User	A	User	A	…	User	A	User	A
22	Harmnica	F2	User	A	User	A	…	User	A	User	A
23	TangoAcd	F2	User	A	User	A	…	User	A	User	A
24	NylonGtr	F2	User	A	User	A	…	User	A	User	A
25	SteelGtr	F2	User	A	User	A	…	User	A	User	A
26	Jazz Gtr	F2	User	A	User	A	…	User	A	User	A
27	CleanGtr	F2	User	A	User	A	…	User	A	User	A
28	Mute.Gtr	F2	User	A	User	A	…	User	A	User	A
29	Ovrdrive	F2	User	A	User	A	…	User	A	User	A
30	Dist.Gtr	F2	User	A	User	A	…	User	A	User	A
31	GtrHarmo	F2	User	A	User	A	…	User	A	User	A
32	Aco.Bass	F2	User	A	User	A	…	User	A	User	A
33	FngrBass	F2	User	A	User	A	…	User	A	User	A
34	PickBass	F2	User	A	User	A	…	User	A	User	A
35	Fretless	F2	User	A	User	A	…	User	A	User	A
36	SlapBas1	F2	User	A	User	A	…	User	A	User	A
37	SlapBas2	F2	User	A	User	A	…	User	A	User	A
38	SynBass1	F2	User	A	User	A	…	User	A	User	A
39	SynBass2	F2	User	A	User	A	…	User	A	User	A
40	Violin	F2	User	A	User	A	…	User	A	User	A
41	Viola	F2	User	A	User	A	…	User	A	User	A
42	Cello	F2	User	A	User	A	…	User	A	User	A
43	ContraBs	F2	User	A	User	A	…	User	A	User	A
44	Trem.Str	F2	User	A	User	A	…	User	A	User	A
45	Pizz.Str	F2	User	A	User	A	…	User	A	User	A
46	Harp	F2	User	A	User	A	…	User	A	User	A
47	Timpani	F2	User	A	User	A	…	User	A	User	A
48	Strings1	F2	User	A	User	A	…	User	A	User	A
49	Strings2	F2	User	A	User	A	…	User	A	User	A
50	Syn.Str1	F2	User	A	User	A	…	User	A	User	A
51	Syn.Str2	F2	User	A	User	A	…	User	A	User	A
52	ChoirAah	F2	User	A	User	A	…	User	A	User	A
53	VoiceOoh	F2	User	A	User	A	…	User	A	User	A
54	SynVoice	F2	User	A	User	A	…	User	A	User	A
55	Orch.Hit	F2	User	A	User	A	…	User	A	User	A
56	Trumpet	F2	User	A	User	A	…	User	A	User	A
57	Trombone	F2	User	A	User	A	…	User	A	User	A
58	Tuba	F2	User	A	User	A	…	User	A	User	A
59	Mute.Trp	F2	User	A	User	A	…	User	A	User	A
60	Fr.Horn	F2	User	A	User	A	…	User	A	User	A
61	BrasSect	F2	User	A	User	A	…	User	A	User	A
62	SynBras1	F2	User	A	User	A	…	User	A	User	A
63	SynBras2	F2	User	A	User	A	…	User	A	User	A

5.2.4. MA-3 Native Normal Voice Map (FM32 mode 64 to 127)

Bank MSB	124		124		124		124	124		124	
Bank LSB	0		1		2		3〜7	8		9	
	Preset		User Assignable								
Pch#	Inst	Typ	Inst	Typ	Inst	Typ		Inst	Typ	Inst	Typ
64	SprnoSax	F2	User	A	User	A	…	User	A	User	A
65	Alto Sax	F2	User	A	User	A	…	User	A	User	A
66	TenorSax	F2	User	A	User	A	…	User	A	User	A
67	Bari.Sax	F2	User	A	User	A	…	User	A	User	A
68	Oboe	F2	User	A	User	A	…	User	A	User	A
69	Eng.Horn	F2	User	A	User	A	…	User	A	User	A
70	Bassoon	F2	User	A	User	A	…	User	A	User	A
71	Clarinet	F2	User	A	User	A	…	User	A	User	A
72	Piccolo	F2	User	A	User	A	…	User	A	User	A
73	Flute	F2	User	A	User	A	…	User	A	User	A
74	Recorder	F2	User	A	User	A	…	User	A	User	A
75	PanFlute	F2	User	A	User	A	…	User	A	User	A
76	Bottle	F2	User	A	User	A	…	User	A	User	A
77	Shakhchi	F2	User	A	User	A	…	User	A	User	A
78	Whistle	F2	User	A	User	A	…	User	A	User	A
79	Ocarina	F2	User	A	User	A	…	User	A	User	A
80	SquareLd	F2	User	A	User	A	…	User	A	User	A
81	Saw.Lead	F2	User	A	User	A	…	User	A	User	A
82	CaliopLd	F2	User	A	User	A	…	User	A	User	A
83	ChiffLd	F2	User	A	User	A	…	User	A	User	A
84	CharanLd	F2	User	A	User	A	…	User	A	User	A
85	Voice Ld	F2	User	A	User	A	…	User	A	User	A
86	Fifth Ld	F2	User	A	User	A	…	User	A	User	A
87	Bass &Ld	F2	User	A	User	A	…	User	A	User	A
88	NewAgeP	F2	User	A	User	A	…	User	A	User	A
89	Warm Pad	F2	User	A	User	A	…	User	A	User	A
90	PolySyPd	F2	User	A	User	A	…	User	A	User	A
91	ChoirPad	F2	User	A	User	A	…	User	A	User	A
92	BowedPa	F2	User	A	User	A	…	User	A	User	A
93	MetalPad	F2	User	A	User	A	…	User	A	User	A
94	Halo Pad	F2	User	A	User	A	…	User	A	User	A
95	SweepPad	F2	User	A	User	A	…	User	A	User	A
96	Rain	F2	User	A	User	A	…	User	A	User	A
97	SoundTrk	F2	User	A	User	A	…	User	A	User	A
98	Crystal	F2	User	A	User	A	…	User	A	User	A
99	Atmosphr	F2	User	A	User	A	…	User	A	User	A
100	Bright	F2	User	A	User	A	…	User	A	User	A
101	Goblins	F2	User	A	User	A	…	User	A	User	A
102	Echoes	F2	User	A	User	A	…	User	A	User	A
103	Sci-Fi	F2	User	A	User	A	…	User	A	User	A
104	Sitar	F2	User	A	User	A	…	User	A	User	A
105	Banjo	F2	User	A	User	A	…	User	A	User	A
106	Shamisen	F2	User	A	User	A	…	User	A	User	A
107	Koto	F2	User	A	User	A	…	User	A	User	A
108	Kalimba	F2	User	A	User	A	…	User	A	User	A
109	Bagpipe	F2	User	A	User	A	…	User	A	User	A
110	Fiddle	F2	User	A	User	A	…	User	A	User	A
111	Shanai	F2	User	A	User	A	…	User	A	User	A
112	TnklBell	F2	User	A	User	A	…	User	A	User	A
113	Agogo	F2	User	A	User	A	…	User	A	User	A
114	SteelDrm	F2	User	A	User	A	…	User	A	User	A
*1 115	WoodBlo	F2	User	A	User	A	…	User	A	User	A
*2 116	TaikoDrn	F2	User	A	User	A	…	User	A	User	A
*3 117	MelodTo	F2	User	A	User	A	…	User	A	User	A
*4 118	Syn.Drum	F2	User	A	User	A	…	User	A	User	A
*4 119	RevCymb	F2	User	A	User	A	…	User	A	User	A
120	FretNoiz	F2	User	A	User	A	…	User	A	User	A
121	BrthNoiz	F2	User	A	User	A	…	User	A	User	A
*5 122	Seashore	F2	User	A	User	A	…	User	A	User	A
*6 123	Tweet	F2	User	A	User	A	…	User	A	User	A
*7 124	Telphone	F2	User	A	User	A	…	User	A	User	A
*7 125	Helicptr	F2	User	A	User	A	…	User	A	User	A
*6 126	Applause	F2	User	A	User	A	…	User	A	User	A
*5 127	Gunshot	F2	User	A	User	A	…	User	A	User	A

*1 : 50cent/halftpne, #69 = F#4
*2 : 50cent/halftone, #69 = A2
*3 : 50cent/halftone, #69 = C#4
*4 : 50cent/halftone
*5 : 20cent/halftone
*6 : 5cent/halftone
*7 : 10cent/halftone
The voice, which is set to Pch# with "*", is treated as drum voice by key control judging. (User Bank is also)

(*) Type F2: FM 2 Operator, F4: FM 4 Operator, P: PCM, A: F2/F4/P Assignable

5.2.5. MA-3 Native Normal Drum Instrument (FM16 mode)

Bank MSB	125		125		125		125	125	
Pch#	0		1		2		3~8	9	
	Preset				User Assignable				
Note#	Inst	Typ	Inst	Typ	Inst	Typ		Inst	Typ
24	Seq Click H	F4	Seq Click H	F4	User	A	…	User	A
25	Brush Tap	F4	Brush Tap	F4	User	A	…	User	A
@ 26	Brush Swirl	F4	Brush Swirl	F4	User	A	…	User	A
27	Brush Slap	F4	Brush Slap	F4	User	A	…	User	A
@ 28	Brush Tap Swirl	F4	Brush Tap Swirl	F4	User	A	…	User	A
@ 29	Snare Roll	F4	Snare Roll	F4	User	A	…	User	A
30	Castanet	F4	Castanet	F4	User	A	…	User	A
31	Snare L	P	Snare L	F4	User	A	…	User	A
32	Sticks	F4	Sticks	F4	User	A	…	User	A
33	Bass Drum L	P	Bass Drum L	F4	User	A	…	User	A
34	Open Rim Shot	F4	Open Rim Shot	F4	User	A	…	User	A
35	Bass Drum M	P	Bass Drum M	F4	User	A	…	User	A
36	Bass Drum H	P	Bass Drum H	F4	User	A	…	User	A
37	Closed Rim Shot	F4	Closed Rim Shot	F4	User	A	…	User	A
38	Snare M	P	Snare M	F4	User	A	…	User	A
39	Hand Clap	F4	Hand Clap	F4	User	A	…	User	A
40	Snare H	P	Snare H	F4	User	A	…	User	A
41	Floor Tom L	P	Floor Tom L	F4	User	A	…	User	A
42	Hi-Hat Closed	P	Hi-Hat Closed	F4	User	A	…	User	A
43	Floor Tom H	P	Floor Tom H	F4	User	A	…	User	A
44	Hi-Hat Pedal	P	Hi-Hat Pedal	F4	User	A	…	User	A
45	Low Tom	P	Low Tom	F4	User	A	…	User	A
46	Hi-Hat Open	P	Hi-Hat Open	F4	User	A	…	User	A
47	Mid Tom L	P	Mid Tom L	F4	User	A	…	User	A
48	Mid Tom H	P	Mid Tom H	F4	User	A	…	User	A
49	Crash Cymbal 1	P	Crash Cymbal 1	F4	User	A	…	User	A
50	High Tom	P	High Tom	F4	User	A	…	User	A
51	Ride Cymbal 1	P	Ride Cymbal 1	F4	User	A	…	User	A
52	Chinese Cymbal	P	Chinese Cymbal	F4	User	A	…	User	A
53	Ride Cymbal	F4	Ride Cymbal	F4	User	A	…	User	A
54	Tambourine	F4	Tambourine	F4	User	A	…	User	A
55	Splash Cymbal	P	Splash Cymbal	F4	User	A	…	User	A
56	Cowbell	F4	Cowbell	F4	User	A	…	User	A
57	Crash Cymbal 2	P	Crash Cymbal 2	F4	User	A	…	User	A
58	Vibraslap	F4	Vibraslap	F4	User	A	…	User	A
59	Ride Cymbal 2	P	Ride Cymbal 2	F4	User	A	…	User	A
60	Bongo H	F4	Bongo H	F4	User	A	…	User	A
61	Bongo L	F4	Bongo L	F4	User	A	…	User	A
62	Conga H Mute	F4	Conga H Mute	F4	User	A	…	User	A
63	Conga H Open	F4	Conga H Open	F4	User	A	…	User	A
64	Conga L	F4	Conga L	F4	User	A	…	User	A
65	Timbale H	F4	Timbale H	F4	User	A	…	User	A
66	Timbale L	F4	Timbale L	F4	User	A	…	User	A
67	Agogo H	F4	Agogo H	F4	User	A	…	User	A
68	Agogo L	F4	Agogo L	F4	User	A	…	User	A
69	Cabasa	F4	Cabasa	F4	User	A	…	User	A
70	Maracas	F4	Maracas	F4	User	A	…	User	A
@ 71	Samba Whistle	F4	Samba Whistle	F4	User	A	…	User	A
@ 72	Samba Whistle L	F4	Samba Whistle L	F4	User	A	…	User	A
73	Guiro Short	F4	Guiro Short	F4	User	A	…	User	A
74	Guiro Long	F4	Guiro Long	F4	User	A	…	User	A
75	Claves	F4	Claves	F4	User	A	…	User	A
76	Wood Block H	F4	Wood Block H	F4	User	A	…	User	A
77	Wood Block L	F4	Wood Block L	F4	User	A	…	User	A
78	Cuica Mute	F4	Cuica Mute	F4	User	A	…	User	A
79	Cuica Open	F4	Cuica Open	F4	User	A	…	User	A
80	Triangle Mute	F4	Triangle Mute	F4	User	A	…	User	A
81	Triangle Open	F4	Triangle Open	F4	User	A	…	User	A
82	Shaker	F4	Shaker	F4	User	A	…	User	A
83	Jingle Bells	F4	Jingle Bells	F4	User	A	…	User	A
84	Bell Tree	F4	Bell Tree	F4	User	A	…	User	A

- Only the voice attached "@" is reacts to KeyOff.
- Exclusion allotment of Key#42/#44/#46
- Exclusion allotment of Key#71/#72
- Exclusion allotment of Key#73/#74
- Exclusion allotment of Key#78/#79
- Exclusion allotment of Key#80/#81
In case also that voice is set to above NoteNo. Of User Bank, Exclusion

(*) Type F2: FM 2 Operator, F4: FM 4 Operator, P: PCM, A: F2/F4/P Assignable

5.2.6. MA-3 Native Normal Drum Instrument (FM32 mode)

Bank MSB	125		125		125		125	125	
Pch#	0		1		2		3~8	9	
	Preset				User Assignable				
Note#	Inst	Typ	Inst	Typ	Inst	Typ		Inst	Typ
24	Seq Click H	F2	Seq Click H	F2	User	A	…	User	A
25	Brush Tap	F2	Brush Tap	F2	User	A	…	User	A
@ 26	Brush Swirl	F2	Brush Swirl	F2	User	A	…	User	A
27	Brush Slap	F2	Brush Slap	F2	User	A	…	User	A
@ 28	Brush Tap Swirl	F2	Brush Tap Swirl	F2	User	A	…	User	A
@ 29	Snare Roll	F2	Snare Roll	F2	User	A	…	User	A
30	Castanet	F2	Castanet	F2	User	A	…	User	A
31	Snare L	P	Snare L	F2	User	A	…	User	A
32	Sticks	F2	Sticks	F2	User	A	…	User	A
33	Bass Drum L	P	Bass Drum L	F2	User	A	…	User	A
34	Open Rim Shot	F2	Open Rim Shot	F2	User	A	…	User	A
35	Bass Drum M	P	Bass Drum M	F2	User	A	…	User	A
36	Bass Drum H	P	Bass Drum H	F2	User	A	…	User	A
37	Closed Rim Shot	F2	Closed Rim Shot	F2	User	A	…	User	A
38	Snare M	P	Snare M	F2	User	A	…	User	A
39	Hand Clap	F2	Hand Clap	F2	User	A	…	User	A
40	Snare H	P	Snare H	F2	User	A	…	User	A
41	Floor Tom L	P	Floor Tom L	F2	User	A	…	User	A
42	Hi-Hat Closed	P	Hi-Hat Closed	F2	User	A	…	User	A
43	Floor Tom H	P	Floor Tom H	F2	User	A	…	User	A
44	Hi-Hat Pedal	P	Hi-Hat Pedal	F2	User	A	…	User	A
45	Low Tom	P	Low Tom	F2	User	A	…	User	A
46	Hi-Hat Open	P	Hi-Hat Open	F2	User	A	…	User	A
47	Mid Tom L	P	Mid Tom L	F2	User	A	…	User	A
48	Mid Tom H	P	Mid Tom H	F2	User	A	…	User	A
49	Crash Cymbal 1	P	Crash Cymbal 1	F2	User	A	…	User	A
50	High Tom	P	High Tom	F2	User	A	…	User	A
51	Ride Cymbal 1	P	Ride Cymbal 1	F2	User	A	…	User	A
52	Chinese Cymbal	P	Chinese Cymbal	F2	User	A	…	User	A
53	Ride Cymbal	F2	Ride Cymbal	F2	User	A	…	User	A
54	Tambourine	F2	Tambourine	F2	User	A	…	User	A
55	Splash Cymbal	P	Splash Cymbal	F2	User	A	…	User	A
56	Cowbell	F2	Cowbell	F2	User	A	…	User	A
57	Crash Cymbal 2	P	Crash Cymbal 2	F2	User	A	…	User	A
58	Vibraslap	F2	Vibraslap	F2	User	A	…	User	A
59	Ride Cymbal 2	P	Ride Cymbal 2	F2	User	A	…	User	A
60	Bongo H	F2	Bongo H	F2	User	A	…	User	A
61	Bongo L	F2	Bongo L	F2	User	A	…	User	A
62	Conga H Mute	F2	Conga H Mute	F2	User	A	…	User	A
63	Conga H Open	F2	Conga H Open	F2	User	A	…	User	A
64	Conga L	F2	Conga L	F2	User	A	…	User	A
65	Timbale H	F2	Timbale H	F2	User	A	…	User	A
66	Timbale L	F2	Timbale L	F2	User	A	…	User	A
67	Agogo H	F2	Agogo H	F2	User	A	…	User	A
68	Agogo L	F2	Agogo L	F2	User	A	…	User	A
69	Cabasa	F2	Cabasa	F2	User	A	…	User	A
70	Maracas	F2	Maracas	F2	User	A	…	User	A
@ 71	Samba Whistle	F2	Samba Whistle	F2	User	A	…	User	A
@ 72	Samba Whistle L	F2	Samba Whistle L	F2	User	A	…	User	A
73	Guiro Short	F2	Guiro Short	F2	User	A	…	User	A
74	Guiro Long	F2	Guiro Long	F2	User	A	…	User	A
75	Claves	F2	Claves	F2	User	A	…	User	A
76	Wood Block H	F2	Wood Block H	F2	User	A	…	User	A
77	Wood Block L	F2	Wood Block L	F2	User	A	…	User	A
78	Cuica Mute	F2	Cuica Mute	F2	User	A	…	User	A
79	Cuica Open	F2	Cuica Open	F2	User	A	…	User	A
80	Triangle Mute	F2	Triangle Mute	F2	User	A	…	User	A
81	Triangle Open	F2	Triangle Open	F2	User	A	…	User	A
82	Shaker	F2	Shaker	F2	User	A	…	User	A
83	Jingle Bells	F2	Jingle Bells	F2	User	A	…	User	A
84	Bell Tree	F2	Bell Tree	F2	User	A	…	User	A

- Only the voice attached "@" is reacts to KeyOff.
- Exclusion allotment of Key#42/#44/#46
- Exclusion allotment of Key#71/#72
- Exclusion allotment of Key#73/#74
- Exclusion allotment of Key#78/#79
- Exclusion allotment of Key#80/#81
In case also that voice set to above NoteNo. Of User Bank, Excusion

(*) Type F2:FM 2 Operator, F4: FM 4 Operator, P: PCM, A: F2/F4/P Assignable

5.2.7. MA-3GM Level1 Normal Voice MAP (built-in ROM Mode)

Bank MSB	0		0		Bank MSB	0		0	
Bank LSB	0		1-127		Bank LSB	0		1-127	
	Preset					Preset			
Pch#	Inst	Typ	Inst	Typ	Pch#	Inst	Typ	Inst	Typ
0	GrandPno	F2	←		64	SprnoSax	F2	←	
1	BritePno	F2	←		65	Alto Sax	F2	←	
2	E.GrandP	F2	←		66	TenorSax	F2	←	
3	HnkyTon	F2	←		67	Bari.Sax	F2	←	
4	E.Piano1	F2	←		68	Oboe	F2	←	
5	E.Piano2	F2	←		69	Eng.Horn	F2	←	
6	Harpsi.	F2	←		70	Bassoon	F2	←	
7	Clavi.	F2	←		71	Clarinet	F2	←	
8	Celesta	F2	←		72	Piccolo	F2	←	
9	Glocken	F2	←		73	Flute	F2	←	
10	MusicBox	F2	←		74	Recorder	F2	←	
11	Vibes	F2	←		75	PanFlute	F2	←	
12	Marimba	F2	←		76	Bottle	F2	←	
13	Xylophon	F2	←		77	Shakhchi	F2	←	
14	TubulBel	F2	←		78	Whistle	F2	←	
15	Dulcimar	F2	←		79	Ocarina	F2	←	
16	DrawOrgn	F2	←		80	SquareLd	F2	←	
17	PercOrgn	F2	←		81	Saw.Lead	F2	←	
18	RockOrgn	F2	←		82	CaliopLd	F2	←	
19	ChrchOrg	F2	←		83	ChiffLd	F2	←	
20	ReedOrgn	F2	←		84	CharanLd	F2	←	
21	Acordion	F2	←		85	Voice Ld	F2	←	
22	Harmnica	F2	←		86	Fifth Ld	F2	←	
23	TangoAcd	F2	←		87	Bass &Ld	F2	←	
24	NylonGtr	F2	←		88	NewAgeP	F2	←	
25	SteelGtr	F2	←		89	Warm Pad	F2	←	
26	Jazz Gtr	F2	←		90	PolySyPd	F2	←	
27	CleanGtr	F2	←		91	ChoirPad	F2	←	
28	Mute.Gtr	F2	←		92	BowedPad	F2	←	
29	Ovrdrive	F2	←		93	MetalPad	F2	←	
30	Dist.Gtr	F2	←		94	Halo Pad	F2	←	
31	GtrHarmo	F2	←		95	SweepPad	F2	←	
32	Aco.Bass	F2	←		96	Rain	F2	←	
33	FngrBass	F2	←		97	SoundTrk	F2	←	
34	PickBass	F2	←		98	Crystal	F2	←	
35	Fretless	F2	←		99	Atmosphr	F2	←	
36	SlapBas1	F2	←		100	Bright	F2	←	
37	SlapBas2	F2	←		101	Goblins	F2	←	
38	SynBass1	F2	←		102	Echoes	F2	←	
39	SynBass2	F2	←		103	Sci-Fi	F2	←	
40	Violin	F2	←		104	Sitar	F2	←	
41	Viola	F2	←		105	Banjo	F2	←	
42	Cello	F2	←		106	Shamisen	F2	←	
43	ContraBs	F2	←		107	Koto	F2	←	
44	Trem.Str	F2	←		108	Kalimba	F2	←	
45	Pizz.Str	F2	←		109	Bagpipe	F2	←	
46	Harp	F2	←		110	Fiddle	F2	←	
47	Timpani	F2	←		111	Shanai	F2	←	
48	Strings1	F2	←		112	TnklBell	F2	←	
49	Strings2	F2	←		113	Agogo	F2	←	
50	Syn.Str1	F2	←		114	SteelDrm	F2	←	
51	Syn.Str2	F2	←		*1 115	WoodBlo	F2	←	
52	ChoirAah	F2	←		*2 116	TaikoDrm	F2	←	
53	VoiceOoh	F2	←		*3 117	MelodTom	F2	←	
54	SynVoice	F2	←		*4 118	Syn.Drum	F2	←	
55	Orch.Hit	F2	←		*4 119	RevCymb	F2	←	
56	Trumpet	F2	←		120	FretNoiz	F2	←	
57	Trombone	F2	←		121	BrthNoiz	F2	←	
58	Tuba	F2	←		*5 122	Seashore	F2	←	
59	Mute.Trp	F2	←		*6 123	Tweet	F2	←	
60	Fr.Horn	F2	←		*7 124	Telphone	F2	←	
61	BrasSect	F2	←		*7 125	Helicptr	F2	←	
62	SynBras1	F2	←		*6 126	Applause	F2	←	
63	SynBras2	F2	←		*5 127	Gunshot	F2	←	

*1 : 50cent/halftpne, #69 = F#4
*2 : 50cent/halftone, #69 = A2
*3 : 50cent/halftone, #69 = C#4
*4 : 50cent/halftone
*5 : 20cent/halftone
*6 : 5cent/halftone
*7 : 10cent/halftone
The voice attached "*" is treated as drum voice by key control judging.

(*)Type F2: FM 2 Operator, F4: FM 4 Operator

5.2.8. MA-3 GM level Drum Instrument (built-in ROM mode)

Bank MSB	0		0	
Pch#	0		1-127	
	ROM			
Note#	Inst	Typ	Inst	Typ
24	Seq Click H	F2	←	
25	Brush Tap	F2	←	
@ 26	Brush Swirl	F2	←	
27	Brush Slap	F2	←	
@ 28	Brush Tap Swirl	F2	←	
@ 29	Snare Roll	F2	←	
30	Castanet	F2	←	
31	Snare L	P	←	
32	Sticks	F2	←	
33	Bass Drum L	P	←	
34	Open Rim Shot	F2	←	
35	Bass Drum M	P	←	
36	Bass Drum H	P	←	
37	Closed Rim Shot	F2	←	
38	Snare M	P	←	
39	Hand Clap	F2	←	
40	Snare H	P	←	
41	Floor Tom L	P	←	
42	Hi-Hat Closed	P	←	
43	Floor Tom H	P	←	
44	Hi-Hat Pedal	P	←	
45	Low Tom	P	←	
46	Hi-Hat Open	P	←	
47	Mid Tom L	P	←	
48	Mid Tom H	P	←	
49	Crash Cymbal 1	P	←	
50	High Tom	P	←	
51	Ride Cymbal 1	P	←	
52	Chinese Cymbal	P	←	
53	Ride Cymbal Cup	F2	←	
54	Tambourine	F2	←	
55	Splash Cymbal	P	←	
56	Cowbell	F2	←	
57	Crash Cymbal 2	P	←	
58	Vibraslap	F2	←	
59	Ride Cymbal 2	P	←	
60	Bongo H	F2	←	
61	Bongo L	F2	←	
62	Conga H Mute	F2	←	
63	Conga H Open	F2	←	
64	Conga L	F2	←	
65	Timbale H	F2	←	
66	Timbale L	F2	←	
67	Agogo H	F2	←	
68	Agogo L	F2	←	
69	Cabasa	F2	←	
70	Maracas	F2	←	
@ 71	Samba Whistle H	F2	←	
@ 72	Samba Whistle L	F2	←	
73	Guiro Short	F2	←	
74	Guiro Long	F2	←	
75	Claves	F2	←	
76	Wood Block H	F2	←	
77	Wood Block L	F2	←	
78	Cuica Mute	F2	←	
79	Cuica Open	F2	←	
80	Triangle Mute	F2	←	
81	Triangle Open	F2	←	
82	Shaker	F2	←	
83	Jingle Bells	F2	←	
84	Bell Tree	F2	←	

- Only the voice attached "@" is reacts to KeyOff.
- Exclusion allotment of Key#42/#44/#46
- Exclusion allotment of Key#71/#72
- Exclusion allotment of Key#73/#74
- Exclusion allotment of Key#78/#79
- Exclusion allotment of Key#80/#81

(*) Type F2: FM 2 Operator, F4: FM 4 Operator, P: PCM, A: F2/F4/P Assignable

5.2.9. MA-3 Native Normal Drum Instrument (FM32 mode)

WaveID	Instrument
0	Bass Drum
1	Snare Drum
2	Tom Tom
3	Hi-Hat Closed
4	Hi-Hat Open
5	Ride Cymbal
6	Clash Cymbal

5.3. Error Message

5.3.1. Error messages issued by input/output

Display	Description of error	Cause
Can not open MA1 (SMF) file Illegal file format.	MA1 file cannot be opened. Format of the file is not correct.	Format of MA1 (MA3) is not correct for reading.
Can not import from SMF file. Can not assign 4-operator on GM1 mode.	SMF file cannot be opened. In GM1 mode, 4 operator tones cannot be assigned.	4 operator tones of bank 124 are stored in SMF or M3N that is defined as FM32 tone mode.
Can not import from file Bank Number is different from selected bank.	File cannot be opened. Type of bank select is wrong.	When importing tones of bank row in VoiceList, the type of bank select is wrong.
Can not open voice file Illegal file format.	Tone file cannot be opened. Format of the file is not correct.	Tone definition file format error
Can not save voice file Illegal bank voice parameter.	Tone file cannot be saved. The bank of voice bank parameter is not correct.	Failed in exporting tones of bank row in VoiceList
Can not open file Illegal file format.	File cannot be opened. Format of the file is not correct.	An attempt was made to read a file with extension that is not supported.
Can not convert DLL: Can not create file.	File cannot be converted. File cannot be made.	File cannot be made due to an error.
Can not convert DLL: Output buffer overflow.	File cannot be converted. It overflows from the buffer.	Converted file overflows from buffer.
Can not convert DLL: Illegal format type.	File cannot be converted. Format type is not correct.	Invalid format identifier exists.
Can not convert DLL: Illegal parameter of function.	File cannot be converted. Value of function parameter is not correct.	Value of function parameter is abnormal.
Can not convert DLL: Illegal event.	File cannot be converted. Even is not correct.	There is an even that is not defined.
Can not convert file DLL: Temporary buffer overflow.	File cannot be converted. File overflows from temporary buffer.	Temporary buffer is full.
Can not convert DLL: RAM Size overflow.	File cannot be converted. File exceeds capacity of built-in RAM.	Capacity of MA-3 RAM is 8176 Bytes, and thus, music data that exceeds this capacity cannot be reproduced. MA-3 Authoring Tool calculates the size of music data to compare it with the RAM capacity, and issues this error message when the capacity is exceeded.
Can not save File. File path exceed 260byte.	Unable to save a file. Path of file name exceeds 260byte.	When the path of file name exceeds 260byte.
Can not assure contents. Max Event Density must be under 1000bytes/s.	The contents cannot be guaranteed. The maximum instantaneous event density exceeds 1000.	In the case of the maximum instantaneous event density exceeds 1000 (Byte/s).
Can not assure contents. Average Event Density must be under 500bytes/s	The contents cannot be guaranteed. Mean event density exceeds 500.	In the case of mean event density exceeds 500 (Byte/s).
Can not save file. Mono mode is used and the maximum number of simultaneous notes is exceeded	Unable to save a file. Using Mono-mode, it exceeds the maximum pronounceable numbers.	When exceeds the maximum pronounceable numbers using Mono-mode.

Display	Description of error	Cause
Can not save file. illegal output stream.	Unable to save MLD file. Output stream is uncorrected.	Document can not be saved into MLD (SMF) file.
Can not open file. illeagal file format.	Unable to open MLD file. File format is uncorrected.	Format is uncorrected at reading of MLD (SMF) file.
Can not save file. 8bit PCM stream Audio exist.	Unable to save files. There is 8bitPCM of StreamPCM exist.	When 8bitPCM of StreamPCM exists.
Can not convert. Program Change is specified at the timing of sounding notes.	Unable to file convert. Program change exists during a sound generation.	Program change is performed in a section between NoteOn of an arbitrary Note message and NoteOff.
Can not convert file. PCM voice setting error: Invalid Loop point setting. Bank MSB/LSB: %u / %u Pch: %u Note: %u	Unable to save a file. The setting of Loop Point is incorrect.	Setting of Loop Point is incorrect.
Can not convert file. PCM voice setting error: Invalid End point setting. Bank MSB/LSB: %u / %u Pch: %u Note: %u	Unable to save a file. The setting of End Point is incorrect.	End Point is incorrect.
Can not convert file. PCM voice setting error: SR <= 1 and XOF is checked. Bank MSB/LSB: %u / %u Pch: %u Note: %u	Unable to save a file. XOF check is on SR <= 1.	XOF check is on SR <= 1.
Can not convert file. PCM voice setting error: DR = 0, SL != 0 and XOF is checked. Bank MSB/LSB: %u / %u Pch: %u Note: %u	Unable to save a file. Checks is on DR = 0, SL != 0 and XOF.	Checks is on DR = 0, SL != 0 and XOF.
Can not convert file. PCM voice setting error: RR <= 1 and XOF is not checked. Bank MSB/LSB: %u / %u Pch: %u Note: %u	Unable to save a file. Check is not on RR <= 1 and XOF	Check is not on RR <= 1 and XOF

5.3.2. Error messages issued by starting

Display	Description of error	Cause
Can not open application Application is already running.	The application has already been started.	An attempt was made to start MA-3 Authoring Tool that has already been started.
Can not open application MA3_AT.ini (initial) file not found.	The application cannot be started. The ini file of MA-3 Authoring Tool does not exist.	MA3_AT.ini does not exist.
Can not open application. Illegal parameter of MA-3_AT.ini (initial) file.	The application cannot be started. The parameter of ini file of MA-3 Authoring Tool is not correct.	The setting of parameter of MA-3_AT.ini is not correct.

5.3.3. Error messages related to internal input/output

Display	Description of error	Cause
Can not export to M3N Unexpected problem is occurred.	M3N cannot be made. An unexpected problem has occurred.	It was impossible to make M3N due to an unknown problem.
Can not export to M3N RAM size overflow.	M3N cannot be made. MA-3 RAM capacity is exceeded.	RAM capacity is exceeded.

5.3.4. Error messages on WaveData

Display	Description of error	Cause
Can not open sound file. Stereo sound file is not supported.	Sound file cannot be opened. This is not compatible with stereophonic sound file.	Conversion processing was stopped because WaveFile is stereophonic.
Can not convert sound file. Unexpected problem is occurred.	Sound file cannot be converted.	Processing was stopped due to an unknown problem during WaveFile conversion.
Can not assign sound file. Numbers of Wave exceed 128.	Sound file cannot be assigned.	Because of no space WaveID on Voice List, process is interrupted.
Can not assign sound file. Numbers of Wave exceed 32.	Sound file cannot be assigned.	Because of no space WaveID on VoiceAssignMap, process is interrupted.
Can not convert sound file. Sampling Frequency is not supported. (Must be over 4kHz)	Sound file cannot be assigned.	With Stream PCM Assign MAP When WaveFile of 8 bit PCM is read Sampling Frequency is under 4000Hz.
Can not convert sound file. Sampling Frequency is not supported. (Must be under 16kHz)	Sound file cannot be converted.	Sampling Frequency is over 16000Hz when WaveFile of Mono 4 bit ADPCM is read at Stream PCM Assign MAP
Can not convert sound file. Sampling Frequency is not supported. (Must be under 48kHz)	Sound file cannot be converted.	Sampling Frequency is over 48000Hz when WaveFile is read at Voice Edit/PCM.
Can not convert sound file. Sampling Frequency is not supported. (Must be over 46Hz)	Unable to convert a sound file.	Save or playback was not able to perform when Sampling Frequency of WaveFile which was read by VoiceEdit/PCM is less than in 4000.

5.3.5. Error messages related to user operations

Display	Description of error	Cause
Can not paste voice parameter Can not assign 4-operator on GM1 mode.	Unable to paste a voice parameter.	4 operators are pasted from VoiceList to VAM.
Can not play. Illegal output stream.	Unable to playback.	The playback is un-normal.
Can not close Voice Edit. Please load wave file or check 'RM'.	Unable to close a Voice Edit. Be sure to check RM, or load a Wave file.	In state, either the voice wave load completed or RM unchecked, O.K button is selected.
Can not close Voice Edit. Invalid Loop point setting.	Unable to close a Voice Edit. Loop Point setting is illegal.	In case of the LP check shows an error.
Can not close Voice Edit. Invalid End point setting.	Unable to close a Voice Edit. End Point setting is illegal.	In case of the EP check shows an error.
Can not close Voice Edit. Setting Error: SR <= 1 and XOF is checked.	Unable to close a Voice Edit. Setting is error: SR <= 1 and XOF is not checked.	EG in case of LP=EP, or check boxes of LPL, and EPL show an error
Can not close Voice Edit. Setting Error: DR = 0, SL != 0 and XOF is checked.	Unable to close a Voice Edit. Setting is error: DR = 0, SL != 0 and XOF is checked.	EG in case of LP=EP, or check boxes of LPL and EPL show an error
Can not close Voice Edit. Setting Error : RR <= 1 and XOF is not checked.	Unable to close a Voice Edit. Setting is error: RR <= 1 and XOF is not checked.	EG in case of LP=EP, or check boxes of LPL and EPL show an error
Can not close Voice Edit. -Voice setting error: Invalid voice name.	Voice Edit can not be closed. Setting error: Voice name is not incorrect.	When an irregular voice name is input in VoiceEdit.

5.3.6. Other error messages

Display	Description of error	Cause
Exit application Unexpected problem is occurred.	The application was closed by some sort of problem.	A problem occurred.

5.4. Warning/Verification Messages

5.4.1. Warning messages issued at input/output

Display	Appears when
Note number（115-127）in file is not supported. DLL: Note Message (#115-127) is ignored.	When the note message of note number from 115 to 127 exists
Automatically operated The Overlapping note was tied.	When a redundant note messages are processed as tied.
Can not convert. DLL:RAM size overflow.	When the total of all voices registered in VoiceAssginMap and setting of Stream PCM Reserved exceeds the RAM size of 8176(Byte).
More than one Note messages found on the same duration in a mono mode channel. Only the last Note message will be accepted.	At the time of MLD output, when the multiple Note messages existed in duration 0 in the Mono-mode designation channels. * Only the last Note message is output (filtered in DLL).
Can not convert. Max Event Density must be under 1000bytes.	At the time of SMF Import, the maximum instantaneous event density exceeds 1000(byte/s).
Can not convert. Average Event Density must be under 500(Byte/s).	At the time of SMF Import, mean event density exceeds 500 (Byte/s).

5.4.2. Warning messages related with WaveData

Display	Appears when
Size of the Stream Data exceed the limit	When the data of StreamPCM is too big.
Sampling fq exceed the limit	When the sampling frequency of StreamPCM exceeds the range.

5.4.3. Warning messages issued at User operation

Display	Appears when
Save the changed document?	When try to cancel the document in the state where the document under edit exists.
Overwriting Voice List Save the changed voice parameters?	When try to cancel the application in the state where the voice under edit exists.
Loop/End Pint is adjusted automatically	When LP/EP automatic adjusting function starts to the timing which opens PCMVoiceEdit
Can not open help Unexpected problem is occurred	When unexpected problem occurs when try to display "Help."
Can not open helo. Viewer application or Help file doesn't exist	When try to display Help and neither viewer application nor a Help file exists

5.4.4. Verification messages issued at User operation

Display	Appears when
Confirm operation. Send MA-3 Native Reset Message?	When Reset in the option menu was clicked.
Confirm operation. Sound file will be detached automatically.	An attempt was made to check RM (ON) when a sound file is being loaded into the PCM Voice Edit dialog.
Overwriting Voice List. Save the changed voice parameters?	When Open Voice File in the File menu was selected.
Overwriting Voice List. Save the changed data of Voice List?	When the Import from Bank Voice in the VoiceList was selected.
Overwriting Voice List. Save the changed voice parameters?	When Preference in the Option menu was selected.
Overwriting Stream PCM Assign Map. Export to Stream PCM File?	When the Import from Stream PCM File In the Stream PCM Assign Map was selected.
Loop / End Point are adjusted automatically.	When rounding was made because of incorrect both Loop Point and End Point.
Stream PCM events exist in SMF. Do you overwrite Stream PCM Edit View?	An attempt was made to reload SMF in which the Stream PCM Event exists.

5.5. Shortcut Key

In MA-3 Authoring Tool, the following shortcut keys can be used.

Sign "+" means "with". For example, "[CTRL]+[F4]" means that "Push [F4] key with pushing the [Ctrl] key".

5.5.1. Shortcut Key common to each window

Key	Operation
[ESC]	Cancels an editing operation.
[DEL]	Deletes the event chosen.
[CTRL]+ [F4]	Closes an active editing window.
[CTRL]+ [F6](or Tab)	Changes an active window in the editing window opened on the application window.
[Alt](or GRPH)+[Tab]	Opens an application window, while minimizing MA-3 authoring tool.
[Alt](or GRPH)+[Space key]	Opens an icon popup menu from the title bar of an application window.
[Alt](or GRPH)+[-](Hyphen)	Opens an icon popup menu from the title bar of an active editing window.
[Alt](or GRPH)+ [F4]	Closes application.

5.5.2. Shortcut Key about menu bar

Key	Operation
[Alt](or [GRPH])+ Letter key	Executes the menu item corresponding to each letter key. For example, when pushes [E] key with pushing [Alt] (or [GRPH]), the pull-down menu of [Edit] menu will open. In addition, copy will be chosen when [C] key is pushed on it.
[Alt](or [GRPH])	Moves cursor to [File] of menu bar. In this status, it is possible to move cursor to right and left by pushing the cursor key of computer keyboard, and move to up and down on the opened menu.

5.5.3. Shortcut Key of Control Button

Key	Operation
Start/Stop button	[Space]

5.5.4. Shortcut Key of File menu

Key	Operation
Open	[Ctrl]+[O]
Save	[Ctrl]+[S]
Import from SMF	[Ctrl]+[L]
Reload from SMF	[Ctrl]+[R]

5.5.5. Shortcut Key of Edit menu

Key	Operation
Copy	[Ctrl]+[C]
Paste	[Ctrl]+[V]
Undo	[Ctrl]+[Z]
Redo	[Ctrl]+[Y]