MA-3 Sound Middleware
API Specification

Version: 1.10.0

April 22, 2003

YAMAHA Corporation

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Contents

Note:

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

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

Definition of error codes

Name of error code	Value	Meaning
MASMW_SUCCESS	0	Successful
MASMW_ERROR	-1	General error
MASMW_ERROR_ARGUMENT	-2	Argument error
MASMW_ERROR_RESOURCE_OVER	-3	Resource cannot be secured.
MASMW_ERROR_FILE	-16	File content error
MASMW_ERROR_CONTENTS_CLASS	-17	Value of SMAF Contents Class is unreproducible.
MASMW_ERROR_CONTENTS_TYPE	-18	Value of SMAF Contents Type is unreproducible
MASMW_ERROR_CHUNK_SIZE	-19	SMAF Chunk Size is incorrect.
MASMW_ERROR_CHUNK	-20	SMAF Track Chunk is incorrect.
MASMW_ERROR_UNMATCHED_TAG	-21	Designated tag information not present.
MASMW_ERROR_SHORT_LENGTH	-22	Sequence data is short.
MASMW_ERROR_LONG_LENGTH	-23	Sequence data is long. (SMF)
MASMW_ERROR_SMF_FORMAT	-50	Format type is abnormal (SMF)
MASMW_ERROR_SMF_TRACKNUM	-51	Track chunk number is abnormal (SMF)
MASMW_ERROR_SMF_TIMEUNIT	-52	division abnormal. (SMF)
MASMW_ERROR_SMF_CMD	-53	Event message format is abnormal. (SMF)

Revision

Ver.	Date	Description
0.7.0	April 23, 2001	Argument of Ma3Sound_Initialize was changed. MA3SRMCNV structural body of Ma3Sound_Create was changed. Argument of Ma3Sound_Load was added and contents of description were corrected.
0.8.0	June 1, 2001	Position of presentation of error code definition was changed. Description of functional specification was added. Status transition was changed. Argument of Ma3Sound_Initialize was changed. Contents of command for Ma3Sound_DeviceControl were changed. Argument of Ma3Sound_Create was changed. Argument of Ma3Sound_Load was changed. Meaning of argument open_mod of Ma3Sound_Open was changed. Contents and description of processing of Ma3Sound_Control was changed.
0.9.0	June 18, 2001	Status transition was changed. Contents of processing of Ma3Sound_Contro was changed.
1.0.0	June 29, 2001	All function names were changed. Content of processing of ctrl_num=14 of MaSound_Control was changed to the panpot value setting. Status transition that can be issued are described. Information needed for acquisition of contents information is descried. Conventional PLL value acquisition was moved to MaSound_DeviceControl.
1.1.0	July 11, 2001	Definition value was added to error code definitio. MaSound_Load () was changed. Description was added to MaSound_Control ().
1.2.0	July 18, 2001	2.3.9 MaSound_Control (): Spec. for acquisition of PhraseList was changed. 2.3.9 MaSound_Control (): Tag definition for contents information was added.
1.2.1	June 25, 2001	2.3.7 MaSound_Open (): Description of the value of argument open_mode was added,
1.2.2	August 3, 2001	2.2 Status transition was corrected. 2.3.9 MaSound_Control (): Description was changed.
1.2.3	September 19, 2001	1.1 The module configuration figure was corrected. 1.3.2 The number of registration of Stream Audio was corrected. 1.3.5 mode was unified into open_mode. 2.1 Explanation of the flow of processing was corrected. 2.2 The clerical error of state transition diagram was corrected. 2.3.7 The clerical error of the table of MaSound_Open() was corrected.
1.3.0	October 5, 2001	2.3.2 The function was added to cmd of MaSound_DeviceControl().
1.4.0	October 31, 2001	2.3.2 The function was added to cmd of MaSound_Control().
1.4.1	November 15, 2001	Contents of 3. Appendix were changed partly.
1.5.0	November 26, 2001	1.3 Module configuration diagram was changed. 1.3.5 Simultaneous reproduction of systems: Specification was simplified and changed substantially. 2.1 Description of flow of processing was added. 2.3.7 Description of MaSound_Open() was changed. 2.3.9 Description of MaSound_Control() was added.
1.6.0	December 7, 2001	2.3.9 Control command of MaSound_Control() was added.
1.6.1	December 20, 2001	2.3.12 Description of MaSound_Start() was added.

Ver.	Date		Description
1.7.0	January 30, 2002	1.1	SMF0 of the module configuration figure was corrected to SMF. Clerical error was corrected.
		1.2	Explanation of MA Stream Converter was changed.
		1.3.2	The number of voice registration was changed into 254 from 256.
			7 (1) was added to WT (Stream) of SMAF/MA-3.
		1.3.3	The number of voice registration was changed into 254 from 256.
			Voice definition support of FM/WT in MIDI was deleted.
		1.3.4	SMAF/MA-2 was added to the correspondence format.
			Fs value was changed into 4K-16 / 32kHz from 4K-24 / 48kHz.
		2.1	The clerical error of a function name Ma3Sound_Create was corrected to MaSound_Create.
		2.3.3	The description of SMAF/Phrase L1 was deleted.
			SMF format 0 was changed into SMF format0 or 1.
		2.3.5	In the definition of id value of a callback function, "0-125: user events" were changed to "0-15: user event" and "16-125: Reserved".
		2.3.7	7 (1) was added to WT (Stream) of a sequencer system and a real-time system.
			The value of RAM was changed into bytes from Kbytes, respectively.
		2.3.9	ctrl_num=9: synchronous setup was changed into Reserved.
			MASMW_SET_BIND was deleted among ctrl_num definitions.
		2.3.11	Assignment of a flag value was changed into unused, set 0.
		3.1	Explanation of 8. was changed.
			2fs time value of 9. was corrected from 40.7 to 41.7.
1.7.1	Feburuary.20, 2002	1.3.4	Fs value was corrected from 4k ~ 16/32kHz to 4k ~ 12/24kHz.
		2.1	Explanation was added.
		2.3.1	The return value was corrected.
		2.3.9	The clerical error in table of a ctrl_num definition was corrected.
1.8.0	February.27, 2002	2.3.9	The definition of 0x00FF was added to code type of contents information.
			The description of a definition of 0x0100 ~ 0xFFFF was added.
1.8.2	March.27, 2002	2.3.2	Precautions were added about LED and Motor relation to description.
1.8.3	May.20, 2002	2.3.6	The type of argument file_id of MaSound_Unload was corrected from UINT8 to SINT32.
1.8.4	June.26, 2002	2.3.7	The function name of function definition of MaSound_Open was changed to MaSound_Open from Ma3Sound_Open.
		2.3.8	The function name of function definition of MaSound_Close was changed to MaSound_Close from Ma3Sound_Close.
		2.3.9	The function name of function definition of MaSound_Control was changed to MaSound_Control from Ma3Sound_Control.
1.8.5	Nov. 15, 2002	2.3.9	The designation of playback speed (26) was added to MaSound_Control.
1.9.0	Jan. 16, 2003		Error code definition related with SMF was added to Definition of error codes.
			WAV playback path was added to the image.
		1.1	WAV playback was added to Audio system.
		1.3.4	"Simultaneous reproduction of systems" was changed to "Simultaneous reproduction between formats".
		1.3.5	
			The setting of playback count, acquisition of playback volume and the setting of period callback were added to MaSound_Control.
		2.3.9	
			Caution was added to MaSound_Control.
		2.3.11	Caution was added to MaSound_Seek.
		3.4	In 3), description of AP3 was deleted.

1.9.1	March 26, 2003	3.4	3) When only Speaker Amplifier was used and Headphone output was not used (only Digital section use), the mistake which sets AP3 as '1' was deleted.
1.10.1	April 22, 2003	1.3.4	The upper limit of WAV playback Fs was changed to 24KHz from 16KHz.
		2.3.2	In the definition of cmd, MASMW_GET_PLL was corrected to MASMW_GET_PLLOUT.
		2.3.3	WAV was added into the definition.
		2.3.9	In the relationship between ctrl_num and I/O, a part of description of playback volume acquisition was corrected.
			Tag LD, VB and KC were added into the tag name of contents information.
			In the specification of playback count of Note for using playback control, MaSound_Stat was corrected to MaSound_Start.

1   Introduction

This document stipulates API (Application Program Interface) which allows utilization of functions of mobile audio LSI "MA-3" (hereafter called MA-3) from OS or applications, and presents the specifications.

For actual operations, refer to the release note of MA-3 Sound Middleware

1.1   Module configuration

The module configuration of MA-3 Sound Middleware is as shown below. MA-3 Sound Middleware consists of multiple modules. Each Stream Converter module is independent from others, and thus, it is possible to remove a module if it is unnecessary.

1.2   Function of each module

▪ MA Sound Sequencer

Provides a group of functions the control stream converters that perform conversion processing dynamically so that musical pieces format data can be reproduced.

▪ MA Stream Converter

Provides a group of functions that executes stream conversion for each data format individually.

Two or more stream converters can also be registered if the existing-together conditions of a system are suited.

・   ▪ MA Sound Driver

Provides a group of functions for generating sounds.

▪ MA Resource Manager

Executes management of hardware resources. Provides a group of functions such as hardware resources utilization status and resource secure / release.
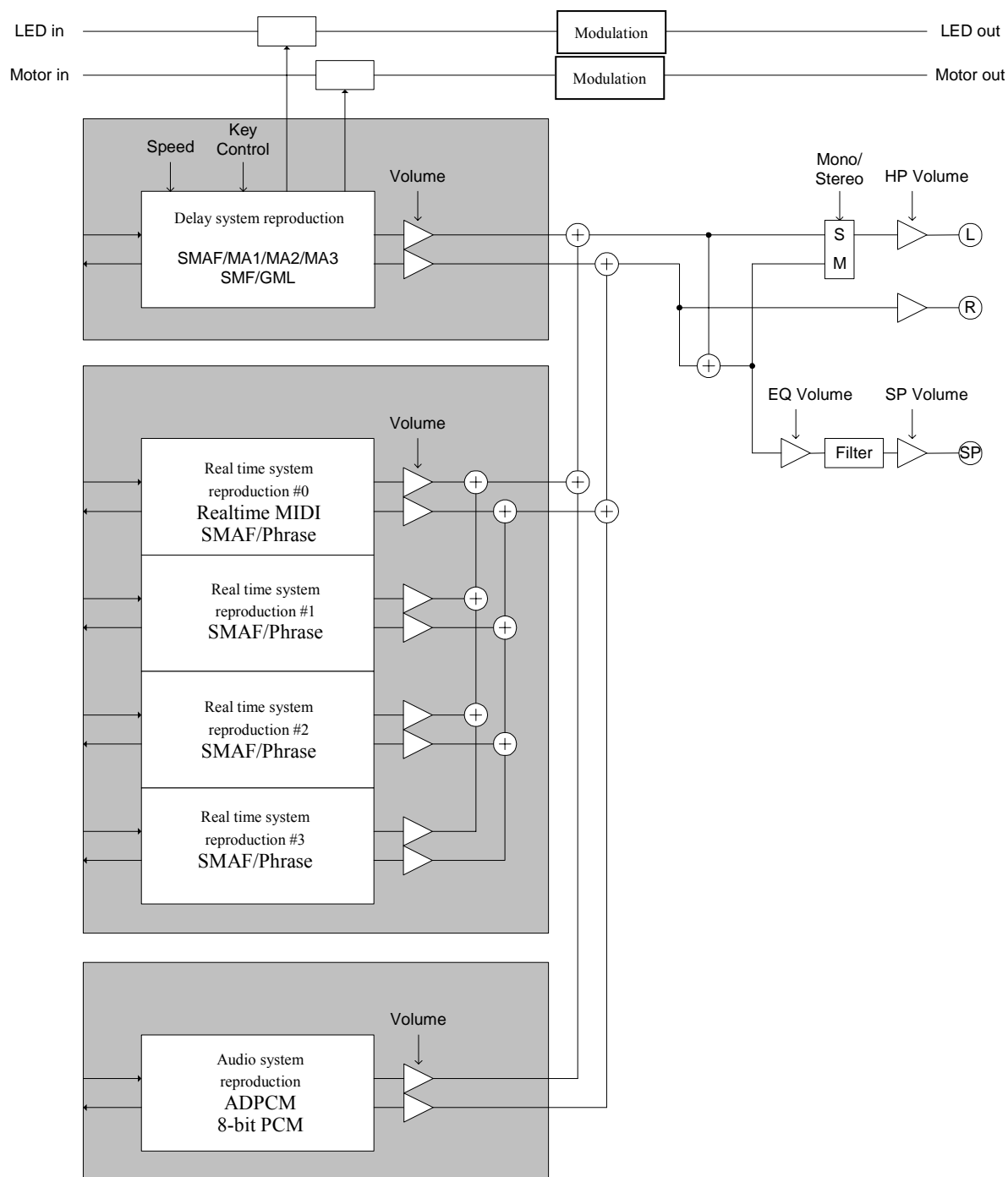
▪ MA Device Driver

Controls devices. Provides a group of functions for device initialization and read / write of individual registers.

1.3 Functional specifications

This specification for Sound Middleware uses hardware resources of MA-3 by stipulating the following specifications.

1.3.1 Functional model

1.3.2   Delay (sequence) system

Executes reproduction that uses hardware sequencer. It also deals with key control and tempo control. The system uses registered tones of up to 254 for FM / WT, and those of up to 32 for Stream Audio. It supports LED / Motor synchronization.

Format	FM mode	CH	FM	WT (Stream)
SMAF/MA-1	4OP	4	4	0 (0)
SMAF/MA-2	4OP	16	16	0 (0)/0 (1)
SMAF/MA-3	2OP	16	32	8 (0)/7 (1)/6 (2)
	4OP	16	16	8 (0)/7 (1)/6 (2)
SMF/GM Lite	2OP	16	32	8 (0)
	4OP	16	16	8 (0)

1.3.3   Real time system

The system uses registered tones of up to 254 for FM / WT. It does not support Stream Audio. Default for MIDI, 2OP or 4OP is designated by the definition file. For Phrase, the system treats four sequences.

Format	FM mode	CH	FM	WT (Stream)
SMAF/Phrase x 4	4OP	16	16	0 (0)
MIDI/GM Lite	2OP	16	32	8 (0)
	4OP	16	16	8 (0)

1.3.4   Audio system

Play audio data.

For SMAF/Audio playback, it complies with Yamaha spec. ADPCM, 8 bit offset bin PCM and 8 bit 2's comp bin PCM. Supports Fs ranging from 4K~12KHz (8bit)/4K~24KHz (4bit).

WAV playback considers only 8bit PCM as waveform format to playback and Fs supports 4K~24KHz.

It executes a call of callback function at the end of a reproduction to notify of the end.

Format	FM mode	CH	FM	WT(Stream)
SMAF/Audio/MA-2	-	0	0	0(1)
SMAF/Audio/MA-3	-	0	0	0(1)
WAV	-	0	0	0(1)

1.3.5   Simultaneous reproduction between formats

Usually, MA-3 sound middleware supports reproducing only one data simultaneously but reproducing one or more data simultaneously for SMAF/Pharse and SMAF/Audio.

Describes the maximum reproduction number for every format in the following.

Format	Maximum number of tones	Note
SMAF/MA-1/2/3	1	Cannot reproduce simultaneously with other data
SMF/GM Lite	1	Cannot reproduce simultaneously with other data
SMAF/Phrase	4	Can reproduce simultaneously with SMAF / Audio
MIDI/GM Lite	1	Cannot reproduce simultaneously with other data
SMAF/Audio/MA-2/3	1	Can reproduce simultaneously with SMAF / Phrase
WAV	1	Cannot reproduce simultaneously with other data

※ Supports to reproduce of maximum 5 data simultaneously by using SMAF/Phrase and SMAF/Audio.

2   MA Sound Player API

MA Sound Player API is an API for reproduction of each format data.

Function name	Description
MaSound_Initialize	Initializes MA Sound Player.
MaSound_DeviceControl	Executes setting of devices.
MaSound_Create	Registration of MA Stream Converter
MaSound_Load	Sequencer loading processing
MaSound_Open	Sequencer opening processing
MaSound_Control	Sets control value.
MaSound_Standby	Sequencer standby processing
MaSound_Seek	Sequencer seeking processing
MaSound_Start	Sequencer starting processing
MaSound_Pause	Sequencer pause processing
MaSound_Restart	Sequencer restart from pause processing
MaSound_Stop	Sequencer stopping processing
MaSound_Close	Sequencer closing processing
MaSound_Unload	Sequencer unloading processing
MaSound_Delete	Deletion of registration of MA Stream Converter

2.1   Flow of processing

MaSound_Initialize is called when initialization is needed.

MaSound_Create function is used to execute registration of Stream Converter to acquire Function ID. When two or more MA Stream Converters exist, perform the registration by the times equal to the number of the converters to acquire each Function ID, and actual directions are to be discriminated in accordance with Function IDs. This function is not needed when these processing are made by MaSound_Initiailize.

MaSound_Load function is used to set information of format data that is to be reproduced to secure hardware resources needed by MaSound_Open function. When these are ended normally, set initial value needed by MaSound_Standby to perform preparation for reproduction. MaSound_Seek is used to designate the position of reproduction. When reproducing from the head, it is not necessary to specify.
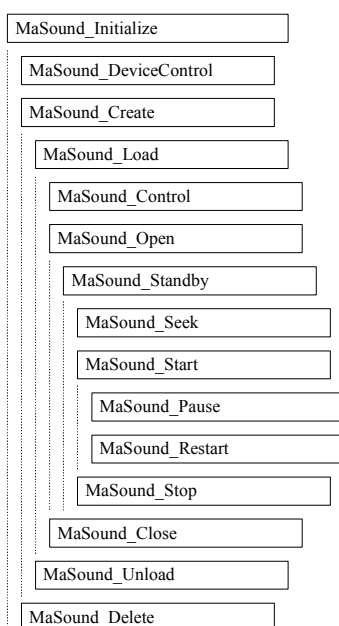
After these processing are finished, the reproduction is performed by calling MaSound_Start function. At this time, designate a reproduction count (including loop designation). However, the number of reproduction counts in the middle cannot be changed. To stop the reproduction expressly, call MaSound_Stop function. The processing is ended automatically when the reproduction of the sequence data is ended. At this time, the position of the reproduction is the last position of the sequence data. At the calling of MaSound_Start function after the reproduction is ended, whether expressly or automatically, the reproduction is restarted from the present position. Therefore, to restart the reproduction from the head, it is necessary to designate the reproduction position expressly by MaSound_Seek function.

MaSound_Close function is used to release hardware resources that have been secured.

When the format data becomes needless, MaSound_Unload function is used to release the domain that has been secured internally.

MaSound_Delete function is used to delete MA Stream Converter that is registered by MaSound_Create function designated with Function ID.

For any reproduction, the procedure for calling API is as described below.

```
MaSound_Initialize
  MaSound_DeviceControl
  MaSound_Create
    MaSound_Load
      MaSound_Control
      MaSound_Open
        MaSound_Standby
          MaSound_Seek
          MaSound_Start
            MaSound_Pause
            MaSound_Restart
          MaSound_Stop
      MaSound_Close
    MaSound_Unload
  MaSound_Delete
```

2.2 Status transition
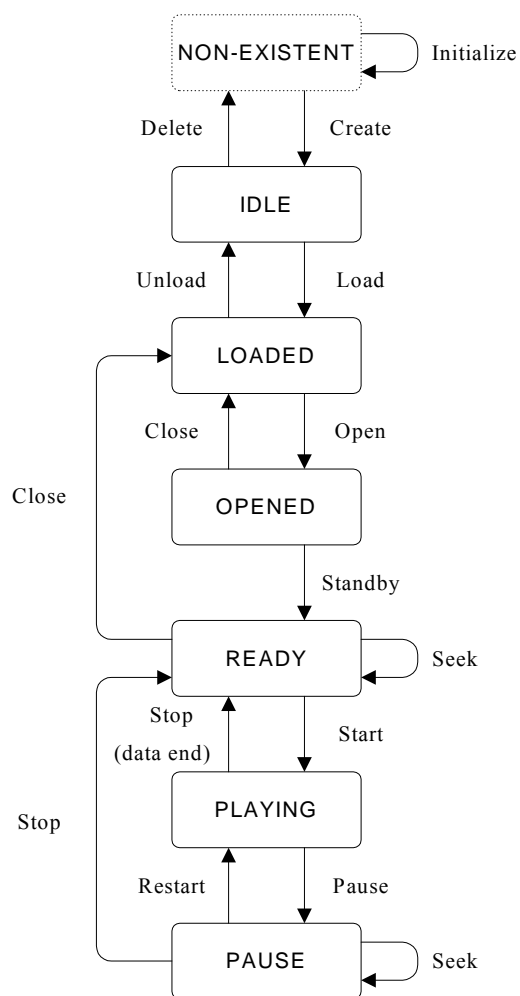
Status	Meaning
NON-EXISTENT	Unregistered
IDLE	Idling
LOADED	File loaded
OPENED	Resources are secured so that the loaded files can be reproduced.
READY	Reproduction can be made immediately.
PLAYING	Reproduction is in progress.
PAUSE	Pausing

2.3 Function definition

2.3.1 MaSound_Initialize

SINT32 MaSound_Initialize (void);

Description

Initialize MA Sound Sequencer.

Argument

None

Returned value

0	Successful
Negative	Error code

▪ Initialization of MA Device Driver is performed, and power down mode cancellation and software reset for devices are performed. And PLL setting is performed.

▪ Initialization of MA Resource Manager is performed. All the resources become released state.

▪ Initialization of MA Sound Sequencer is performed.

▪ Initialization of MA Sound Driver is performed.

▪ Since hardware reset resets the volume setting of analog section, it is necessary to perform the volume setting of analog section by using MaSound_DrviceControl.

2.3.2   MaSound_DeviceControl

SINT32 MaSound_DeviceControl (UINT8 cmd, UINT8 param1, UINT8 param2, UINT8 param3);

Description

Performs various settings of devices.

By the default, since a controlling agency setup of LED and a Motor is turned off, set it up according to a required situation.

Moreover, since ON/OFF control is not performed Sequence synchronization in the case where there is no synchronous setup into Sequence data, and the case where it is not supported by Sequence etc. even if it has set as sequence synchronization, if required, set up suitably.

However, it is necessary to publish each LED and Motor-related setup in the state of power down release. And it should perform about the change of controlling agency setup before MaSound_Standby() is published.

Argument

cmd   Command number
param1   Parameter 1
param2   Parameter 2
param3   Parameter 3

Setting	cmd	param1	param2	param3
Power management (digital)	0	val	0	0
Power management (analog)	1	val	0	0
EQ Volume	2	eq_vol	0	0
HP Volume	3	mono	vol_l	vol_r
SP Volume	4	hp_vol	0	0
LED control source setting	5	source	0	0
LED blinking setting	6	val	0	0
LED forced control	7	sw	0	0
Motor control source setting	8	source	0	0
Motor blinking setting	9	val	0	0
Motor forced control	10	sw	0	0
Acquisition of PLL value	11	0	0	0
Acquisition of sequencer processing flag	12	0	0	0

Returned value

Non-negative   Successful. When a value is returned, the value.
Negative   Error code

■ Definition of cmd

Name	Value	Message
MASMW_PWM_DIGITAL	0	Power management (digital)
MASMW_PWM_ANALOG	1	Power management (analog)
MASMW_EQ_VOLUME	2	EQ Volume
MASMW_HP_VOLUME	3	HP Volume
MASMW_SP_VOLUME	4	SP Volume
MASMW_LED_MASTER	5	LED control source setting
MASMW_LED_BLINK	6	LED blinking setting
MASMW_LED_DIRECT	7	LED forced control
MASMW_MTR_MASTER	8	Motor control source setting
MASMW_MTR_BLINK	9	Motor blinking control
MASMW_MTR_DIRECT	10	Motor forced control
MASMW_GET_PLLOUT	11	Acquisition of PLL value
MASMW_GET_SEQSTATUS	12	Acquisition of sequencer processing flag

1) Power management setting (digital)

Performs setting for power management of digital section.

val							
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	0	0	0	DP3	DP2	DP1	DP0

Note: Default is 0x0F (power down).

bits	Description
DP3	Controls current of built-in memory. Power down when "1".
DP2, DP1	Control operation of internal clock. Power down when "1".
DP0	Controls clock input from CLKI pin. Power down when "1".

2) Power management setting (analog)

Performs setting for power management of analog section.

val							
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
PLLPD	0	AP4R	AP4L	AP3	AP2	AP1	AP0

Note: Default is 0xBF (power down).

bit	Description
PLLPD	PLL power down bit. Power down when "1".
AP4R	Headphone Volume Rch side power down. Power down when "1".
AP4L	Headphone Volume Lch side power down. Power down when "1".
AP3	DAC and "Stereo to Mono" section power down. Power down when "1".
AP2	Speaker output section SPOUT2 terminal side power down. Power down when "1".
AP1	EQ Volume, EQ amplifier, SP Volume, speaker output section SPOUT1 terminal side power down. Power down when "1".
AP0	VREF circuit power down. Power down when "1".

3) EQ volume

Sets volume of EQ amplifier section (eq_vol).

eq_vol							
Set value	Volume [dB]	Set value	Volume [dB]	Set value	Volume [dB]	Set value	Volume [dB]
00h	-∞	08h	-23	10h	-15	18h	-7
01h	-30	09h	-22	11h	-14	19h	-6
02h	-29	0Ah	-21	12h	-13	1Ah	-5
03h	-28	0Bh	-20	13h	-12	1Bh	-4
04h	-27	0Ch	-19	14h	-11	1Ch	-3
05h	-26	0Dh	-18	15h	-10	1Dh	-2
06h	-25	0Eh	-17	16h	-9	1Eh	-1
07h	-24	0Fh	-16	17h	-8	1Fh	-0

Note: Default is 0 (-∞).

4) HP volume

Sets volume of monaural / stereophonic output (mono) (vol_l, vol_r) of headphone amplifier.

mono	
Set value	Meaning
0	Stereophonic output
1	Monaural output

Note: Default is 0 (stereophonic).

vol_l, vol_r							
Set value	Volume [dB]	Set value	Volume [dB]	Set value	Volume [dB]	Set value	Volume [dB]
00h	-∞	08h	-23	10h	-15	18h	-7
01h	-30	09h	-22	11h	-14	19h	-6
02h	-29	0Ah	-21	12h	-13	1Ah	-5
03h	-28	0Bh	-20	13h	-12	1Bh	-4
04h	-27	0Ch	-19	14h	-11	1Ch	-3
05h	-26	0Dh	-18	15h	-10	1Dh	-2
06h	-25	0Eh	-17	16h	-9	1Eh	-1
07h	-24	0Fh	-16	17h	-8	1Fh	-0

Note: Default is 0 (-∞).

5) SP volume

Sets volume of speaker amplifier (sp_vol).

sp_vol							
Set value	Volume [dB]	Set value	Volume [dB]	Set value	Volume [dB]	Set value	Volume [dB]
00h	-∞	08h	-23	10h	-15	18h	-7
01h	-30	09h	-22	11h	-14	19h	-6
02h	-29	0Ah	-21	12h	-13	1Ah	-5
03h	-28	0Bh	-20	13h	-12	1Bh	-4
04h	-27	0Ch	-19	14h	-11	1Ch	-3
05h	-26	0Dh	-18	15h	-10	1Dh	-2
06h	-25	0Eh	-17	16h	-9	1Eh	-1
07h	-24	0Fh	-16	17h	-8	1Fh	-0

Note: Default is 0 (-∞).

6)   LED control source setting

Performs setting of LED control source.

val	
0	OFF
1	Forced control
2	Sequence synchronization

Note: Default is 0 (OFF).

7)   LED blinking control

Performs blinking setting of LED control.

val	Blinking control	Blinking frequency
0	No blinking control	
1	Blinking control	18 Hz
2		16 Hz
3		12 Hz
4		8 Hz
5		4 Hz

Note: Default is 0 (no blinking control).

8)   LED forced control

Performed LED forced control. However, LED control source setting is to be designated for forced control.

val	
0	OFF
1	ON

Note: Default is 0 (OFF).

9)   Motor control source setting

Performs setting for motor control source.

val	
0	OFF
1	forced control
2	Sequence synchronization

Note: Default is 0 (OFF).

10) Motor blinking control

Performs blinking setting of motor control.

val	blinking control	Blinking frequency
0	No blinking control	
1	With Blinking control	2.25 Hz
2		2.0 Hz
3		1.5 Hz
4		1.0 Hz
5		0.5 Hz

Note: Default is 0 (No blinking control).

11) Motor forced control

Performs motor forced control. However, motor control source setting is to be designated for forced control.

val	
0	OFF
1	ON

Note: Default is 0 (OFF).

12) Acquisition of PLL value

Returns PLL value that was set.

13) Acquisition of sequencer processing flag

"1" is returned when sequencer stop / restart processing is performed so that the sequence time reset function of devices is disabled when overloaded state occurs at reproduction processing of the delay system. The parameter is reset to "0" when the acquisition is performed. "0" is returned when sequencer stop / restart processing is not performed.

2.3.3   MaSound_Create

SINT32 MaSound_Create (UINT8 cnv_id);

Description

     Registers the designated MA Stream Converter and initialize it.

Argument

     cnv_id   ID number of MA Stream Converter

Returned value

     Non-negative   Function ID of registered MA Stream Converter

     Negative   Error code

Name	Value	Stream converter
MASMW_CNVID_MMF	1	SMAF/MA-1/MA-2/MA-3
MASMW_CNVID_RMD	3	Realtime MIDI
MASMW_CNVID_AUD	4	SMAF/Audio
MASMW_CNVID_MID	5	SMF format 0 or 1/GM Lite or Level 1
MASMW_CNVID_WAV	11	WAV

2.3.4   MaSound_Delete

SINT32 MaSound_Delete (SINT32 func_id);

Description

     Deletes MA Stream Converter that has been registered with func_id.

Argument

     func_id   Function ID of MA Stream Converter that is to be released

Returned value

     0   Successful

     Negative   Error code

2.3.5　MaSound_Load

SINT32 MaSound_Load (SINT32 func_id, UINT8 *file_ptr, UINT32 file_size, UINT8 mode, SINT32 (*func) (UINT8 id), void * ext_args);

Description

Performs loading processing of MA Stream Converter.

Contents of the loading processing includes preparation for registration of designated format data, interpretation of format data on the memory, and processing of MA Stream Converter. Error is returned when the format data is abnormal.

Argument

func_id	Function ID of MA Stream Converter to be designated.			
file_ptr	Pointer for file data storage domain			
file_size	Byte size of file data			
mode	Designates format check for file data.			
	0:	Check is not performed.		
	1:	Check is performed.		
	2:	Only check is performed. Since internal information is not acquired, it cannot be opened after this.		
	3:	Performs acquisition of contents information. Since internal information is not acquired, it cannot be opened after this.		
func	Callback function	id	0 - 15	User event
			16 – 125	Reserved
			126	Notification of repeat
			127	Notification of sequence end
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.			

Returned value

Non-negative	Successful. File ID.
Negative	Error code

2.3.6　MaSound_Unload

SINT32 MaSound_Unload(SINT32 func_id, SINT32 file_id, void * ext_args);

Description

Performs unloading processing of MA Stream Converter.

The unloading processing release internal work domain that has been secured by loading.

Be sure that MaSound_Load and MaSound_Unload with the same func_id are to be used as a pair.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

2.3.7   MaSound_Open

SINT32 MaSound_Open(SINT32 func_id, SINT32 file_id, UINT16 open_mode, void * ext_args);

Description

Performs opening processing of MA Stream Converter.

Contents of the opening processing include securing of resources necessary for format data that has been registered by loading and judgement for possibility of reproduction.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
open_mode	Function mode (0/1/16)
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

[Sequencer system]

open_mode	FM-OP	CH	FM	WT (Stream)	RAM
0	4/2-OP	16	16 (32)	8(0)/7(1)/6(2)	**8176bytes**

[Real time system]

open_mode	FM-OP	CH	FM	WT (Stream)	RAM
0	4/2-OP	16	16 (32)	8(0)/7(1)/6(2)	**8176bytes**
16	4-OP	16	16	7 (0)	**7152bytes**

[Audio system]

open_mode	FM-OP	CH	FM	WT (Stream)	RAM
1	-	0	0	0 (1)	**1024bytes**

Returned value

0	Successful
Negative	Error code

2.3.8   MaSound_Close

SINT32 MaSound_Close(SINT32 func_id, SINT32 file_id, void * ext_args);

Description

Performs closing processing of MA Stream Converter.

The closing processing releases resources that has been secured by the opening processing.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

2.3.9   MaSound_Control

SINT32 MaSound_Control(SINT32 func_id, SINT32 file_id, UINT8 ctrl_num, void *prm, void * ext_args);

Description

Performs controlling processing of MA Stream Converter

Acquisition of present internal status (6) is dealt with after MaSound_Create ().

Setting of reproduction start point (12) and setting of reproduction end point (13) are dealt with only after MaSound_Open () and before MaSound_Standby ()

Acquisition of contents information (10) and acquisition of Phrase List information (11) can be done after MaSound_Load (), but other controls are dealt with only after MaSound_Open ().

Acquisition (19) of the information for playback can be performed after MaSound_Load (mode=2/1).

Registration (20) of the information for playback can be performed after MaSound_Create() before MaSound_Load().

* Since effective ctrl_num is different by each converter, refer to the API specification of each converter.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ctrl_num	Designates contents of processing.

0:	Sets volume of reproduction (0 - 127). Default is 100. Volume designation[dB] = 40 * Log (val / 127)
1:	Designates speed of reproduction (70 - 100 - 130). Default is 100.
2:	Designates relative change of reproduction key (-12 - 0 - +12). Default is 0.
3:	Acquires difference between basic time setting and actual value of time.
4:	Acquires reproduction position (unit: ms)
5:	Acquires reproduction time (unit: ms)
6:	Acquires present internal status.
7:	Sends usual MIDI message. (Specific to real time MIDI)
8:	Sends SysEx MIDI message. (Specific to real time MIDI)
9:	Reserved
10:	Acquires designated data of contents information.
11:	Acquires Phrase List information.
12:	Sets start point of reproduction.
13:	Sets end point of reproduction.
14:	Sets value of panpot (0 - 127). Default is 64。
15:	Acquires LED synchronization status. "1" is returned when LED synchronization is set for opened data and LED synchronization is set for sequence synchronization.
16:	Acquires vibration motor synchronization status. "1" is returned when VIB synchronization is set for opened data and VIB synchronization is set for sequence synchronization.
17:	Designates the Note number which generates a user event. (0 – 127)
18:	Acquires the sequence time under conversion. (unit: ms)
19:	Acquires the information for playback.
20:	Registers the information for playback.
26:	Designate the playback speed (25 - 100 - 400). Default is 100.
27:	Designate the playback count (0 - 255). Default is not set.
29:	Acquires the playback volume.
30:	Sets the period callback.

prm	Parameter needed for processing that are designated with ctrl_num.
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

Non-negative	Successful. When a value is returned, the value.
Negative	Error code

■ ctrl_num definition

Name	Value	Message
MASMW_SET_VOLUME	0	Sets volume for reproduction.
MASMW_SET_SPEED	1	Sets speed of reproduction.
MASMW_SET_KEYCONTROL	2	Designates relative change of reproduction key.
MASMW_GET_TIMERROR	3	Acquires difference between basic time setting and actual value of time.
MASMW_GET_POSITION	4	Acquires position of reproduction.
MASMW_GET_LENGTH	5	Acquires time of reproduction.
MASMW_GET_STATE	6	Acquires internal status.
MASMW_SEND_MIDIMSG	7	Sets usual MIDI message.
MASMW_SEND_SYSEXMIDIMSG	8	Sets SysEx MIDI message.
MASMW_GET_CONTENTSDATA	10	Acquires contents information.
MASMW_GET_PHRASELIST	11	Acquires Phrase List information.
MASMW_SET_STARTPOINT	12	Sets start point of reproduction.
MASMW_SET_ENDPOINT	13	Sets end point of reproduction.
MASMW_SET_PANPOT	14	Sets panpot.
MASMW_GET_LEDSTATUS	15	Acquires LED synch. status
MASMW_GET_VIBSTATUS	16	Acquires Vibration Motor synch. status
MASMW_SET_EVENTNOTE	17	Designates the Note number which generates a user event.
MASMW_GET_CONVERTERTIME	18	Acquires the sequence time under conversion.
MASMW_GET_LOADINFO	19	Acquires the information for playback.
MASMW_SET_LOADINFO	20	Registers the information for playback.
MASMW_SET_SPEEDWIDE	26	Designates the playback speed.
MASMW_SET_REPEAT	27	Designates the playback count.
MASMW_GET_CONTROL_VAL	29	Acquires the playback volume.
MASMW_SET_CB_INTERVAL	30	Designates the period callback.

■ Relationship between ctrl_num and I/O

ctrl#	Content	I/O		
0	Sets tone for reproduction.	prm	UINT8 *	Value of volume (0 - 127)
1	Sets speed of reproduction.	prm	UINT8 *	Value of speed (70 - 130)
2	Sets relative change of reproduction key.	prm	SINT8 *	Value of relative change (-12 - 12)
3	Acquires difference of basic time.	prm	NULL	
		return	Value of time difference	
4	Acquires position of reproduction.	prm	NULL	
		return	Reproduction position [ms]	
5	Acquires time of reproduction.	prm	NULL	
		return	Reproduction time [ms]	
6	Acquires internal status.	prm	NULL	
		return	Value of internal status	
7	Usual MIDI message	prm	UINT32 * msg	MIDI message (setting from LSB side)
8	SysEx MIDI message	prm	MASMW_MIDIMSG structural body	
			UINT8 * msg	Pointer for MIDI message
			UINT32 size	Size of MIDI message

10	Acquires data of contents information.	prm	MASMW_CONTENTSINFO structural body	
			UINT16 code	Code type
			UINT8 tag[2]	Tag name to be read
			UINT8 * buf	Buffer pointer of destination of data storage
			UINT32 size	Buffer size of destination of data storage
		return	No. of bytes of tag contents (When the buffer size is exceeded, data to the point is set and error value is returned.)	
11	Acquires Phrase List information.	prm	MASMW_PHRASELIST structural body	
			UINT8 tag[2]	Tag name to be read
			UINT32 start	Start point [ms]
			UINT32 stop	Stop point [ms]
12	Sets start point of reproduction.	prm	UINT32 *	Start point [ms]
13	Sets end point of reproduction.	prm	UINT32 *	End point [ms]
14	Sets value of panpot.	prm	UINT8 *	Value of panpot (0 - 127)
15	Acquires LED synch. status	prm	NULL	
		return	1: LED synch is set to the opened data and LED synch is set to the sequence synch.	
16	Acquires Motor synch. status	prm	NULL	
		return	1: VIB synch is set to the opened data and VIB synch. is set to the sequence synch.	
17	User event Note number	prm	MASMW_EVENTNOTE structure	
			UINT8 ch	Channel number (0-15)
			UINT8 note	Note number (0-127)
18	Time acquisition under conversion	prm	NULL	
		return	Sequence data time under conversion [ms]	
19	Acquisition of the information for playback	prm	UINT8 *info	The pointer to the information write-in area for playback (128 bytes of size is required)
20	Registration of the information for playback	prm	UINT8 *info	The pointer to the information storing area for playback (128 bytes of size is required)
26	Designates the playback speed	prm	UINT32 *	Speeed value (25-400)
27	Designates the playback count	prm	UINT8*	Playback count (0-255). However, 0 is infinitely
29	Sets the period callback	prm	**MASMW_GETCTL** structure	
			UINT8 bControl	Control number
			UINT8 bCh	Channel number
		return	Volume number	
30	Sets the period callback	prm	UINT8*	Call time [msec] However, supports only 0 and 20. 0 is interpreted as callback-free.

■ Code type of content information

Code type	Code type name	Applicable language
0x0000	Shift-JIS	Japanese
0x0001	Latin-1	English, French, German, Italian, Spanish, Portuguese
0x0002	EUC-KR	Korean
0x0003	HZ-GB-2312	Chinese (informal letters)
0x0004	Big5	Chinese (formal letters)
0x0005	KOI8-R	Russian and others
0x0006	TCVN-5773:1993	Vietnamese
0x0007 ~ 0x001F	Reserved	-
0x0020	UCS-2	Unicode
0x0021	UCS-4	Unicode
0x0022	UTF-7	Unicode
0x0023	UTF-8	Unicode
0x0024	UTF-16	Unicode
0x0025	UTF-32	Unicode
0x0026 ~ 0x00FE	Reserved	-
0x00FF	Octet Stream	Binary value
0x0100 ~ 0xFFFF	Reserved	-

■ Tag name of content information

Name	Tag name	Hex
Vender's name	VN	0x56 0x4E
Carrier name	CN	0x43 0x4E
Category name	CA	0x43 0x41
Title of musical composition	ST	0x53 0x54
Artist's name	AN	0x41 0x4E
Writer	WW	0x57 0x57
Composer	SW	0x53 0x57
Arranger	AW	0x41 0x57
Copyright©	CR	0x43 0x52
Date and time of creation	CD	0x43 0x44
Date and time of update	UD	0x55 0x44
Name of managing organization	GR	0x47 0x52
Management information	MI	0x4D 0x49
Music management information	ZZ	0x5A 0x5A
Contents class	C0	0x43 0x30
Contents type	C1	0x43 0x31
Copy status	C2	0x43 0x32
Copy count	C3	0x43 0x33
Acquires LED synch. Information	LD	0x4C 0x44
Acquires VIB synch. Information	VB	0x56 0x42
Acquires KCS	KC	0x4B 0x43

Definition of C0, C1, C2 and C3 tags	
C0	Contents class value of 1 byte
C1	Contents type value of 1 byte
C2	Copy definition of 1 byte. Each bit has a meaning as described below.
C3	Copy count of 1 byte

b7	b6	b5	b4	b3	b2	b1	b0
Reserved	Reserved	Reserved	Reserved	Reserved	Edit	Save	Transfer

* The tag which can actually be used differs with converter and contents.

■ Tag name of Phrase List information

Name	Tag name	Hex
A (A melody)	**PA**	**0x50 0x41**
B (B melody)	**PB**	**0x50 0x42**
E (ending)	**PE**	**0x50 0x45**
I (introduction)	**PI**	**0x50 0x49**
K (interlude)	**PK**	**0x50 0x4B**
S (sabi)	**PS**	**0x50 0x53**
R (refrain)	**PR**	**0x50 0x52**

■ Note for using playback control

Limitation for playback	Caution
Change of playback volume	After this change, the setting is reflected to the interpreted sequence data. However, this setting is not reflected to the data that finished interpretation and stored into H/W buffer or S/W buffer. Therefore, it needs time which depended on data in this section to reflect the setting to playback.
Change of playback speed	Reflect the setting by the extension and shortening of Duration or Gate Time. Therefore, the waveform data which is replayed at a normal pace stops when it is set to quicken the playback speed for the data included Stream PCM tone generation.
Change of the relative change of playback key	For the same reason with the change of playback volume, it needs time for reflection from the setting. And because of the reflection of the setting is performed by adding the setting value to key number in data, when the bottom line does not fall within the range (0 – 114), it is rounded. Moreover, this setting is not reflected to the StreamPCM tone generation.
Setting of playback count	Sets the playback count (repeat count). (When '0' is designated, it is interpreted as infinitely) This setting is given priority over the playback count that can be designated by the argument of MaSound_Start. Therefore, if you use this setting one time, the designation of the playback count of MaSound_Start is ignored. This setting is initialized in MaSound_Open.

2.3.10   MaSound_Standby

SINT32 MaSound_Standby (SINT32 func_id, SINT32 file_id, void * ext_args);

Description

        Performs standby processing of MA Stream Converter.

        Standby processing includes preparation for immediately starting reproduction when Start is executed.

        Setting initial value is performed.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

2.3.11   MaSound_Seek

SINT32 MaSound_Seek (SINT32 func_id, SINT32 file_id, UINT32 pos, UINT8 flag, void * ext_args);

Description

        Performs seeking processing of MA Stream Converter.

        The seek cannot be performed during reproduction.

        Because the note event before the playback start position is ignored, when the event which is generated tone at before and after the playback start position exists, that event does not generate tone.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
pos	Reproduction starting position (ms).
flag	Unused Sets up 0.
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

2.3.12 MaSound_Start

SINT32 MaSound_Start (SINT32 func_id, SINT32 file_id, UINT16 play_mode, void * ext_args);

Description

> Performs starting processing of MA Stream Converter.
>
> The starting processing performs starting of reproduction.
>
> play_mode which is published after MaSound_Standby() is effective until next MaSound_Standby().
>
> Forbids change of the numeric value in the middle. However, after an automatic end can be reconfigured.

Argument

func_id	Function ID of MA Stream Converter to be designated.	
file_id	File ID	
play_mode	Reproduction mode. May take the following values.	
	0	Loop reproduction
	1 - 255	Reproduction count
	Other than the above	reserved
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.	

Returned value

0	Successful
Negative	Error code

2.3.13 MaSound_Stop

SINT32 MaSound_Stop (SINT32 func_id, SINT32 file_id, void * ext_args);

Description

> Performs stopping processing of MA Stream Converter.
>
> The stopping processing performs stopping of reproduction.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

2.3.14   MaSound_Pause

SINT32 MaSound_Pause (SINT32 func_id, SINT32 file_id, void * ext_args);

Description

    Pauses sequence data reproduction temporarily.

    For audio systems, this operation is the same as Stop.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

2.3.15   MaSound_Restart

SINT32 MaSound_Restart (SINT32 func_id, SINT32 file_id, void * ext_args);

Description

    Cancels pause of sequence data reproduction.

    For audio systems, this operation is the same as Start.

Argument

func_id	Function ID of MA Stream Converter to be designated.
file_id	File ID
ext_args	Extension argument specific to each MA Stream Converter. NULL is set when no extension argument is needed.

Returned value

0	Successful
Negative	Error code

3   Appendix

3.1   Hardware initialization sequence

When going immediately to tone generation operation after hardware reset, go through the following steps.

1. Set /RST to "L" at the time of rise of VDD. The width of /RST="L" is 100μs or wider. Clock can be inputted optionally in the period of /RST="L".
   However, do not input intermediate level that does not meet VIH or VIL to CLKI terminal.
2. Perform setting for PLL. (Intermediate register group BANK=1 #5, #6)
3. Set DP0 to "0".
4. Set PLLPD and AP0 to "0" after the input from CLKI is stabilized at the state of actual use (frequency and level).
5. Set DP1 to "0" after waiting at least 10ms (*).
6. Set DP2 to "0".
7. Set software reset RST to "1".
8. Returns software reset RST to "0".
9. Set DP3 to "0" after time equivalent to 2 fs (= 41.7μs) has elapsed.
10. Set AP1, AP3 and AP4 to "0".
11. Set AP2 to "0" after time of 10μs has elapsed.
12. Usual operation

When the operation does not move to tone generation after hardware reset, go through the following steps.

1. Set /RST to "L" at the time of rise of VDD. The width of /RST="L" is 100μs or wider. Clock can be inputted optionally in the period of /RST="L".
   However, do not input intermediate level that does not meet VIH or VIL to CLKI terminal.
2. Perform setting for PLL. (Intermediate register group BANK=1 #5, #6)
3. Set DP0 to "0".
4. Set PLLPD to "0" after the input from CLKI is stabilized at the state of actual use (frequency and level).
5. Set DP1 to "0" after waiting at least 10ms (*).
6. Set DP2 to "0".
7. Set software reset RST to "1".
8. Returns software reset RST to "0".
9. Set DP2 to "1" after time equivalent to 2 fs (= 41.7μs) has elapsed.
10. Set DP1 to "1".
11. Set PLLPD to "1".
12. Set DP1 to "1". Now, MA-3 goes to power down state.

(*) When a capacitor other than 0.1μF is used on VREF pin, secure time equivalent to or longer than 10 ms x (capacitance [μF] divided by 0.1).

3.2   Power down transition sequence

1.   Set HP Vol L, HP Vol R, EQ Vol, and SP Vol to MUTE.
2.   Set DP2 and DP3 "1"
3.   Set DP1 to "1".
4.   Set PLLPD, and AP0 - AP4* to "1".
5.   Set DP0 to "1".

3.3   Power down release sequence

1.   Set DP0 to "0".
2.   Set PLLPD and AP0 to "0" after the input from CLKI is stabilized at the state of actual use (frequency and level).
3.   Set DP1 to "0" after waiting at least 10ms (*).
4.   Set DP2 and DP3 "0"
5.   Set AP1, AP3 and AP4 to "0".
6.   Set AP2 to "0" after time equivalent to $10\mu s$ or longer has elapsed.
7.   Usual operation. Release **HP Vol L, HP Vol R, EQ Vol, and SP Vol from MUTE.**

3.4   Setting by mode of use

1)   When only headphone output is used and speaker output is not used;

Fix AP1 and AP2 to "1".

SPVol (intermediate register #10) must be made MUTE.

2)   When only speaker amplifier is used and digital section and headphone section are not used;

Fix DP0 - DP3, PLLPD, AP3, AP4L and AP4R to "1" to use.

However, control of DP0 - DP3 and PLLPD must be made without fail at initialization sequence.

HP Vol L, HP Vol R and EQ Vol (intermediate registers #7 ~ 9) must be made MUTE.

3)   When only speaker amplifier is used and headphone output are not used (digital section is used);

Fix AP4L and AP4R to "1" to use.

HP Vol L, HP Vol R and EQ Vol (intermediate registers #8 ~ 9) must be made MUTE.