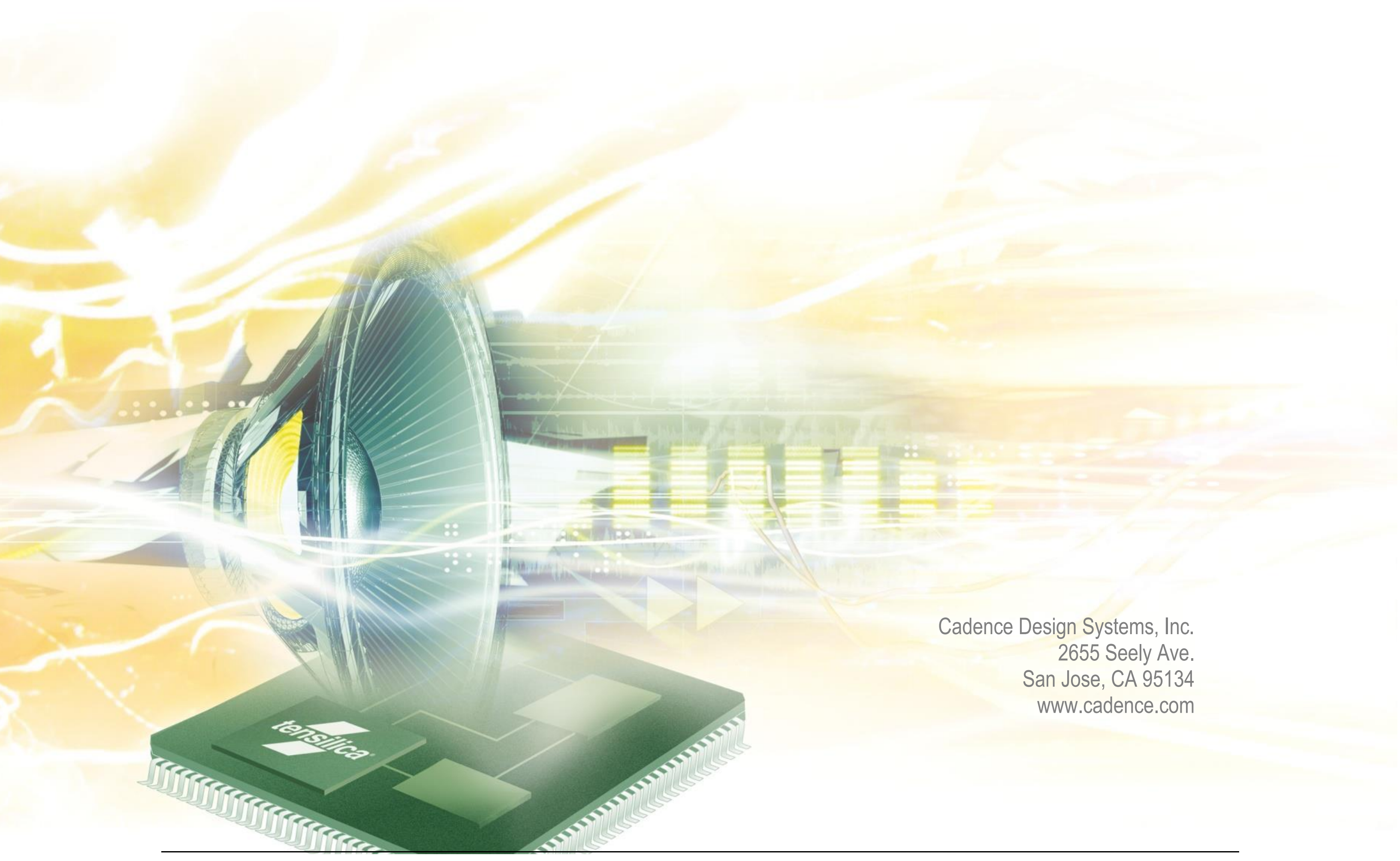
Vorbis Decoder

Programmer's Guide

For HiFi DSPs



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Document Change History

Version	Changes
1.3	■ Added 16-bit PCM data output feature to Section 1.3 ■ Updated Text Library Kbytes in Section 1.4.1 ■ Updated Section 1.4.2 ■ Added restriction information to XA_API_CMD_SET_CONFIG_PARAM in Section 2.6.19 ■ Added information for granule_pos and file_type in Section 3.2. ■ Added new bullet items in Section 3.4. ■ Added XA_VORBISDEC_CONFIG_NONFATAL_GROUPED_STREAM, XA_VORBISDEC_CONFIG_FATAL_INVALID_PARAM, and XA_VORBISDEC_EXECUTE_FATAL_CORRUPT_STREAM in Section 3.5.1.
1.4	■ Changed generic references of HiFi 2 to HiFi ■ Deleted references to Diamond 330HiFi. ■ Added memory and timings data for HiFi Mini and HiFi 3.
1.5	■ Added Performance data for HiFi 4 in Section 1.4.
1.6	■ Added Performance data for HiFi 3z in Section 1.4. ■ Added new API for managing runtime memory use in Section 3.

1. Introduction to the HiFi Vorbis Decoder

The HiFi Vorbis Decoder implements the Vorbis I audio codec standard specified by the Xiph.Org foundation. It is capable of decoding audio streams encoded by the reference implementation of the codec (*libvorbis* versions 1.0 and later). [1] [2]

The vendor source code version is Xiph.org Vorbis 1.0.2 with some modifications (including raw Vorbis decoding support).

1.1 Vorbis Background

A quote from the Xiph.Org foundation:

“Ogg Vorbis is a fully open, non-proprietary, patent-and-royalty-free, general-purpose compressed audio format for mid to high quality (8kHz-48.0kHz, 16+ bit, polyphonic) audio and music at fixed and variable bitrates from 16 to 128 kbps/channel. This places Vorbis in the same competitive class as audio representations such as MPEG-4 (AAC), and similar to, but higher performance than MPEG-1/2 audio layer 3, MPEG-4 audio (TwinVQ), WMA and PAC.”

Ogg Vorbis files and streams contain audio payloads encoded using the Vorbis audio codec standard and carried in Ogg – Xiph.Org’s container format for audio, video, and metadata. However, the Vorbis streams are not required to be carried inside an Ogg container; they can also be decoded in the raw format. The rest of this document refers to the HiFi Vorbis decoder as the *HiFi Vorbis decoder* or simply as the *Vorbis decoder*.

1.2 Document Overview

This document covers all the information required to integrate the HiFi audio codecs into an application. The HiFi codec libraries implement a simple API to encapsulate the complexities of the coding operations and simplify the application and system implementation. Parts of the API are common to all the HiFi codecs and these are described after the introduction. Section 3 covers all the features and information particular to the HiFi Vorbis Decoder. Section 4 describes the example test bench. Section 5 provides references.

1.3 HiFi Vorbis Decoder Specifications

The HiFi DSP Vorbis Decoder from Cadence Tensilica implements the following features in conformance to the Ogg Vorbis specifications:

- Cadence Audio Codec API is used
- Sampling rates: 8, 11.025, 16, 22.05, 32, 44.1, and 48 kHz
- Mono and stereo channels
- Quality levels: 0 through 10. Vorbis is variable bit rate by design and quality levels are proportional to bit rates
- Support for Floor 1 encoded streams
- Support for bit-rate peeled streams
- Support for decoding of Ogg Vorbis streams
- Support for decoding of raw Vorbis streams (Vorbis streams without an Ogg container)
- Output: 16 bit PCM data, interleaved

1.4 HiFi Vorbis Decoder Performance

The HiFi DSP Voribs Decoder from Cadence was characterized on the HiFi 5-stage DSP. The memory usage and performance figures are provided for design reference.

1.4.1 Memory

		Text (Kbytes)			Data
HiFi Mini	HiFi 2	HiFi 3	HiFi 3z	HiFi 4	Kbytes
30.1	32.5	32.8	34.6	35.7	18.6

Stream Type	Runtime Memory	Runtime Memory (Kbytes)				
		Persistent	Scratch	Stack	Input	Output
Ogg Stream	0	84.0	33.1	0.7	<ogg_maxpage>	4.0
	1	115.0	65.0	0.7	<ogg_maxpage>	4.0
Raw Stream	0	86.0	33.1	0.7	12.0	4.0
	1	117.0	65.0	0.7	12.0	4.0

Note Default value of <ogg_maxpage> is 12, minimum is 12, and maximum is 128. Pre config parameter XA_VORBISDEC_CONFIG_PARAM_OGG_MAX_PAGE_SIZE is provided to modify this, for more details refer to Table 3-5. Pre-config parameter XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM is provided to choose between Runtime Memory 0 or 1 configuration (default is 0), for more details refer to Table 3-6.

1.4.2 Timings

Rate	Channels	Bit Rate	Average CPU Load (MHz)				
kHz		kbps	HiFi Mini	HiFi 2	HiFi 3	HiFi 3z	HiFi 4
44.1	2	128	12.4	12.4	11.1	9.5	9.7
44.1	2	320	16.9	16.9	15.2	12.7	13.3
48	2	500	19.2	19.2	17.2	14.4	15.1

Note Performance specification measurements are carried on a cycle-accurate simulator assuming an ideal memory system; that is, one with zero memory wait states. This is equivalent to running with all code and data in local memories or using an infinite-size, pre-filled cache model. The MCPS numbers for HiFi 3/HiFi 3z/HiFi 4/HiFi Mini are obtained by running the test that is recompiled from the HiFi 2 source code in the HiFi 3/HiFi 3 z /HiFi 4/HiFi Mini configuration. No specific optimization is done for HiFi 3/HiFi 3 z /HiFi 4/HiFi Mini.

Note In the Ogg Vorbis format, codebooks are encoded in the Ogg Vorbis stream. Due to codebook processing, decoder initialization may take up to 16 million cycles per audio stream.

2. Generic HiFi Audio Codec API

This chapter describes the API which is common to all the HiFi audio codec libraries. The API facilitates any codec that works in the overall method shown in the following diagram.

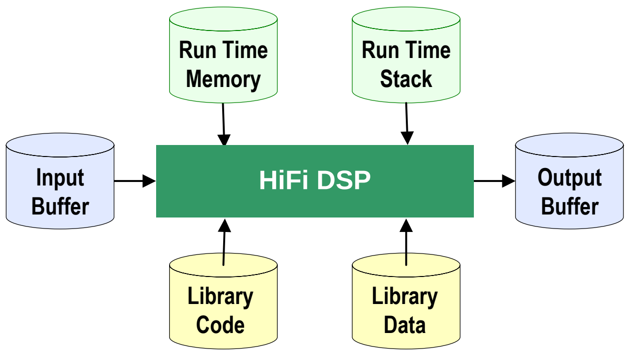

Figure 1 HiFi Audio Codec Interfaces

Section 2.1 discusses all the types of run time memory required by the codecs. There is no state information held in static memory, therefore a single thread can perform time division processing of multiple codecs. Additionally, multiple threads can perform concurrent codec processing. The API is implemented so that the application does not need to consider the codec implementation.

Through the API, the codec requests the minimum sizes required for the input and output buffers. Prior to executing the codec execution command, the codec requires that the input buffer be filled with data up to the minimum size for the input buffer. However, the codec may not consume all of the data in the input buffer. Therefore, the application must check the amount of input data consumed, copy downwards any unused portion of the input buffer, and then continue to fill the rest of the buffer with new data until the input buffer is again filled to the minimum size. The codec will produce data in the output buffer. The output data must be removed from the output buffer after the codec operation.

Applications that use these libraries should not make any assumptions about the size of the PCM chunks of data that each call to a codec produces or consumes. Although normally the chunks are the exact size of the underlying frame of the specified codec algorithm, they will vary between codecs and also between different operating modes of the same codec. The application should provide enough data to fill the input buffer. However, some codecs do provide information, after the initialization stage, to adjust the number of bytes of PCM data they need.

2.1 Memory Management

The HiFi audio codec API supports a flexible memory scheme and a simple interface that eases the integration into the final application. The API allows the codecs to request the required memory for their operations during run time.

The run time memory requirement consists primarily of the scratch and persistent memory. The codecs also require an input buffer and output buffer for the passing of data into and out of the codec.

API Object

The codec API stores its data in a small structure that is passed via a handle that is a pointer to an opaque object from the application for each API call. All state information and the memory tables that the codec requires are referenced from this structure.

API Memory Table

During the memory allocation the application is prompted to allocate memory for each of the following memory areas. The reference pointer to each memory area is stored in this memory table. The reference to the table is stored in the API object.

Persistent Memory

This is also known as static or context memory. This is the state or history information that is maintained from one codec invocation to the next within the same thread or instance. The codecs expect that the contents of the persistent memory be unchanged by the system apart from the codec library itself for the complete lifetime of the codec operation.

Scratch Memory

This is the temporary buffer used by the codec for processing. The contents of this memory region should be unchanged if the actual codec execution process is active, *i.e.*, if the thread running the codec is inside any API call. This region can be used freely by the system between successive calls to the codec.

Input Buffer

This is the buffer used by the algorithm for accepting input data. Before the call to the codec, the input buffer needs to be completely filled with input data.

Output Buffer

This is the buffer in which the algorithm writes the output. This buffer needs to be made available for the codec before its execution call. The output buffer pointer can be changed by the application between calls to the codec. This allows the codec to write directly to the required output area. The codec will never write more data than the requested size of the output buffer.

2.2 C Language API

A single interface function is used to access the codec, with the operation specified by command codes. The actual API C call is defined per codec library and is specified in the codec-specific section. Each library has a single C API call. The C parameter definitions for every codec library are the same and are specified in Table 2-1.

Table 2-1 Vorbis Decoder API

xa_vorbis_dec	
Description	This C API is the only access function to the audio codec.

Syntax	`XA_ERRORCODE xa_<codec>(`
	`      xa_codec_handle_t  p_xa_module_obj,`
	`      WORD32 i_cmd,`
	`      WORD32 i_idx,`
	`      pVOID  pv_value);`

Parameters	`p_xa_module_obj`
	Pointer to opaque API structure.
	
	`i_cmd`
	Command.
	
	`i_idx`
	Command subtype or index.
	
	`pv_value`
	Pointer to the variable used to pass in, or get out properties from the state structure

Returns	Error Code based on the success or failure of API command

The types used for the C API call are defined in the supplied header files as:

```
typedef signed int             WORD32;
typedef void                  *pVOID;
```

Each time the C API for the codec is called, a pointer to a private allocated data structure is passed as the first argument. This argument is treated as an opaque handle as there is no requirement by the application to look at the data within the structure. The size of the structure is supplied by a specific API command so that the application can allocate the required memory. Do not use `sizeof()` on the type of the opaque handle.

Some command codes are further divided into subcommands. The command and its subcommand are passed to the codec via the second and third arguments respectively.

When a value must be passed to a particular API command or an API command returns a value, the value expected or returned is passed through a pointer which is given as the fourth argument to the C API function. In the case of passing a pointer value to the codec, the pointer is just cast to `pVOID`. It is incorrect to pass a pointer to a pointer in these cases. An example would be when the application is passing the codec a pointer to an allocated memory region.

Due to the similarities of the operations required to decode or encode audio streams, the HiFi DSP API allows the application to use a common set of procedures for each stage. By maintaining a pointer to the single API function and passing the correct API object the same code base can be used to implement the operations required for any of the supported codecs.

2.3 Generic API Errors

The error code returned is of type `XA_ERRORCODE` which is of type `signed int`. The format of the error codes are defined in the following table.

31	30-15	14 – 11	10 – 6	5 – 0
Fatal	Reserved	Class	Codec	Sub code

The errors that can be returned from the API are sub divided into those that are fatal, which require the restarting of the entire codec and those that are nonfatal and are provided for information to the application.

The class of an error can be API, Config, or Execution. The API errors are concerned with the incorrect use of the API. The Config errors are produced when the codec parameters are incorrect or outside the supported usage. The Execution errors are returned after a call to the main encoding or decoding process and indicate situations that have arisen due to the input data.

2.4 Commands

This section covers the commands associated with the command sequence overview flow chart below. For each stage of the flow chart there is a section that lists the required commands in the order they should occur. For individual commands, definitions and examples refer to Section 2.6. The codecs have a common set of generic API commands that are represented by the white stages. The yellow stages are specific to each codec.

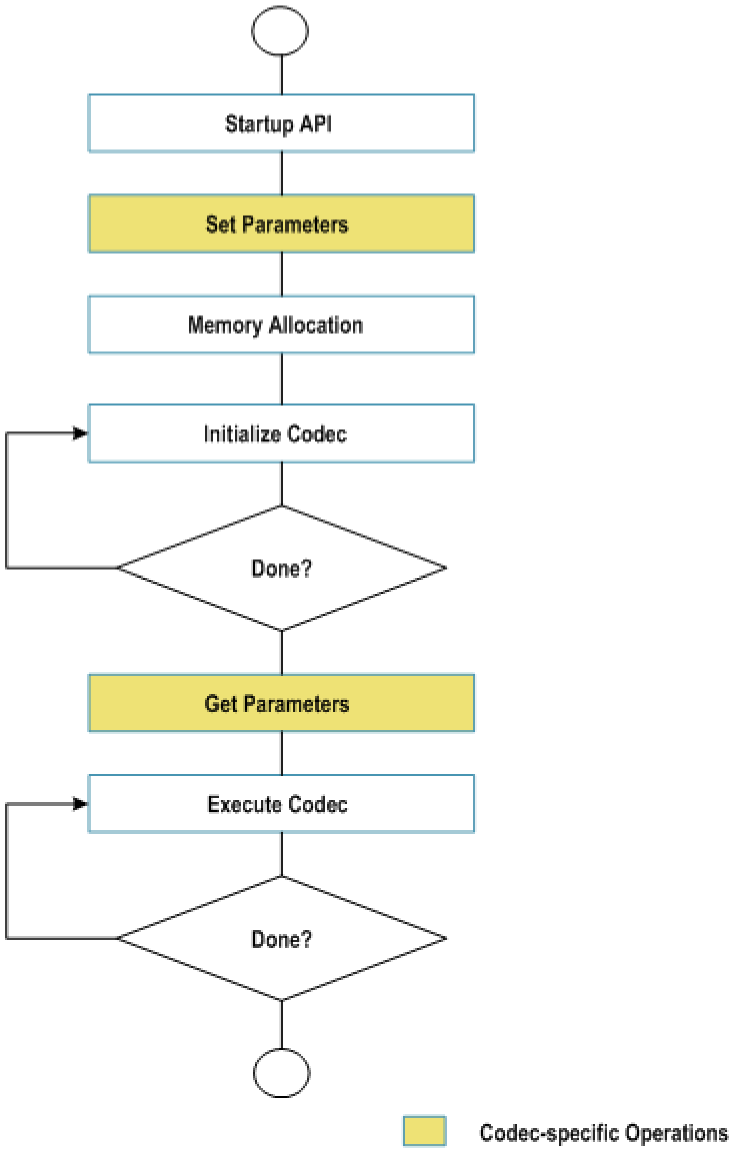

Figure 2 API Command Sequence Overview

2.4.1 Start-up API Stage

The following commands should be executed once each during start-up. The commands to get the various identification strings from the codec library are for information only and are optional. The command to get the API object size is mandatory as the real object type is hidden in the library and therefore there is no type available to use with `sizeof()`.

Table 2-2 Commands for Initialization

Command / Subcommand	Description
`XA_API_CMD_GET_LIB_ID_STRINGS` `XA_CMD_TYPE_LIB_NAME`	Get the name of the library.
`XA_API_CMD_GET_LIB_ID_STRINGS` `XA_CMD_TYPE_LIB_VERSION`	Get the version of the library.
`XA_API_CMD_GET_LIB_ID_STRINGS` `XA_CMD_TYPE_API_VERSION`	Get the version of the API.
`XA_API_CMD_GET_API_SIZE`	Get the size of the API structure.
`XA_API_CMD_INIT` `XA_CMD_TYPE_INIT_API_PRE_CONFIG_PARAMS`	Set the default values of all the configuration parameters.

2.4.2 Set Codec-Specific Parameters Stage

Refer to the specific codec section for the parameters that can be set. These parameters either control the encoding process or determine the output format of the decoder PCM data.

Table 2-3 Commands for Setting Parameters

Command / Subcommand	Description
`XA_API_CMD_SET_CONFIG_PARAM` XA_*<codec>*_CONFIG_PARAM_*<param_name>*	Set the codec-specific parameter. See the codec-specific section for parameter definitions.

2.4.3 Memory Allocation Stage

The following commands should be executed once only after all the codec-specific parameters have been set. The API is passed the pointer to the memory table structure (MEMTABS) after it is allocated by the application to the size specified. Once the codec specific parameters are set, the initial codec setup is completed by performing the post-configuration portion of the initialization to determine the initial operating mode of the codec and assign sizes to the blocks of memory required for its operation. The application then requests a count of the number of memory blocks.

Table 2-4 Commands for Initial Table Allocation

Command / Subcommand	Description
`XA_API_CMD_GET_MEMTABS_SIZE`	Get the size of the memory structures to be allocated for the codec tables.
`XA_API_CMD_SET_MEMTABS_PTR`	Pass the memory structure pointer allocated for the tables.
`XA_API_CMD_INIT` `XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS`	Calculate the required sizes for all the memory blocks based on the codec-specific parameters.
`XA_API_CMD_GET_N_MEMTABS`	Obtain the number of memory blocks required by codec.

The following commands should then be executed in a loop to allocate the memory. The application first requests all the attributes of the memory block and then allocates it. It is important to abide by the alignment requirements. Finally, the pointer to the allocated block of memory is passed back through the API. For the input and output buffers it is not necessary to assign the correct memory at this point. The input and output buffer locations must be assigned before their first use in the EXECUTE stage. The type field refers to the memory blocks, for example input or persistent, as described in section 2.1.

Table 2-5 Commands for Memory Allocation

Command / Subcommand	Description
`XA_API_CMD_GET_MEM_INFO_SIZE`	Get the size of the memory type being referred to by the index.
`XA_API_CMD_GET_MEM_INFO_ALIGNMENT`	Get the alignment information of the memory-type being referred to by the index.
`XA_API_CMD_GET_MEM_INFO_TYPE`	Get the type of memory being referred to by the index.
`XA_API_CMD_GET_MEM_INFO_PRIORITY`	Get the allocation priority of memory being referred to by the index.
`XA_API_CMD_SET_MEM_PTR`	Set the pointer to the memory allocated for the referred index to the input value.

2.4.4 Initialize Codec Stage

The following commands should be executed in a loop during initialization. These commands should be called until the initialization is completed as indicated by the `XA_CMD_TYPE_INIT_DONE_QUERY` command. In general, decoders can loop multiple times until the header information is found. However, encoders will perform exactly one call before they signal they are done.

There is a major difference between encoding Pulse Code Modulated (PCM) data and decoding stream data. During the initialization of a decoder, the initialization task reads the input stream to discover the parameters of the encoding. However, for an encoder there is no header information in PCM data. Even so, the encode application is still required to perform the initialization described in this stage. However, encoders will not consume data during initialization. Furthermore, this has an implication in that some encoders provide parameters that can be used to modify the input buffer data requirements after the initialization stage. These modifications will always be a reduction in the size. The application only needs to provide the reduced amount per execution of the main codec process.

In general, the application will signal to the codec the number of bytes available in the input buffer and signal if it is the last iteration. It is not normal to hit the end of the data during initialization, but in the case of a decoder being presented with a corrupt stream it will allow a graceful termination. After the codec initialization is called the application will ask for the number of bytes consumed. The application can also ask if the initialization is complete, it is advisable to always ask even in the case of encoders that require only a single pass. A decoder application must keep iterating until it is complete.

Table 2-6 Commands for Codec Initialization

Command / Subcommand	Description
`XA_API_CMD_SET_INPUT_BYTES`	Set the number of bytes available in the input buffer for initialization.
`XA_API_CMD_INPUT_OVER`	Signal to the codec the end of the bitstream.
`XA_API_CMD_INIT` `XA_CMD_TYPE_INIT_PROCESS`	Search for the valid header, does header decoding to get the parameters and initializes state and configuration structures.
`XA_API_CMD_INIT` `XA_CMD_TYPE_INIT_DONE_QUERY`	Check if the initialization process has completed.
`XA_API_CMD_GET_CURIDX_INPUT_BUF`	Get the number of input buffer bytes consumed by the last initialization.

2.4.5 Get Codec-Specific Parameters Stage

Finally, after the initialization, the codec can supply the application with information. In the case of decoders, this would be the parameters it has extracted from the encoded header in the stream.

Table 2-7 Commands for Getting Parameters

Command / Subcommand	Description

`XA_API_CMD_GET_CONFIG_PARAM`
`XA_<codec>_CONFIG_PARAM_<param_name>`
	Get the value of the parameter from the codec. See codec-specific section for parameter definitions.

2.4.6 Execute Codec Stage

The following commands should be executed continuously until the data is exhausted or the application wants to terminate the process. This is similar to the initialization stage but includes support for the management of the output buffer. After each iteration, the application requests how much data is written to the output buffer. This amount is always limited by the size of the buffer requested during the memory block allocation. (To alter the output buffer position, use XA_API_CMD_SET_MEM_PTR with the output buffer index)

Table 2-8 Commands for Codec Execution

Command / Subcommand	Description
`XA_API_CMD_INPUT_OVER`	Signal the end of bitstream to the library.
`XA_API_CMD_SET_INPUT_BYTES`	Set the number of bytes available in the input buffer for the execution.
`XA_API_CMD_EXECUTE` `XA_CMD_TYPE_DO_EXECUTE`	Execute the codec thread.
`XA_API_CMD_EXECUTE` `XA_CMD_TYPE_DONE_QUERY`	Check if the end of stream has been reached.
`XA_API_CMD_GET_OUTPUT_BYTES`	Get the number of bytes output by the codec in the last frame.
`XA_API_CMD_GET_CURIDX_INPUT_BUF`	Get the number of input buffer bytes consumed by the last call to the codec.

2.5 Files Describing the API

The common include files (`include`)

- `xa_apicmd_standards.h`

  The command definitions for the generic API calls

- `xa_error_standards.h`

  The macros and definitions for all the generic errors

- `xa_memory_standards.h`

  The definitions for memory the block allocation

- `xa_type_def.h`

  All the types required for the API calls

2.6 HiFi API Command Reference

In this section, the different commands are described along with their associated subcommands. The only commands missing are those specific to a single codec. The particular codec commands are generally the SET and GET commands for the operational parameters.

The commands are listed below in sections based on their primary commands type (`i_cmd`). Each section contains a table for every subcommand. In the case of no subcommands the one primary command is presented.

The commands are followed by an example C call. Along with the call, there is a definition of the variable types used. This is to avoid any confusion over the type of the 4th argument. The examples are not complete C code extracts as there is no initialization of the variables before they are used.

The errors returned by the API are detailed after each of the command definitions. However, there are a few errors that are common to all the API commands and they are listed in section 2.6.1 below. All the errors possible from the codec-specific commands will be defined in the codec-specific sections. Further, the codec-specific sections will also cover the Execution errors that occur during the initialization or execution calls to the API.

2.6.1 Common API Errors

All these errors are fatal and should not be encountered during normal application operation. They signal that a serious error has occurred in the application that is calling the codec.

- XA_API_FATAL_MEM_ALLOC

  `p_xa_module_obj` is NULL

- XA_API_FATAL_MEM_ALIGN

  `p_xa_module_obj` is not aligned to 4 bytes

- XA_API_FATAL_INVALID_CMD

  `i_cmd` is not a valid command

- XA_API_FATAL_INVALID_CMD_TYPE

  `i_idx` is invalid for the specified command (`i_cmd`)

2.6.2 XA_API_CMD_GET_LIB_ID_STRINGS

Table 2-9 XA_CMD_TYPE_LIB_NAME subcommand

Subcommand	`XA_CMD_TYPE_LIB_NAME`
Description	This command obtains the name of the library in the form of a string. The maximum length of the string that the library will provide is 30 bytes. Therefore the application shall pass a pointer to a buffer of a minimum size of 30 bytes. This command is optional.

Actual Parameters	`p_xa_module_obj`
	`NULL`
	
	`i_cmd`
	`XA_API_CMD_GET_LIB_ID_STRINGS`
	
	`i_idx`
	`XA_CMD_TYPE_LIB_NAME`
	
	`pv_value`
	`process_name` – Pointer to a character buffer in which the name of the library is returned.

Restrictions	None

Note No codec object is required due to the name being static data in the codec library

Example

```
char process_name[30];
res = (*api_func)(NULL,
                  XA_API_CMD_GET_LIB_ID_STRINGS,
                  XA_CMD_TYPE_LIB_NAME,
                  (pVOID) process_name);
```

Errors

- XA_API_FATAL_MEM_ALLOC

  This error is suppressed as `p_xa_module_obj` is `NULL`

- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 2-10 XA_CMD_TYPE_LIB_VERSION subcommand

Subcommand	`XA_CMD_TYPE_LIB_VERSION`
Description	This command obtains the version of the library in the form of a string. The maximum length of the string that the library will provide is 30 bytes. Therefore the application shall pass a pointer to a buffer of a minimum size of 30 bytes. This command is optional.

Actual Parameters	`p_xa_module_obj`
	`NULL`
	
	`i_cmd`
	`XA_API_CMD_GET_LIB_ID_STRINGS`
	
	`i_idx`
	`XA_CMD_TYPE_LIB_VERSION`
	
	`pv_value`
	`lib_version` – Pointer to a character buffer in which the version of the library is returned

Restrictions	None

Note No codec object is required due to the version being static data in the codec library

Example

```
char lib_version[30];
res = (*api_func)(NULL,
                  XA_API_CMD_GET_LIB_ID_STRINGS,
                  XA_CMD_TYPE_LIB_VERSION,
                  (pVOID) lib_version);
```

Errors

- XA_API_FATAL_MEM_ALLOC

  This error is suppressed as `p_xa_module_obj` is `NULL`

- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 2-11 XA_CMD_TYPE_API_VERSION subcommand

Subcommand	`XA_CMD_TYPE_API_VERSION`
Description	This command obtains the version of the API in the form of a string. The maximum length of the string that the library will provide is 30 bytes. Therefore the application shall pass a pointer to a buffer of a minimum size of 30 bytes. This command is optional.

Actual Parameters	`p_xa_module_obj`
	`NULL`
	
	`i_cmd`
	`XA_API_CMD_GET_LIB_ID_STRINGS`
	
	`i_idx`
	`XA_CMD_TYPE_API_VERSION`
	
	`pv_value`
	`api_version` – Pointer to a character buffer in which the version of the API is returned.

Restrictions	None

Note No codec object is required due to the version being static data in the codec library

Example

```
char api_version[30];
res = (*api_func)(NULL,
                  XA_API_CMD_GET_LIB_ID_STRINGS,
                  XA_CMD_TYPE_API_VERSION,
                  (pVOID) api_version);
```

Errors

- XA_API_FATAL_MEM_ALLOC

  This error is suppressed as `p_xa_module_obj` is `NULL`

- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.3 XA_API_CMD_GET_API_SIZE

Table 2-12 XA_API_CMD_GET_API_SIZE command

Subcommand	None
Description	This command obtains the size of the API structure, in order to allocate memory for the API structure. The pointer to the API size variable is passed and the API returns the size of the structure in bytes. The API structure is used for the interface and is persistent.

Actual Parameters	`p_xa_module_obj`
	`NULL`
	
	`i_cmd`
	`XA_API_CMD_GET_API_SIZE`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`&api_size` – Pointer to the API size variable

Restrictions	The application shall allocate memory with an alignment of 4 bytes.

Note No codec object is required due to the size being fixed for the codec library

Example

```
unsigned int api_size;
res = (*api_func)(NULL,
                  XA_API_CMD_GET_API_SIZE,
                  0,
                  (pVOID) &api_size);
```

Errors

- XA_API_FATAL_MEM_ALLOC

  This error is suppressed as `p_xa_module_obj` is `NULL`

- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.4 XA_API_CMD_INIT

Table 2-13 XA_CMD_TYPE_INIT_API_PRE_CONFIG_PARAMS subcommand

Subcommand	`XA_CMD_TYPE_INIT_API_PRE_CONFIG_PARAMS`
Description	This command sets the default value of the configuration parameters. The configuration parameters can then be altered by using one of the codec-specific parameter setting commands. Refer to the codec-specific section.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_INIT`
	
	`i_idx`
	`XA_CMD_TYPE_INIT_API_PRE_CONFIG_PARAMS`
	
	`pv_value`
	`NULL`

Restrictions	None

Example

```
res = (*api_func)(api_obj,
                  XA_API_CMD_INIT,
                  XA_CMD_TYPE_INIT_API_PRE_CONFIG_PARAMS,
                  NULL);
```

Errors

- Common API Errors

Table 2-14 XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS subcommand

Subcommand	`XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS`
Description	This command calculates the sizes of all the memory blocks required by the application. It should occur after the codec-specific parameters have been set.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_INIT`
	
	`i_idx`
	`XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS`
	
	`pv_value`
	`NULL`

Restrictions	None

Example

```
res = (*api_func)(api_obj,
                  XA_API_CMD_INIT,
                  XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS,
                  NULL);
```

Errors

- Common API Errors

Table 2-15 XA_CMD_TYPE_INIT_PROCESS subcommand

Subcommand	`XA_CMD_TYPE_INIT_PROCESS`
Description	This command initializes the codec. In the case of a decoder, it searches for the valid header and performs the header decoding to get the encoded stream parameters. This command is part of the initialization loop. It must be repeatedly called until the codec signals it has finished. In the case of an encoder, the initialization of codec is performed. No output data is created during initialization.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_INIT`
	
	`i_idx`
	`XA_CMD_TYPE_INIT_PROCESS`
	
	`pv_value`
	`NULL`

Restrictions	None

Example

```
res = (*api_func)(api_obj,
                  XA_API_CMD_INIT,
                  XA_CMD_TYPE_INIT_PROCESS,
                  NULL);
```

Errors

- Common API Errors
- See the codec-specific section for execution errors

Table 2-16 XA_CMD_TYPE_INIT_DONE_QUERY subcommand

Subcommand	`XA_CMD_TYPE_INIT_DONE_QUERY`
Description	This command checks to see if the initialization process has completed. If it has, the flag value is set to 1 else it is set to zero. A pointer to the flag variable is passed as an argument.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_INIT`
	
	`i_idx`
	`XA_CMD_TYPE_INIT_DONE_QUERY`
	
	`pv_value`
	`&init_done` – Pointer to the flag that indicates the completion of initialization process.

Restrictions	None

Example

```
unsigned int init_done;
res = (*api_func)(api_obj,
                  XA_API_CMD_INIT,
                  XA_CMD_TYPE_INIT_DONE_QUERY,
                  (pVOID) &init_done);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.5 XA_API_CMD_GET_MEMTABS_SIZE

Table 2-17 XA_API_CMD_GET_MEMTABS_SIZE command

Subcommand	None
Description	This command obtains the size of the table used to hold the memory blocks required for the codec operation. The API returns the total size of the required table. A pointer to the size variable is sent with this API command and the codec writes the value to the variable.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_MEMTABS_SIZE`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`&proc_mem_tabs_size` – Pointer to the memory size variable

Restrictions	The application will allocate memory with an alignment of 4 bytes.

Example

```
unsigned int proc_mem_tabs_size;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_MEMTABS_SIZE,
                  0,
                  (pVOID) &proc_mem_tabs_size);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.6 XA_API_CMD_SET_MEMTABS_PTR

Table 2-18 XA_API_CMD_SET_MEMTABS_PTR command

Subcommand	None
Description	This command sets the memory structure pointer in the library to the allocated value.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_MEMTABS_PTR`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`alloc` – Allocated pointer

Restrictions	The application will allocate memory with an alignment of 4 bytes.

Example

```
int * alloc; //alloc is a pointer to the allocated memory
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_MEMTABS_PTR,
                  0,
                  (pVOID) alloc);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`
- XA_API_FATAL_MEM_ALIGN

  `pv_value` is not aligned to 4 bytes

2.6.7 XA_API_CMD_GET_N_MEMTABS

Table 2-19 XA_API_CMD_GET_N_MEMTABS command

Subcommand	None
Description	This command obtains the number of memory blocks needed by the codec. This value is used as the iteration counter for the allocation of the memory blocks. A pointer to each memory block will be placed in the previously allocated memory tables. The pointer to the variable is passed to the API and the codec writes the value to this variable.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_N_MEMTABS`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`&n_mems` – Number of memory blocks required to be allocated

Restrictions	None

Example

```
int n_mems;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_N_MEMTABS,
                  0,
                  (pVOID) &n_mems);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.8 XA_API_CMD_GET_MEM_INFO_SIZE

Table 2-20 XA_API_CMD_GET_MEM_INFO_SIZE command

Subcommand	Memory index
Description	This command obtains the size of the memory type being referred to by the index. The size in bytes is returned in the variable pointed to by the final argument. Note this is the actual size needed, not including any alignment packing space.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_MEM_INFO_SIZE`
	
	`i_idx`
	Index of the memory
	
	`pv_value`
	`&size` – Pointer to the memory size.

Restrictions	None

Example

```
int index;
unsigned int size;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_MEM_INFO_SIZE,
                  index,
                  (pVOID) &size);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`
- XA_API_FATAL_INVALID_CMD_TYPE

  `i_idx` is an invalid memory block number; valid block numbers obey the relation `0 <= i_idx < n_mems` (See XA_API_CMD_GET_N_MEMTABS)

2.6.9 XA_API_CMD_GET_MEM_INFO_ALIGNMENT

Table 2-21 XA_API_CMD_GET_MEM_INFO_ALIGNMENT command

Subcommand	Memory index
Description	This command gets the alignment information of the memory-type being referred to by the index. The alignment required in bytes is returned to the application.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_MEM_INFO_ALIGNMENT`
	
	`i_idx`
	Index of the memory
	
	`pv_value`
	`&alignment` – Pointer to the alignment info variable

Restrictions	None

Example

```
int index;
unsigned int alignment;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_MEM_INFO_ALIGNMENT,
                  index,
                  (pVOID) &alignment);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`
- XA_API_FATAL_INVALID_CMD_TYPE

  `i_idx` is an invalid memory block number; valid block numbers obey the relation `0 <= i_idx < n_mems` (See XA_API_CMD_GET_N_MEMTABS)

2.6.10 XA_API_CMD_GET_MEM_INFO_TYPE

Table 2-22 XA_API_CMD_GET_MEM_INFO_TYPE command

Subcommand	Memory index
Description	This command gets the type of memory being referred to by the index.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_MEM_INFO_TYPE`
	
	`i_idx`
	Index of the memory
	
	`pv_value`
	`&type` – Pointer to the memory type variable

Restrictions	None

Example

```
int index;
unsigned int type;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_MEM_INFO_TYPE,
                  index,
                  (pVOID) &type);
```

Table 2-23 Memory Type Indices

Type	Description
XA_MEMTYPE_PERSIST	Persistent memory
XA_MEMTYPE_SCRATCH	Scratch memory
XA_MEMTYPE_INPUT	Input Buffer
XA_MEMTYPE_OUTPUT	Output Buffer

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`
- XA_API_FATAL_INVALID_CMD_TYPE

  `i_idx` is an invalid memory block number; valid block numbers obey the relation `0 <= i_idx < n_mems` (See XA_API_CMD_GET_N_MEMTABS)

2.6.11 XA_API_CMD_GET_MEM_INFO_PRIORITY

Table 2-24 XA_API_CMD_GET_MEM_INFO_PRIORITY command

Subcommand	Memory index
Description	This command gets the allocation priority of memory being referred to by the index. (The meaning of the levels is defined on a codec-specific basis. This command returns a fixed dummy value unless the codec defines it otherwise.)

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_MEM_INFO_PRIORITY`
	
	`i_idx`
	Index of the memory
	
	`pv_value`
	`&priority` – Pointer to the memory priority variable

Restrictions	None

Example

```
int index;
unsigned int priority;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_MEM_INFO_PRIORITY,
                  index,
                  (pVOID) &priority);
```

Table 2-25 Memory Priorities

Priority	Type
0	XA_MEMPRIORITY_ANYWHERE
1	XA_MEMPRIORITY_LOWEST
2	XA_MEMPRIORITY_LOW
3	XA_MEMPRIORITY_NORM
4	XA_MEMPRIORITY_ABOVE_NORM
5	XA_MEMPRIORITY_HIGH
6	XA_MEMPRIORITY_HIGHER
7	XA_MEMPRIORITY_CRITICAL

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`
- XA_API_FATAL_INVALID_CMD_TYPE

  `i_idx` is an invalid memory block number; valid block numbers obey the relation `0 <= i_idx < n_mems` (See XA_API_CMD_GET_N_MEMTABS)

2.6.12 XA_API_CMD_SET_MEM_PTR

Table 2-26 XA_API_CMD_SET_MEM_PTR command

Subcommand	Memory index
Description	This command passes to the codec the pointer to the allocated memory. This is then stored in the memory tables structure allocated earlier. For the input and output buffers it is legitimate to execute this command during the main codec loop.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_MEM_PTR`
	
	`i_idx`
	Index of the memory
	
	`pv_value`
	`alloc` – Pointer to the memory buffer allocated

Restrictions	The pointer must be correctly aligned to the requirements

Example

```
int index;
void * alloc; //alloc is a pointer to the aligned memory
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_MEM_PTR,
                  index,
                  (pVOID) alloc);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`
- XA_API_FATAL_INVALID_CMD_TYPE

  `i_idx` is an invalid memory block number; valid block numbers obey the relation `0 <= i_idx < n_mems` (See XA_API_CMD_GET_N_MEMTABS)
- XA_API_FATAL_MEM_ALIGN

  `pv_value` is not of the required alignment for the requested memory block

2.6.13 XA_API_CMD_INPUT_OVER

Table 2-27 XA_API_CMD_INPUT_OVER command

Subcommand	None
Description	This command is used to tell the codec that the end of the input data has been reached. This situation can arise both in the initialization loop and the execute loop.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_INPUT_OVER`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`NULL`

Restrictions	None

Example

```
res = (*api_func)(api_obj,
                  XA_API_CMD_INPUT_OVER,
                  0,
                  NULL);
```

Errors

- Common API Errors

2.6.14 XA_API_CMD_SET_INPUT_BYTES

Table 2-28 XA_API_CMD_SET_INPUT_BYTES command

Subcommand	None
Description	This command sets the number of bytes available in the input buffer for the codec. It is used both in the initialization loop and the execute loop. It is the number of valid bytes from the buffer pointer. It should be at least the minimum buffer size requested unless this is the end of the data.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_INPUT_BYTES`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`&buff_size` – Pointer to the input byte variable

Restrictions	None

Example

```
int buff_size;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_INPUT_BYTES,
                  0,
                  (pVOID) &buff_size);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.15 XA_API_CMD_GET_CURIDX_INPUT_BUF

Table 2-29 XA_API_CMD_GET_CURIDX_INPUT_BUF command

Subcommand	None
Description	This command gets the number of input buffer bytes consumed by the codec. It is used both in the initialization loop and execute loop.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CURIDX_INPUT_BUF`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`&bytes_consumed` – Pointer to the bytes consumed variable

Restrictions	None

Example

```
int bytes_consumed;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CURIDX_INPUT_BUF,
                  0,
                  (pVOID) &bytes_consumed);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.16 XA_API_CMD_EXECUTE

Table 2-30 XA_CMD_TYPE_DO_EXECUTE subcommand

Subcommand	`XA_CMD_TYPE_DO_EXECUTE`
Description	This command executes the codec.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_EXECUTE`
	
	`i_idx`
	`XA_CMD_TYPE_DO_EXECUTE`
	
	`pv_value`
	`NULL`

Restrictions	None

Example

```
    res = (*api_func)(api_obj,
                      XA_API_CMD_EXECUTE,
                      XA_CMD_TYPE_DO_EXECUTE,
                      NULL);
```

Errors

- Common API Errors
- See the codec-specific section for execution errors

Table 2-31 XA_CMD_TYPE_DONE_QUERY subcommand

Subcommand	`XA_CMD_TYPE_DONE_QUERY`
Description	This command checks to see if the end of processing has been reached. If it is, the flag value is set to 1; otherwise it is set to zero. The pointer to the flag is passed as an argument. Processing by the codec can continue for several invocations of the DO_EXECUTE command after the last input data has been passed to the codec, thus the application should not assume that the codec has finished generating all its output until so indicated by this command.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_EXECUTE`
	
	`i_idx`
	`XA_CMD_TYPE_DONE_QUERY`
	
	`pv_value`
	`&flag` – Pointer to the flag variable

Restrictions	None

Example

```
int flag;
res = (*api_func)(api_obj,
                  XA_API_CMD_EXECUTE,
                  XA_CMD_TYPE_DONE_QUERY,
                  (pVOID) &flag);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 2-32 XA_CMD_TYPE_DO_RUNTIME_INIT subcommand

Subcommand	`XA_CMD_TYPE_DO_RUNTIME_INIT`
Description	This command resets the decoder's history buffers. It can be used to avoid distortions and clicks by facilitating playback ramping up and down during trick-play. The command should be issued before the application starts feeding the decoder with new data from a random place in the input stream. When runtime init is in progress, for the first frame, the `XA_CMD_TYPE_DO_EXECUTE` command call will return an `XA_VORBISDEC_EXECUTE_NONFATAL_OV_RUNTIME_DECODE_FLUSH_IN_PROGRESS` error. **Note:** This command is available in API version 1.14 or later.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_EXECUTE`
	
	`i_idx`
	`XA_CMD_TYPE_DO_RUNTIME_INIT`
	
	`pv_value`
	`NULL`

Restrictions	None

Example

```
res = (*api_func)(api_obj,
                  XA_API_CMD_EXECUTE,
                  XA_CMD_TYPE_DO_RUNTIME_INIT,
                  NULL);
```

Errors

- Common API Errors

2.6.17 XA_API_CMD_GET_OUTPUT_BYTES

Table 2-33 XA_API_CMD_GET_OUTPUT_BYTES command

Subcommand	None
Description	This command obtains the number of bytes output by the codec during the last execution.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_OUTPUT_BYTES`
	
	`i_idx`
	`NULL`
	
	`pv_value`
	`&out_bytes` – Pointer to output bytes variable

Restrictions	None

Example

```
int out_bytes;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_OUTPUT_BYTES,
                  0,
                  (pVOID) &out_bytes);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

2.6.18 XA_API_CMD_GET_CONFIG_PARAM

Table 2-34 XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS subcommand

Subcommand	`XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS`

Description	This command reads the current input stream position, which is equal to the total number of consumed input bytes until the start of the input buffer. This running counter is set to zero at library initialization time and incremented every time the codec library consumes any bytes from the input buffer. If the application layer places a unit of input data with a byte size equal to `size` at byte offset in the input buffer, then the input stream position range for this unit may be calculated as follows:
	`start_pos = CUR_INPUT_STREAM_POS + offset`
	`end_pos   = CUR_INPUT_STREAM_POS + offset + size`

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CONFIG_PARAM`
	
	`i_idx`
	`XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS`
	
	`pv_value`
	`&ui_cur_input_stream_pos` – Pointer to the current input stream position variable

Restrictions	The current input stream position counter is 32-bits and, therefore, will overflow and wrap-around if the input stream length is more than 2^{32}-1 bytes. This command is available in API version 1.15 or later.

Example

```
unsigned int ui_cur_input_stream_pos;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CONFIG_PARAM,
                  XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS,
                  (void *) &ui_cur_input_stream_pos);
```

Errors

- Common API Errors

Table 2-35 XA_CONFIG_PARAM_GEN_INPUT_STREAM_POS subcommand

Subcommand	`XA_CONFIG_PARAM_GEN_INPUT_STREAM_POS`
Description	This command reads the input stream position of the unit (e.g., frame) corresponding to the generated (decoded or encoded) output data block. That is, if the main processing (`DO_EXECUTE`) call into the library generates any data in the output buffer, then this command reads the total number of input bytes consumed until the start of the unit that has been processed and placed into the output buffer. For example, if the application layer places a unit in the input buffer at input stream position `start_pos`, when the library generates the decoded or encoded data corresponding to this unit, it sets `GEN_INPUT_STREAM_POS` to `start_pos`.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CONFIG_PARAM`
	
	`i_idx`
	`XA_CONFIG_PARAM_GEN_INPUT_STREAM_POS`
	
	`pv_value`
	`&ui_gen_input_stream_pos` – Pointer to the input stream position of the generated data variable

Restrictions	The input stream position of the generated data counter is 32-bit and, therefore, will overflow and wrap-around if the input stream length is more than 2^{32}-1 bytes. This command is available in API version 1.15 or later.

Example

```
unsigned int ui_gen_input_stream_pos;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CONFIG_PARAM,
                  XA_CONFIG_PARAM_GEN_INPUT_STREAM_POS,
                  (void *) &ui_gen_input_stream_pos);
```

Errors

- Common API Errors

2.6.19 XA_API_CMD_SET_CONFIG_PARAM

Table 2-36 XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS subcommand

Subcommand	`XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS`
Description	This command resets the current input stream position. See Table 2-34 for details.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS`
	
	`pv_value`
	`&ui_cur_input_stream_pos` – Pointer to the current input stream position variable

Restrictions	This command is available in API version 1.15 or later. This command is supported for only Ogg Vorbis streams. This command is not supported for raw Vorbis streams as the sync words /packet boundaries are not available.

Example

```
unsigned int ui_cur_input_stream_pos = 0;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_CONFIG_PARAM_CUR_INPUT_STREAM_POS,
                  (void *) &ui_cur_input_stream_pos);
```

Errors

- Common API Errors

3. HiFi DSP Vorbis Decoder

The HiFi DSP Vorbis Decoder conforms to the generic codec API. The flow chart of the command sequence used in the example test bench is provided below.

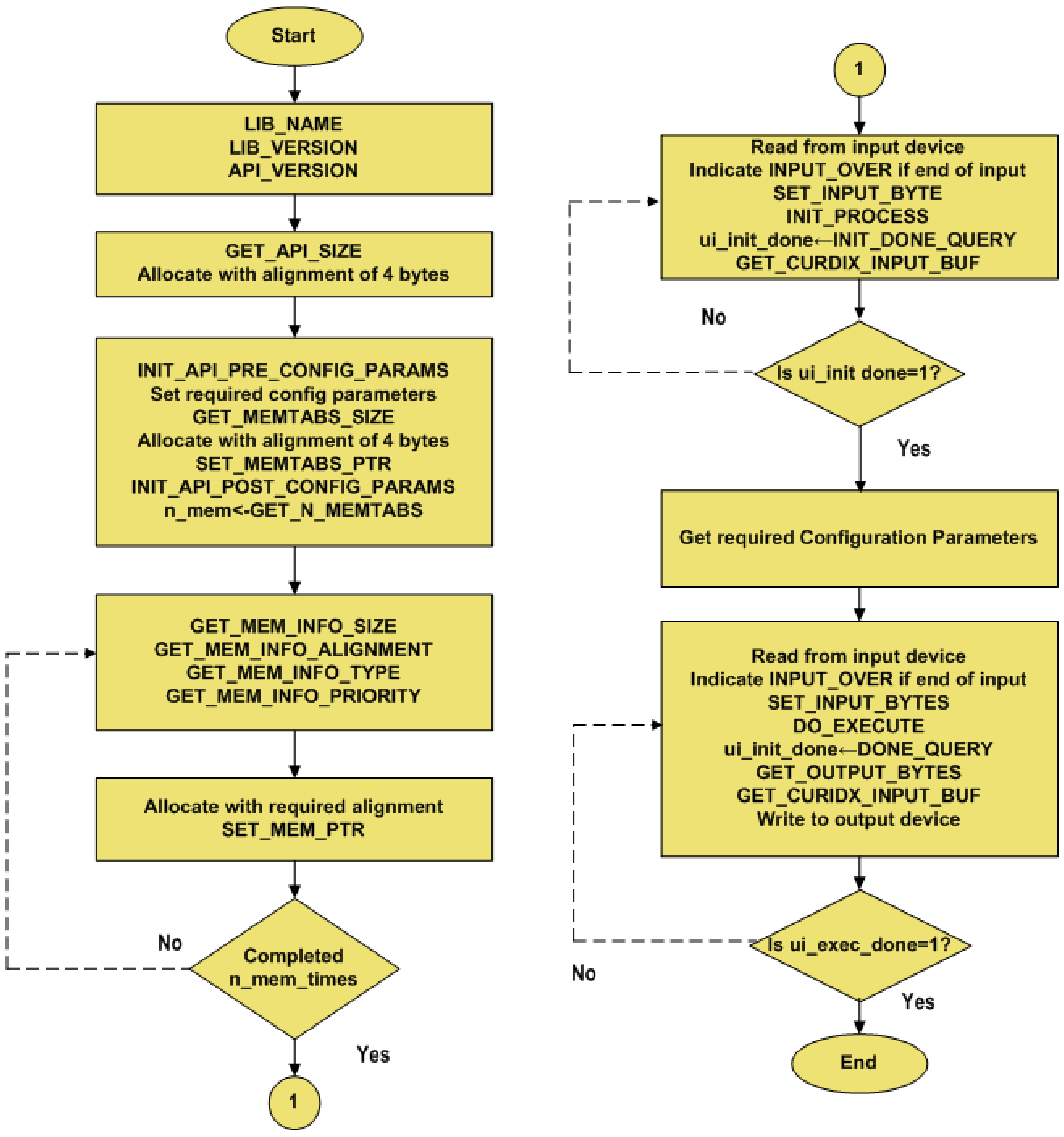

Figure 3 Flow Chart for Vorbis Decoder Integration

3.1 Files Specific to the Vorbis Decoder

- Vorbis decoder parameter header file (include/vorbis_dec): `xa_vorbis_dec_api.h`
- Vorbis decoder library (lib): `xa_vorbis_dec.a`
- The Vorbis decoder API call is defined as:

```
XA_ERRORCODE xa_vorbis_dec(xa_codec_handle_t p_xa_module_obj,
                               WORD32            i_cmd,
                               WORD32            i_idx,
                               pVOID            pv_value);
```

3.2 Configuration Parameters

The HiFi Vorbis decoder library accepts the following parameters from the user. Details of the Set config API commands for these parameters are described in Section 3.5.2.

- **`comment_mem_ptr`** – A pointer to an optional memory block to hold the vendor string and the user comments extracted from the Ogg Vorbis stream. The format of the comment block is described in Section 3.3. The size of the memory block may be arbitrary and is provided by the application through the `comment_mem_size` parameter. The default value of `comment_mem_ptr` is `NULL`.
- **`comment_mem_size`** – The size of the optional comment memory block pointed by the `comment_mem_ptr` parameter. The default value of `comment_mem_size` is `0`.
- **`granule_pos`** – The granule position for the last packet in the stream. This parameter is optional when decoding raw Vorbis streams. If the raw Vorbis stream is extracted from an Ogg Vorbis file, this value can be extracted from the same file. When not available, the value of this parameter is set to -1 by default. The presence of this parameter only affects the decoding of the last packet; the decoder returns some extra PCM output samples when this parameter is not present. In most audio applications, the effects of this behavior is negligible.
- **`file_type`** – file_type specifies whether the input file is a raw Vorbis file or Ogg Vorbis file. The default value is 0, which means the input file is an Ogg Vorbis file. For Ogg Vorbis files, the Vorbis decoder parses and decodes the Ogg container inside the library. The valid Ogg page is first captured and the Vorbis packets are extracted using information provided in the Ogg container. These extracted Vorbis packets are further processed by the core decoder. For raw Vorbis files, the library expects the complete Vorbis packet to be passed in the input buffer to the decoder library.
- **`ogg_max_page_size`** – ogg_max_page_size specifies the maximum ogg page size for ogg vorbis input stream. This parameter decides the input buffer size required to successfully decode the ogg vorbis input stream and has no effect if file mode it raw.

- **`runtime_mem`** – runtime_mem provides option to increase runtime memories persistent and scratch. If the decoder fails to decode a stream with the default persistent and scratch memory, this parameter can be used to increase them.

The parameters required for storage and audio output though a DAC are obtained from the bitstream during the initialization stage. After the initialization the following parameters are available. Details of the Get config API commands for these parameters are described in Section 3.5.3.

- **`samp_freq`** – This is the sample frequency of the output buffer samples. The units are Hz (samples per second). For example, a valid output is 44100.
- **`num_chan`** – This is the number of channels of data put into the output buffer. There are only two valid values: 1 (mono) and 2 (stereo). In the case of stereo, the output data is interleaved in the output buffer with the first output sample in each pair being the left channel value and the second sample in each pair being the right channel value.
- **`pcm_wd_sz`** – This is the PCM word size of the data in the output buffer. The only valid value is 16.

3.3 Comment Buffer Usage

The format of the comment buffer specified through the `comment_mem_ptr` and the `comment_mem_size` configuration parameters is equivalent to the Ogg Vorbis comment header format [3]. It is decoded as follows:

- `[vendor_length]` = unsigned 32-bit integer (little-endian format)
- `[vendor_string]` = UTF-8 vector of `[vendor_length]` octets
- `[user_comment_list_length]` = unsigned 32-bit integer (little-endian format)
- iterate `[user_comment_list_length]` times:

`[length]` = unsigned 32-bit integer (little-endian format)

`[user_comment]` = UTF-8 vector of `[length]` octets

The comment block contents become available after the decoder has been initialized. If the comment header is corrupted or the comment memory buffer provided by the application is not big enough to hold all comment fields, the `[vendor_length]` field is set to `0xFFFFFFFF`. If the application does not point the decoder to a comment memory block, the decoder skips over the comment header. As the decoder does not write to the output buffer until the Execute phase, the application may use the output buffer to extract the vendor string and the comment fields from the stream.

3.4 API Usage Notes

Although the HiFi Vorbis Decoder conforms to the generic codec API described in Section 2, to achieve optimal performance during the Execution phase, take into account the following:

- The decoder does not consume bytes from the input buffer every `DO_EXECUTE` call and, therefore, the `GET_CURIDX_INPUT_BUF` command may sometimes return 0. The application may use this information to avoid unnecessary shifting of the input buffer data.
- Because of the varying Vorbis frame sizes, the decoder does not always fill the output buffer completely. Also, some `DO_EXECUTE` calls perform CRC checks for the Ogg page that will increase the peak CPU usage. To improve performance and smooth the CPU load, the application may need to buffer up output samples.
- Support for comment headerless streams: As per Vorbis specifications, the Vorbis stream starts with three header packets (Info, Comment, Setup) in that order. The Vorbis library now supports decoding of the streams without the comment header packet because (1) the comment header packet is not useful for intialization of the decoder, (2) proper decoding of the Vorbis stream can be done without it, and (3) there are known use cases where raw Vorbis streams do not contain the comment header. If the stream has valid info and setup header packets in the above mentioned order, the library can decode it.
- Maximum page/packet size limitations: The Vorbis decoder library assumes that the maximum Ogg page or maximum Vorbis packet size for any Ogg Vorbis stream is no greater than 12k bytes. If the packets/page size is beyond this, the decoder will not be able to process such a stream. Packet processing for raw streams: As the packet sizes for raw Vorbis streams are not available/known in advance, the Vorbis decoder initialization and execution for raw streams is designed in such a way that once the library detects /decodes a valid packet, the library will consume a single packet at a time, and then pass the control to the test application. The test application then needs to discard the consumed bytes of the processed packet, load the input buffer with new data, and then pass the new data to the library.
- For raw stream decoding, the application must ensure that header packets are correct. For example, if the bitstream is in an Ogg container, the application must validate the checksum, if the bitstream is an RTP payload, the application must follow the RFC5215. If the wrong header packet is passed to the decoder, the decoder behavior is unknown, and may cause exceptions.
- Use stream position APIs after initialization is complete and at least one packet is successfully decoded. For stream-repositioning, do not set a new stream position before the start of the first packet; as the packet start for a raw stream is not known, stream position APIs will not work well for raw streams.

3.5 Vorbis Decoder-Specific Commands

This section describes the HiFi Vorbis Decoder specific commands. They are listed in sections based on their primary command type (`i_cmd`). Each section contains a table for every subcommand. In the case of no subcommands, the one primary command is presented.

3.5.1 Initialization and Execution Errors

These errors can result from initialization or execution API calls:

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_HOLE

  The Ogg Vorbis bitstream is missing one or more packets. The application may ignore the error and continue with the decoding process.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_NOTAUDIO

  The Ogg Vorbis bitstream contains a non-audio packet. The application may ignore the error and continue with the decoding process, in which case the decoder will skip the non-audio packet.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_BADPACKET

  The Ogg Vorbis bitstream contains a packet with invalid mode or window size parameters. The application may ignore the error and continue the decoding process, in which case the decoder will skip the corrupted packet.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_RUNTIME_DECODE_FLUSH_IN_PROGRESS

  This error indicates that because of the RUNTIME_INIT command, decode data flushing is in progress.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_INVALID_STRM_POS

  This error indicates that the decoded frame stream position may be invalid.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_INSUFFICIENT_DATA

  This error indicates that the decoder needs more bits for the processing.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_UNEXPECTED_IDENT_PKT_RECEIVED

  This error indicates that the decoder has received an identification packet when decoding is in progress. Hence, re-init may be required.

- XA_VORBISDEC_EXECUTE_NONFATAL_OV_UNEXPECTED_HEADER_PKT_RECEIVED

  This error indicates that the decoder has received a comment/setup packet when decoding is in progress. Hence, re-init may be required.

- XA_VORBISDEC_CONFIG_NONFATAL_BAD_PARAM

  The config parameter is out of range.

- XA_VORBISDEC_CONFIG_NONFATAL_GROUPED_STREAM

  This error indicates that the decoder has received an Ogg page corresponding to a different Ogg Vorbis stream. Grouped Ogg Vorbis streams are not supported.

Fatal errors require the codec to be completely reinitialized and presented with an alternative bitstream.

- XA_VORBISDEC_CONFIG_FATAL_BADHDR

  The stream contains invalid headers or a header checksum verification fails.

- XA_VORBISDEC_CONFIG_FATAL_NOTVORBIS

  A packet header without the Vorbis identification string (“`vorbis`”) is encountered at configuration time.

- XA_VORBISDEC_CONFIG_FATAL_BADINFO

  The Vorbis identification header that provides the information about the audio stream is invalid.

- XA_VORBISDEC_CONFIG_FATAL_BADVERSION

  The Vorbis version specified in the headers is incorrect, i.e., the `vorbis_version` field is different than 0 as required by the Ogg Vorbis I format specification.

- XA_VORBISDEC_CONFIG_FATAL_INVALID_PARAM

  The config parameter is invalid.

- XA_VORBISDEC_CONFIG_FATAL_BADBOOKS

  The codebook header is corrupted.

- XA_VORBISDEC_CONFIG_FATAL_CODEBOOK_DECODE

  Codebook decode fails because of an invalid Huffman entry value.

- XA_VORBISDEC_EXECUTE_FATAL_PERSIST_ALLOC

  The decoder runs out of persistent memory. The decoder has been tested on an extensive suite of Ogg Vorbis streams and this error is not expected to occur. In case it occurs, pre-config parameter XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM can be used to increase persistent and scratch memory sizes (Refer to Table 3-6).

- XA_VORBISDEC_EXECUTE_FATAL_CORRUPT_STREAM

  The stream is either unsupported or corrupt and cannot be decoded further.

- XA_VORBISDEC_EXECUTE_FATAL_SCRATCH_ALLOC

  The decoder runs out of scratch memory. The decoder has been tested on an extensive suite of Ogg Vorbis streams and this error is not expected to occur. In case it occurs, pre-config parameter XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM can be used to increase persistent and scratch memory sizes (Refer to Table 3-6).

- XA_VORBISDEC_EXECUTE_FATAL_INSUFFICIENT_INP_BUF_SIZE

  The decoder input buffer is not sufficient to hold one full ogg page (or the last packet from previous page if that is a continued packet and next full page) from input stream. In case of this error pre-config parameter XA_VORBISDEC_CONFIG_PARAM_OGG_MAX_PAGE_SIZE can be used to increase input buffer size (Refer to Table 3-5).

3.5.2 XA_API_CMD_SET_CONFIG_PARAM

Table 3-1 XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_PTR subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_PTR`
Description	This command points the decoder to a user-allocated memory block. The pointer has no specific alignment requirements and the size of the block is set through the `XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_SIZE` parameter (see Table 3-2). The decoder initializes this block with the vendor string and the user comment fields from the Ogg Vorbis stream. The format of the comment block is described in Section 3.3. Default value: `NULL`. The use of the comment memory block is optional: by default, the application skips over the comment header.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_PTR`
	
	`pv_value`
	`comment_mem_ptr` – Pointer to the comment memory block

Restrictions	None.

Example

```
char *comment = malloc(4096);
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_PTR,
                  (pVOID)comment);
```

Errors

- Common API Errors

Table 3-2 XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_SIZE subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_SIZE`
Description	This command initializes the size of the user-allocated comment memory block specified through the `XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_PTR` parameter (see Table 3-1). The format of the comment block is described in Section 3.3. Default value: `0`. The use of the comment memory block is optional: by default, the application skips over the comment header.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_SIZE`
	
	`pv_value`
	`&comment_mem_size` – Pointer to comment memory size variable

Restrictions	None

Example

```
int comment_size = 4096;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_COMMENT_MEM_SIZE,
                  (pVOID)&comment_size);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-3 XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_FILE_MODE subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_FILE_MODE`
Description	This command provides the file type of the currently decoded file. The 0 value indicates an Ogg Vorbis file. The 1 value indicates a raw Vorbis file without an Ogg container. The default value is `0`. By default, the library assumes the file as an Ogg Vorbis file.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_FILE_MODE`
	`pv_value`
	`&file_type` – Pointer to file type variable

Restrictions	This command must be called before calling `XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS command`.

Example

```
int file_type = 1;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_FILE_MO
DE,
                  (pVOID)&file_type);
```

Errors

- Common API Errors
- XA_API_FATAL_INVALID_CMD_TYPE

  Configuration of Vorbis file mode is not allowed after calling `XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS`, since memory size has been calculated by then.
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-4 XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_LAST_PKT_GRANULE_POS subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_LAST_PKT_GRANULE_POS`
Description	This command provides the granule position of last packet of the currently decoded file. The default value is -1.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_LAST_PKT_GRANULE_POS pv_value`
	`&granule_pos` – Pointer to granule position variable

Restrictions	None

Example

```
long long granule_pos = 1000000;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_RAW_VORBIS_LAST_PK
T_GRANULE_POS,
                  (pVOID)&granule_pos);
```

Errors

- Common API Errors
- XA_VORBISDEC_CONFIG_NONFATAL_BAD_PARAM

  The parameter value is not within valid range
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-5 XA_VORBISDEC_CONFIG_PARAM_OGG_MAX_PAGE_SIZE subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_OGG_MAX_PAGE_SIZE`
Description	This command specifies the input buffer size (kB) required for ogg vorbis mode. Minimum value is 12, maximum is 128. The default value is 12. **Note:** The maximum page size specified in Ogg standard is 64 kB, however for decoding continued packets decoder needs the continued packet from last page and full next page in input buffer and hence input buffer size requirement can go beyond 64 kB. To handle those scenarios maximum is kept to 128. Suggested value for this parameter is max. packet size + max. ogg page size (in kB).

Actual Parameters	`p_xa_module_obj`
	`api_obj` - Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_OGG_MAX_PAGE_SIZE`
	
	`pv_value`
	`&ogg_maxpage` – Pointer to ogg max page size variable

Restrictions	This command must be called before calling `XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS command`.

Example

```
int ogg_maxpage = 14;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_OGG_MAX_PAGE_SIZE,
                  (pVOID)&ogg_maxpage);
```

Errors

- Common API Errors
- XA_API_FATAL_INVALID_CMD_TYPE

  Maximum ogg page size is not allowed to be modified after calling XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS, since memory sizes have been calculated by then.
- XA_VORBISDEC_CONFIG_NONFATAL_BAD_PARAM

  The parameter value is not within valid range
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-6 XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM`
Description	This command provides whether additional runtime memory required for stream with 8 kB blocksize is to be allocated or not. Minimum value is 0, maximum is 1. The default value is 0. 0 – Runtime memory allocation will be assuming 4 kB blocksize. 1 – Runtime memory allocation will be assuming 8 kB blocksize.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_SET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM`
	
	`pv_value`
	`&rtmem` – Pointer to runtime memory variable

Restrictions	This command must be called before calling `XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS command`.

Example

```
int rtmem = 1;
res = (*api_func)(api_obj,
                  XA_API_CMD_SET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_RUNTIME_MEM,
                  (pVOID)&rtmem);
```

Errors

- Common API Errors
- XA_API_FATAL_INVALID_CMD_TYPE

  Runtime memory sizes are not allowed to be modified after calling XA_CMD_TYPE_INIT_API_POST_CONFIG_PARAMS, since memory sizes have been calculated by then.
- XA_VORBISDEC_CONFIG_NONFATAL_BAD_PARAM

  The parameter value is not within valid range
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

3.5.3 XA_API_CMD_GET_CONFIG_PARAM

Table 3-7 XA_VORBISDEC_CONFIG_PARAM_SAMP_FREQ subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_SAMP_FREQ`
Description	This command gets the sampling frequency from the codec. The sampling frequency can be used, for example, to write a '.wav' file header or to initialize a DAC or sample rate converter for real-time playout. The sampling frequency in Hz is returned. The parameter becomes available after the codec has been initialized.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_SAMP_FREQ`
	
	`pv_value`
	`&samp_freq` – Pointer to sampling frequency variable

Restrictions	None

Example

```
int samp_freq;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_SAMP_FREQ,
                  (pVOID) &samp_freq);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-8 XA_VORBISDEC_CONFIG_PARAM_NUM_CHANNELS subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_NUM_CHANNELS`
Description	This command gets the number of channels in the decoded bitstream. This information can be used to write a '.wav' file header or to initialize a DAC or sample rate converter for real-time playout. This parameter becomes available after the codec has been initialized.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_NUM_CHANNELS`
	
	`pv_value`
	`&num_chan` – Pointer to the channel count variable

Restrictions	None

Example

```
int num_chan;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_NUM_CHANNELS,
                  (pVOID) &num_chan);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-9 XA_VORBISDEC_CONFIG_PARAM_PCM_WDSZ subcommand

Subcommand	`XA_VORBISDEC_CONFIG_PARAM_PCM_WDSZ`
Description	This command gets the output PCM word size in bits. The current version of the library always returns 16.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CONFIG_PARAM`
	
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_PCM_WDSZ`
	
	`pv_value`
	`&pcm_wd_sz` – Pointer to PCM word size variable

Restrictions	None

Example

```
int pcm_wd_sz;
res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_PCM_WDSZ,
                  (pVOID) &pcm_wd_sz);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

Table 3-10 XA_VORBISDEC_CONFIG_PARAM_GET_CUR_BITRATE subcommand

Subcommand	`None`
Description	This command gets the current bit rate.

Actual Parameters	`p_xa_module_obj`
	`api_obj` – Pointer to API Structure
	
	`i_cmd`
	`XA_API_CMD_GET_CONFIG_PARAM`
	`i_idx`
	`XA_VORBISDEC_CONFIG_PARAM_GET_CUR_BITRATE`
	
	`pv_value`
	`&bitrate` – Pointer to the bit rate variable

Restrictions	None

Example

```
int bitrate;

res = (*api_func)(api_obj,
                  XA_API_CMD_GET_CONFIG_PARAM,
                  XA_VORBISDEC_CONFIG_PARAM_GET_CUR_BITRATE,
                  (void *) &bitrate);
```

Errors

- Common API Errors
- XA_API_FATAL_MEM_ALLOC

  `pv_value` is `NULL`

4. Introduction to Example Test Bench

The supplied test bench contains the following files:

- Test bench source files (`test/src`)

  `xa_vorbis_dec_error_handler.c`
  `xa_vorbis_dec_sample_testbench.c`

- Makefile to build the executable (`test/build`)

  `makefile_testbench_sample`

- Sample parameter file to run the test bench (`test/build`)

  `parameters.txt`

4.1 Building the Executable

To build the application, follow these steps:

1. Go to `test/build`.
2. At the command prompt, type
   ```
   xt-make -f makefile_testbench_sample clean all
   ```

This will build the decoder application `xa_vorbis_dec_test`.

Note: If you have source code distribution, you must build the xa_vorbis_dec.a library before you can build the test-bench. To build the library, follow these steps:

1. Go to the build directory.
2. Type:
   ```
   $xt-make clean all install
   ```

This will build the xa_vorbis_dec.a library and copy it to the `lib` directory.

4.2 Usage

The sample application executable can be run with command-line options or with a parameter file.

The command line usage is as follows:

```
xt-run xa_vorbis_dec_test -ifile:<infile> -ofile:<outfile> [-
r] [-g<granule_pos>] [-ogg_maxpage:<omp>] [-rtmem:<rtm>]
```

Where

`<infile>` is the name of the input Vorbis file.

`<outfile>` is the name of the output raw PCM file.

`<granule_pos>` specifies the granule position for last audio packet.

`-r` flag specifies that the current input file is a raw Vorbis file, without this flag, the current input file is an Ogg Vorbis file

<omp> specifies maximum ogg page size (in kB) which can fit in input buffer. Min- 12, max- 128. Default – 12.

<rtm> specifies whether to allocate extra runtime memory or not. Min- 0, max – 1. Default – 0 (Extra runtime mem not allocated).

If no command line argument is given, the application reads the commands from the parameter file, `parameter.txt`, in the current directory.

The syntax for writing into the `parameter.txt` file is as follows:

```
@Start
@Input_path <path to be prepended to all input filenames>
@Output_path <path to be prepended to all output filenames>
<command line 1>
<command line 2>
....
@Stop
```

The Vorbis Decoder can be run for multiple test files using different command lines. The syntax for the command lines in the parameter file is the same as the syntax for specifying options on the command line to the test bench program.

Note All the @<*command*>s should be at the first column of a line except the `@New_line` command.

Note All the @<*command*>s are case sensitive. If the command line in the parameter file has to be broken to two parts on two different lines use the `@New_line` command. For example:

```
<command line part 1> @New_line
<command line part 2>
```

Note	Blank lines will be ignored.
Note	Individual lines can be commented out using "//" at the beginning of the line.

5. References

[1] The Xiph.Org Foundation: http://www.xiph.org/

[2] Vorbis I Specification: http://www.xiph.org/vorbis/doc/Vorbis_I_spec.html

[3] Ogg Vorbis I format specification: comment field and header specification: http://www.xiph.org/vorbis/doc/v-comment.html