Developer's Information Pack

Version 2.0

Creative Technology Ltd

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Introduction

This developer's information pack is made for third party DOS and Microsoft Windows 3.1 developers who intend to develop MIDI oriented software programs for Creative's Sound Blaster AWE32. It includes easy-to-use functions and a complete interface that supports MIDI playback and Sound Blaster AWE32 DRAM downloading.

This document describes the pack's set of low level DOS and Microsoft Windows 3.1 APIs to program the Sound Blaster AWE32. It contains object libraries for common MIDI routines and SB AWE32 SoundFont bank downloading for DOS (real and protected modes) and Microsoft Windows 3.1. These library functions are designed with the objective of allowing you to create your own code in the following forms :

- Terminate-stay-resident MIDI driver
- Loadable MIDI driver
- Embedded MIDI application

We at Creative Labs has spent much effort in creating the drivers and libraries to save your development time. We have taken great care to meet the requirements of the various types of developers and to reduce the possibilities of clashes with other TSRs or Windows system drivers. It is our hope that all the facilities provided in this information pack meet with your development needs.

Using this Manual

This document is organized into three main parts. The first details the API for DOS, the second the API for Windows 3.1 and the third on SB AWE32's MIDI non-registered-parameter-number implementation. The organization, in detail, is as follows:

PART I, "**DOS Real/Protected Mode API**," describes the SB AWE32 DOS real and protected mode API.

Chapter 1, "Overview," gives a quick look at the SB AWE32 DOS real and protected mode API.

Chapter 2, "Hardware Detection and Initialization," provides interfaces to prepare the EMU8000 subsystem for use.

Chapter 3, "MIDI Services," provides interfaces to process MIDI events.

Chapter 4, "SoundFont Bank and Downloadable DRAM Services," gives interfaces to load SoundFont banks and wave data.

Chapter 5, "Programming Guide" gives a general description on using the DOS Real and Protected mode APIs.

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PART II, "**SB AWE32 Microsoft Windows 3.1 API**," describes the SB AWE32 Windows 3.1 API.

Chapter 6, "Overview," gives a general look at the SB AWE32 Windows 3.1 API.

Chapter 7, "AWE Manager DLL," provides a detailed description of the AWE Manager and its functions.

Chapter 8, "AWE GUI DLL," provides a thorough description of the GUI resources made available by AWEGUI.DLL.

Chapter 9, "Windows Programming Guide," provides C examples to let you access and manipulate the Windows drivers.

PART III, "**SB AWE32 MIDI Non-Registered Parameter Number implementation**," describes the MIDI NRPN implementation of the SB AWE32.

Chapter 10, "SB AWE32 Non-Registered Parameter Numbers Implementation," details the Non-Registered Parameter Number implementation of the SB AWE32 Window MIDI driver.

Document Conventions

To help you locate and identify information easily, this manual uses visual cues and standard text formats. The following typographical conventions are used throughout this document:

Example	Description
bold_letter	Bold letters indicate variable names, library functions, or commands. These are case-sensitive. Bold letters are also used for terms intended as keywords or for emphasis in certain phrases.
BOLD_CAPS	All bold capital letters indicate constants.
NORMAL_CAPS	All capital letters indicate file names or directory names.
italics	Italic letters represent actual values or values of variables that you are expected to provide.
`program`	This font is used for example codes.

`program`
.
.
`fragment`
	Vertical ellipsis in an example program indicate that part of the program has been intentionally omitted.

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[ ]	Square brackets in a command line indicate that the enclosed item is optional.
< >	Angle brackets in a command line indicate that you must provide the actual value of the enclosed item.
/	A forward slash in a command line indicates an either/or choice.

In this document, "you" refers to you the developer or sometimes your application. The word "user" refers to the person who uses your application.

Borland C++, Turbo C++, Turbo C, Microsoft C and Watcom C++ are referred collectively as C compilers.

Getting Assistance

If you have any comments, suggestions, questions, or problems concerning this information pack, please feel free to contact us. You can reach us at:

CompuServe: GO BLASTER
Internet E-mail address: 72662.1602@compuserve.com

What You Need to Know

This manual assumes you are an experienced software developer who is familiar with using Sound Blaster cards or any of its derivatives. Thus, the focus in this document is on highly technical aspects of the cards.

This developer information pack supports the following programming tools :

- Microsoft Visual C++ version 1.0 and 1.5
- Microsoft C version 6.0 and 7.0
- Borland C++ version 3.1 and 4.0
- Watcom C/C++^{32} version 9.5
- MetaWare High C/C++ version 3.2
- Symantec C/C++ version 6.1

The real mode DOS object libraries are available for the following memory models :

- Small
- Medium
- Compact
- Large

A flat model protected mode library is also provided.

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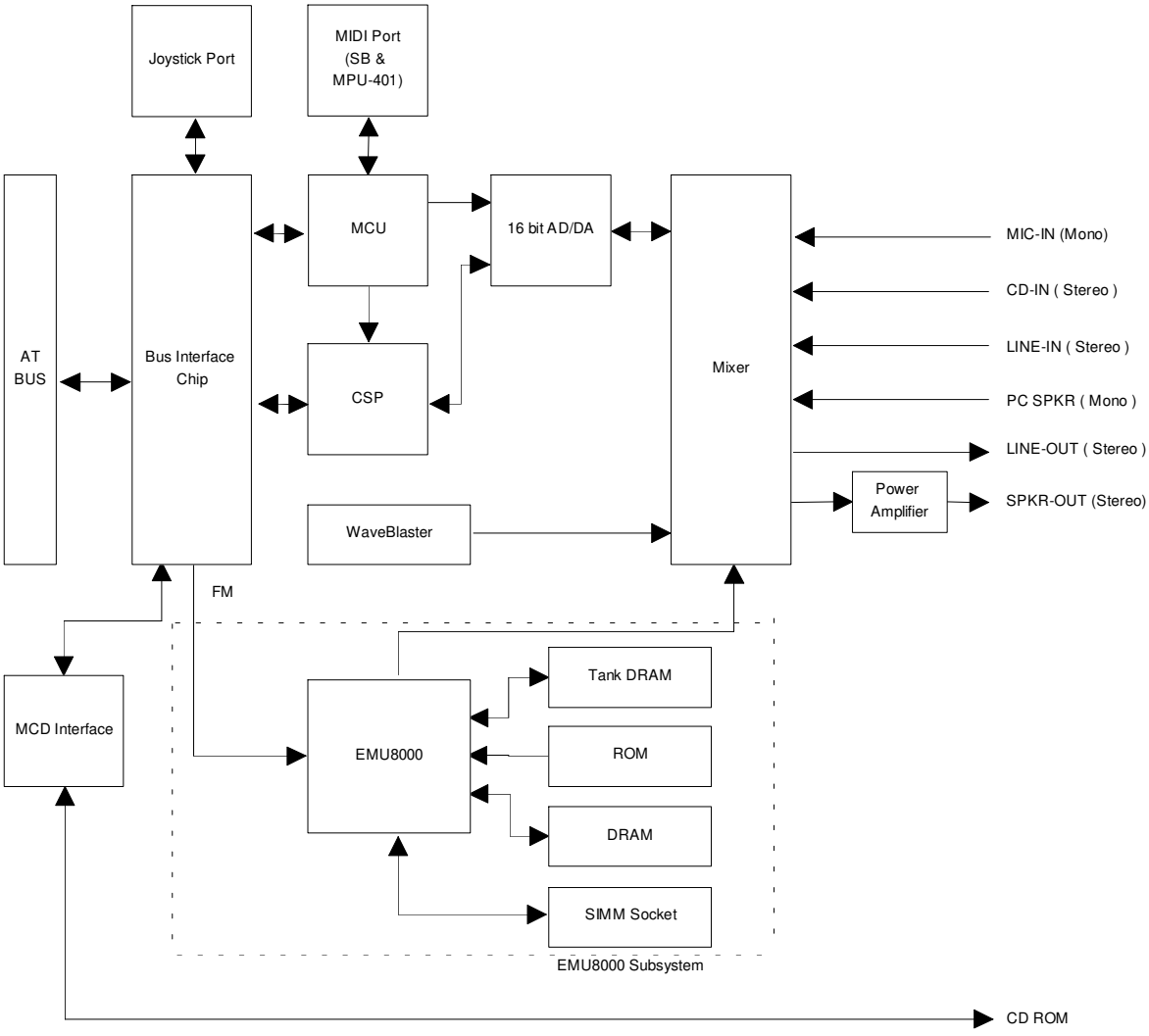
Before you proceed to Part I, II and III of this manual, you need to familiarize yourself with the hardware functional blocks of the Sound Blaster AWE32 audio card. A diagram of the functional blocks is provided below.



Functional Block Diagram of Sound Blaster AWE32

The EMU8000 subsystem consists of the following parts :

- ROM

  The ROM contains 1MB of General MIDI sound data. This region of ROM is accessible only through the library functions.

- DRAM

  This is a 512 KB DRAM for you to download your custom sound samples.

- SIMM Socket

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You can expand the on-board DRAM size from the built in 512 KB to a maximum of 28 MB by inserting off-the-shelf SIMM modules.

The following table lists the I/O ports used by the EMU8000 subsystem :

I/O Ports
0x6X0
0x6X2
0xAX0
0xAX2
0xEX0
0xEX2

'X' denotes the center digit in the base I/O address.

The library functions provided accesses all the EMU8000 subsystem's I/O addresses.

For a detailed look at the other functional blocks in the diagram, refer to "Developer Kit for Sound Blaster Series Hardware Programming Reference" documentation from us.

Change Log

Version 1.0.0

Released to developers during Creativity '94

Version 1.1.0

Added a new API in AWEMAN, "AWE_SEND_MIDI".

Version 1.1.1 (un-released)

Implemented MIDI Controller 11 (Expression) and MIDI Channel Aftertouch in DOS MIDI engine.

Added DOS API to load user SoundFont Banks.

Added DOS API "awe32Terminate" to restore the EMU8000 to its previous state.

Introduced the 'E' BLASTER environment parameter for detection of EMU8000 subsystem.

Remove the constraint of acquiring MMSYSTEM before AWEMAN can be opened.

Added several new API in AWEMAN, namely "AWE_GET_UBANK_PARENT", "AWE_GET_DRUM_KIT" and "AWE_ISHANDLE".

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Version 2.0 (this version)

Added the ability to load a PCM sample file into the SB AWE32 DRAM.

Added MIDI Non-registered parameter number capabilities.

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PART I DOS Real/Protected Mode API

This part describes in detail the DOS Real/Protected Mode API. It consists of five chapters:

- Overview
- Hardware Detection and Initialization
- MIDI Services
- SoundFont Bank and Downloadable DRAM Services
- Real and Protected Mode API Programming Guide

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Chapter 1 Overview

This chapter gives an overview of the DOS object modules and the sample applications. Note that this chapter does not attempt to cover programming the Sound Blaster. Please refer to "Sound Blaster Developer Kit for Sound Blaster Series" if you need more information on programming the Sound Blaster.

The object modules are provided in five memory models; SMALL, COMPACT, MEDIUM, LARGE and FLAT. The object module files are :

MIDIENG.OBJ	MIDI engine. Contains all MIDI channel message services.
EMBED.OBJ	General MIDI preset module
MIDIVAR.OBJ	MIDI variables, used by APIs
HARDWARE.OBJ	EMU8000 hardware initialization module
SBKLOAD.OBJ	SoundFont bank loader module
NRPN.OBJ	Non-Registered Parameter Number interpreter.
NRPNVAR.OBJ	Data buffers use by Non-Registered Parameter Number interpreter.

Of all these module files, HARDWARE.OBJ and SBKLOAD.OBJ are discardable after they have been used. For example, in a TSR program, after you have initialized the SB AWE32 hardware and loaded your SoundFont bank file, you can mark portions of your code that must stay resident (the MIDI engine, the embedded General MIDI preset data and any SoundFont preset data), and discard the hardware and the SoundFont loader module.

A sample application is included in this information package.

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Chapter 2 Hardware Detection and Initialization

This group of APIs consists of the following :

```
awe32Detect
awe32InitHardware
awe32Terminate
```

awe32Detect

```
WORD
PASCAL
awe32Detect(WORD wBaseIOAddx)
```

Action Detects the presence of the EMU8000 subsystem.

Parameters *wBaseIOAddx*

Specifies the base I/O address of the EMU8000 subsystem. The address can be found in the BLASTER environment variable with a 'E' prefix. For example, E620.

The ‘E’ BLASTER environment parameter is introduced to cater for future derivatives of the SB AWE32 sound card that may have the EMU8000 at different I/O addresses.

This API in this release is backwards compatible with its previous version, i.e., it can detect for the presence of the EMU8000 subsystem using the ‘A’ parameter.

Return Value The return value is 0 if the EMU8000 is detected, and non-zero if otherwise.

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awe32InitHardware

```
WORD
PASCAL
awe32InitHardware(VOID)
```

Action Prepares the EMU8000 subsystem for MIDI playback.

Parameters None.

Return Returns 0 if the EMU8000 subsystem had been properly initialized, and non-zero if otherwise.

awe32Terminate

```
WORD
PASCAL
awe32Terminate(VOID)
```

Action Restores the EMU8000 chip to a known state.

Parameters None.

Return Returns 0 if the EMU8000 subsystem had been properly terminated, and non-zero if otherwise.

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Chapter 3 MIDI Services

This group of APIs consists of the following :

```
awe32InitMIDI
awe32InitNRPN
awe32NoteOn
awe32NoteOff
awe32ProgramChange
awe32PitchBend
awe32Controller
awe32ChannelPressure
awe32PolyKeyPressure
awe32Sysex
__awe32NoteOff
__awe32IsPlaying
```

awe32InitMIDI

```
WORD
PASCAL
awe32InitMIDI(VOID)
```

Action Initialize MIDI engine. It resets all controller values and prepares for subsequent MIDI engine calls.

Parameters None.

Return Value The return value is 0 if the initialization is successful, non-zero if otherwise.

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awe32InitNRPN

```
WORD
PASCAL
awe32InitNRPN(VOID)
```

Action Initializes the data buffer used for NRPN and to link in the NRPN.OBJ and NRPNVAR.OBJ modules.

Parameters None.

Return Returns 0 upon successful initialization, and non-zero if otherwise.

awe32NoteOn

```
WORD
PASCAL
awe32NoteOn(WORD wMIDIChannel,
            WORD wNoteNumber,
            WORD wVelocity)
```

Action Turn on a MIDI note.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the note on originated. Valid range for this variable is from 0 to 15 decimal.

wNoteNumber

Specifies the MIDI note number. Valid range for this variable is from 0 to 127.

wVelocity

Specifies the MIDI note's velocity. Valid range for this variable is from 0 to 127.

Return Value The return value is 0 if the MIDI note on is successful, non-zero if otherwise.

awe32NoteOff

```
WORD
PASCAL
awe32NoteOff(WORD wMIDIChannel,
```


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```
    WORD wNoteNumber,
    WORD wVelocity)
```

Action Turn off a MIDI note.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the note off originated. Valid range for this variable is from 0 to 15 decimal.

wNoteNumber

Specifies the MIDI note number. Valid range for this variable is from 0 to 127.

wVelocity

Specifies the MIDI note's velocity. Valid range for this variable is from 0 to 127.

Return Value The return value is 0 if the MIDI note off is successful, non-zero if otherwise.

awe32ProgramChange

```
WORD
PASCAL
awe32ProgramChange(WORD wMIDIChannel,
                   WORD wProgram)
```

Action Selects a program.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the program change originated. Valid range for this variable is from 0 to 15 decimal.

wProgram

Specifies the desired program value. Valid range for this variable is from 0 to 127.

Return Value The return value is 0 if the MIDI program change is successful, non-zero if otherwise.

awe32PitchBend

```
WORD
PASCAL
awe32PitchBend(WORD wMIDIChannel,
```


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```
    WORD wLSB,
    WORD wMSB)
```

Action Pitch bend all notes sounding in a MIDI channel.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the pitch bend originated. Valid range for this variable is from 0 to 15 decimal.

wLSB

Specifies the MIDI pitch bend LSB data value. Valid range for this variable is from 0 to 127.

wMSB

Specifies the MIDI pitch bend MSB data value. Valid range for this variable is from 0 to 127.

Return Value The return value is 0 if the MIDI pitch bend is successful, non-zero otherwise.

awe32Controller

```
WORD
PASCAL
awe32Controller(WORD wMIDIChannel,
                WORD wControlNumber,
                WORD wControlData)
```

Action Controller change on a MIDI channel.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the note on originated. Valid range for this variable is from 0 to 15 decimal.

wControlNumber

Specifies the MIDI controller number. Valid range for this variable is from 0 to 127.

wControlData

Specifies the MIDI controller's data value. Valid range for this variable is from 0 to 127.

Return Value The return value is 0 if the MIDI control change is successful, non-zero if otherwise.

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awe32ChannelPressure

```
WORD
PASCAL
awe32ChannelPressure(WORD wMIDIChannel,
                     WORD wData)
```

Action MIDI Channel Pressure.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the channel pressure originated. Valid range for this variable is from 0 to 15 decimal.

wData

Specifies the channel pressure data value. Valid range for this variable is from 0 to 127.

Return Value This function will return 0 if successful, and non-zero if otherwise.

awe32PolyKeyPressure

```
WORD
PASCAL
awe32PolyKeyPressure(WORD wMIDIChannel,
                     WORD wNoteNumber,
                     WORD wData)
```

Action None.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the polyphonic key pressure originated. Valid range for this variable is from 0 to 15 decimal.

wNoteNumber

Specifies the MIDI note number. Valid range for this variable is from 0 to 127.

wData

Specifies the polyphonic key pressure data value. Valid range for this variable is from 0 to 127.

Return Value This function will always return 0.

Remarks This function is a dummy place holder and does not do anything in its main body. It is provided for MIDI compatibility purposes.

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awe32Sysex

```
WORD
PASCAL
awe32Sysex(WORD   wMIDIChannel,
           LPBYTE lpSysexBuffer,
           WORD   wBufferSize)
```

Action MIDI Sysex command

Parameters *wMIDIChannel*

Specifies from which MIDI channel the Sysex originated. Valid range for this variable is from 0 to 15 decimal.

lpSysexBuffer

Specifies a far byte pointer to a string of Sysex data.

wBufferSize

Specifies the size of the Sysex buffer.

Return Value The return value is 0 if the MIDI Sysex command is successful, non-zero if otherwise.

Remarks This current API recognizes the Sysex message switching Reverb/Chorus effects variation.

Reverb Sysex macro :

F0 41 10 42 12 40 01 30 XX CS F7

where XX denotes the Reverb variation to be selected, and CS denotes a checksum value that is ignored. The valid values for XX are

0 - Room 1
1 - Room 2
2 - Room 3
3 - Hall 1
4 - Hall 2
5 - Plate
6 - Delay
7 - Panning Delay

Chorus Sysex macro

F0 41 10 42 12 40 01 38 XX CS F7

again, XX denotes the chorus variation to be selected, and CS notes a checksum value that is ignored. The valid values for XX are :

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0 - Chorus 1
1 - Chorus 2
2 - Chorus 3
3 - Chorus 4
4 - Feedback chorus
5 - Flanger
6 - Short Delay
7 - Short delay (FB)

__awe32NoteOff

```
WORD
PASCAL
__awe32NoteOff(WORD wMIDIChannel,
               WORD wBank,
               WORD wPreset,
               WORD wNote)
```

Action Turn off a MIDI note. You would use this function to turn off a specific user bank note.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the note off originated. Valid range for this variable is from 0 to 15 decimal.

wBank

Specifies the user bank the note originated from. Valid range for this variable is from 0 to 127.

wPreset

Specifies the note's preset number. Valid range for this variable is from 0 to 127.

wNote

Specifies the note's note number. Valid range for this variable is from 0 to 127.

Return Value The return value is 0 if the MIDI note off is successful, non-zero if otherwise.

__awe32IsPlaying

```
BOOL
PASCAL
__awe32IsPlaying(WORD wMIDIChannel,
                 WORD wBank,
```


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```
WORD wPreset,
WORD wNote)
```

Action Check if a MIDI note is still playing.

Parameters *wMIDIChannel*

Specifies from which MIDI channel the note off originated. Valid range for this variable is from 0 to 15 decimal.

wBank

Specifies the user bank the note originated from. Valid range for this variable is from 0 to 127.

wPreset

Specifies the note's preset number. Valid range for this variable is from 0 to 127.

wNote

Specifies the note's note number. Valid range for this variable is from 0 to 127.

Return Value The return value is TRUE if the note is still playing, FALSE otherwise.

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Chapter 4 SoundFont Bank and Downloadable DRAM Services

This chapter gives an overview of the SoundFont Bank and WAVE file loading API. You will typically use these APIs when you want to customize the MIDI instruments and sound effects in your application.

These API use the following data structures :

```
typedef struct {
    SHORT bank_no;          /* Slot number being used */
    SHORT total_banks;      /* Total number of banks */
    LONG FAR* banksizes;    /* Pointer to a list of bank sizes */
    LONG reserved;          /* Unused */
    char FAR* data;         /* Address of buffer of size PACKETSIZE */
    char FAR* presets;      /* Allocated memory for preset data */

    LONG total_patch_ram;   /* Total patch ram available */
    SHORT no_sample_packets;/* No. of packets of samples to stream */
    LONG sample_seek;       /* Start file location of sound sample */
    LONG preset_seek;       /* Address of preset_seek location */
    LONG preset_read_size;  /* No. of bytes from preset_seek to */
                            /* read into a buffer */
    LONG preset_size;       /* Preset actual size */
} SOUND_PACKET;

typedef struct {
    SHORT tag;              /* Must be 0x100 or 0x101 */
    SHORT preset_size;      /* Preset table of this size is required */
    SHORT no_wave_packets;  /* No. of packets of Wave sample */
    LONG reserved;

    SHORT bank_no;          /* Bank number */
    char FAR* data;         /* Address of packet of size PACKETSIZE */
    char FAR* presets;      /* Allocated memory for preset data */
    LONG sample_size;       /* Sample size, i.e. number of samples */
    LONG samples_per_sec;   /* Samples per second */
    SHORT bits_per_sample;  /* Bits per sample, 8 or 16 */
    SHORT no_channels;      /* Number of channels, 1=mono, 2=stereo */
    SHORT looping;          /* Looping? 0=no, 1=yes */
    LONG startloop;         /* If looping, these addresses */
    LONG endloop;
    SHORT release;          /* Release time, 0=24ms, 8191=23.78s */
} WAVE_PACKET;
```


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SOUND_PACKET data structure is used in APIs that involve loading and unloading of SoundFont bank data objects.

WAVE_PACKET data structure provides WAVE loading functionality on top of SOUND_PACKET data structure.

awe32TotalPatchRam

```
WORD
PASCAL
awe32TotalPatchRam(SOUND_PACKET FAR* SP)
```

Action `awe32TotalPatchRam` determines the total amount of RAM on the AWE32. This is not the amount of "unused" RAM but the total amount of RAM. `awe32TotalPatchRam` assumes the AWE32 card has been detected and initialized.

Parameters *SP*

Points to the SOUND_PACKET. `awe32TotalPatchRam` assumes that SP is not NULL.

Return Value If successful, `awe32TotalPatchRam` returns zero; otherwise, it returns non-zero. The following fields of SP will filled upon successful return from this API.

Member	Remarks
total_patch_ram	The total amount of RAM on the SB AWE32 card.

awe32DefineBankSizes

```
WORD
PASCAL
awe32DefineBankSizes(SOUND_PACKET FAR* SP)
```

Action `awe32DefineBankSizes` divides the AWE32's RAM into banks. All previous bank divisions are forgotten. You would normally invoke this API at the beginning of your application.

Parameters *SP*

Points to the SOUND_PACKET data object in which the size of each bank and the number of banks is specified. `awe32DefineBankSizes` assumes `SP` is not `NULL`.

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Member	Remarks
total_banks	The total number of banks that will be used. This is also the number of elements in `SP->banks[]`. The number of banks may range from 1 to 64.
banksizes[]	The sizes of the banks are in `SP->banksizes[];` the number of banks is in `SP->total_banks`. `SP->banksizes[0]` through `SP->banksizes[SP->total_banks-1]` are used to define the bank sizes. The sum of all the bank sizes must be less than or equal to the total amount of patch RAM (which may be obtained by calling awe32TotalPatchRam).

The AWE32 uses only 16-bit samples internally; all 8-bit sample data are converted to 16-bit by the library. Also, each bank requires 160 bytes of overhead for internal storage. So the bank memory required for a single sound is 160 bytes plus two bytes for every sample in the sound, regardless of whether the sound is composed of 8-bit samples or 16-bit samples.

That is, the bank memory required is

(2 bytes) * number_of_samples + 160 bytes

For example, the bank memory required for a WAV file of 10000 bytes of 16-bit samples is (10000 + 160 = 10160 bytes). The bank memory required by a WAV file of 15000 bytes of 8-bit samples is (2 bytes * 15000 + 160 = 30160 bytes).

The bank memory required for a SoundFont bank file that does not contain samples is simply 0 byte.

Return Value If successful, `awe32DefineBankSizes` returns zero; otherwise, it returns non-zero.

awe32SFontLoadRequest

```
WORD
PASCAL
awe32SFontLoadRequest(SOUND_PACKET FAR* SP)
```

Action `awe32SFontLoadRequest` prepares the specified SOUND_PACKET to download a SoundFont bank.

Parameters *SP*

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Points to the SOUND_PACKET data object in which the bank number, the SoundFont file size, and the memory buffer are specified. `awe32SFontLoadRequest` assumes `SP` is not `NULL`.

Member	Remarks
bank_no	The bank number into which a SoundFont file will be loaded.
data	Points to the buffer where the first PACKETSIZE bytes of SoundFont file are read.

Return Value If successful, `awe32SFontLoadRequest` returns zero; otherwise, it returns non-zero. The following fields of SP will filled upon successful return from this API.

Member	Remarks
sample_seek	The offset in the SoundFont bank file where the instrument samples are stored. The application must seek to this position before it begins a read and `awe32StreamSample` loop.
no_sample_packets	The number of packets of PACKETSIZE bytes, each, that must be read and passed to `awe32StreamSample`.
preset_seek	The offset in the SoundFont bank file where the preset data are stored. The application must seek to this position before reading the preset data.
preset_read_size	This number of bytes the client should read for the presets.

awe32StreamSample

```
WORD
PASCAL
awe32StreamSample(SOUND_PACKET FAR* SP)
```

Action For each call, `awe32StreamSample` loads one packet of SoundFont bank instrument samples into a bank.

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`awe32SFontLoadRequest` must be used before calling `awe32StreamSample`.

Parameters *SP*

Points to the SOUND_PACKET in which the bank number, the size of the SoundFont file, and the memory buffer are specified. `awe32StreamSample` assumes `SP` is not `NULL`.

Member	Remarks
bank_no	The bank number into which a SoundFont file will be loaded.
data	Points to the buffer that contains PACKETSIZE bytes of SoundFont data.

Return Value If successful, `awe32StreamSample` returns zero; otherwise, it returns non-zero.

awe32SetPresets

```
WORD
PASCAL
awe32SetPresets(SOUND_PACKET FAR* SP)
```

Action `awe32SetPresets` uses the specified presets (in `SP->presets`) for the specified SoundFont bank (in `SP->bank_no`). Until the `awe32Terminate` function is called or the presets are reset with `awe32ReleaseBank`, the library will continue to use the memory block pointed to by `SP->presets`.

Parameters *SP*

Points to the SOUND_PACKET in which the bank number, and the memory buffer are specified. `awe32SetPresets` assumes `SP` is not `NULL`.

Member	Remarks
bank_no	The bank number for which these presets will be set.

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presets	Points to the buffer in which the presets are stored. The buffer should be at least `SP->presets_read_size` bytes in length. (`SP->presets_read_size` is set by calling `awe32SFontLoadRequest`). The library will continue to use this memory for the SoundFont bank, so you must not free it unless the library is terminated with `awe32Terminate` or the presets are reset with a call to `awe32ReleaseBank`.

Return Value If successful, `awe32SetPresets` returns zero; otherwise, it returns non-zero. The following fields of SP will filled upon successful return from this API.

Member	Remarks
preset_size	The actual size required in `SP->presets`. This will not be more than the value in `SP->preset_read_size`; typically, it will be about 30 percent smaller. The client may resize the presets memory block if the location of the block does not change. (The Standard C library function, `realloc`, may move a block to resize it, so `realloc` is not suitable for resizing the presets block.)

awe32ReleaseBank

```
WORD
PASCAL
awe32ReleaseBank(SOUND_PACKET FAR* SP)
```

Action `awe32ReleaseBank` marks the memory being used for presets by the bank as free and makes the bank unusable. Applications are responsible for freeing any allocated memory buffers. Attempting to play a patch from the released bank results in undefined behavior.

Parameters *SP*

Points to the SOUND_PACKET in which the bank number is specified. `awe32ReleaseBank` assumes `SP` is not `NULL`.

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Member	Remarks
bank_no	The bank number to be released.

Return Value If successful, `awe32ReleaseBank` returns zero, otherwise, it returns non-zero.

awe32ReleaseAllBanks

```
WORD
PASCAL
awe32ReleaseAllBanks(SOUND_PACKET FAR* SP)
```

Action `awe32ReleaseAllBanks` is equivalent to calling `awe32ReleaseBank` for each bank..

Parameters *SP*

Points to the SOUND_PACKET data object. SP is not used and is meant as a place-holder.

Return Value If successful, `awe32ReleaseAllBanks` returns zero; otherwise, it returns non-zero.

awe32WPLoadRequest

```
WORD
PASCAL
awe32WPLoadRequest(WAVE_PACKET FAR* WP)
```

Action `awe32WPLoadRequest` prepares the specified WAVE_PACKET to load wave data (PCM samples) into a specified bank. The wave data is later load into the bank by calling `awe32WPStreamWave`, or `awe32WPLoadWave`. So the wave data may reside in a file, memory, or any other place; the client has the responsibility of retrieving the data.

Parameters *WP*

Points to the WAVE_PACKET. `awe32WPLoadRequest` assumes `WP` is not `NULL`.

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Member	Remarks
bank_no	The bank number into which the wave data will be loaded.
sample_size	Size of wave data in number of samples.
no_channels	The number of channels in the wave data. 1 is mono and 2 is stereo. Only mono (1) is supported.
bits_per_sample	The number of bits per sample. 8 and 16 bits samples are supported.
tag	Current version number of WAVE_PACKET. Must be 0x101.

Return Value If successful, `awe32WPLoadRequest` returns zero; otherwise, it returns non-zero. In addition, values are returned in some fields of WAVE_PACKET object.

Member	Remarks
no_wave_packets	The number of wave packets of PACKETSIZE bytes, each, that must be passed to `awe32WPStreamWave`; if it is used.
preset_size	The number of bytes required by the library for presets for the bank. Allocate this much memory for this purpose.

awe32WPLoadWave

```
WORD
PASCAL
awe32WPLoadWave(WAVE_PACKET FAR* WP)
```

Action `awe32WPLoadWave` loads all of the wave data into a bank. Use this function instead of repeatedly calling `awe32WPStreamWave` when all the sound data can fit in a single block of memory. (In Real mode, the sound data must be less than 64 KB long.)

Parameters *WP*

Points to the WAVE_PACKET. `awe32WPLoadWave` assumes `WP` is not `NULL`.

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Member	Remarks
data	Points to the sample data.
bits_per_sample	The wave data resolution (number of bits per sample) of the sample object. This should have the same value as it did when `awe32WPLoadRequest` was called.

Return Value If successful, `awe32WPLoadWave` returns zero; otherwise, it returns non-zero.

awe32WPStreamWave

```
WORD
PASCAL
awe32WPStreamWave(WAVE_PACKET FAR* WP)
```

Action `awe32WPStreamWave` loads one packet of wave data into the specified bank.

Parameters *WP*

Points to the WAVE_PACKET. `awe32WPStreamWave` assumes `WP` is not `NULL`. The fields in the WAVE_PACKET should have the same values they did when previous call to `awe32WPLoadRequest` returned.

Member	Remarks
bank_no	The bank number to which the wave data will be loaded.
data	Points to the wave data buffer of PACKETSIZE bytes.
bits_per_sample	The wave data resolution (number of bits per sample) of the sample object. This should have the same value as it did when `awe32WPLoadRequest` was called.

Return Value If successful, `awe32WPStreamWave` returns zero; otherwise, it returns non-zero.

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awe32WPBuildSFont

```
WORD
PASCAL
awe32WBuildSFont(WAVE_PACKET FAR* WP)
```

Action `awe32WPBuildSFont` constructs a SoundFont preset object for the download wave data. In effect the wave data becomes an instrument in the specified bank.

Parameters *WP*

Points to the WAVE_PACKET. `awe32WPBuildSFont` assumes `WP` is not `NULL`.

Member	Remarks
bank_no	The bank number into which the wave data will be loaded.
tag	Current version number of WAVE_PACKET. This value must be the same value that was present when `awe32WPLoadRequest` and `awe32WPStreamWave` were called.
sample_size	Holds the number of samples in the sample object. This must be the same value that was present when `awe32WPLoadRequest` and `awe32WPStreamWave` were called.
samples_per_sec	Holds the frequency of the wave data. Supported frequencies are 8000hz, 11025hz, 22050hz, and 44100hz.
looping	Holds zero if there is no loop in the sample. Otherwise, holds non-zero and the start and end of the loop as offsets into the WAVE data are specified in `WP->startloop` and `WP->endloop`, respectively.
release	Specifies the duration of the release section of the sample. Zero causes a release duration of 24 milliseconds; 5940, 23.78 seconds. Values higher than 5940 are treated as 5940.
presets	Points to a block of memory the library may use for holding presets. The block of memory must be at least `WP->preset_size` bytes in length. (This length was obtained by calling `awe32WPLoadRequest`).

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Return Value If successful, awe32WPBuildSFont returns zero; otherwise, it returns non-zero.

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Chapter 5 Real and Protected Mode API Programming Guide

This chapter gives a general guide in using the DOS Real and Protected mode API. This chapter consists of 6 sections:

- ❑ Using the libraries
- ❑ Initialization
- ❑ Termination
- ❑ Using embedded GM presets
- ❑ Loading a SoundFont Bank
- ❑ Loading wave data as an instrument
- ❑ Using `awe32DefineBankSizes`
- ❑ Starting and ending addresses
- ❑ Significance of awe32NumG variable

Using the libraries

A header file CTAWEAPI.H for C/C++ compilers is included in this package. The libraries are provided in 2 formats: OBJ and LIB files. Libraries of 5 memory models are provided:

- Small memory model
- Compact memory model
- Medium memory model
- Large memory model
- Flat memory model (protected mode)

Please note that all libraries are compiled using structure members alignment of 1. For flat memory model library, the FAR keyword has been defined away, LPBYTE is the same as PBYTE.

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Initialization

The SB AWE32 EMU8000 subsystem must be properly initialized prior to any MIDI playback. Two steps are required for initialization as shown be below. The example assumes that the base I/O addresses of the EMU8000 subsystem is at 0x620.

```
wEmuBase = 0x620;
if ( awe32Detect(wEmuBase) ) {
        // Error, EMU8000 not found
}
else {
        if ( awe32InitHardware() ) {
                // Error, initialising EMU8000 failed
        }
}
```

Termination

The SB AWE32 EMU8000 subsystem must be properly terminated when your application wishes to quit. Failure to do so may render any subsequent playing of FM music inaudible.

```
if ( awe32Terminate() ) {
        // Error, termination failed
}
```

Using embedded GM presets

General MIDI presets are included in this package, EMBED.OBJ. In order to embed the presets, you need to initialize the `awe32SoundPad` structure as shown below :

```
awe32SoundPad.SPad1 = awe32SPad1Obj;
awe32SoundPad.SPad2 = awe32SPad2Obj;
awe32SoundPad.SPad3 = awe32SPad3Obj;
awe32SoundPad.SPad4 = awe32SPad4Obj;
awe32SoundPad.SPad5 = awe32SPad5Obj;
awe32SoundPad.SPad6 = awe32SPad6Obj;
awe32SoundPad.SPad7 = awe32SPad7Obj;

if ( awe32InitMIDI() ) {
        // Error, MIDI engine initialisation failed
}
```

The `awe32SoundPad` is of type SOUNDPAD and is defined in MIDIVAR.OBJ, and the `awe32SPadXObj` variables are defined in EMBED.OBJ.

`awe32SoundPad` has to be initialized before calling `awe32InitMIDI`. The General MIDI presets will be setup as Bank 0 and uses the ROM samples.

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Loading a SoundFont Bank

There are several steps involved. For example, to load a User Bank.

```
#include "ctaweapi.h"

int i;
FILE *fp;
LONG banks[1];
SOUND_PACKET sp;
char buffer[PACKETSIZE];

// Determine available patch DRAM
awe32TotalPatchRam(&sp);
if ( sp.total_patch_ram < 512*1024 ) {
        // Error, not enough patch DRAM
}

// Setup bank sizes
banks[0] = sp.total_patch_ram;        // Use all available ram,
sp.banksizes = banks;                 // could be less
sp.total_banks = 1;                   // Total no. of banks
if ( awe32DefineBankSizes(&sp) ) {
        // Error, invalid sizes
}

// Open SoundFont Bank
fp = fopen("USER.SBK", "rb");
fread(buffer, 1, PACKETSIZE, fp);     // Read SoundFont header

// Prepare to load SoundFont Bank
sp.bank_no = 0;                       // Load into bank 0
sp.data = buffer;                     // Packet buffer
if ( awe32SFontLoadRequest(&sp) ) {
        // Error, invalid SoundFont bank
}

// To stream sound sample
if ( sp.no_sample_packets > 0 ) {
        fseek(fp, sp.sample_seek, SEEK_SET);
        for (i=0; i<sp.no_sample_packets; i++) {
                fread(buffer, 1, PACKETSIZE, fp);
                awe32StreamSample(&sp);
        }
}

// To load presets
sp.presets = (char *) malloc(sp.preset_read_size);
fseek(fp, sp.preset_seek, SEEK_SET);
fread(sp.presets, 1, sp.preset_read_size, fp);
if ( awe32SetPresets(&sp) ) {
        // Error, invalid SoundFont bank
}

if ( awe32InitMIDI() ) {
        // Error, MIDI engine initialization failed
}
```

It is recommended that synthesizer SoundFont bank such as SYNTHGM.SBK loads as Bank 0.

Loading wave data as an instrument

The steps are similar to those of loading a SoundFont bank except that WAVE_PACKET functions are used.

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```
#include "ctaweapi.h"

int i;
FILE *fp;
LONG banks[2];
WAVE_PACKET wp;
SOUND_PACKET sp;
char buffer[PACKETSIZE];

// Embed GM presets
awe32SoundPad.SPad1 = awe32SPad1Obj;
awe32SoundPad.SPad2 = awe32SPad2Obj;
awe32SoundPad.SPad3 = awe32SPad3Obj;
awe32SoundPad.SPad4 = awe32SPad4Obj;
awe32SoundPad.SPad5 = awe32SPad5Obj;
awe32SoundPad.SPad6 = awe32SPad6Obj;
awe32SoundPad.SPad7 = awe32SPad7Obj;

// Determine available patch DRAM
awe32TotalPatchRam(&sp);
if ( sp.total_patch_ram < 512*1024 ) {
        // Error, not enough patch DRAM
}

// Setup bank sizes
banks[0] = 0;                           // Embeded GM presets
banks[1] = sp.total_patch_ram;          // Use all available ram,
sp.banksizes = banks;                   // could be less
sp.total_banks = 2;                     // Total no. of banks
if ( awe32DefineBankSizes(&sp) ) {
        // Error, invalid sizes
}

// Open wave data
fp = fopen("WAVE.PCM", "rb");

// Prepare to load wave data
wp.tag = 0x101;                         // Tag
wp.bank_no = 1;                         // Load into bank 1
wp.data = buffer;                       // Packet buffer
wp.sample_size = 10240;                 // 10240 samples
wp.samples_per_sec = 22050;             // 22050 Hz
wp.bits_per_sample = 8;                 // 8-bit sample
wp.no_channels = 1;                     // Mono sample
wp.looping = 1;                         // Looping on
wp.startloop = 0;                       // Loop from beginning
wp.endloop = 10240;                     // To the end
wp.release = 0;                         // Immediate release
if ( awe32WPLoadRequest(&wp) ) {
        // Error, cannot use specified wave data
}

// To stream wave data
// See also awe32WPLoadWave
for (i=0; i<wp.no_wave_packets; i++) {
        fread(buffer, 1, PACKETSIZE, fp);
        awe32WPStreamWave(&wp);
}

// To build SoundFont presets
wp.presets = (char *) malloc(wp.preset_size);
if ( awe32WPBuildSFont(&wp) ) {
        // Error, cannot build SoundFont presets
}

if ( awe32InitMIDI() ) {
        // Error, MIDI engine initialization failed
}
```


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Using awe32DefineBankSizes

Beside defining bank sizes, awe32DefineBankSizes can in the following ways:

- To resize an existing bank. However, the bank to be resized has to be the last bank.
- To define additional banks. The new banks have to be added beyond the last bank.

Assume that the RAM on the SB AWE32 is divided into 3 banks of 128 kilobytes each.

```
LONG banks[4];       /* reserve for 4 banks */
SOUND_PACKET sp;
.
.
banks[0] = 128000;
banks[1] = 128000;
banks[2] = 128000;
sp.total_banks = 3;
sp.banksizes = banks;
if ( awe32DefineBankSizes(&sp) ) {
       // Error, invalid sizes
}
```

The last bank can be resized by calling awe32DefineBankSizes.

```
banks[2] = 150000;     /* new size */
sp.total_banks = 3;
sp.banksizes = banks;
if ( awe32DefineBankSizes(&sp) ) {
       // Error, invalid sizes
}
```

An additional bank can be added beyond the last bank.

```
banks[3] = 64000;      /* new bank */
sp.total_banks = 4;
sp.banksizes = banks;
if ( awe32DefineBankSizes(&sp) ) {
       // Error, invalid sizes
}
```

In order to resize other banks, the bank(s) beyond the bank to be resized must be freed first by calling awe32ReleaseBank.

Starting and ending addresses

The starting and ending addresses for code and data segments of all the module files are marked.

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MIDIENG.OBJ	CODE Start	`__midieng_code()`
	CODE End	`__midieng_ecode()`
	DATA Start	`int* __midi_code()`
	DATA End	`int* __midieng_ecode()`
HARDWARE.OBJ	CODE Start	`__hardware_code()`
	CODE End	`__hardware_ecode()`
	DATA Start	`int* __hardware_code()`
	DATA End	`int* __hardware_ecode()`
SBKLOAD.OBJ	CODE Start	`__sbkload_code()`
	CODE End	`__sbkload_ecode()`
	DATA Start	`int* __sbkload_code()`
	DATA End	`int* __sbkload_ecode()`
NRPN.OBJ	CODE Start	`__nrpn_code()`
	CODE End	`__nrpn_ecode()`
	DATA Start	`int* __nrpn_code()`
	DATA End	`int*  __nrpn_ecode()`
MIDIVAR.OBJ	DATA Start	`__midivar_data`
	DATA End	`__midivar_edata`
NRPNVAR.OBJ	DATA Start	`__nrpnvar_data`
	DATA End	`__nrpnvar_edata`
EMBED.OBJ	DATA Start	`__embed_data`
	DATA End	`__embed_edata`

For applications that require the starting and ending addresses of each file module, they can be obtained as follows:

```
// midieng.obj
void* code_start = (void*) __midieng_code;
void* code_end   = (void*) __midieng_ecode;
void* data_start = (void*) __midieng_code();
void* data_end   = (void*) __midieng_ecode();
```

For users who are developing drivers that make use of hardware interrupts in protected mode, all modules except HARDWARE.OBJ and SBKLOAD.OBJ and any additional preset buffers must be page locked. If NRPN is not used, NRPN.OBJ and NRPNVAR.OBJ can be omitted.

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Significance of awe32NumG variable

If you intend to use only the ROM (i.e., General MIDI) instruments, you can set awe32NumG to 32 and you will be using the full 32 oscillators on the EMU8000 subsystem.

If you plan to use both ROM sound and DRAM instruments/sound effects, or instruments/sound effects from DRAM only, you have to set awe32NumG to 30, i.e., using only 30 oscillators on the EMU8000 subsystem. The remaining 2 oscillators have to be used for DRAM memory refresh. Failure to do so may result in the DRAM sound being playback incorrectly.

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PART II Sound Blaster AWE32 Microsoft Windows 3.1 API

This part describes the API available for Microsoft Windows 3.1. The APIs are provided by a pair of Dynamic Link Libraries (DLL), AWEMAN.DLL and AWEGUI.DLL.

This part consists of the following chapters:

- Overview
- AWE Manager DLL
- AWE GUI DLL
- Programming Guide

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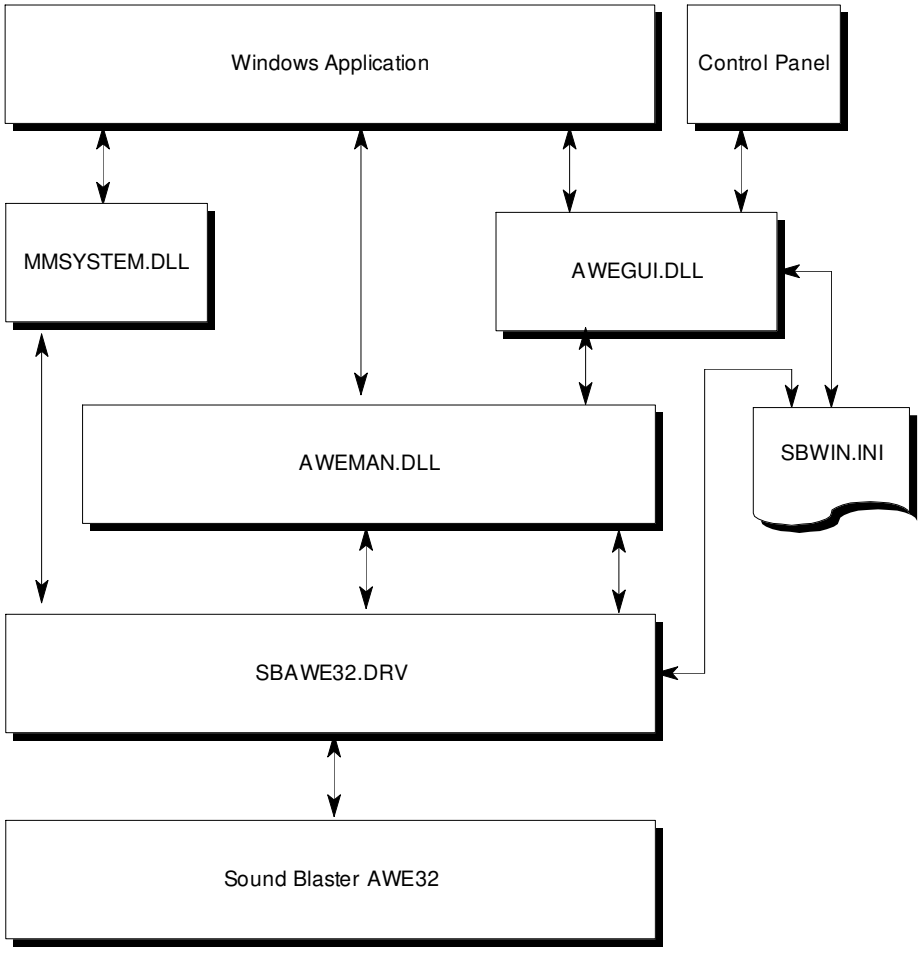
Chapter 6 Overview

AWEMAN.DLL is a resource (effects microcode and user samples) manager. As mentioned, there are two types of resources, effects microcode and user samples. Download requests from effects microcode or user samples can be initiated by the user application that uses AWEMAN.DLL's API. When an effect is selected by the user, AWEMAN.DLL will relay the request to the SBAWE32.DRV driver. This driver will search for the required files in SBWIN.INI and download them to the AWE32.

The diagram below depicts the relationships of the libraries and drivers for the Sound Blaster AWE32.



The diagram below gives a detailed functional description of AWEMAN.DLL.

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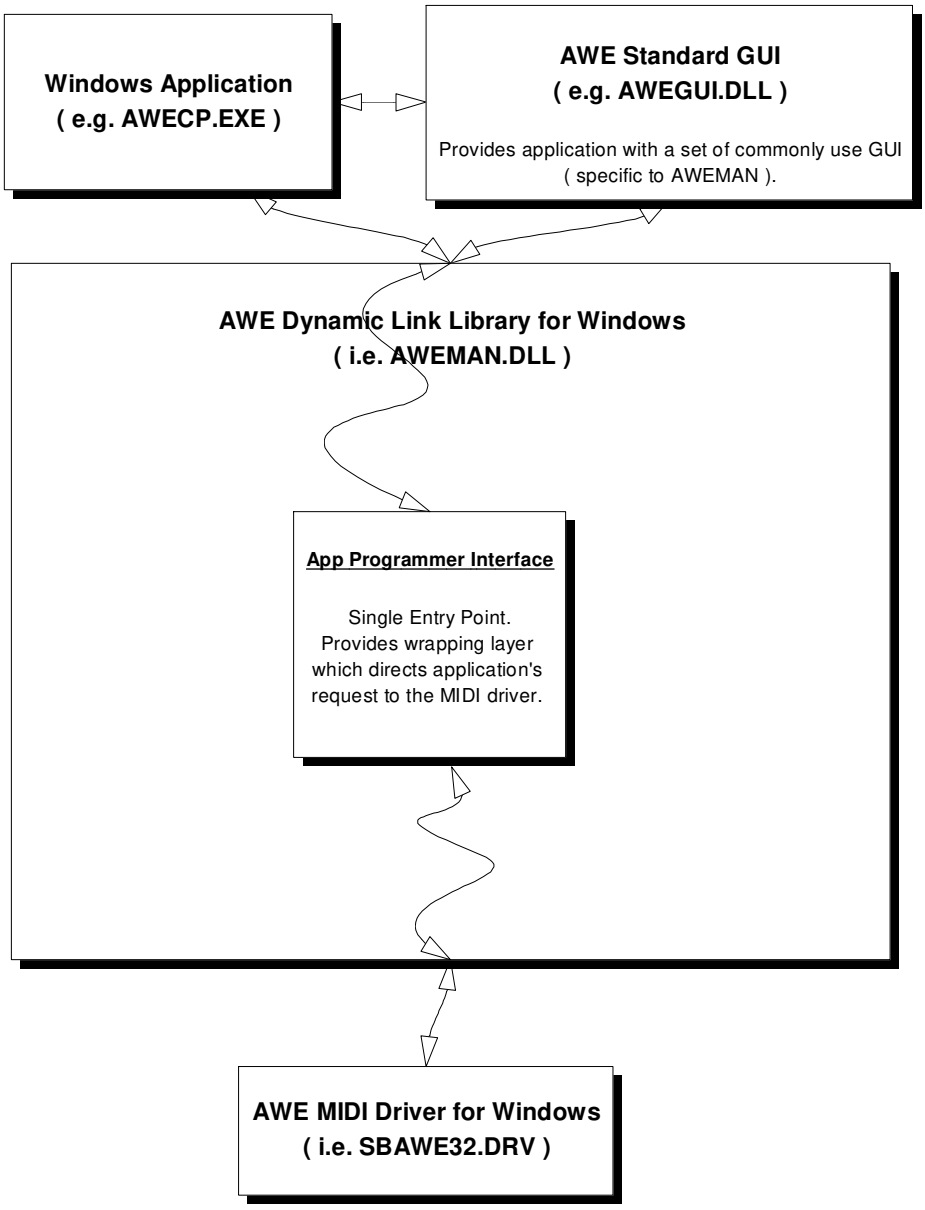

AWE Standard GUI

The GUI provides applications with a common set of user interfaces to access the AWE features. The GUI consist of several dialog boxes and are embedded within AWEGUI.DLL. Each dialog box has a function attached to it. The dialog boxes serve as an enumeration of features supplied by the API functions. These features are limited to the global view.

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Application Programmer Interface

The current implementation of API is via message-based system (different from Windows' WM_USER). API provides parent applications with a set of functions, accessing the features of AWE. These functions are mirrored from the MIDI driver, SBAWE32.DRV. API exports one function call AWEManager. Applications communicate to AWEMAN.DLL through this function using the pre-defined messages. Each message will trigger different functions in AWEMAN.DLL.

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Chapter 7 AWE Manager DLL

This chapter describes the specifications of the Windows 3.1 API. These are the functions that an application should interact with when required to access the AWE32.

This chapter is divided into four sections:

- AWE Manager Message Function
- AWE Manager Messages
- AWE Manager Message Reference
- AWE Manager Error Messages

The first section describes how to gain access to the AWE Manager entry point function. The second section gives a quick and brief description of what the AWE Manager DLL offers. The third section takes a deeper view into the message functions. The fourth section explains anticipated error messages.

In this chapter, AWE Manager DLL is also referenced as DLL or AWE Manager.

AWE Manager Message Function

AWEMAN.DLL provides a single entry point to its message-based function. This function has the following prototype:

```
LRESULT FAR PASCAL AWEManager(AWEHANDLE hUserID,
                              UINT unMsg,
                              LPARAM lParam1,
                              LPARAM lParam2 )
```

The parameters' descriptions are as follows:

hUserID	Specifies a user ID, issued by AWE Manager.
unMsg	Identifies a message that AWE Manager must process.
lParam1	
lParam2	Specifies message dependent parameters.

The *AWEHANDLE* is actually a handle to a data structure, classed as CAWEObject, describing the settings and relationship between the application and the DLL. It is

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recommended that the AWE Manager DLL be dynamically linked with the application. In the application, the pointer to function declaration should bear the same parameter declaration as stated above.

After making such declaration in the code and loading the DLL using the **LoadLibrary** function call in Windows, the manager's message function can be access, simply, like normal pointer to function manner. It is important to realize that AWE Manager will only support one user application accessing its public APIs at one time. It is the task of user application to 'release' the AWE Manager before the AWE Manager can be accessed by other user application.

The parameter of the message function take form of a pre-defined structure. The user application will have to allocate these structures before passing in as parameter. These structures have the following form:

```
typedef struct {
   enum SBANK         m_SBankIndex;
   WORD               m_UBankIndex;
   WORD               m_InstrIndex;
   enum TYPEINDEX     m_TypeIndex;
   WORD               m_SubIndex;
   WORD               m_VariIndex;
   } CParamObject;

typedef struct {
   DWORD              m_Size;
   LPSTR              m_Buffer;
   DWORD              m_SizeUsed;
   WORD               m_Flag;
   } CBufferObject;
```

Not all of the fields within the structure will be used every time. It is the duty of both application and DLL to retrieve and set the values from the appropriate parameters. The long pointer version of the two structures is defined as *LPPARAMOBJECT* and *LPBUFFEROBJECT*.

All the above mentioned structures are already provided in the **`AWE_DLL.H`** header file. Hence, by including this header file in your application, the AWE Manager will be ready for accessing.

Manager Messages

The following messages are implemented in AWEMAN.DLL:

AWE_OPEN	Acquire AWE Manager to control and configure the hardware.
AWE_CLOSE	Releases control of AWE Manager to other applications.
AWE_REFRESH	Informs AWE Manager to reconfigure the hardware according to the current selected settings. This will cause an

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	unconditional downloading of effects module and/or the various banks.
AWE_QUERY_EFXT_SUPPORT	Retrieve a list of available or supported Effect Types.
AWE_QUERY_EFXV_SUPPORT	Retrieve a list of available or supported Type Variations.
AWE_GET_EFX	Get the current Effect Types and/or Type Variations in use.
AWE_SELECT_EFX	Select an Effect Type and its variations, if any. This selection will be downloaded immediately into the hardware.
AWE_QUERY_SYN_SUPPORT	Retrieve a list of available or supported Synthesizer Emulation.
AWE_GET_SYN_BANK	Get the bank descriptor of the current Emulation used in Synthesizer Bank.
AWE_SELECT_SYN_BANK	Select a Synthesizer Emulation for the Synthesizer Bank.
AWE_LOAD_USER_BANK	An application wishes to load a bank of instruments into the User Bank area.
AWE_GET_USER_BANK	An application wishes to retrieve the descriptor of a User Bank.
AWE_CLEAR_USER_BANK	Notifies AWE Manager to unload (remove) entire bank of instruments from the User Bank area.
AWE_LOAD_USER_INSTR	Load instrument presets into a User Bank.
AWE_GET_USER_INSTR	Retrieve the descriptor attached to an instrument in a bank. This bank can be either Synthesizer Bank or User Bank.
AWE_CLEAR_USER_INSTR	Remove instrument presets from a User Bank.
AWE_GET_UBANK_PARENT	To identify if a user bank is loaded by the Synthesizer Bank or loaded separately on its own.
AWE_GET_DRUM_KIT	Retrieve the descriptor of the drum section in either the Synthesizer or User Bank.
AWE_QUERY_DRAM_SIZE	Retrieve current available and maximum memory on the AWE32 hardware.

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AWE_GET_VERSION	Return the current AWE Manager version number.
AWE_SEND_MIDI	Sends a MIDI message directly to the driver.
AWE_ISHANDLE	To identify if the handle returned by the Manager is valid.

Message Reference

Explanations of messages from the manager are documented below.

AWE_OPEN

Actions An application sends this message to AWE Manager when it wishes to acquire the manager.

Parameters **`lParam1`**

Specify a far pointer to a user declared handle type, *AWEHANDLE*. The DLL fills this location with a `hUserID` value if the initialization is successful.

`lParam2`

Unused.

`hUserID`

Unused.

Remarks This message can only be called once during initialization.

The manager will check for the existence of the MIDI driver and in-turn register with it. If the driver fails because of hardware failure or contention, this function will also fail. Upon successful initialization, the manager will return a unique user identification (handle) to the application. All subsequent calls to the manager should have this ID associated with

Following files must be present in Windows,

- `SBAWE32.DRV` - AWE MIDI Driver v1.1 or above

In version 1.0, there is a restriction of requiring to acquire the MIDI driver via MMSystem. This restriction is currently removed. However, the Open function still supports only one user application, at any time. Opening more than once will cause the manager to return a busy message. If the MIDI driver is not available at the time of Open, the manager will still fail and return the access not permitted message. Such cases happen, for example, when Media Player has already acquire the MIDI driver before the user application opens the manager

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Return Value The return value would be AWE_NO_ERR if the operation is successful and an error code otherwise. Possible error messages are:

AWE_ERR_DEVICE_DRV_INVALID

AWE_ERR_DLL_BUSY

AWE_ERR_SYSMEM_INSUFFICIENT

AWE_ERR_ACCESS_NOT_PERMITTED

AWE_ERR_VERSION_INVALID

See Also AWE_CLOSE

AWE_CLOSE

Actions An application sends this message to AWE Manager when it wishes to release control of the manager to other applications.

Parameters **`lParam1`**

Unused.

`lParam2`

Unused.

`hUserID`

Current ID assigned to the application by AWE Manager during initialization.

Remarks The following are some important points to note when using this function.

The close function will not cause Windows to unload the AWE Manager from memory. Unloading depends on whether anymore application is still accessing it. Only when the last application issues a close message, then the manager will be unloaded. This is the 'last one off the lights' metaphor. When the manager is unloaded by Windows, all unused handles will be 'clean' up by the manager.

The application mentioned above can only be either user application or control panel application and not two or more of the same kind

In version 1.0, the when closing the manager, it is also necessary to release the MIDI driver (via MMSystem). This is because if the driver is not being release, other applications will not be able to Open the manager without acquiring the driver first. In version 1.1, this restriction is removed since the need of acquiring the MIDI driver before opening the manager is removed.

Return Value The return value is AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error message is:

AWE_ERR_USERID_INVALID

See Also AWE_OPEN

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AWE_REFRESH

Actions An application sends this message to the AWE Manager requesting it to refresh the current hardware settings. This means that all currently in used effects and Synthesizer Bank settings will be downloaded again.

Parameters **`lParam1`**

Boolean value, BOOL. If it is TRUE, indicates that the Effect Types and Type Variations will be required to refresh. FALSE value will not cause any refreshing.

`lParam2`

Boolean value, BOOL. If it is TRUE, indicates that the Synthesizer Emulation settings will be required to refresh. FALSE value will not cause any refreshing.

`hUserID`

Current ID assigned to the application by AWE Manager during initialization.

Remarks This function will not refresh the instruments loaded in the User Bank area.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_DEVICE_BUSY

See Also AWE_SELECT_EFX, AWE_SELECT_SYN_BANK, AWE_QUERY_EFXT_SUPPORT, AWE_QUERY_EFXV_SUPPORT, AWE_QUERY_SYN_SUPPORT

AWE_QUERY_EFXT_SUPPORT

Actions An application sends this message to the AWE Manager to retrieve a list of supported Effect Types.

Parameters **`lParam1`**

Specifies a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Buffer size in characters.
m_Buffer	Far pointer of buffer area.

The manager upon returning will fill or change the following fields:

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Member	Remarks
m_SizeUsed	Number of characters from buffer used.
m_Flag	Number of entries stored in buffer.
m_Buffer	String entries of effect types.

The m_SizeUsed includes the '\0's used to delimit entries. Current version of MIDI driver, version 1.00, supports two Effect Types. The string representations (not including quotes) are as follows:

String Equivalent	Type Index	Sub-Index	
"Reverb & Chorus"	0	0 - Reverb	1 - Chorus
"QSound"	1	-	-

The buffer area filled by the manager are entries of Effect Types supported by the current MIDI driver. These entries are in string format, each terminated with a '\0'. The last entry of the list will have two consecutive '\0's. An example is:

"Reverb & Chorus\0QSound\0\0"

With the example above, the m_SizeUsed is 24 and m_Flag is 2.

`lParam2`

Unused.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks

The following are some important points to note when using this function.

The location passed in as pointer must be valid memory locations allocated by the parent application.

If the buffer is not sufficient to complete the operation, AWE Manager will not update string entries into the buffer. However, other return parameters will still be updated.

Return Value

The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

AWE_ERR_SYSMEM_INSUFFICIENT

See Also

AWE_QUERY_EFXV_SUPPORT, AWE_GET_EFX, AWE_SELECT_EFX

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AWE_QUERY_EFXV_SUPPORT

Actions An application sends this message to the AWE Manager to retrieve a list of supported Type Variations.

Parameters `lParam1`

Specify a far pointer to CParamObject, *LPPARAMOBJECT*. When the application is calling the manager, the following fields of the structure are used,

Member	Remarks
m_SubIndex	The Sub-Index of the effect types.
m_TypeIndex	The effect types index.

Current MIDI driver supports two basic Effect Types of which only one has variations. The 'Reverb & Chorus' Effect Types supports two sets of variations, one for Reverb and the other for Chorus. For example, if the application wishes to query the variations supported by Chorus of 'Reverb and Chorus', then m_SubIndex will be 01 and m_TypeIndex will be 00. If the type is 'QSound', then the m_SubIndex can be set to 0, though not necessary. The manager will fill the following field when returning:

Member	Remarks
m_SubIndex	Total number of Sub-Index available for current selected Effect Types.

When returning, AWE Manager will update the m_SubIndex to contain the maximum number of Sub-Index available for the Effect Types. For the example above, m_SubIndex will be 2 for Type Index 0. Each set of variations has the following entries and variation index.

String Equivalent	Vari-Index	Type Index	Sub-Index
"Room 1"	0	0	0
"Room 2"	1	0	0
"Room 3"	2	0	0
"Hall 1"	3	0	0
"Hall 2"	4	0	0
"Plate"	5	0	0
"Delay"	6	0	0

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"Panning Delay"	7	0	0
"Chorus 1"	0	0	1
"Chorus 2"	1	0	1
"Chorus 3"	2	0	1
"Chorus 4"	3	0	1
"Feedback Delay"	4	0	1
"Flanger"	5	0	1
"Short Delay"	6	0	1
"Short Delay FB"	7	0	1

The Sub-Index refers to an individual Effect Type of a conjunctive effects pair. For example, Type Index 0 is 'Reverb and Chorus' where this pair is a composition of the Reverb and Chorus Effect Types. The MIDI driver treats this as a single Effect Type which is actually a composition of two. To selectively identify each individual Effect Type within a pair, a Sub-Index is used. This index will allow an application to 'pin-point' at a specific Effect Type of a pair. 'QSound' being a single-type effect does not require Sub-Index. Future extensions on the Effect Types will be appended onto the current supported list.

lParam2

Specify a far pointer to CBufferObject, *LPBUFFEROBJECT*. Upon calling, the application will fill the following fields:

Member	Remarks
m_Size	Indicates the size of buffer available.
m_Buffer	Far pointer to a buffer area.

The Manager upon returning, will fill the following fields:

Member	Remarks
m_SizeUsed	Number of characters from buffer used.
m_Flag	Number of entries written into the buffer.
m_Buffer	String entries of type variations.

The m_SizeUsed includes the '\0's used to delimit entries. The buffer area will be filled by the manager with the entries of Type Variation supported by the current MIDI driver. These entries are in string format, each terminated with a '\0'. The last entry of the list will have two consecutive '\0's. As an example, we have:

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```
"Chorus 1\0Chorus 2\0Chorus 3\0Chorus
4\0Feedback Delay\0Flanger\0Short
Delay\0Short Delay FB\0\0"
```

The m_Flag will have 8 and m_SizeUsed will be filled with 87.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks The following are some important points to note when using this function.

The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip a General Protection Fault in Windows.

If the buffer is not sufficient to complete the operation, AWE Manager will not update string entries into the buffer. However, other return parameters will still be updated.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_EFXT_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

AWE_ERR_SYSMEM_INSUFFICIENT

See Also AWE_QUERY_EFXT_SUPPORT, AWE_GET_EFX, AWE_SELECT_EFX

AWE_GET_EFX

Actions An application sends this message to the AWE Manager to retrieve the currently in use Effect Type and its Type Variations if any.

Parameters **`lParam1`**

Specifies a far pointer to CParamObject, *LPPARAMOBJECT*. The manager will fill the following field with the following appropriate values:

Member	Remarks
m_TypeIndex	The effect types index.
m_SubIndex	Number of variations index returned.
m_VariIndex[..]	The type variations index.

The m_VariIndex[..] is an array type. At this moment, for 'Reverb & Chorus', only 0 and 1 are supported respectively. The 'Reverb and Chorus' has two sets of variations (one for each of 'Reverb' and 'Chorus') and is the largest. This might change in

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future. To access them, simply index the VariIndex[..] with the appropriate numbers, e.g. VariIndex[0] for Reverb and VariIndex[1] for Chorus. m_SubIndex indicates the number of variations indices returned in the array. If the Effect Types specified by m_TypeIndex does not have variations, the m_VariIndex[..] will not be used.

`lParam2`

Unused.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks None.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error is:

AWE_ERR_USERID_INVALID

See Also AWE_QUERY_EFXT_SUPPORT, AWE_QUERY_EFXV_SUPPORT, AWE_SELECT_EFX

AWE_SELECT_EFX

Actions An application sends this message to inform the AWE Manager of the Effect Types and Variations that it wishes to use.

Parameters **`lParam1`**

Specify a far pointer to CParamObject, *LPPARAMOBJECT*. The application should fill the following fields with appropriate values:

Member	Remarks
m_TypeIndex	The effect types index.
m_VariIndex[..]	The type variations index.

The m_VariIndex[..] is an array type. At this moment, for 'Reverb & Chorus', only 0 and 1 are supported respectively. The 'Reverb and Chorus' has two sets of variations (one for each of 'Reverb' and 'Chorus') and is the largest. This might change in future. To access them, simply index the VariIndex[..] with the appropriate numbers e.g. VariIndex[0] for Reverb and VariIndex[1] for Chorus. If the Effect Types specified by m_TypeIndex does not have variations, the m_VariIndex[..] will not be used.

String Equivalent	Type Index	Sub-Index	
"Reverb & Chorus"	0	0 - Reverb	1 - Chorus

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"QSound"	1	-	-

If the Type Index is pointing to 'Reverb & Chorus', then m_VariIndex[0] should contain the Vari-Index of 'Reverb' and m_VariIndex[1] should have index of 'Chorus'.

lParam2

Unused.

hUserID

Current ID assigned to the application by the AWE Manager during initialization.

Remarks None.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_DEVICE_BUSY

AWE_ERR_EFXT_CHANGE_NOT_ALLOWED

AWE_ERR_EFXT_INVALID

AWE_ERR_EFXV_INVALID

See Also AWE_QUERY_EFXT_SUPPORT, AWE_QUERY_EFXV_SUPPORT, AWE_GET_EFX, AWE_REFRESH

AWE_QUERY_SYN_SUPPORT

Actions An application sends this message to the AWE Manager to request a list of available or supported Emulations for Synthesizer Bank.

Parameters **lParam1**

Specifies a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Indicates the size of buffer available.
m_Buffer	Far pointer to a buffer area.

Upon returning, the manager will update the following fields:

Member	Remarks
m_SizeUsed	Number of characters from buffer used.

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m_Flag	Number of entries written into the buffer.
m_Buffer	String entries of synthesizer emulation.

The buffer area will be filled by the manager with the entries of Synthesizer Emulation supported by the current MIDI driver. These entries are in string format, each delimited by a '\0'. The last entry of the list will have two consecutive '\0's. Using the above example, we have:

```
"General MIDI\0GS\0MT 32\0User Custom
Synth\0\0"
```

The size returned includes the '\0's used to delimit two entries. The current version of MIDI driver supports the following Synthesizer Emulation:

String Equivalent	Idx	Entry	File
"General MIDI	0	GM	SYNTHGM.SBK
"GS"	1	GS	SYNTHGS.SBK
"MT 32"	2	MT	SYNTHMT.SBK
"User Custom Synth"	3	USER	SYNTHUSR.SBK

The bank files can be located in the default directory of AWE. This default directory is usually a sub-directory of the Sound Blaster path. The Sound Blaster path can be located from the environment variable "SOUND". The default name is used whenever a user specified file cannot be located. The path specified by the user can be found in the SBWIN.INI file under "AWE32" section. The entry name for each respective synthesizer emulation are listed in the table. Hence,

```
[AWE32]
GM = C:\SBANK\USER1.SBK
```

will have an assignment of USER1.SBK file as the General MIDI Bank.

lParam2

Unused.

hUserID

Current ID assigned to the application by the AWE Manager during initialization.

Remarks

The following are some important points to note when using this function.

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The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip General Protection Fault in Windows

If the buffer is not sufficient to complete the operation, AWE Manager will not update string entries into the buffer. However, other return parameters will still be updated.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

AWE_ERR_SYSMEM_INSUFFICIENT

See Also AWE_SELECT_SYN_BANK, AWE_GET_SYN_BANK

AWE_GET_SYN_BANK

Actions An application sends this message to the AWE Manager to query for the currently used Synthesizer Bank and its descriptor.

Parameters **`lParam1`**

Specifies a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Indicates the size of buffer available.
m_Buffer	Far pointer to a buffer area.

Upon returning, the manager will update the following fields:

Member	Remarks
m_SizeUsed	Number of characters from buffer used.
m_Flag	The synthesizer emulation index.
m_Buffer	String of current bank descriptor.

The m_SizeUsed includes the '\0's used to delimit entries. The buffer area will be filled by the manager with the descriptor of the current Synthesizer Bank. The m_Flag will contain the SBank Index to the available emulation. The current version of MIDI driver supports the following Synthesizer Emulation:

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String Equivalent	Idx	Entry	File
"General MIDI	0	GM	SYNTHGM.SBK
"GS"	1	GS	SYNTHGS.SBK
"MT 32"	2	MT	SYNTHMT.SBK
"User Custom Synth"	3	USER	SYNTHUSR.SBK

The bank files can be located in the default directory of AWE. This default directory is usually a sub-directory of the Sound Blaster path. The Sound Blaster path can be located from the environment variable "SOUND". The default name is used whenever a user specified file cannot be located. The path specified by the user can be found in the SBWIN.INI file under the "AWE32" section. The entry name for each respective synthesizer emulation is listed in the table. Hence,

```
[AWE32]
GM = C:\SBANK\USER1.SBK
```

will have an assignment of USER1.SBK file as the General MIDI Bank.

lParam2

Unused.

hUserID

Current ID assigned to the application by the AWE Manager during initialization.

Remarks

The following are some important points to note when using this function.

The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip General Protection Fault in Windows.

If the buffer is not sufficient to complete the operation, AWE Manager will not update string entries into the buffer. However, other return parameters will still be updated.

Return Value

The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

See Also

AWE_QUERY_SYN_SUPPORT, AWE_SELECT_SYN_BANK

AWE_SELECT_SYN_BANK

Actions

An application sends this message to inform the AWE Manager of the emulation it wishes to use as current Synthesizer Bank.

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Parameters

lParam1

Specifies a word data type. This word contains the SBank Index, pointing to the desired Synthesizer Emulation. The following shows a list of available Emulations loadable into Synthesizer Bank:

String Equivalent	Idx	Entry	File
"General MIDI	0	GM	SYNTHGM.SBK
"GS"	1	GS	SYNTHGS.SBK
"MT 32"	2	MT	SYNTHMT.SBK
"User Custom Synth"	3	USER	SYNTHUSR.SBK

The bank files can be located in the default directory of AWE. This default directory is usually a sub-directory of the Sound Blaster path. The Sound Blaster path can be located from the environment variable "SOUND". The default name is used whenever a user specified file cannot be located. The path specified by the user can be found in the SBWIN.INI file under the "AWE32" section. The entry name for each respective synthesizer emulation is listed in the table. Hence,

```
[AWE32]
GM = C:\SBANK\USER1.SBK
```

will have an assignment of USER1.SBK file as the General MIDI Bank.

lParam2

Unused.

hUserID

Current ID assigned to the application by the AWE Manager during initialization.

Remarks

This function does not allow an application to specify a file name and overwrite the original Synthesizer Bank instrument files. The AWE Manager uses a predetermined name which is known to both the MIDI driver and itself. To use a user-define emulation as Synthesizer Bank, copy it to the default AWE directory and rename it SYNTHUSR.SBK.

Return Value

The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_DEVICE_BUSY

AWE_ERR_SBANK_INVALID

AWE_ERR_PATHNAME_INVALID

AWE_ERR_SYSMEM_INSUFFICIENT

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AWE_ERR_DRAM_INSUFFICIENT

See Also AWE_QUERY_SYN_SUPPORT, AWE_GET_SYN_BANK, AWE_REFRESH

AWE_LOAD_USER_BANK

Actions An application sends this message to inform the AWE Manager that it wishes to load a bank of instruments into the User Bank area. The source can be either in a file or in memory blocks.

Parameters **`lParam1`**

Specifies a word data type. The application should fill the word with the desired User Bank number. The valid range of User Bank numbers is 1 to 127.

`lParam2`

Specifies a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Indicates the size of buffer area.
m_Flag	Indicates if buffer contains a path name.
m_Buffer	Far pointer to a buffer area.

The m_Flag field is used to indicate whether the User Bank will be loaded from a file or from a chunk of memory buffer. The value of m_Flag should be either OPER_MEMORY or OPER_FILE where OPER_MEMORY indicates loading from memory buffer pointer by the m_Buffer and OPER_FILE indicates loading from a file.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks The following are some important points to note when using this function.

The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip a General Protection Fault in Windows.

It is recommend that the application use the macro defined by this API library. The OPER_FILE and OPER_MEMORY are constant macros used to distinguish between file loading or memory operations.

Return Value The return value will be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

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AWE_ERR_DEVICE_BUSY

AWE_ERR_PATHNAME_INVALID

AWE_ERR_USER_OBJ_INVALID

AWE_ERR_UBANK_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

AWE_ERR_SYSMEM_INSUFFICIENT

AWE_ERR_DRAM_INSUFFICIENT

See Also AWE_LOAD_USER_INSTR, AWE_CLEAR_USER_BANK

AWE_GET_USER_BANK

Actions An application sends this message to the AWE Manager to request for the descriptor describing the User Bank.

Parameters **`lParam1`**

Specifies a word data type. This word contains the UBank Index, pointing to one of the 127 User Banks. Valid range is 1 to 127.

`lParam2`

Specifies a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Indicates the size of buffer available.
m_Buffer	Far pointer to a buffer area.

Upon returning, the manager will update the following fields:

Member	Remarks
m_SizeUsed	Number of characters from buffer used.
m_Buffer	String of current bank descriptor.

The buffer area will be filled by the manager with the descriptor of the selected User Bank. The string ends with two consecutive '\0's. Size returned includes the '\0's.

`UserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks The following are some important points to note when using this function.

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The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to a trip General Protection Fault in Windows.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_UBANK_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

See Also AWE_LOAD_USER_BANK, AWE_CLEAR_USER_BANK

AWE_CLEAR_USER_BANK

Actions An application sends this message to remove a loaded User Bank from memory.

Parameters **`lParam1`**

Specifies a word data type. This word contains the UBank Index indicating which User Bank to be removed from memory. Valid range is 1 to 127.

`Param2`

Unused.

`UserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks None.

Return Value The return value will be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_DEVICE_BUSY

AWE_ERR_UBANK_INVALID

See Also AWE_LOAD_USER_BANK, AWE_CLEAR_USER_BANK

AWE_LOAD_USER_INSTR

Actions An application sends this message to download a chunk of instrument presets into the AWE DRAM. The loading can be either from file or direct from memory area.

Parameters **`lParam1`**

Specifies a far pointer to CParamObject, *LPPARAMOBJECT*. The application should fill the following fields with appropriate values:

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Member	Remarks
m_UBankIndex	The index to designate User Bank.
m_InstrIndex	The index to an Instrument within the UBank.

The m_InstrIndex will be the instrument offset of the User Bank specified by UBank Index. The m_InstrIndex must be a valid value between 0 to 127.

`lParam2`

Specifies a far pointer to a CBufferObject data type, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Indicates the size of buffer area.
m_SizeUsed	Indicates Instrument number of the bank located by m_Buffer.
m_Flag	Indicates if buffer contains a path name.
m_Buffer	Far pointer to a buffer area.

The m_Flag field is used to indicate whether the User Bank will be loaded from a file or from a chunk of memory buffer. The value of m_Flag should be either OPER_MEMORY or OPER_FILE where OPER_MEMORY indicates loading from memory buffer pointer by the m_Buffer and OPER_FILE indicates loading from a file. The m_SizeUsed is loaded with the Instrument index which will be loaded from the bank located by the m_Buffer variable.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks

The following are some important points to note when using this function.

The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip a General Protection Fault in Windows.

It is recommend that the application use the macro defined by this API library. The OPER_FILE and OPER_MEMORY are constant macros used to distinguish between file loading or memory operations.

This function will overwrite any instrument presets previously attached to the m_InstrIndex. No error or warning message is given.

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Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_DEVICE_BUSY

AWE_ERR_PATHNAME_INVALID

AWE_ERR_USER_OBJ_INVALID

AWE_ERR_INSTR_INVALID

AWE_ERR_UBANK_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

AWE_ERR_SYSMEM_INSUFFICIENT

AWE_ERR_DRAM_INSUFFICIENT

See Also AWE_CLEAR_USER_INSTR

AWE_GET_USER_INSTR

Actions An application sends this message to the AWE Manager to request for an instrument descriptor of the Synthesizer Bank or User Bank.

Parameters **`lParam1`**

Specifies a far pointer to a CParamObject data type, *LPPARAMOBJECT*. The application should fill the following field with appropriate values:

Member	Remarks
m_UBankIndex	The index to destinate User Bank.
m_InstrIndex	The index to an Instrument within the UBank.

The m_InstrIndex will be the instrument offset of the User Bank specified by UBank Index. The m_InstrIndex must be a valid value between 0 to 127.

`lParam2`

Specifies a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used:

Member	Remarks
m_Size	Indicates the size of buffer available.
m_Buffer	Far pointer to a buffer area.

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Upon returning, the manager will update the following fields:

Member	Remarks
m_SizeUsed	Number of characters from buffer used.
m_Buffer	String of current instrument descriptor.

The buffer area will be filled by the manager with the descriptor of the instrument.

hUserID

Current ID assigned to the application by the AWE Manager during initialization.

Remarks

The following are some important points to note when using this function.

The location passed in as pointer must be valid memory locations allocated by the parent application.

If the buffer is not sufficient to complete the operation, AWE Manager will not update string entries into the buffer. However, other return parameters will still be updated.

Return Value

The return value will be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_UBANK_INVALID

AWE_ERR_INSTR_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

See Also

AWE_LOAD_USER_INSTR, AWE_CLEAR_USER_INSTR

AWE_CLEAR_USER_INSTR

Actions

An application sends this message to clear an instrument's presets located in the User Bank area.

Parameters

lParam1

Specifies a word data type. The word contains the UBank Index where the instrument is to be removed from.

lParam2

Specifies a word data type. This word contains the instrument number in the User Bank specified by the UBank Index in `lParam1`. The instrument's presets will be deleted from the memory area.

hUserID

Current ID assigned to the application by the AWE Manager during initialization.

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Remarks None.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_DEVICE_BUSY

AWE_ERR_INSTR_INVALID

AWE_ERR_UBANK_INVALID

See Also AWE_LOAD_USER_INSTR

AWE_GET_UBANK_PARENT

Actions An application sends this message to manager requesting the it identify the original parent of specified user bank. This parent is considered as the bank which loads the user bank.

Parameters **`lParam1`**
A far pointer to a *WORD* containing the User Bank index. The valid range for this is 1 to 127.
The driver upon returning will fill or change the contents of this word. Three types of values may be returned.

lParam1's Contents	Remarks
Unchanged	The User Bank in query actually is self loaded (i.e. parent of itself).
0 to 127 excluding its original value	The User Bank is loaded in by other bank. The parent bank has the index from 0 to 127. 0 signify Synthesiser Bank.
-1	The User Bank in query is not loaded yet.

`lParam2`

`Unused`

Remark This message is introduced because there is no way to differentiate between a User Bank that is self-loaded or loaded by other User Bank.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible errors are:

AWE_ERR_USERID_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

See Also None.

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AWE_GET_DRUM_KIT

Actions An application sends this message to the AWE Manager to request for the descriptor describing the Drum section of the Synthesizer or User Bank.

Parameters **`lParam1`**

Specify a word data type. This word contains the Bank Index, pointing to either Synthesizer bank or User bank. 0 represent Synthesizer bank while 1 to 127 is valid range for User Bank.

`lParam2`

Specify a far pointer to CBufferObject, *LPBUFFEROBJECT*. When the application calls the manager, the following fields are used,

Member	Remarks
m_Size	Indicates the size of buffer available.
m_Buffer	Far pointer to a buffer area.

Upon returning, the manager will update the following fields,

Member	Remarks
m_SizeUsed	No of characters from buffer used.
m_Buffer	String of drum section descriptor.

The buffer area will be filled by the driver with the descriptor of the instrument. If the m_SizeUsed is 1, then it represents that there is no descriptor for the drum section. If the descriptor is returned without any error, the string will end with two consecutive '\0's. Size returned also includes the '\0's.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks The following are some important points to note when using this function :

If the buffer is not sufficient to complete the operation, the manager will not update string entries into the buffer. However, other return parameters will still be updated.

The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip General Protection Fault in Windows.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error is:

AWE_ERR_USERID_INVALID

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AWE_ERR_UBANK_INVALID

AWE_ERR_RESOURCE_INSUFFICIENT

See Also None.

AWE_QUERY_DRAM_SIZE

Actions An application sends this message to the AWE Manager to request for current available and maximum DRAM size in the AWE hardware.

Parameters **`lParam1`**

Specifies a far pointer to a double word, *DWORD FAR **. This location will be used to store the maximum amount of DRAM found on the hardware.

`lParam2`

Specifies a far pointer to a double word, *DWORD FAR **. This location will be used to store the current available amount of DRAM found on the hardware.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks The unit for both `lParam1` and `lParam2` is words. That is, the return size is in terms of number of words.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error is:

AWE_ERR_USERID_INVALID

See Also None.

AWE_GET_VERSION

Actions This message prompts the AWE Manager for its current version number.

Parameters **`lParam1`**

Specifies a far pointer to word, *WORD FAR **. The location of this pointer will be filled with the current major version of the AWE Manager.

`lParam2`

Specifies a far pointer to word, *WORD FAR **. The location of this pointer will be filled with the current minor version of the AWE Manager.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

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Remarks None.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error is:

AWE_ERR_USERID_INVALID

See Also None.

AWE_SEND_MIDI

Actions An application sends this message to the manager requiring it to service MIDI commands.

Parameters **`lParam1`**

A *DWORD* containing the MIDI message. This message follows the format as specified by the Standard MIDI Message Format. The message is decoded as:

00000000 0*ccccccc* 0*bbbbbbb* 1*aaaaaaa*

High-Order Byte Low-Order Byte

where,

aaaaaaa:	Specifies the status byte.
bbbbbbb:	Specifies the first data byte. (0-127)
ccccccc:	Specifies the second data byte. (0-127)

`lParam2`

Unused

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks This message is provided so that MIDI events can inserted synchronously without go through the MMSYSTEM. The MIDI command accepted here are generic commands drafted. If a command is not supported by the driver, it will not be executed

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error is:

AWE_ERR_USERID_INVALID

AWE_ERR_DRIVER_BUSY

See Also None.

AWE_ISHANDLE

Actions An application sends this message to the AWE Manager to identify if a handle is a successful candidate of the manger.

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Applications may use this message to validate a handle before committed to any operations.

Parameters **`lParam1`**

Specify a declared handle type, *AWEHANDLE*. This is the handle used in query.

`lParam2`

Unused.

`hUserID`

Current ID assigned to the application by the AWE Manager during initialization.

Remarks The following are some important points to note when using this function :

This message is only meaningful to be called after successful acquisition of the Manager.

The location passed in as pointer must be valid memory locations allocated by the parent application. If the locations are invalid, it is possible to trip General Protection Fault in Windows.

Return Value The return value would be AWE_NO_ERR if the operation is successful, and an error code otherwise. Possible error is:

AWE_ERR_USERID_INVALID

See Also None.

Error Messages

The error messages generated by the AWE Manager are described below. They can be divided into three categories:

- General Error Messages
- Invalid Parameter Messages
- Resource Contention Messages

General Error Messages

AWE_NO_ERR	No error message. This message will be display most of the time to indicate a successful operation.
AWE_ERR_UNDEFINE_ERROR	A reserved error message indicating an error not defined during development. A new error message may be added to it at a later stage when the cause of the error is identified.

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Invalid Parameter Message

AWE_ERR_DEVICE_DRV_INVALID	This error message is return when the **SBAWE32.DRV** MIDI driver is not located.
AWE_ERR_USERID_INVALID	An invalid user ID is used to gain access to the AWE Manager. This ID should be obtained from the AWE_OPEN API call.
AWE_ERR_EFXT_INVALID	An invalid Effect Type Index is specified. This error happens when an application specifies an Effect Type Index that is not currently supported by the MIDI driver.
AWE_ERR_EFXV_INVALID	An invalid Type Variation index is specified. This error happens when an application specifies a Type Variation index that is not supported by the MIDI driver.
AWE_ERR_SBANK_INVALID	An invalid Synthesizer Bank index is specified. This error occurs when the MIDI driver cannot support the specified Synthesizer Bank index.
AWE_ERR_PATHNAME_INVALID	An invalid path name to a file is specified. This happens when an operation, which requires a user file or a predetermined path, cannot locate the desired file.
AWE_ERR_USER_OBJ_INVALID	An user object module has an incorrect format. This error occurs when an application attempts to download an unrecognized bank of instruments (or single instrument) into a specific User Bank area. This module uses the SBK format.
AWE_ERR_INSTR_INVALID	An invalid instrument index is specified. This index is only supported within the range of 0 to 127, i.e. 128 instruments.
AWE_ERR_UBANK_INVALID	An invalid User Bank index is specified. This index is only supported within the range of 1 to 127. An error occurs when the application points to a bank index higher or lesser than the legal range.
AWE_ERR_MSG_INVALID	Indicates that an undefined API message is received by the manager.
AWE_ERR_ACCESS_NOT_PERMITTED	When an application calls the manager without first acquiring the MMSystem,

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	the AWE Manager will not allow the application to gain access to it.
AWE_ERR_VERSION_INVALID	Indicates that a incompatible MIDI driver is used. This driver does not conform to the required version number of the Manager.

Resource Contention Message

AWE_ERR_DLL_BUSY	Notifies the application that another application has already accessed the manager and is still accessing it. This error message is to prevent multiple applications calling the manager simultaneously.
AWE_ERR_DEVICE_BUSY	Indicates that the MIDI driver is performing hardware specific operations. The calling application may have to wait till it is ready.
AWE_ERR_RESOURCE_INSUFFICIENT	Indicates that the calling application has provided insufficient memory buffer space required to complete the current query operation.
AWE_ERR_SYSMEM_INSUFFICIENT	Indicates that the AWE Manager is unable to allocate any more memory from Windows for internal use.
AWE_ERR_EFXT_CHANGE_NOT_ALLOWED	Indicates that effect types cannot be changed while MIDI driver is in play back mode.
AWE_ERR_DRAM_INSUFFICIENT	Indicates that the MIDI driver has detected insufficient memory available on the AWE hardware to complete an operation.

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Chapter 8 AWE GUI DLL

This chapter describes the API, which accesses the GUI resources, provided by AWEGUI.DLL. These APIs will be sitting on top of AWEMAN.DLL. The aim of providing this set of APIs is to grant user application with the possibility of changing global settings of the MIDI driver, as there are no public APIs exported to modify the global settings. This chapter is divided into four sections as follows:

- AWE GUI DLL Overview
- API Functions
- Function Reference
- Error Messages

The first section states the pre-requisites for accessing the GUI. The second section lists the API functions offered by this DLL. The third section describes, in detail, how to use the APIs. The fourth section touches on the error messages returned by the APIs.

AWEGUI.DLL will also be referenced as DLL within the context of this chapter.

AWE GUI DLL Overview

AWEGUI.DLL is a DLL that contains common dialog applications (in modal form) for user application to utilize. The two current supported dialogs are AWE Control Panel and AWE Controller Break-Out-Box.

This DLL, like that of AWEMAN.DLL, will not support more than one application calling it. In other words, it is strictly single instance and non-reentrant. Application using these GUI APIs resume the role of control panel status. They are not require to register with the AWEMAN.DLL or AWEGUI.DLL. However, once this DLL is being 'used' by an application, it will block any other application from calling the same set of APIs. Since it provides control panel like operations, APIs provided by AWEMAN.DLL that access the general local view of the MIDI driver will not be affected. Application are still able to access AWEMAN.DLL provided it is not already being used. The following prototype serve as a guideline on how to access the API function.

```
LRESULT FAR PASCAL _export
AWEControlPanel(LPCSTR lpszAppTitle, BOOL bButton);
LRESULT FAR PASCAL _export
```


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AWEControllerBOB(LPCSTR **lpszAppTitle,** BOOL **bButton**);

The *LRESULT* return type will usually consist of an error message. This DLL will load the AWEMAN.DLL when itself is being loaded by user application. When the service of these APIs is no longer required, this AWEGUI.DLL has to be unloaded explicitly. Failing to do so might cause 'hogging' to the DLL indefinitely until the next Windows session.

AWE GUI DLL API Functions

The following functions are implemented in the AWEGUI.DLL.

AWEControlPanel	Pops up a dialog box which allows a user to manually configure the Synthesizer Bank, User Bank, and the Effect Types.
AWEControllerBOB	Pops up a dialog box, filled with sliders, allowing a user to monitor the controller change messages of any 16 MIDI channels.

AWE GUI DLL API Function Reference

The following gives a detailed description of the AWE GUI DLL API functions.

AWEControlPanel

Syntax LRESULT **AWEControlPanel**(LPCSTR lpszAppTitle, BOOL bButton)

This function prompts the DLL to activate the common dialog box for configuring the global Synthesizer Bank, User Bank, and Effect Types.

Parameters **lpszAppTitle**

Contains a null terminated string for the caption title of the dialog box. If NULL is specified, the default name, "AWE Control" will be used.

bButton

A Boolean which shows or hides the button that allows the control panel to switch over to Controller BOB. TRUE will show the button.

Remarks None.

Return Value The return value would be AWE_NO_ERR if the operation is successful and an error code otherwise. Possible errors are:

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AWE_ERR_DLL_BUSY

AWE_ERR_SYSMEM_INSUFFICIENT

AWE_ERR_ACTIVATE_BOB

AWE_ERR_DEVICE_DRV_INVALID

See Also AWEControllerBOB

AWEControllerBOB

Syntax LRESULT **AWEControllerBOB**(LPCSTR lpszAppTitle, BOOL bButton)

This function prompts the DLL to activate its common dialog box for monitoring the channel's controller messages.

Parameters **lpszAppTitle**

Contains a null terminated string for the caption title of the dialog box. If NULL is specified, the default name, "AWE Controller Break-Out-Box" will be used.

bButton

A Boolean which shows or hides the button that allows the control panel to switch over to Control Panel. TRUE will show the button.

Remarks None.

Return Value The return value would be AWE_NO_ERR if the operation is successful and an error code otherwise. Possible errors are:

AWE_ERR_DLL_BUSY

AWE_ERR_SYSMEM_INSUFFICIENT

AWE_ERR_ACTIVATE_CONTROLPANEL

AWE_ERR_DEVICE_DRV_INVALID

See Also AWEControlPanel

AWE GUI DLL API Error Messages

Some of the error messages returned by the APIs coincide with those from AWEMAN.DLL. These error messages are usually caused by errors also encountered by AWEMAN.DLL. Therefore only error messages that are specific to these APIs will be explained.

AWE_ERR_DLL_BUSY	Notify the application that the required GUI dialog box is not available or another application has already accessed it.
AWE_ERR_ACTIVATE_BOB	Notify the application that the user has just clicked on the button that requests a controller BOB dialog box.

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	Application should take initiative to call up the BOB dialog box or ignore it.
AWE_ERR_ACTIVATE_CONTROLPANEL	Notify the application that the user has just clicked on the button that requests the control panel dialog box. Application can either activate the setup dialog box or ignore it.
AWE_ERR_SYSMEM_INSUFFICIENT	Indicates that the AWEGUI.DLL or AWEMAN.DLL is unable to allocate any more memory from Windows for internal use.

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Chapter 9 Windows Programming Guide

This section provides you with examples on how to use the APIs of AWEMAN.DLL and AWEGUI.DLL. The examples provided, in fragments of code, are sufficient to let you start accessing and manipulating the Sound Blaster AWE32. This guide will show, in step by step examples, how the AWE32 features can be programmed using the two DLLs provided. Refer to the reference sections in the last two chapters for details of AWEMAN.DLL and AWEGUI.DLL.

This guide assumes that you are proficient in 'C' and Windows programming basics. The code present in the examples assume that the DLLs are statically linked to your program.

This chapter consists of the following sections :

- Opening and closing DLLs
- Query for support
- Retrieving selections
- Issuing selections
- Using AWEGUI.DLL

OPENING AND CLOSING

The first step in your application is to obtain the AWE device by calling the API provided in the `AWEMAN.DLL`. This can be done during your program's initialization in WinMain.

```
#include "windows.h"
#include "AWE_DLL.H"

/* Global variables */
extern AWEHANDLE hDeviceID;
.
.
int PASCAL WinMain (HANDLE hInst, HANDLE hPrevInst, LPSTR lpCmdLine,
int nCmdShow)
{
   MSG msg;
   LRESULT lResult;
   HWND hWnd;
        .
        .
   /* Perform your program's initialization and create main window */
   InitApplication(hInst);
```


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```
   hWnd = CreateWindow("DEMO", "AWE Application", WS_OVERLAPPEDWINDOW,
      CW_USEDEFAULT, CW_USEDEFAULT, CW_USEDEFAULT, CW_USEDEFAULT,
      NULL, NULL, hInst, NULL);
        .
        .
   /* Open the AWE Manager and retrieve a registered ID. */
   lResult = AWEManager((AWEHANDLE)0, AWE_OPEN, (LPARAM)&hDeviceID,
               0L);
   if(lResult != AWE_NO_ERR)
   {
   /* Do error processing here! */
        .
        .
      return NULL;
   }
        .
        .
   /* Acquire & dispatch messages until a WM_QUIT msg is received */
   while(GetMessage(&msg,NULL,NULL,NULL))
   {
      TranslateMessage(&msg);
      DispatchMessage(&msg);
   }

   /* Close AWE Manager */
   AWEManager(hDeviceID, AWE_CLOSE, 0L, 0L);

   return (msg.wParam);
}
```

Remember to close the AWE Manager by calling AWE_CLOSE as shown in the example above. This will allow other applications to use the manager after you have finished using it.

QUERYING FOR SUPPORT

The query class APIs provided by the Manager allows you to query the AWE's current available resources. It is important to query for available support before issuing them. This is because, the features provided by the Manager may increase or changes as time goes past. Generally, the options available of querying are Synthesizer Bank, Effect Types and Type Variations. In addition, the memory available on the AWE can also be queried.

The following function retrieves the available support and updates the global variables. This example can be added in your program's initialization routine.

```
#include "string.h"
#include "windows.h"
#include "AWE_DLL.H"

#define   BUF_SIZE   255

AWEHANDLE hID;
char      cSynthName[4][100]; // Buffer to store support strings
char      cEffectType[3][50];
char      cReverbList[8][50];
char      cChorusList[8][50];
DWORD     dwMemAvail;
DWORD     dwMemMax;

char *GetElement( char *source, int index, int size )
//
```


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```
// Return the indexed element in a list of string.
// Each element terminated by '0'.
// Last element terminates with two '0'.
//
{
   char  *dest = source;
   char  *end  = source + size;
   int   i;

   for( i=0; i < index; i++ )
   {
      // Traverse the pointer till a \0 is met.
      while( *dest != 0 && dest < end ) dest++;
      ++dest;                          // skip the \0.
   }
   return dest;                        // return head of next string.
}

void RetrieveSupport( void )
//
// Retrieve Synth and Effect Type supported by the MIDI driver.
//
{
   char           scratch[BUF_SIZE];
   WORD           i;
   CBufferObject  buffer;
   CParamObject   param;

   //
   // SYNTHESIZER BANK
   // Get Synthesizer Emulation List
   buffer.m_Size        =  BUF_SIZE;
   buffer.m_Buffer      =  (LPSTR)&scratch[0];


   AWEManager(hID, AWE_QUERY_SYN_SUPPORT,
               (LPARAM)(LPBUFFEROBJECT)&buffer, 0L);

   // Add into the Synth buffer
   for( i=0; i<buffer.m_Flag; i++ )
      strcpy(&cSynthName[i][0],(const char*) GetElement(&scratch[0],i,
         (int)buffer.m_SizeUsed));

   //
   // EFFECTS TYPE
   // Get Effects Type List
   // Same buffer settings as before.
   AWEManager(hID, AWE_QUERY_EFXT_SUPPORT,
              (LPARAM)(LPBUFFEROBJECT)&buffer, 0L);

   // Add into the EfxType buffer
   for( i=0; i<buffer.m_Flag; i++ )
      strcpy(&cEffectType[i][0],(const char*) GetElement(&scratch[0],i,
         (int)buffer.m_SizeUsed));

   //
   // REVERB TYPE VARIATIONS
   // Get REVERB Type Variations List
   // Same buffer settings as before.
   param.m_SubIndex     =  REVERB;
   param.m_TypeIndex    =  REVERB_CHORUS;
   AWEManager(hID,AWE_QUERY_EFXV_SUPPORT,(LPARAM)(LPPARAMOBJECT)&param,
                     (LPARAM)(LPBUFFEROBJECT)&buffer);

   // Add into the Reverb Buffer
   for( i=0; i<buffer.m_Flag; i++ )
      strcpy(&cReverbList[i][0], (const char*)
               GetElement(&scratch[0], i, (int) buffer.m_SizeUsed));

   //
   // CHORUS TYPE VARIATIONS
   // Get CHORUS Type Variations List
   // Same buffer settings as before.
   param.m_SubIndex     =  CHORUS;
   AWEManager(hID,AWE_QUERY_EFXV_SUPPORT,(LPARAM)(LPPARAMOBJECT)&param,
```


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```
                        (LPARAM)(LPBUFFEROBJECT)&buffer);

   // Add into the Chorus Buffer
   for( i=0; i<buffer.m_Flag; i++ )
      strcpy(&cChorusList[i][0],(const char*) GetElement(&scratch[0],i,
         (int)buffer.m_SizeUsed));

   // QUERY MEMORY STATUS
   // Get Memory status for both available and maximum.
   AWEManager(hID,AWE_QUERY_DRAM_SIZE,(LPARAM)(DWORD FAR*)&dwMemMax,
                        (LPARAM)(DWORD FAR*)&dwMemAvail);
}
```

Note that there is no error handling implemented in the above functions. It is assume that the buffer size used to retrieve the strings is sufficient. If you do not wish to allocate the scratch buffer from the stack, you will have to query for the required buffer size. Using the size obtained you can then use it for dynamic allocation. To query for buffer size required, specify a buffer of 1 character. This will cause the AWE Manager to return the error AWE_ERR_RESOURCE_INSUFFICIENT. From the CBufferObject, the member m_SizeUsed will contain the number of bytes required to contain the entire list of strings.

RETRIEVING SELECTION

The 'Get' class APIs provided by the Manager allows you to retrieve the AWE's current selection. You can retrieve the current in use selection from Effect Types and Variations. For Synthesizer Bank, User Bank and Instruments in the bank, these APIs will be used to retrieve their descriptors.

The following set of functions retrieve the current selection and updates the global variables. This example can be added to your program.

```
#include "string.h"
#include "windows.h"
#include "AWE_DLL.H"

#define   BUF_SIZE 255

AWEHANDLE       hID;
enum SBANK      m_CurSynthBank;       // Current synthesizer bank
enum TYPEINDEX  m_CurEfxType;         // Current effects type
enum VARIINDEX  m_CurTypeVari[2];     // Current type variations
char            cUBankDescriptor[30]; // User Bank Descriptor

void GetCurrentSelection( void )
//
// Retrieve the current Hardware Settings
//
{
   CParamObject         param;
   CBufferObject        buffer;
   char                 scratch;

   // Get current Synthesizer Bank from AWEMAN
   buffer.m_Size = sizeof(scratch);
   buffer.m_Buffer = (LPSTR)&scratch;

   AWEManager(hID,AWE_GET_SYN_BANK,(LPARAM)(LPBUFFEROBJECT)&buffer,0L);
```


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```
   // should return an error, since buffer not enough
   // Ignore error, since we only want m_Flag => SBANK INDEX

   m_CurSynthBank = (enum SBANK)buffer.m_Flag;

   // Get Current Effects Type and Variations
   param.m_VariIndex[REVERB] = param.m_VariIndex[CHORUS] = 0;

   AWEManager(hID,AWE_GET_EFX,(LPARAM)(LPPARAMOBJECT)&param,0L);

   m_CurEfxType = (enum TYPEINDEX)param.m_TypeIndex;

   if( m_CurEfxType == REVERB_CHORUS )
   {
      m_CurTypeVari[REVERB] = (enum VARIINDEX)
                               param.m_VariIndex[REVERB];
      m_CurTypeVari[CHORUS] = (enum VARIINDEX)
                               param.m_VariIndex[CHORUS];
   }
   else        // if QSound, also set the defaults....
   {
      m_CurTypeVari[REVERB] = (enum VARIINDEX)0;
      m_CurTypeVari[CHORUS] = (enum VARIINDEX)0;
   }
}

void GetUBankDescriptor( int nUBNum )
//
// Retrieve the User Bank's Descriptor, filename and bank number.
//
{
   char           scratch[BUF_SIZE];
   CBufferObject  buffer;

   buffer.m_Size = BUF_SIZE;
   buffer.m_Buffer = (LPSTR)&scratch;


   AWEManager(hID,AWE_GET_USER_BANK,(LPARAM)(WORD)nUBNum,
                     (LPARAM)(LPBUFFEROBJECT)&buffer);

   if(buffer.m_SizeUsed==1)
      strcpy((char *) &cUBankDescriptor[0],
             (const char*)"NO DESCRIPTOR\0");
   else
      strcpy((char *)&cUBankDescriptor[0],(const char*)&scratch[0]);
}

char *GetInstrDescriptor( int nBNum, int nINum, char *desc )
//
// Retrieve the Instrument's Descriptor.
//
{
   char           scratch[BUF_SIZE];
   CBufferObject  buffer;
   CParamObject  param;

   param.m_UBankIndex = nBNum;
   param.m_InstrIndex = nINum;

   buffer.m_Size = BUF_SIZE;
   buffer.m_Buffer = (LPSTR)&scratch;

   AWEManager(hID,AWE_GET_USER_INSTR,(LPARAM)(LPPARAMOBJECT)&param,
              (LPARAM)(LPBUFFEROBJECT)&buffer);

   if(buffer.m_SizeUsed==1)
      strcpy(desc,(const char*)"NO DESCRIPTOR\0");
   else
      strcpy(desc,(const char*)&scratch[0]);

   return desc;
}
```


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Note that there is no error handling implemented in the above functions. It is assume that the buffer size used to retrieve the strings is sufficient. Unlike the query class APIs, the size required to contain the descriptor will not be returned if the input buffer size is not large enough. This is because the descriptor store in the memory has a maximum size of 20 bytes.

ISSUING SELECTION

The select class APIs provided by the Manager allows you to instate selection to the AWE's features. These APIs allow you to configure the AWE's Effect Types, Variations and Synthesizer Bank. For User Bank, a user object module must be specified when using the APIs. The object module for Banks has the SBK extension. Individual instruments and banks of instruments uses the same format.

The following functions demostrate how to set the features and load a user define SBK file into the bank. This example can be added in your program.

```
#include "windows.h"
#include "AWE_DLL.H"

#define   BUF_SIZE      255
#define   MAX_USER_BANK 127
#define   MAX_INSTR     127

AWEHANDLE      hID;
enum SBANK     m_CurSynthBank;       // Current synthesizer bank
enum TYPEINDEX m_CurEfxType;         // Current effects type
enum VARIINDEX m_CurTypeVari[2];     // Current type variations
int            m_CurUserBank;        // Current user bank number
char           cUBankDescriptor[30]; // User Bank Descriptor

void SetSynth( int nSNum )
//
// Configure the hardware with current Synth.
//
{
   LRESULT lResult;

   lResult = AWEManager(hID,AWE_SELECT_SYN_BANK,
                        (LPARAM)(WORD)nSNum, 0L);

   if(lResult!=AWE_NO_ERR)
   {
      // TO DO:
      // DisplayErrorMsg( lResult );
   }
}

void SetEffects( void )
//
// Configure the hardware with current effects.
//
{
   CParamObject   param;
   enum TYPEINDEX EfxTypeSel = m_CurEfxType;
   enum VARIINDEX TypeVariSel[2];
   LRESULT        lResult;

   TypeVariSel[REVERB] = (enum VARIINDEX)m_CurTypeVari[REVERB];
   TypeVariSel[CHORUS] = (enum VARIINDEX)m_CurTypeVari[CHORUS];

   // TO DO: Display HOUR GLASS
```


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```
   if( EfxTypeSel == REVERB_CHORUS )
   {
      param.m_TypeIndex = REVERB_CHORUS;
      param.m_VariIndex[REVERB] = TypeVariSel[REVERB];
      param.m_VariIndex[CHORUS] = TypeVariSel[CHORUS];
   }
   else
   {
      param.m_TypeIndex = QSOUND;
      param.m_VariIndex[0] = 0;
   }

   lResult = AWEManager(hID, AWE_SELECT_EFX,
                        (LPARAM)(LPPARAMOBJECT)&param, 0L);

   if(lResult!=AWE_NO_ERR)
   {
      // TO DO:
      // DisplayErrorMsg( lResult );
   }

   // TO DO: Restore normal arrow cursor
}

void SetUserBank( int nUBNum, char *filename, int nStrlen )
//
// Configure the User Bank.
//
{
   CBufferObject  buffer;
   LRESULT        lResult;

   // validate the range first!
   m_CurUserBank = min( MAX_USER_BANK, max( nUBNum, 1 ) );

   // TO DO: Display HOUR GLASS

   buffer.m_Size = nStrlen;
   buffer.m_Flag = OPER_FILE;
   buffer.m_Buffer = (LPSTR)filename;

   lResult = AWEManager(hID,AWE_LOAD_USER_BANK,(LPARAM)(WORD)nUBNum,
                        (LPARAM)(LPBUFFEROBJECT)&buffer);

   if(lResult!=AWE_NO_ERR)
   {
      // TO DO:
      // DisplayErrorMsg( lResult );
   }
   else
   {
      // Update the global user bank descriptor buffer!
      GetUBankDescriptor( nUBNum );
   }

   // TO DO: Restore normal arrow cursor
}

void SetInstr( int nUBNum, int nINum, int nFINum, char *filename,
         int nStrlen )
//
// Download an instrument from a bank file.
// nFINum - Instrument number from the SBK file to download from.
// nINum  - Instrument number in the nUBNum bank to download to.
//
{
   char           scratch[BUF_SIZE];
   CBufferObject  buffer;
   CParamObject   param;
   LRESULT        lResult;

   // validate the range first!
   nINum= min( MAX_USER_BANK, max( nUBNum, 0 ) );
   nINum= min( MAX_INSTR, max( nINum, 0 ) );
```


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```
   // TO DO: Display HOUR GLASS

   param.m_UBankIndex = nUBNum;
   param.m_InstrIndex = nINum;

   buffer.m_SizeUsed = nFINum;
   buffer.m_Size = nStrlen;
   buffer.m_Flag = OPER_FILE;
   buffer.m_Buffer = (LPSTR)filename;

   lResult = AWEManager(hID,AWE_LOAD_USER_INSTR,(LPARAM)(LPPARAMOBJECT)
                        &param,(LPARAM)(LPBUFFEROBJECT)&buffer);

   if(lResult!=AWE_NO_ERR)
   {
      // TO DO:
      // DisplayErrorMsg( lResult );
   }
   else
   {
      // TO DO: Update the instrument descriptor if necessary!
   }

   // TO DO: Restore normal arrow cursor
}
```

USING AWEGUI

The common dialog provided by the `AWEGUI.DLL` includes the AWE Control Panel and the AWE Controller Break-Out-Box. Both of the dialog can be called using the same manner. Although they have the look of a modeless dialog box, however, when calling it via the DLL, they behaved like modal dialog application. If you required modeless operation, it can also be achieved by a round-about method. Both ways of accessing the DLL will be demostrated below.

The following functions demostrate how to call the DLL function from your program. This example can be added in your program.

```
#include "windows.h"
#include "awe_dll.h"

int PASCAL WinMain(
        HANDLE hInst,
        HANDLE hPrevInst,
        LPSTR  lpCmdLine,
        int    nCmdShow
    )
{
   LRESULT     lResult;
   BOOL        Running = TRUE;
   BOOL        RunBOB = FALSE;

   // Load error message box's caption.
   while(Running==TRUE)
   {
      if(RunBOB==FALSE)
         lResult = AWEControlPanel(NULL,TRUE);
      else
         lResult = AWEControllerBOB(NULL,TRUE);

      switch(lResult)
      {
```


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```
            case AWE_NO_ERR:
                    Running = FALSE;
                    break;
            case AWE_ERR_ACTIVATE_BOB:
                    RunBOB = TRUE;
                    break;
            case AWE_ERR_ACTIVATE_CONTROLPANEL:
                    RunBOB = FALSE;
                    break;
            default:
                  // To Do:
                  // DisplayErrorMsg(lResult);
                  Running = FALSE;
                  break;
         }
      }

      return NULL;
}

void RunControlModeless()
{
      WORD wReturn;
      char szValue[128]="No AWE Control";

      // Get the directory for the mixer.
      GetPrivateProfileString("General", "AWE Control", szValue, szValue,
                  128, "SBWIN.INI");

      if(lstrcmp(szValue, "No AWE Control"))
         wReturn = WinExec(szValue, SW_SHOW);
      else
      {
         wReturn=0;
      }

      if(wReturn<32)
      {
         // TO DO: Print message to indicate launching the control fails!
      }

}
```


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Part III SB AWE32 MIDI Non-Registered Parameter Number implementation

What is MIDI Non-Registered-Parameter-Number ?

Non-Registered Parameter Numbers are used to represent sound or performance parameters, and in the case of the EMU8000, **SoundFont Parameters**. NRPN can be transmitted via MIDI, as it is itself a pair of MIDI controller messages. NRPN consists of

NRPN MSB MIDI Controller 99
NRPN LSB MIDI Controller 98

NRPN MSB and LSB forms a value that indicates the desired sound parameter. After sending NRPN MSB and LSB messages, MIDI controllers 6 (**Data Entry MSB**) and 38 (**Data Entry LSB)** are sent to pass in the value for the sound parameter.

In general, to send a NRPN message, the following steps are required :

send NRPN MSB with MSB of sound parameter
send NRPN LSB with LSB of sound parameter
send Data Entry MSB with MSB of sound parameter value
send Data Entry LSB with LSB of sound parameter value

As NRPN and Data Entry messages are MIDI controller messages, any MIDI sequencer software that supports editing of controller message are capable of sending them.

Take note that NRPN is MIDI channel oriented, in other words, the NRPN values only affect the current instrument assigned on the MIDI channel where your NRPN values was sent.

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How do I use SBAWE32 NRPN ?

For SB AWE32 NRPN to be functional, NRPN MSB has to be 127, and NRPN LSB set to the desired parameter to be controlled (see the following for a list of available NRPN LSB for each parameter).

Data entry MSB with Data entry LSB together forms a 14bit number. The middle value 8192 (0x2000, Data MSB = 64 and Data LSB = 0) is taken as value 0. To convert from MSB and LSB to actual value, here is the equation:

Actual value = (MSB * 128 + LSB) - 8192

To convert a actual value into MSB and LSB, here are the steps:

MSB = (actual value + 8192) / 128

LSB = (actual value + 8192) % 128

A "Reset All Controllers" message (MIDI controller 121) will restore the instrument's original SoundFont parameters.

The EMU8000 Sound Architecture

The EMU8000 has an extensive modulation implementation using two sine-wave LFO's (Low Frequency Oscillator) and two multi-stage envelope generators.

Modulation means to dynamically change a parameter of an audio signal, whether it be the volume (amplitude modulation, or tremolo), pitch (frequency modulation, or vibrato) or filter cutoff frequency (filter modulation, or wah-wah). To modulate something we would require a modulation source, and a modulation destination. In the EMU8000, the modulation sources are the LFOs and the envelope generators, and the modulation destinations can be the pitch, the volume or and filter cutoff frequency.

The EMU8000's LFO's and envelope generators provides a complex modulation environment. Each sound producing element of the EMU8000 consists of a resonant low-pass filter, two LFOs, in which one modulates the pitch (LFO2), and the other modulates pitch, filter cutoff and volume (LFO1) simultaneously. There are two envelope generators; envelope 1 contours both pitch and filter cutoff simultaneously, and envelope 2 contours volume. The output stage consists of an effects engine which mixes the dry signals with the Reverb/chorus level signals to produce the final mix. The diagram on the next page shows the typical blocks of an EMU8000 sound element.

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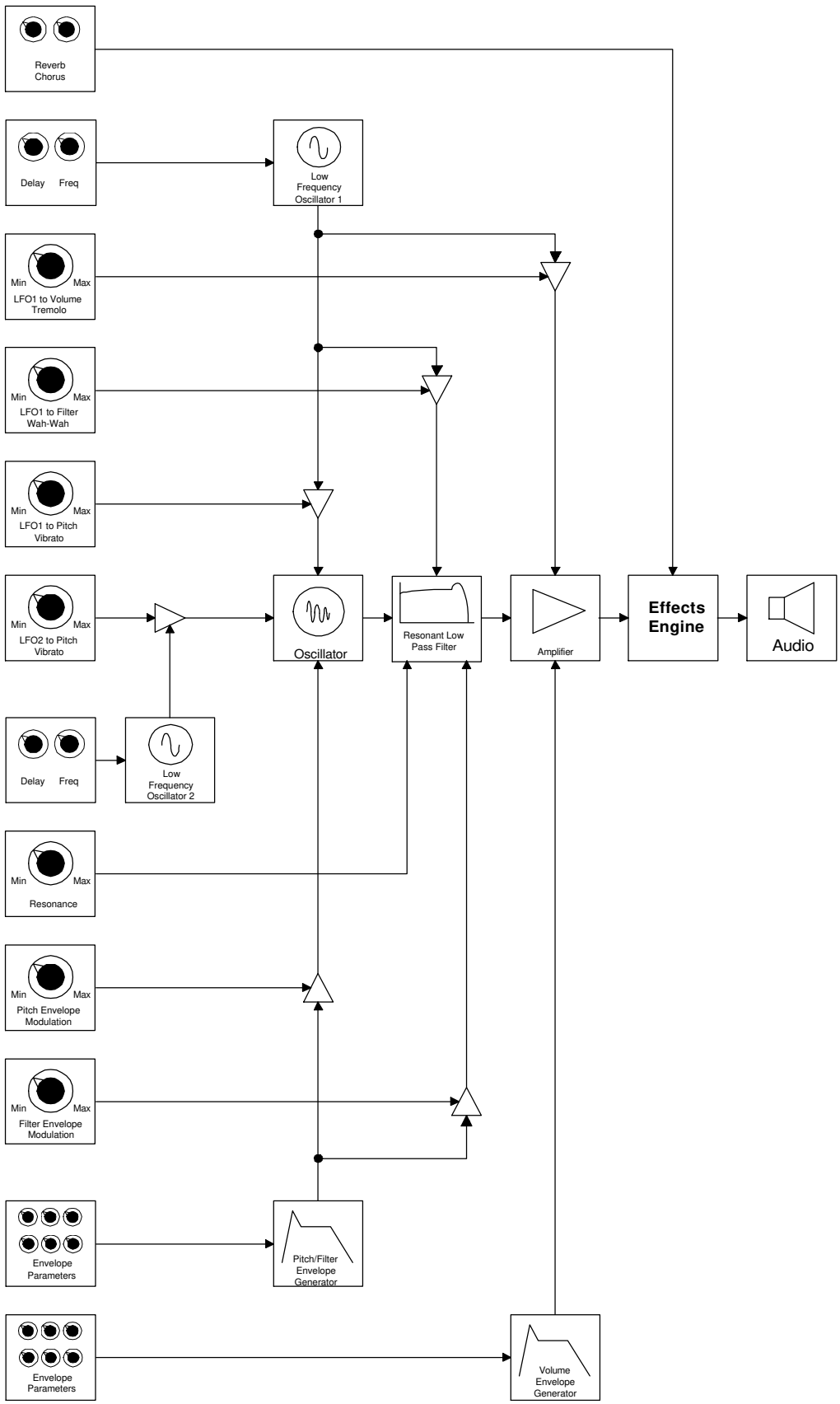

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EMU8000 sound element

The blocks within an EMU8000 sound element can be programmed to produce a variety of sound effects.

Oscillator

An oscillator is the source of an audio signal.

Low Pass Filter

The low pass filter is responsible for modifying the timbres of an instrument. The low pass filter's filter cutoff values can be varied from 100 Hz to 8000 Hz. By changing the values of the filter cutoff, a myriad of analogue sounding filter sweeps can be achieved. An example of a GM instrument that makes use of filter sweep is instrument number 87, Lead 7 (fifths).

Amplifier

The amplifier determines the loudness of an audio signal.

LFO1

An LFO, or Low Frequency Oscillator, is normally used to periodically modulate, i.e., dynamically change a sound parameter, whether it be volume (amplitude modulation), pitch (frequency modulation) or filter cutoff (filter modulation). It operates at sub-audio frequency from 0.042 Hz to 10.71 Hz. The LFO1 in the EMU8000 modulates the pitch, volume and filter cutoff simultaneously.

LFO2

The LFO2 is similar to the LFO1, except that it modulates only the pitch of the audio signal only.

Filter Resonance

A filter alone would be like an equaliser, making a bright audio signal duller, but the addition of resonance greatly increases the creative potential of a filter. Increasing the resonance of a filter makes it emphasis signal at the cutoff frequency, giving the audio signal a subtle "wah-wah", i.e., imagine a siren sound going from bright to dull and bright again periodically.

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LFO1 to Volume (Tremolo)

As indicated in figure 1, LFO1's output is routed to the amplifier, with the depth of oscillation determined by LFO1 to Volume. LFO1 to Volume produces tremolo, which is a periodic fluctuation of volume. Lets say you are listening to a piece of music on your home stereo system. When you rapidly increase and decrease the playback volume, you are creating tremolo effect, and the speed in which you increases and decreases the volume is the tremolo rate (which corresponds to the speed at which the LFO is oscillating at) . An example of a GM instrument that makes use of LFO1 to Volume is instrument number 45, Tremolo Strings.

LFO1 to Filter Cutoff (Wah-Wah)

As indicated in figure 1, LFO1's output is routed to the filter, with the depth of oscillation determined by LFO1 to Filter. LFO1 to Filter produces a periodic fluctuation in the filter cutoff frequency, producing an effect very similar to that of a wah-wah guitar (see resonance for a description of "wah-wah"). An example of a GM instrument that makes use of LFO1 to Filter Cutoff is instrument number 19, Rock Organ.

LFO1 to Pitch (Vibrato)

As indicated in figure 1, LFO1's output is routed to the oscillator, with the depth of oscillation determined by LFO1 to Pitch. LFO1 to Pitch produces a periodic fluctuation in the pitch of the oscillator, producing a vibrato effect. An example of a GM instrument that makes use of LFO1 to Pitch is instrument number 57, Trumpet.

LFO2 to Pitch (Vibrato)

The LFO1 in the EMU8000 can simultaneously modulates pitch, volume and filter. LFO2, on the other hand, modulates only the pitch, with the depth of modulation determined by LFO2 to Pitch. LFO2 to Pitch produces a periodic fluctuation in the pitch of the oscillator, producing a vibrato effect. When this is couple with LFO1 to Pitch, a complex vibrato effect can be achieved.

Volume Envelope

The character of a musical instrument is largely determined by it's volume envelope, the way in which the level of the sound changes with time. For example, percussive sounds usually starts suddenly and then die away, whereas a bowed sound might take some time to start and then sustain at a more or less fixed level.

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A six-stage envelope made up the volume envelope of the EMU8000. The six stages are delay, attack, hold, decay, sustain and release. The stages can be described as follows :

Delay The time between when a key is played and when the attack phase begins

Attack The time it takes to go from zero to the peak (full) level.

Hold The time the envelope will stay at the peak level before starting the decay phase.

Decay The time it takes the envelope to go from the peak level to the sustain level.

Sustain The level at which the envelope remains as long as a key is held down.

Release The time it takes the envelope to fall to the zero level after the key is released.

Using these six parameters can yield very realistic reproduction of the volume envelope characteristics of many musical instruments.

Pitch and Filter Envelope

The pitch and filter envelope is similar to the volume envelope in that it has the same envelope stages. The difference between them is that whereas the volume envelope contours the volume of the instrument over time, the pitch and filter envelope contours the pitch and filter values of the instrument over time. The pitch envelope is particularly useful in putting the finishing touches in simulating a natural instrument. For example, some wind instruments tends to go slight sharp when they are first blown, and this characteristics can be simulated by setting up a pitch envelope with a fairly fast attack and decay. The filter envelope, on the other hand, is useful in creating synthetic sci-fi sound textures. An example of a GM instrument that makes use of the filter envelope is instrument number 86, Pad 8 (Sweep).

Pitch/Filter Envelope Modulation

These two parameters determine that modulation depth of the pitch and filter envelope. In the wind instrument example above, a small amount of pitch envelope modulation is desirable to simulate it's natural pitch characteristics.

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SB AWE32 MIDI NRPN List

Note: “Realtime” means that the parameter can also affect a sustaining note. For example, filter sweep on a sustaining sound can be achieved by sending continuous NRPN LSB 21 (initial filter cutoff).

NRPN LSB 0 (Delay before LFO1 starts)

Realtime : No
Range : [0, 5900]
Unit : 4 milliseconds
LFO1 Delay from 0 to 22 seconds.

NRPN LSB 1 (LFO1 Frequency)

Realtime : Yes
Range : [0, 127]
Unit : 0.084Hz
LFO1 frequency from 0Hz to 10.72 Hz.

NRPN LSB 2 (Delay before LFO2 starts)

Realtime : No
Range : [0, 5900]
Unit : 4 milliseconds
LFO2 Delay from 0 to 22 seconds.

NRPN LSB 3 (LFO2 Frequency)

Realtime : Yes
Range : [0, 127]
Unit : 0.084Hz
LFO2 frequency from 0Hz to 10.72 Hz.

NRPN LSB 4 (Envelope 1 delay time)

Realtime : No
Range : [0, 5900]
Unit : 4 milliseconds
Envelope 1 Delay from 0 to 22 seconds.

NRPN LSB 5 (Envelope 1 attack time)

Realtime : No
Range : [0, 5940]
Unit : Milliseconds
Envelope 1 attack time from 0 to 5.9 seconds.

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NRPN LSB 6 (Envelope 1 hold time)

Realtime : No
Range : [0, 8191]
Unit : Milliseconds
Envelope 1 hold time from 0 to 8 seconds.

NRPN LSB 7 (Envelope 1 decay time)

Realtime : No
Range : [0, 5940]
Unit : 4 Milliseconds
Envelope 1 decay time from 0.023 to 23.7 seconds.

NRPN LSB 8 (Envelope 1 sustain level)

Realtime : No
Range : [0, 127]
Unit : 0.75dB
Envelope 1 sustain level from full level down to off (0.75 dB step).

NRPN LSB 9 (Envelope 1 release time)

Realtime : No
Range : [0, 5940]
Unit : 4 milliseconds
Envelope 1 release time from 0.023 to 23.7 seconds.

NRPN LSB 10 (Envelope 2 delay time)

Realtime : No
Range : [0, 5900]
Unit : 4 milliseconds
Envelope 2 Delay from 0 to 22 seconds.

NRPN LSB 11 (Envelope 2 attack time)

Realtime : No
Range : [0, 5940]
Unit : Milliseconds
Envelope 2 attack time from 0 to 5.9 seconds.

NRPN LSB 12 (Envelope 2 hold time)

Realtime : No
Range : [0, 8191]
Unit : Millisecond
Envelope 2 hold time from 0 to 8 seconds.

NRPN LSB 13 (Envelope 2 decay time)

Realtime : No
Range : [0, 5940]
Unit : 4 milliseconds

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Envelope 2 decay time from 0.023 to 23.7 seconds.

NRPN LSB 14 (Envelope 2 sustain level)

Realtime : No
Range : [0, 127]
Unit : 0.75dB
Envelope 2 sustain level from full level down to off.

NRPN LSB 15 (Envelope 2 release time)

Realtime : No
Range : [0, 5940]
Unit : 4 milliseconds
Envelope 2 release time from 0.023 to 23.7 seconds.

NRPN LSB 16 (Initial Pitch)

Realtime : Yes
Range : [-8192, 8191]
Unit : cents
Pitch tuning between -8192 and 8191 cents.

NRPN LSB 17 (LFO1 to Pitch)

Realtime : Yes
Range : [-127, 127]
Unit : 9.375 cents
If data value is greater than 0, this will cause a positive (from 0 to maximum) of 1 octave shift at LFO peak. On the other hand, if data value is smaller than 0, this will cause a negative (from o to minimum) of 1 octave shift at LFO peak.

NRPN LSB 18 (LFO2 to Pitch)

Realtime : Yes
Range : [-127, 127]
Unit : 9.375 cents
If data value is greater than 0, this will cause a positive (from 0 to maximum) of 1 octave shift at LFO peak. On the other hand, if data value is smaller than 0, this will cause a negative (from o to minimum) of 1 octave shift at LFO peak.

NRPN LSB 19 (Envelope 1 to Pitch)

Realtime : No
Range : [-127, 127]
Unit : 9.375 cents
If data value is greater than 0, this will cause a positive (from 0 to maximum) of 1 octave shift at envelope peak. On the other hand, if data value is smaller than 0, this will cause a negative (from 0 to minimum) of 1 octave shift at envelope peak.

NRPN LSB 20 (LFO1 to Volume)

Realtime : Yes
Range : [0, 127]

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Unit : 0.1875 dB
Data value smaller than 64 causes a positive phase (from 0 to maximum) volume modulation via LFO1 with magnitude of 12 dB at LFO peak. On the other hand, data value greater than or equals to 64 causes a negative phase (from 0 to minimum) volume modulation via LFO1 with magnitude of 12 dB at LFO peak.

NRPN LSB 21 (Initial Filter Cutoff)

Realtime : Yes
Range : [0, 127]
Unit : 62Hz
Filter cutoff from 100Hz to 8000Hz

NRPN LSB 22 (Initial Filter Resonance Coefficient)

Realtime : No
Range : [0, 127]
The EMU8000 had a built in resonance coefficient table comprising of 16 entries. Values 0-7 will select the first (0) entry, values 8-15 selects the second (1) entry and so on.

Coeff	Low Fc(Hz)	Low Q(dB)	High Fc(kHz)	High Q(dB)	DC Attenuation(dB)
0	92	5	Flat	Flat	-0.0
1	93	6	8.5	0.5	-0.5
2	94	8	8.3	1	-1.2
3	95	10	8.2	2	-1.8
4	96	11	8.1	3	-2.5
5	97	13	8.0	4	-3.3
6	98	14	7.9	5	-4.1
7	99	16	7.8	6	-5.5
8	100	17	7.7	7	-6.0
9	100	19	7.5	9	-6.6
10	100	20	7.4	10	-7.2
11	100	22	7.3	11	-7.9
12	100	23	7.2	13	-8.5
13	100	25	7.1	15	-9.3
14	100	26	7.1	16	-10.1
15	100	28	7.0	18	-11.0

NRPN LSB 23 (LFO1 to Filter Cutoff)

Realtime : Yes
Range : [0, 127]
Unit : 56.25 cents
Data value smaller than 64 causes a positive phase (from 0 to maximum) filter modulation via LFO1 with magnitude of 3 octave at LFO peak. On the other hand, data value greater than or equals to 64 causes a negative phase (from 0 to minimum) filter modulation via LFO1 with magnitude of 3 octave at LFO peak.

NRPN LSB 24 (Envelope 1 to Filter Cutoff)

Realtime : No

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Range : [-127, 127]
Unit : 56.25 cents

Data value greater than 0 causes a positive phase (from 0 to maximum) filter modulation via Envelope1 with magnitude of 6 octave at envelope peak. On the other hand, value smaller than 0 causes a negative phase (from 0 to minimum) filter modulation via Envelope 1 with magnitude of 6 octave at envelope peak.

NRPN LSB 25 (Chorus Effects Send)

Realtime : No
Range : [0, 255]

Chorus send, with 0 being the driest (no chorus effects processing), and 255 being the wettest (full chorus effect processing).

NRPN LSB 26 (Reverb Effects Send)

Realtime : No
Range : [0, 255]

Reverb send, with 0 being the driest (no reverb effects processing), and 255 being the wettest (full reverb effect processing).

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