

Frequently Asked Questions for SB AWE32

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This is a frequently asked question document for the Creative SB AWE32 sound card. This document summarizes many frequently asked questions and answers about the SB AWE32. If you have a question, please check this file before calling Creative Technical Support as you may find the answer contained in this document.

This FAQ is organized into the following sections:

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This document assumes you have a basic understanding of how MIDI works, the different MIDI messages, and how your MIDI sequencer works. If you are not familiar with these topics, please consider consulting a friend who has experience with MIDI, or consulting books on MIDI. A list of recommended reading on MIDI can be found in section G of this document.

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Section A - SB AWE32

1. What is the SB AWE32? How does it differ from the SB16?

The SB AWE32 is a standard SB16 MultiCD with the EMU 8000 Enhanced WaveEffect music synthesizer chip. The card includes all the standard SB16 features. Additionally, the SB AWE32 includes the Advanced Signal Processor and multiple interfaces supporting Creative, Mitsumi and Sony CD-ROM drives.

The EMU8000 is a sub-system offering high quality music synthesis using advanced wave effects technology. It comes with an onboard dedicated effect engine. The effect engine provides high quality effects like

reverb and chorus to MIDI playback. The EMU8000 supports up to 32 voices, and the effect amount for each voice can be controlled via MIDI. The EMU8000 comes integrated with 1MB of General MIDI samples and 512KB of DRAM for additional sample downloading. It can address up to 28 MB of external DRAM memory. There are two SIMM sockets on board for DRAM expansion. The SB AWE32 supports General MIDI, Roland GS and Sound Canvas MT-32 emulation.

Note: MT-32 Emulation on the SB AWE32 is similar to that of the Sound Canvas; e.g., MT-32 sysex is not supported.

2. How much memory is shipped with the SB AWE32 card?

The card ships with 1 MB of General MIDI ROM samples and 512 KB of DRAM for user sample downloading. There is a pair of SIMM sockets for DRAM upgrades.

3. What is the recommended SIMM memory access speed?

Hardware specifications call for SIMM modules with 80 nanosecond or better access times.

4. How do I upgrade the memory on the card?

To upgrade the memory, you can purchase standard SIMM modules and insert them into the SIMM sockets provided on the SB AWE32. (If you are not familiar with inserting SIMM modules, check with a technician where you purchased the SIMM's. They should be able to help). You will also need to reconfigure the memory selector jumper on the SB AWE32 card. The SIMM socket on the SB AWE32 were designed to accommodate industry standard 30-pin SIMM modules. You will need to insert two SIMMs of the same memory size into both of the sockets. The available memory options are:

- 2 MB (using 2 1 MB SIMMs)
- 8 MB (using 2 4 MB SIMMs)
- 32 MB (using 2 16 MB SIMMs)

Note that you cannot mix different size (that is, 2 MB and 8 MB) SIMM modules together on a single SB AWE32 card.

There are also 72 pins SIMM modules on the market. Such SIMMs can be found on motherboards that use 8 or 16 megabit SIMMs or as cache RAM. They are incompatible with the SIMM sockets on the SB AWE32 card. The EMU8000 treats the first 4 MB of its DRAM address space as ROM memory. As a result, when you insert two 16 MB SIMMs onto the SB AWE32, only 28 MB will be addressable.

5. What are the uses of the 512 KB DRAM on the SB AWE32?

The on-board 512 KB of memory is used to hold user samples. In GS synthesizer mode, this 512 KB is used to hold the sound effects of GS. In GM synthesizer mode, the 512 KB DRAM is free, so it can hold SoundFont banks containing samples.

MT-32 Synthesizer mode uses a small portion of the 512 KB of memory, therefore you can still load your own SoundFont bank samples into the rest of the free RAM space.

6. Would adding DRAM to the SB AWE32 increase the performance of WAVE file editing or manipulation?

Addition of SIMM DRAM to the SB AWE32 will allow you to accommodate more SoundFont bank data. This, however, will not increase the performance of

WAVE file editing or manipulation as the latter does not make use of the SIMM DRAM on the SB AWE32.

7. Is it possible to use AWE32 sounds (16 channels) together with FM sounds from the OPL-3 chip (16 channels) in CakeWalk?

You can use both the AWE32 sounds AND the OPL-3 FM sounds together in CakeWalk. As both the AWE32 and OPL-3 appear under Microsoft Windows as two separate MIDI devices, you can play both devices simultaneously. The following is a step-by-step guide:

1. Startup CakeWalk.
2. Select "Settings", then "MIDI Devices"
3. You will see a dialog box with MIDI IN devices on the left, and MIDI OUT devices on the right. Click on both "Sound Blaster AWE32 MIDI Synth" and "Voyetra Super Sapi FM Driver."
4. Select "OK"
5. Activate the "Track/Measure" Window.
6. Locate the "Port" column in the Track/Measure Windows.
7. If you want a track to be playing back using AWE32, double click on the track's "Port" section, and select "1:Sound Blaster AWE32 MIDI Synth." On the other hand if you want the track to be playing back using the OPL-3 then select "2:Voyetra Super Sapi FM Driver."

You can repeat steps 6 and 7 on other CakeWalk tracks to assign the output port as desired.

8. How many MIDI channels can the SB AWE32 handle in Windows?

Under Windows, the SB AWE32 has two MIDI synthesizer devices, "EMU8000" and "OPL3". Each MIDI device is capable of supporting 16 MIDI channels, with 15 being melodic, and one channel (MIDI channel 10) being percussive.

9. What MIDI sequencers will work with SB AWE32? Are special drivers required?

The SB AWE32 package ships with a Windows SB AWE32 MIDI driver. Therefore, the SB AWE32 can be used with any Windows based MIDI sequencer software. For DOS, the sequencer software needs to have native SB AWE32 support.

10. Are there any plans for OS/2 and Windows NT SB AWE32 drivers?

The SB AWE32 OS/2 driver is currently in beta stage. The Windows NT driver is currently in development.

11. What I/O port addresses are used by the EMU8000?

The addresses used by the EMU8000 are relative to the base I/O address of the SB16. EMU8000 Addresses are at 6xxH, AxxH and ExxH. It occupies the first four addresses at each location. For example, if the SB16 base I/O address is 220H, the EMU8000 addresses are 620H-623H, A20H-A23H and E20H-E23H.

12. Why doesn't the EMU8000 have a built in MIDI interpreter?

One of the design goal of the SB AWE32 is to offer high quality music at an affordable price. The EMU8000 is just like any other synthesizer chip such as OPL2, OPL3 or OPL4. It does not have the capability to interpret MIDI commands. For it to understand MIDI commands, a MIDI interpreter is required, and this will involve adding an additional processor to handle MIDI commands and other components adding to the cost of the product.

After our analysis of price and performance, we decided that our current

implementation offers the best in terms of price as well as performance.

To support existing games that use MPU-401, we provide a feature known as MIDI feedback using NMI (non-maskable-interrupt) which installs a small TSR program, AWEUTIL. AWEUTIL works by trapping data going out to the MPU-401 port and re-directs it back to the SB AWE32. AWEUTIL provides compatibility with many games that support the MPU-401 interface, but will not always work with protected mode games due to the complicated ways in which DOS extenders handle NMI. Note that you can still continue to play your favorite DOS protected mode game with the on-board OPL3 FM chip.

We are working closely with the game developer community to port their MIDI driver to support the SB AWE32. We have a porting laboratory at Creative Labs, Inc., where we invite developers to port their drivers to natively support the SB AWE32. We believe that in the near future the SB AWE32 will be widely supported. Currently, we already have support from several major audio driver developers for the SB AWE32 platform.

13. Does the SB AWE32 support MIDI Sample Dump to transfer samples to the EMU8000?

No. The sample transfer between PC and SB AWE32 is through the PC bus, and does not dump via the SB AWE32 MIDI port.

14. What is "CC0" documented in Appendix G-4 and G-5 of the SB AWE32 Getting Started Manual? How are these variation tones accessed?

CC0 is short form for Continuous Controller 0 (zero), which is MIDI Bank Change.

The SB AWE32 offers Sound Canvas compatibility by including the user bank instruments found on the Sound Canvas. User bank instruments are simply instruments of a similar class or variation. For example, General MIDI instrument number 25 is the Steel Acoustic Guitar, and its variation is the Ukulele.

A user bank tone is just like any other General MIDI instrument. Take for example the Ukulele variation tone. Lets assume you are currently doing MIDI editing under CakeWalk Apprentice, and you sequenced a track that uses Steel Acoustic Guitar. You play the track back, and feel that the Steel Acoustic Guitar does not quite cut it, so you decide to give Ukulele a try. What you would need to do is to insert a MIDI bank change of value 8 (the user bank for Ukulele) in that track, follow immediately by a program change of Acoustic Value to select the user bank tone. What you have just accomplished is to set the MIDI channel in which the Steel Acoustic Guitar instrument is playing to the user bank instrument "Ukulele."

Note that the user bank instruments are available only in the "GS" mode of the SB AWE32. You can switch to "GS" mode via the Windows AWE Control Panel applet.

15. What "drum kits" are available in GS mode?

A drum kit is a collection of percussive instruments (snare drum, bass drum, hi-hats, etc.) laid across the entire MIDI keyboard. Under General MIDI, MIDI channel 10 is reserved for percussion instruments. General MIDI defines only one drum kit, which is the Standard Kit. Under the "GM" synth mode of the SB AWE32, channel 10 automatically uses the "Standard Kit". MIDI music would be very boring if everybody used the same drum kit in every MIDI song. Imagine all MIDI songs using the same snare drum and the same bass drum, and you will have an idea of how similar every MIDI song will sound.

Under the "GS" synth mode of the SB AWE32 there are 11 (including the Standard Drum Kit) different drum kits you can use on MIDI Channel 10. These drum kits are:

Name	Program No.	Description
Standard/Jazz	1 or 33	Standard General MIDI drum kit. Jazz is similar to the Standard drum kit.
Room	9	Similar to that of the Standard kit except that it has more room ambiance.
Power	17	Again similar to that of the Standard kit, but with more power kick and snare drums.
Electronic	25	Electronic drum kit. Most of the percussion instruments in this drum kit are reminiscence of old analogue and digital rhythm machines (such as the Roland TR-707 and TR-909 rhythm machine)
TR-808	26	Electronic drum kit, reminiscence of the Roland TR-808 rhythm machine.
Brush	41	Similar to the Standard kit except that brushes have been added. This kit is mostly used for Jazz MIDI pieces.
Orchestra	49	An immense collection of concert drums and timpani.
SFX	57	A collection of Sound Effects.
CM-64/32L	127	Same as the Roland MT-32 drum kit. This drum kit contains standard percussion at the lower range of the keyboard, and sound effects at the higher range of the keyboard.

Drum kits are very easy to access under MIDI. Each drum kit is essentially an instrument and you select a drum kit by selecting an instrument, just as if you would select a melodic instrument. For example, if you want to select the TR-808, all you have to do is to perform a program change to 25 on MIDI channel 10. After the program change, all percussion sounds will be played back through the TR-808 drum kit.

16. Does the SB AWE32 respond to MIDI aftertouch?

The SB AWE32 Windows MIDI driver prior to version 1.03 does not support MIDI aftertouch. The current SB AWE32 driver supports aftertouch AND MIDI controller 11 (expression).

See the item "How do I get the latest drivers for the SB AWE32?" in section F for further information.

17. My PC system does not have a working NMI. What can I do to use AWEUTIL?

One of the most common causes of a system not having a working NMI is that the system's memory parity checking has been turned off. You can check your system's memory parity checking status by activating your system's BIOS setup. Consult your system's user manual on how to activate BIOS/CMOS setup and memory parity checking.

If your system does not have a working NMI or you have a DOS protected mode game, then you can only play games using FM music. Note that this NMI problem only applies to DOS games or applications, not to Windows games or applications. Under Windows, all applications play music and sound effects through the standard SB AWE32 Windows drivers.

As more developers include native SB AWE32 support, this NMI problem will gradually disappear.

Some of the protected mode games already have SB AWE32 support via special drivers (such as Miles Design Inc's AIL drivers). You can obtain more information on these drivers in the Sound Blaster forum on CompuServe, or on Creative's BBS. See the item "How do I get the latest drivers for the SB AWE32?" in Section F.

18. Is there a WaveBlaster upgrade option on the SB AWE32?

Yes. Each SB AWE32 features a WaveBlaster connector.

19. What is the benefit of adding a WaveBlaster to the SB AWE32?

The WaveBlaster connector was included on the SB AWE32 to provide users an alternative wave-sample synthesis method other than the EMU8000 on the SB AWE32. By incorporating a WaveBlaster onto the SB AWE32, the total polyphony of this combination will be increased to 64, the total number of timbres expanded to 32, and you will have access to a secondary palette of sampled sounds.

20. Is it possible to load AWEUTIL into high memory?

AWEUTIL automatically searches for high memory and will attempt to load itself high if enough high memory is available.

21. Does AWEUTIL have to stay memory resident?

AWEUTIL serves two purposes; to initialize and control the reverb and chorus effects of the FM hardware on the SB AWE32 card, and to provide NMI MIDI Feedback.

AWEUTIL /S

will initialize and set the reverb and chorus effect of the FM hardware, and then terminate. It will not stay resident in memory.

If you want to activate NMI MIDI Feedback, then run

AWEUTIL /EM:XX (XX = GM, GS or MT32)

before starting your game.

When you finish the game, remember to run

AWEUTIL /U

to unload AWEUTIL from memory.

22. What are the long term plans to solve the problem with DOS extender

games?

We are currently getting developers to natively support the SB AWE32. So far we have had good support from John Miles Inc. with their SB AWE32 Miles (real and protected mode) drivers, from Accolade, from HMI and from John Ratcliff with his MIDPAK drivers. As more and more developers support the SB AWE32, the DOS extended game's problem will gradually disappear.

23. Will software written for the SB16 work with the SB AWE32?

Definitely. The SB AWE32 uses the same base system as the SB16, so it is fully compatible.

24. Does Creative have any plans for a SCSI version of the SB AWE32?

We will deliver a SCSI version of the SB AWE32 when there is sufficient demand.

25. What CD-ROM drives does the SB AWE32 support?

The SB AWE32 supports Creative, Sony and Mitsumi CD-ROM drives.

26. What are the different reverb and chorus variations available on the SB AWE32?

Reverb and chorus effects add warmth and movement to MIDI playback. There are eight reverb types and eight chorus types available on the SB AWE32.

Room 1-3,	This group of reverb variation simulates the natural ambiance of a room. Room 1 simulates a small room, Room 2 simulates a slightly bigger room, and Room 3 simulates a big room.
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Hall 1-2,	This group of reverb variation simulates the natural ambiance of a concert hall. It has greater depth than the room variations. Again, Hall 1 simulates a small hall, and Hall 2 simulates a larger hall.
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Plate,	Back in the old days, reverb effects were sometimes produced using a metal plate, and this type of reverb produces a metallic echo. The SB AWE32's Plate variation simulates this form of reverb.
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Delay,	This reverb produces a delay, that is, echo effect.
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Panning Delay,	This reverb variation produces a delay effect that is continuously panned left and right.
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Chorus 1-4,	Chorus produces a "beating" effect. The chorus effects are more prominent going from chorus 1 to chorus 4.
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Feedback Chorus,	This chorus variation simulates a soft "swishing" effect.
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Flanger,	This chorus variation produces a more prominent feedback chorus effect.
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Short Delay,	This chorus variation simulates a delay repeated in a short time.
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Short Delay, (feedback)	This chorus variation simulates a short delay repeated (feedback) many times.
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These effect variations can be selected by the following sysex messages:

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 denote 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:

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

27. What are the undocumented "JP6," "JP8" and "JP9" jumpers on the card?

JP8 Is a digital (SPDIF) out from the EMU8000.

Pin definition: 0 - signal,
 1 - signal ground.

JP6 and JP9 are meant for manufacture diagnostic purpose, and should not be used by end user.

Section B - Editing Tool

1. Will there be a preset editor for the SB AWE32?

We are currently working on a preset editor for the SB AWE32, code-named "Vienna." Vienna will allow you to create and customize your own SoundFont bank files. You can create WAVE files to import into Vienna to create your own instruments. Vienna also allows you to program you own presets (tweaking the envelopes' generators, the LFOs and such).

2. Will it be possible to patch multiple sounds across different keys, such as a drum kit?

Yes, Vienna was designed for making drum kits as well.

3. How are new instruments on the SB AWE32 created?

As mentioned above, you can create your own samples (using WaveStudio) to import into Vienna. As an example, let's say you have a Steinway piano you would like to sample it and use the Steinway sound on your SB AWE32. What you need to do is sample your Steinway in 16 bit mono WAVE files. Then you can use Vienna to edit its preset and save it as a SoundFont bank file and load it as a user bank into your SB AWE32 to play just like any normal MIDI instrument.

4. What functionality will the preset editor offer?

Here is what you will be able to do with Vienna:

- Multi-sample arrangement

Multi-sampling is the technique of sampling a musical instrument at different musical intervals, arranging the samples across a MIDI keyboard and assigning key ranges (for example, from key C3 to C4) to these samples. Vienna allows you to visually assign samples to key ranges.

- Preset editing

Once you arrange your samples across the keyboard, you can then start to program the instrument's envelopes and LFOs to your liking. Refer to the section on "Introduction to EMU8000" for information on envelopes and LFOs.

- Loop point selection

Vienna allows you to visually select the loop points of a sample.

- Drum kit arrangement

Vienna is not limited to just creating musical instruments; you can also layout and save a drum kit using any samples you desire.

5. What is SoundFont Bank Maker for SB AWE32? How do I get this application?

SoundFont bank Maker for SB AWE32 is a simple utility for you to experiment with SB AWE32 sample downloading capability. It is not a substitute for Vienna. Refer to the section "How do I..." for more information on obtaining this utility.

6. Will the bank editing software load samples for other systems e.g. Akai S1000 or Yamaha TG55?

There is no plans at this time.

Section C - Programming Information

1. Is programming information available for the SB AWE32?

We are working on a SB AWE32 Developer Information Pack, which will contain both Windows and DOS programming information. For DOS environments, we have created library functions based on common MIDI commands such as NoteOn, NoteOff, ProgramChange, etc. Special care has been taken to ensure that the library can be used for building TSR drivers or embedded MIDI drivers in an application.

For Windows environments, we will provide the API for sample downloading and effect control.

2. Is the effect engine on the SB AWE32 programmable?

The effect engine on the SB AWE32 is dedicated to produce reverb, chorus and QSound effect, and is not intended to be programmable. You can, however, select different reverb or chorus variations using sysex. Refer to the section "What are the different reverb and chorus variations available on the SB AWE32?" for more information.

3. When will the developer kit become available? What sort of prices will the developer kit be?

There will not be a SB AWE32 developer kit available for sale. Once the Developer Information Pack is ready, we will make it publicly available for free. Keep a look out in Compuserve and Creative BBS for SB AWE32 developer kit announcement.

Section D - SoundFont Bank

1. What are SoundFont Collections?

E-mu SoundFont Collections are CD-ROMs that contains SoundFont Banks of varying sizes (0.5 MB to 8 MB). E-mu's SoundFont Banks will include both instruments and sound effects. Many of E-mu's traditional instrument sounds will be included (for example Proteus 1-3) as well as some new sounds.

2. How do SoundFont Bank work?

SoundFont Banks can be loaded into RAM on the SB AWE32. They can then be used in conjunction with a MIDI sequencer to create soundtracks or other kinds of audio creations.

3. When will SoundFont Bank be available?

SoundFont Banks will be available this summer. SoundFont catalogs should be available in June, and E-mu will start taking orders once the catalog is available.

4. What can I do with SoundFont Banks?

You can:

- a. Load SoundFont banks of your choice into the RAM of your SB AWE32 and use this set of sounds as you compose with a MIDI sequencer.
- b. Create your own SoundFont Bank with SoundFont Objects from various SoundFont Banks you already have using E-mu's SoundFont Editor software.
- c. Edit individual SoundFont parameters with E-mu's SoundFont Editor to create your own version of the sounds and then assemble your own SoundFont Objects into a SoundFont Bank. Creating your own SoundFont Objects and Banks gives you the freedom to create your own unique instruments and sound effects to differentiate your soundtracks.

5. Will having 28 MB on the SB AWE32 improve the sound quality over a standard 512 KB SB AWE32?

Absolutely! The more RAM memory on your SB AWE32 the larger and fuller the sound samples you can include in your SoundFont Banks. E-mu will be

providing 8 MB of SoundFont Banks in our collection that will be of interest to serious musicians.

Section E - Introduction to the EMU8000 Chip

The EMU8000 has its roots in E-mu's Proteus sample playback modules and their renowned Emulator sampler. The EMU8000 has 32 individual oscillators, each playing back at 44.1 kHz. By incorporating sophisticated sample interpolation algorithms and digital filtering, the EMU8000 is capable of producing high fidelity sample playback.

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

1. What exactly does modulation mean?

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 the filter cutoff frequency.

The EMU8000's LFOs and envelope generators provide 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 that mixes the dry signals with the Reverb/chorus level signals to produce the final mix.

2. What are the EMU8000 sound elements?

Each of the sound elements in an EMU8000 consists of the following:

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, that is, 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 the pitch of the audio signal only.

Resonance

A filter alone would be like an equalizer, 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 emphasize signals at the cutoff frequency, giving the audio signal a subtle "wah-wah," that is, imagine a siren sound going from bright to dull to bright again periodically.

LFO1 to Volume (Tremolo)

The 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). 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)

The 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)

The 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 modulate 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 coupled with LFO1 to Pitch, a complex vibrato effect can be achieved.

Volume Envelope

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

A six-stage envelope makes 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 tend to go slightly sharp when they are first blown, and this characteristic 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 the 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 its natural pitch characteristics.

This rich modulation capability of the EMU8000 is fully exploited by the SB AWE32 MIDI drivers. The driver also provides you with a means to change these parameters over MIDI in real time. Refer to the section "How do I change an instrument's sound parameter in real time" for more information.

Section F - How Do I ...

1. How do I make use of RPN documented in the SB AWE32 MIDI Implementation chart?

RPN is a short form for "Registered Parameter Number." Registered Parameter Numbers are used to represent sound or performance parameters. MIDI 1.0 specified three RPNs: RPN 0 for Pitch Bend Sensitivity, RPN 1 for Coarse Tune and RPN 2 for Fine Tune. The SB AWE32 implements only RPN 0, Pitch Bend Sensitivity.

Before going into how to set pitch bend sensitivity, let's go into how pitch bending is used in MIDI. Pitch Bending is normally used to pitch shift (that is, make the pitch go higher or lower) a sustained note to achieve a "pitch gliding" effect. The default pitch bend sensitivity of the SB AWE32 is +/- 2 semitones, that is, you can go high or low of the current note by 2 semitones when using the pitch bend wheel. If you desire a more dramatic pitch bending effect, then you would need to change the pitch bend sensitivity to a higher value.

Following are step-by-step instructions to set a pitch bend sensitivity value other than the default 2 semitones. CakeWalk Apprentice will be used as an example.

1. Bring up the "Event List" window for the track you want to set pitch bend sensitivity.
 2. Go to the top of the event list (page up) and insert a MIDI controller event, with controller number 101 and a controller value of 0.
 3. Insert another MIDI Controller event immediately, with controller number 100 and controller value of 0.
 4. Insert another MIDI controller event immediately, with controller number 6, and set the controller value to the desired pitch bend sensitivity in semitones.
2. How do I change an instrument's sound parameter in real time?

You can change an instrument's SoundFont parameters (for example, LFO depth and speed, envelope contour) through MIDI in real time via NRPN, or Non Registered Parameter Number control.

NRPN is identical to that of RPN, except that Registered Parameter Numbers are agreed upon by the MMA (MIDI Manufacturers Association) and JMSC (Japan MIDI Standards Committee), and Non Registered Parameter Number may be assigned as needed by individual manufacturers.

NRPN consists of:

NRPN MSB	MIDI Controller 99
NRPN LSB	MIDI Controller 98

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

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 (such as CakeWalk, MasterTracks Pro) is capable of sending them.

For SB AWE32 NRPN to be functional, NRPN MSB has to be 127, and NRPN LSB set to the desired parameter to be controlled (refer to the section "SB AWE32 NRPN Implementation" for a list of NRPN implemented on the SB AWE32.)

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:

$$\text{Actual value} = (\text{MSB} * 128 + \text{LSB}) - 8192$$

To convert an 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) restores the instrument's original SoundFont parameters.

Refer to section [H] for a table of NRPN implementation.

3. How do I select the SB AWE32's reverb and chorus variation type through MIDI?

You can select the reverb and chorus variation via sysex. The SB AWE32 Windows (not DOS) driver recognizes two strings of sysex; one for selecting reverb variation, and the other for selecting chorus variation.

Reverb sysex string:

F0 41 10 42 12 40 01 30 XX CS F7

Where XX indicates the reverb variations (from 0 to 7), and CS indicate a checksum for this sysex string. CS is ignored by the MIDI driver.

Chorus sysex string:

F0 41 10 42 12 40 01 38 XX CS F7

Where XX indicates the chorus variation (from 0 to 7), and CS indicate a checksum for this sysex string. CS is ignored by the MIDI driver.

4. How can I maximize my system's memory so that I still have plenty of room to run games after installing the SB AWE32?

There are two drivers (CTMMSYS.SYS and CTSB16.SYS) you can remove from CONFIG.SYS. These two drivers provide digital playback and recording interface under DOS. They are not used by the EMU8000 subsystem.

By removing these two drivers, you will not be able to run PLAY.EXE, RECORD.EXE and SB16SET.EXE under DOS, but you will gain approximately 30K of memory.

5. How do I load a SoundFont Bank?

Loading SoundFont Banks is easy. Just use the SB AWE32 Windows Control Panel Applet, AWECP.EXE, as follows:

- a. Use the up or down arrow keys next to the user bank number to select the desired bank. A dialog box appears.
- b. Select the directory that contains the *.SBK files.
- c. Double-click the desired file to load it into the particular user bank.

6. How do I get the latest drivers for the SB AWE32?

The latest SB AWE32 drivers, utilities and game compatibility list can be found at the following sites:

Inside U.S.A., Canada and South America
Creative Labs, Inc BBS : (405)742-6660

Inside Europe
UK BBS : (44)743-360287
Germany BBS : (49)2131-919820

Inside Asia
Creative Technology BBS : (65)776-2423

CompuServe
type GO BLASTER to enter the Creative Labs Forum

Section G - References

The definitive guide to MIDI would be "MIDI 1.0 Detailed Specification",
published and distributed exclusively by :

International MIDI Association
23634 Emelita Street
Woodland Hills, CA 91367
USA

Other MIDI related publications are :

Music Through MIDI
Using MIDI to create your own electronic music system by Michael Boom
published by Microsoft Press
Catalog number : ISBN 1-55615-0260-1

The MIDI Manual
by David Miles Huber
published by SAM
Catalog number : ISBN 0-672-22755-6

Section H - SB AWE32 NRPN Implementation

NRPN LSB 0 (Delay before LFO1 starts)
Realtime : No
Range : [0, 5900]
Unit : 4 milliseconds
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
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.

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
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) 1 octave shift at LFO peak. On the other hand, if data value is smaller than 0, this will cause a negative (from 0 to minimum) 1 octave shift at LFO peak.

NRPN LSB 18 (LFO2 to Pitch)

Realtime : Yes
Description :
Range : [-127, 127]
Unit : 9.375 cents

If data value is greater than 0, this will cause a positive (from 0 to maximum) 1 octave shift at LFO peak. On the other hand, if data value is smaller than 0, this will cause a negative (from 0 to minimum) 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) 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) 1 octave shift at envelope peak.

NRPN LSB 20 (LFO1 to Volume)

Realtime : Yes
Range : [0, 127]
Unit : 0.1875 dB

Data values 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 values greater than or equal 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 has a built in resonance coefficient table comprising 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
 Description :
 Range : [0, 127]
 Unit : 56.25 cents

Data values smaller than 64 causes a positive phase (from 0 to maximum) filter modulation via LFO1 with magnitude of 3 octaves at LFO peak. On the other hand, data values greater than or equal to 64 causes a negative phase (from 0 to minimum) filter modulation via LFO1 with magnitude of 3 octaves at LFO peak.

NRPN LSB 24 (Envelope 1 to Filter Cutoff)

Realtime : No
 Description :
 Range : [-127, 127]
 Unit : 56.25 cents

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