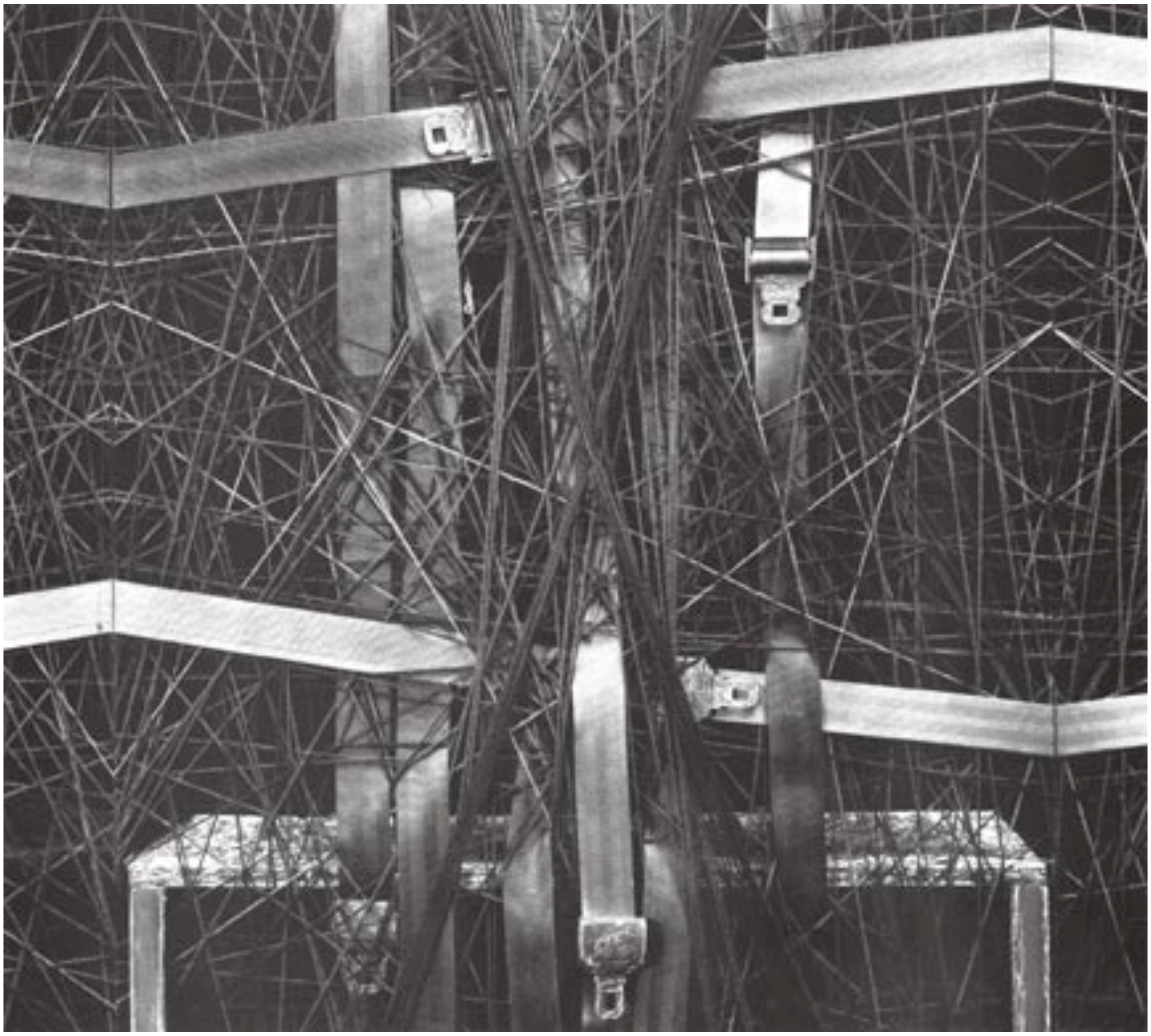
MSP



What’s New in MSP2

Introduction

This document is for users of MSP 1.x versions and describes new features present in the MSP 2 release. For changes in Max 4, please read the What's New in Max 4 document.

There are three chapters that follow: *The New Audio Driver System*, *New MSP Objects*, and *Changed MSP Objects*.

Especially if you are using an audio card with MSP, we strongly recommend you read the first chapter. The other chapters are meant simply as a guide to assist in your exploration of the many new features of MSP 2.

Installing

In a word, it's simpler, and you can treat Max and MSP as if they were a single program.

There is no longer a separate MSP installer. The Max/MSP installer creates a Max/MSP folder with an application that contains the Max Audio Library file previously needed to use MSP as well as all of the MSP external objects and help files.

There is no longer a separate authorization for MSP. There are, however, different authorizations for Max and Max/MSP, so if you are authorized for Max/MSP, you won't be authorized for the version of Max installed by the Max-only installer.

The New Audio Driver System

MSP 2 supports a new architecture for audio I/O that is more flexible and provides a number of new features for communicating audio to and from other applications.

The new system uses a folder of "audio driver objects" in a folder named "*ad*" that the Max/MSP installer places in the externals folder. The folder can actually be anywhere in the Max search path, but it must be named *ad*.

When Max/MSP starts up, the first external object that uses MSP will initialize the audio library and find all the audio driver objects in the ad folder. The currently selected driver will attempt to initialize.

By default, MSP uses the Sound Manager audio driver. However, unlike previous versions of MSP, you can switch to another driver without needing to restart Max. You can choose a new driver from the Driver pop-up menu in the new DSP Status window. It's easier to see the DSP Status window now: Choose DSP Status... from the Options menu to see the window, which, by the way, is now a patch you can modify if you feel like it.

Here is a brief description of the drivers included with MSP. For more information on audio drivers, refer to the completely revised *Audio Input and Output* chapter of the MSP manual.

- Sound Manager. This is a version of the audio driver built into MSP 1.x with a few minor improvements: you can now use the Internal CD as an input source in OS 9 (although since you can't disable playthrough, it's fairly useless).

- ASIO. None of the specific third-party audio card support in MSP 1.x (for Korg 1212, Sonorus, or Digidesign) is available in MSP 2; instead, you need to use the ASIO driver for the audio card. MSP's ASIO support requires that you place your ASIO driver files inside the *ASIO Drivers* folder inside the Max/MSP application folder. This folder is created by the Max/MSP installer, but there are no ASIO drivers included.

  For each ASIO driver found in the folder, you'll see a choice in the Driver pop-up menu in the DSP Status window. Choose the desired driver and it will attempt to find and initialize the hardware it's designed to work with. As with other ASIO-compatible applications such as Cubase, the presence of the driver's name in the DSP Status window menu does not indicate that it has successfully initialized; nothing happens until you choose the driver from the menu.

  If you add an ASIO driver file to the ASIO Drivers folder, you'll need to restart Max/MSP before you'll see it listed in the driver menu.

  More information on support for Digidesign hardware using ASIO is found below in the section *Using ASIO with Direct I/O.*

- ReWire. This standard, created by Propellerhead Software (makers of ReBirth and Reason), allows MSP to output to audio sequencer applications such Cubase, Vision, and Digital Performer. You'll need to install both the ReWire and ReWireMSP shared libraries in the *Extensions* folder; the Max/MSP Installer places them in a folder called *audio stuff* inside the Max/MSP application folder.

- DirectConnect. This driver allows MSP to play into ProTools. It requires version 5.0.1 or later of the Digi System Init.

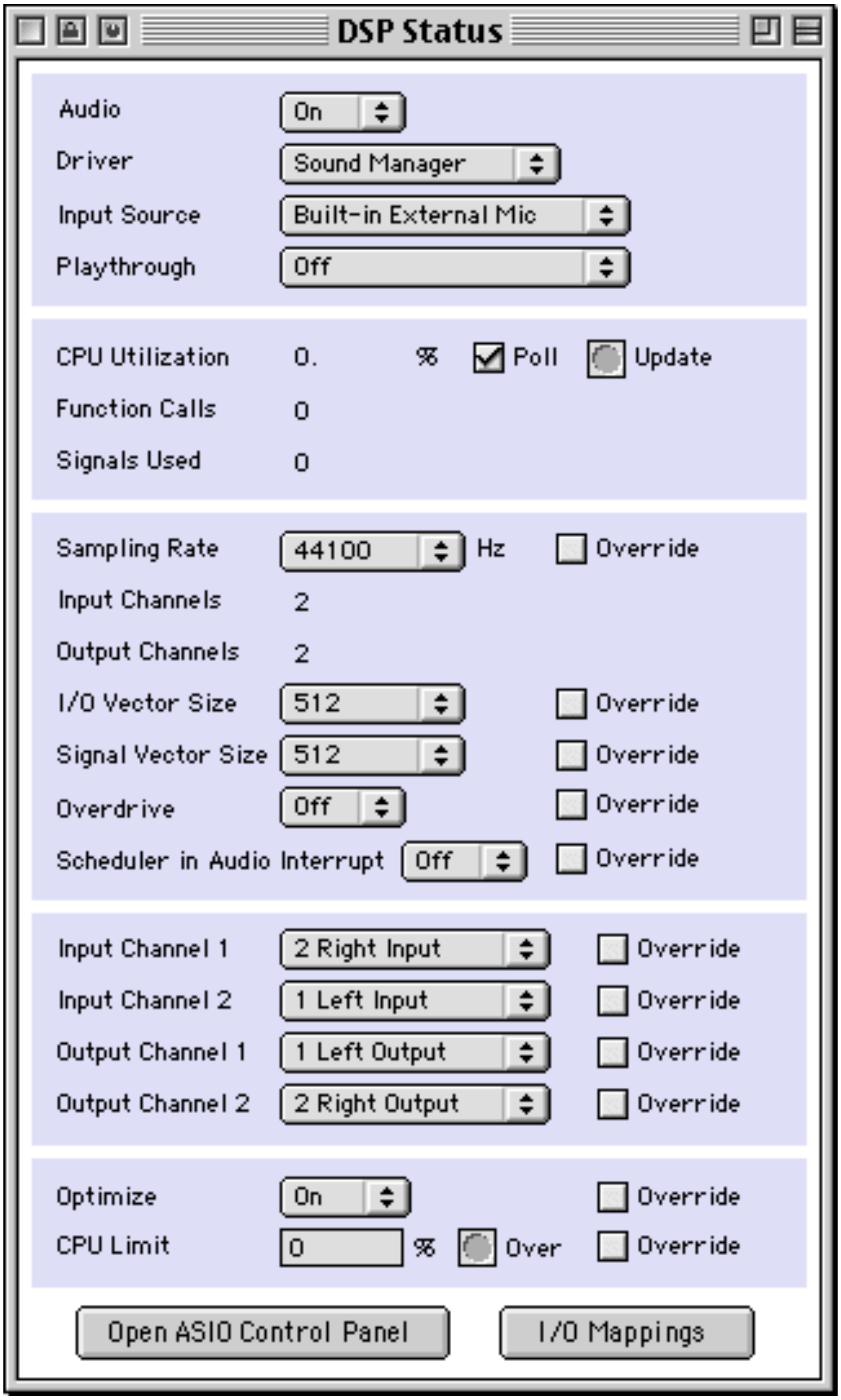
- VST. This driver communicates with a special VST plug-in that allows you to use Max/MSP as an effects plug-in for a VST-compatible sequencer.

- NonRealTime. This driver runs audio processing as fast as possible at low priority, allowing you to synthesize or process sounds that wouldn't be possible in real time. You can use **sfrecord~** to record the synthesized output to an audio file.

New Audio Driver System

Setting Driver Options

The new DSP Status window, shown below, contains settings that should be familiar to MSP 1.x users. There are a few new features, however.



Audio	On		
Driver	Sound Manager		
Input Source	Built-in External Mic		
Playthrough	Off		
CPU Utilization	0.	%	☑ Poll ○ Update
Function Calls	0		
Signals Used	0		
Sampling Rate	44100	Hz	□ Override
Input Channels	2		
Output Channels	2		
I/O Vector Size	512		□ Override
Signal Vector Size	512		□ Override
Overdrive	Off		□ Override
Scheduler in Audio Interrupt	Off		□ Override
Input Channel 1	2 Right Input		□ Override
Input Channel 2	1 Left Input		□ Override
Output Channel 1	1 Left Output		□ Override
Output Channel 2	2 Right Output		□ Override
Optimize	On		□ Override
CPU Limit	0	% ○ Over	□ Override

In the example shown above, the Sound Manager audio driver is in use. If an ASIO driver has been selected. ASIO has two special options shown below the driver name: *Clock Source* lets you choose how the audio interface is synchronized, and the *Prioritize MIDI* option, when checked, runs audio processing at a slightly lower priority to allow MIDI and timing interrupts to occur more regularly.

The *Sampling Rate*, *I/O Vector Size* and *Signal Vector Size* menus will be familiar from the old DSP Status window. But notice that the Signal Vector Size can now be as small as 2 samples. Small vector sizes will dramatically increase the amount of CPU time it takes to process audio, but maybe useful for certain types of applications.

The *Input Channel* and *Output Channel* menus let you map MSP's first two logical input and output channels (those represented by **dac~** and **adc~**) to physical device channels (those of the hardware you're using). MSP has 512 logical channels and as many physical device channels as the hardware you're using allows. (In other words, the MSP 1.x limitation of 16 channels is gone.) To assign the other 510 channels, click the *I/O Mappings* button to open a subwindow that displays all channel mappings.

The *Optimize* checkbox turns Altivec (G4) optimization on and off. As long as the Signal Vector Size is 4 or more samples, selected MSP objects will use processing algorithms that operate on 4 floating-point samples in a single instruction. The overall gain with optimization depends upon the algorithm you're using. We'll be working on additional optimization to be released in updates to MSP 2.

The *CPU Limit* lets you set a percentage of the processor's total capacity to allocate to signal processing. When the limit is exceeded, MSP skips signal vectors (producing clicks and gaps in the output). By setting this value at 60 to 70 percent, you can be assured of never losing control over your computer when doing expensive DSP processing, as can occur when the DSP takes over the entire processing capability of the machine, preventing it from responding to the keyboard or mouse.

Using ASIO with Direct I/O

A number of MSP 1.x worked with the Audiodriver file that provided direct support for Digidesign hardware using Direct I/O. MSP 2 has no built-in Direct I/O support—we've decided to concentrate on ASIO instead, since ASIO drivers exist for a large collection of audio cards, including Digidesign hardware.

To obtain the ASIO Driver for Digidesign Direct I/O, visit the Steinberg web site at *http://www.steinberg.de*. Since the site changes frequently, we can't reliably tell you exactly how to find the Digidesign DirectIO ASIO driver, but it's there. After downloading the file, place it in your *ASIO Drivers* folder. Ensure that you have a recent Digi System Init (we recommend version 5.0.1 or later) in your *Extensions* folder and restart your computer if necessary if you updated it.

Note that you cannot use Direct I/O while ProTools is running. Digidesign hardware is dedicated to a single application at a time. If you want to combine ProTools and MSP, try the new MSP DirectConnect audio driver.

New Audio Driver System

Summary of MSP 2 Audio Support Issues

- Switch audio drivers without restarting Max
- Support for ASIO, ReWire, VST, and DirectConnect interface standards
- 512 logical input and output channels with no limit on simultaneous hardware channels
- No direct support for specific hardware; use ASIO instead

New MSP Objects

MSP 2 has over 70 new objects. This brief summary of some of the major objects and categories is intended merely as an introduction to guide your exploration of the additions.

User Interface Objects

The **filtergraph~** object allows you to design seven different types of filters graphically. It can also display the frequency response of coefficient parameters to the **biquad~** object. The **filtergraph~** inspector allows a high degree of customization of the display.

The **waveform~** object displays the contents of a **buffer~** object in a patcher window. The interface is a major improvement over the **buffer~** object's own window, with a fully configurable display and even some simple editing features.

Polyphony Management

The **poly~** object and its helpers **thispoly~**, **in**, **in~**, **out**, and **out~** are designed for control over one or more copies of the same patch. **poly~** is the preferred way to control CPU resources by shutting off parts of a patch. It also has voice allocation features designed to work with synthesis and signal processing. **poly~** also has the ability to upsample or downsample the patch it is controlling relative to the main sampling rate, or change the vector size used.

Spectral-Domain Processing

The **pfft~** object and its helpers **fftin~**, **fftout~**, **fftinfo~**, **frameaccum~**, and **framedelta~** greatly simplify the implementation of windowed overlapping spectral-domain processing algorithms. As with **poly~**, you create a patcher for use inside of **pfft~**.

The **vectral~** object can be used for envelope following on spectral frame data produced by the **fft~** object.

Mathematical Operators

A number of new objects implement transcendental and arithmetic operations--examples include **sin~**, **sinx~**, and **atan2~**. The **cartopol~** and **poltocar~** convert between Cartesian and polar coordinates. **trunc~** and **round~** perform truncation and rounding of signals.

Distortion

A group of bitwise operators (**bitor~**, **bitshift~** etc.) transform signals based on the bits in the floating-point word.

The **degrade~** object performs bit-depth and sampling-rate reduction.

New MSP Objects

The **downsamp~** object samples an input periodically and repeats the sample value without interpolation.

Control Signals

A number of new MSP objects deal with audio-rate control signals.

The **zigzag~** object is similar to the **line~** object, but it stores the function you define and lets you modify it, loop it, or skip breakpoints.

The **seq~** object is an event sequencer (similar to **mtr**) that records and plays back synchronized to an audio signal. You could use it for synchronizing MIDI to an audio loop or a hard disk track using the new sync outlet of **sfplay~**.

The **pong~** object folds or wraps a signal to keep it between 0 and 1.

The **trapezoid~** and **triangle~** objects implement standard wavetable function shapes.

Sampling and Synthesis

The **stutter~** object is designed for granular sampling and synthesis applications.

The **2d.wave~** object allows you to move through a portion of a **buffer~** divided into evenly-sized chunks. One signal input determines the check to play and the other determines the position within the chunk.

The **oscbank~** and **ioscbank~** objects are highly efficient wavetable oscillator banks.

Filters

The **fffb~** object is an efficient bank of bandpass filters.

The s**vf~** object implements a state-variable filter, providing simultaneous output from different filter types.

The **teeth~** object is a comb filter (similar to the **comb~** object) with independent feedback and feedforward delay times.

The **onepole~** object is a simple and efficient filter that may be used to replace **biquad~** in certain situations.

The **buffir~** object is a finite impulse response filter that uses a **buffer~** to store the data points that are convolved with the input signal.

New MSP Objects

System Objects

The **rewire~** object hosts ReWire devices (other applications such as soft synths). MIDI and synchronization info can be communicated in addition to 256 channels of audio output from the device.

The **adoutput~** object lets you process the previous vector of audio output.

The **adstatus** object was used to build the DSP Status window. You can include it in your own patches for customizing all aspects of audio processing.

The **dsptime~** object can be used in conjunction with the NonRealTime audio driver. When it receives a bang it outputs the number of milliseconds since audio processing began. You can use this information to drive a score of events that affect audio processing.

The **cd~** object is similar to **sfplay~** but operates directly on audio CDs by reading the data digitally. It doesn't work perfectly on every CD drive but does fairly well on newer models. It's a good workaround for the difficulties in processing CD audio introduced by more recent Mac OS versions.

Changed MSP Objects

- The **scope~**, **number~**, and **meter~** objects provide inspectors that let you customize colors and other appearance modes.

- The **sfplay~** object features bidirectional cues, looping, a sync output, audio-signal triggering, more simultaneous playback channels, and support for more file formats and sample sizes (from 8- to 64-bits). A preview dialog (actually part of Max) lets you audition audio files before choosing them.

- The **sfrecord~** object features support for more channels, file formats, and sample sizes.

- The **buffer~** object has a new import message that uses QuickTime to convert MP3 files and movie audio tracks to sample data. It also supports reading and writing more file formats and bit depths.

- The **dac~** and **adc~** objects now accept an unlimited number of arguments for specifying logical audio channels for input or output. They also accept a set message that lets you change which logical channels they use.

- A number of MSP objects have been Altivec-optimized including most mathematical operators and objects that perform FFTs. Performance gains vary.

  In order to use Altivec optimization the signal vector size must be at least 4 and the Optimize setting must be checked in the DSP Status window.