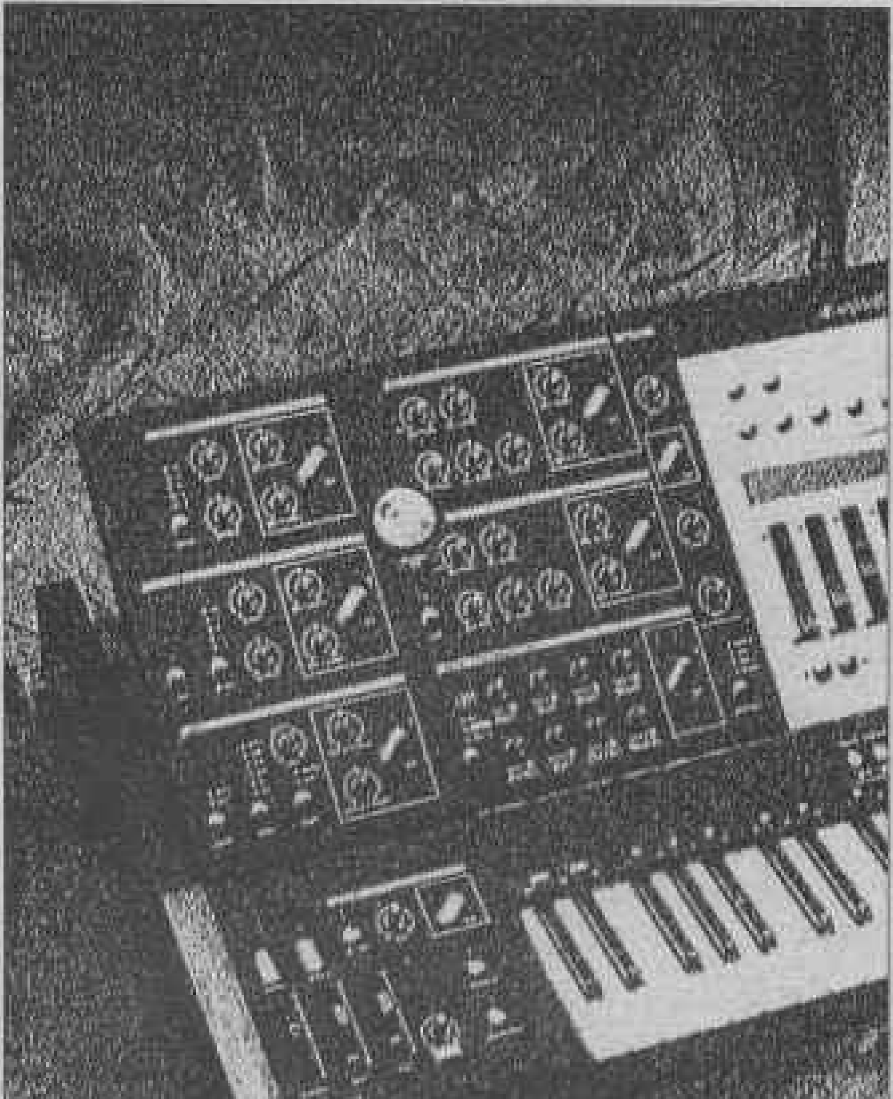
WAVE

ADVANCED MODULAR
WAVETABLE SYNTHESIZER

Manual



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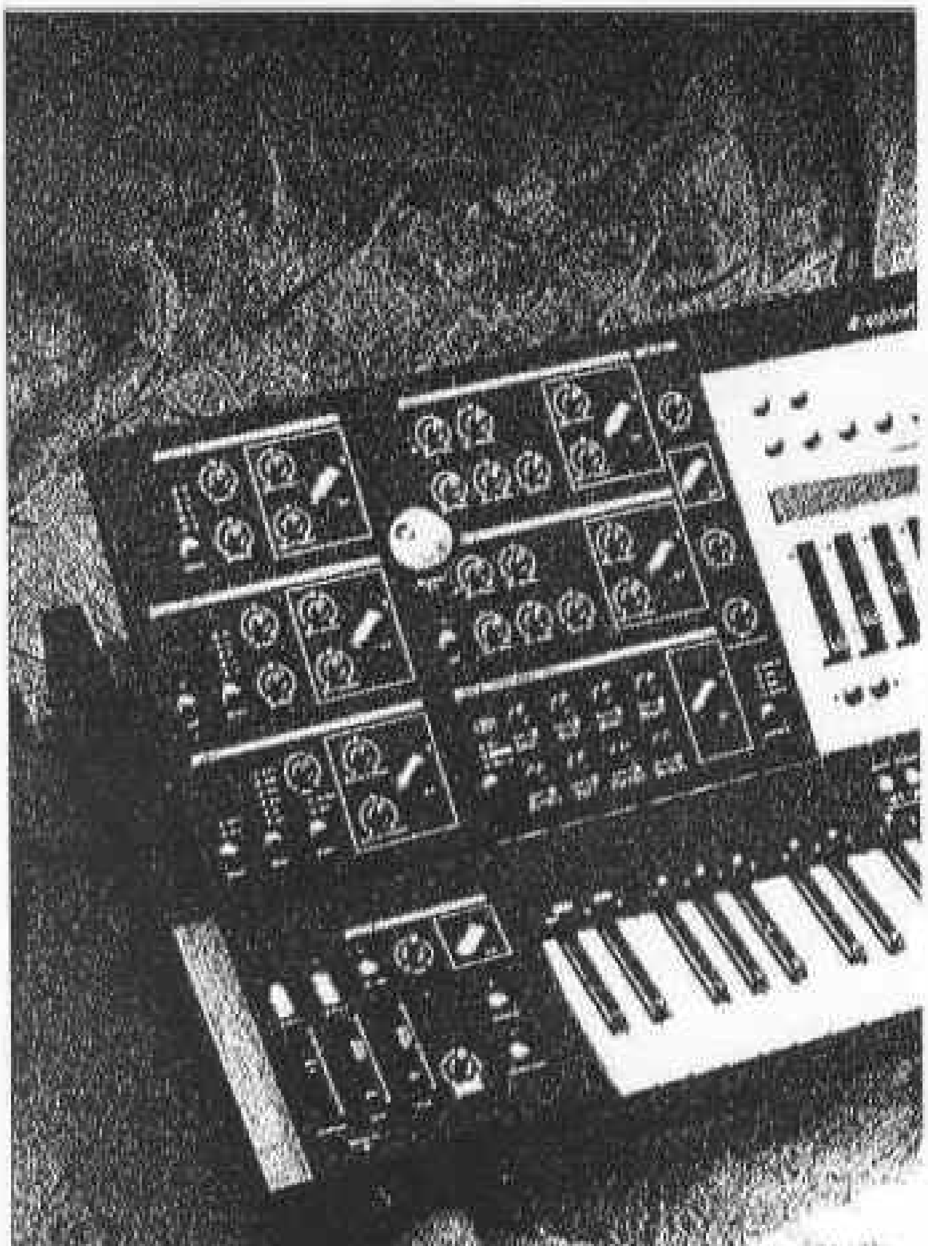

PERFORMANCE

SOUND DESIGN

WAVETABLE DESIGN

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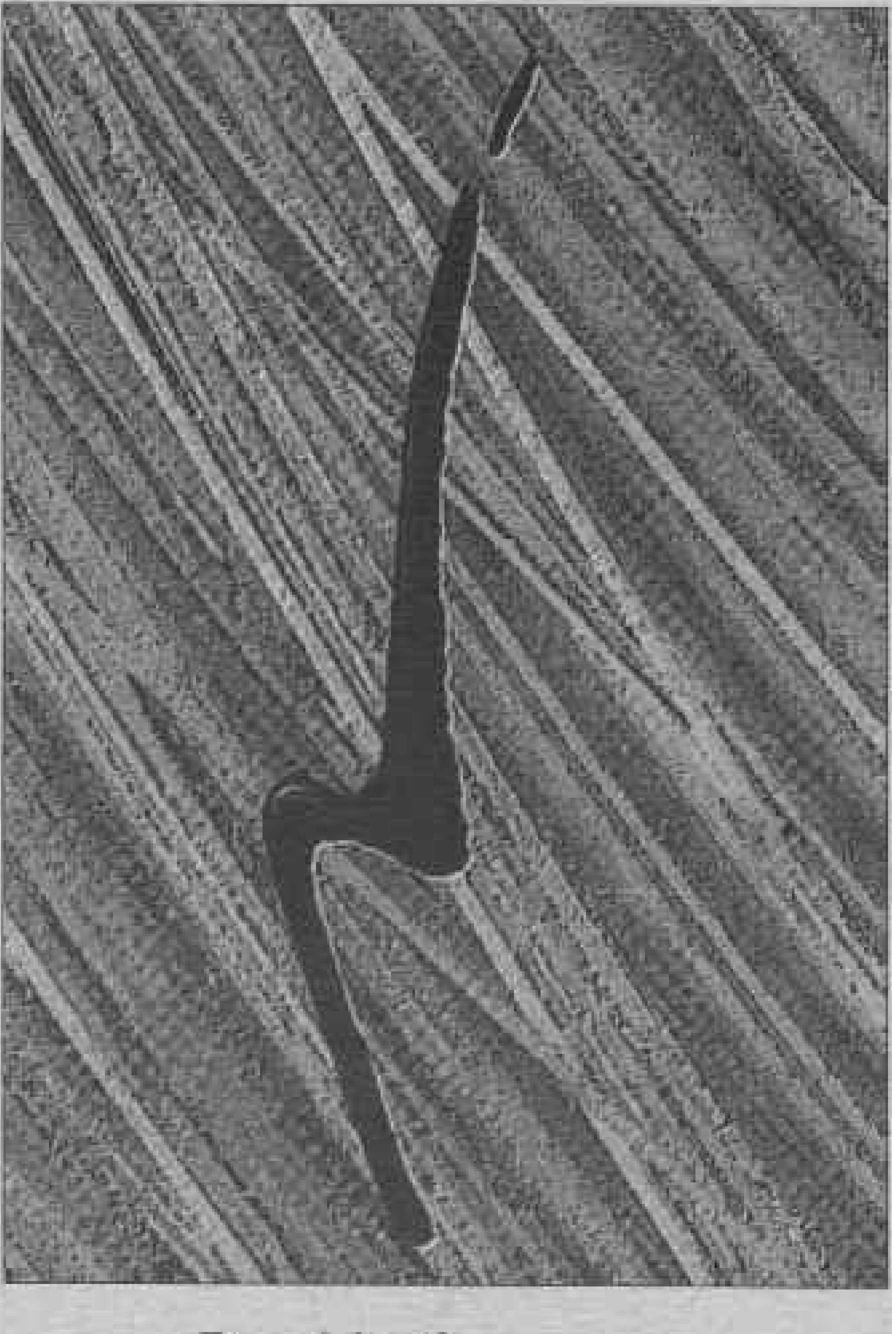

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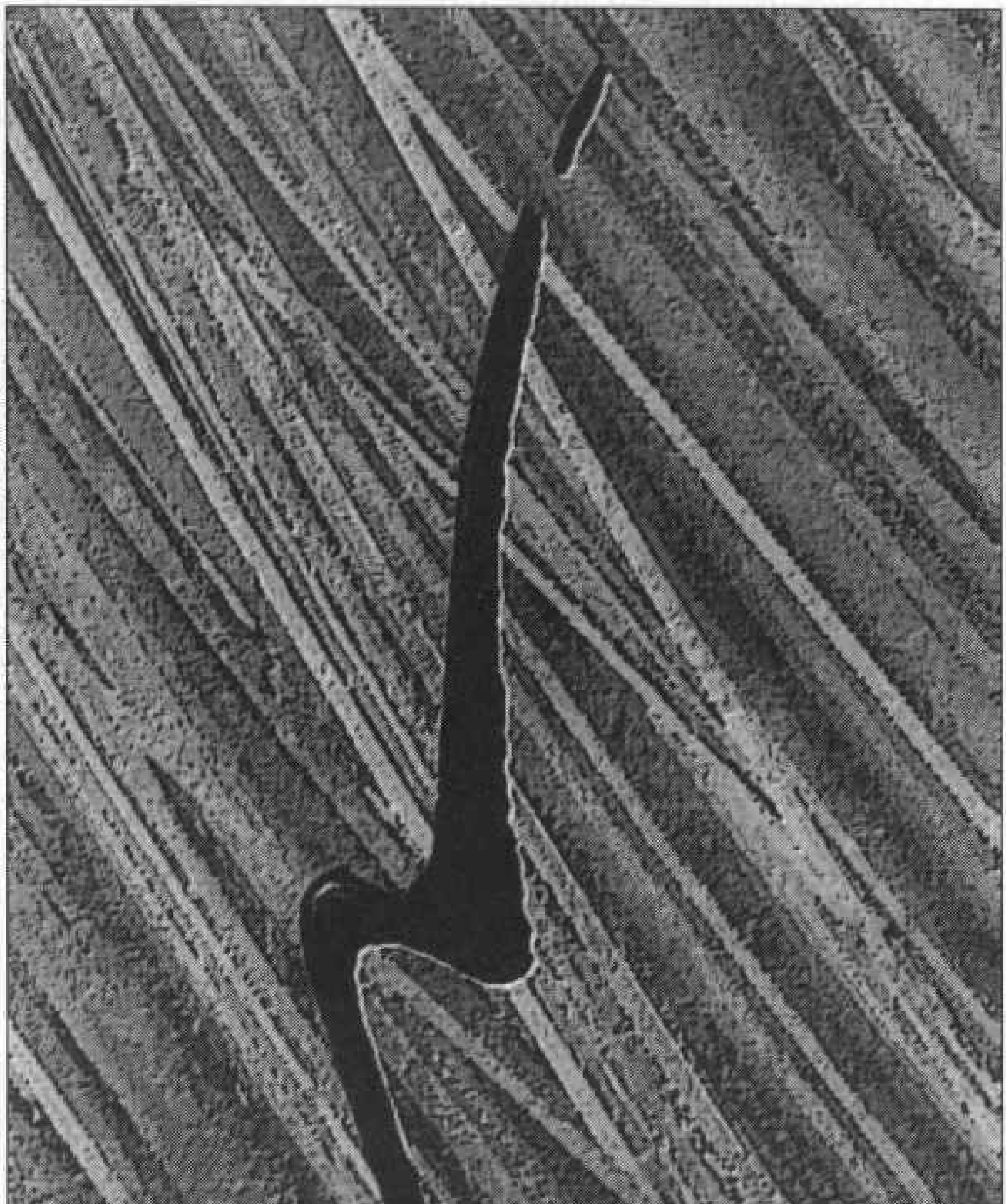
Setting Up



Welcome to the Wave! The synthesizer you've purchased may very well be the most unique electronic musical instrument currently available. And it is most definitely a synthesizer with a capital "S." Utmost consideration went into designing both the synthesis features and the corresponding user-interface, making the Wave not only easy to operate, but very powerful for sound design - even in strenuous situations where a studio clock might be the accountant's best friend.

There are many areas in which the Wave excels; listed below are some of the more significant features of your new acquisition (just in case one of your friends calls right now and asks about it...):

- Dynamic Spectral Wavetable Synthesis
- elaborate hybrid digital/analog synthesis engine
- control over timbre down to a single harmonic
- user-generated Spectral Wavetables
- sample analysis and spectral extraction
- true analog multimode-filter
- extensive modulation capabilities
- dynamic panning and aux-send
- real-time just intonation
- comprehensive master-keyboard functions
- MS-DOS compatible floppy-drive with database-functions
- software-expandable, both for updating the operating system and adding applications
- hardware-expandable via voice boards (up to 48 voices) and two free processor-slots

Each Wave package includes:

- This manual (though if it were missing you wouldn't know you should have it...)
- Floppy-disk I (the system disk, containing the operating system)
- Floppy-disk II (containing sounds, performances and wavetables)
- obviously, your Wave

After unpacking the Wave, please make sure that all of these items have been included in your shipment. If any of them are missing, please contact your dealer or distributor immediately.

You should keep the original box your Wave came in, so that you can transport the instrument safely, or ship it if necessary. If you plan to take the Wave on the road frequently, we strongly suggest that you purchase a sturdy flight-case to protect your investment. Inside the Wave there are a number of delicate electronic components that are much happier when they're carried around all safe and cozy.

Important!

Please fill out the enclosed registration form and send it to your local distributor **right now**! This is the only way you can be certain of receiving the best possible customer support, as well as keeping informed of upcoming news, attractions and software updates. Since the operating system of the Wave is loaded from disk, chances are there will be updates coming along sooner or later. The Wave can also be updated with additional application software and new hardware, so you will no doubt want to be notified as soon as new enhancements become available. This will only be possible if you return your registration form immediately.

About this Manual

This chapter tells you how the Wave manual is organized. It's not essential that you read it, but doing so will definitely help you get up and running more quickly. Thanks.

A Brief Intro to the Intro

No doubt, you've discovered that not only is the Wave rather large in size, but so is the accompanying owner's manual. The reason is not simply that we love to write about this beautiful instrument, rather, we want to give you as much information about the Wave as possible. And while a great deal of the user interface is likely to be clear to you right from the start, we think it will help you to have as much background information as possible, including our thoughts on why certain functions are implemented in certain ways. Additionally, there are functions in the instrument that are likely new territory for many of you, so some in-depth explanations of both the "how" and the "why" seem appropriate.

We have organized this manual in a way that makes sense for those of you who would like to read it from cover-to-cover, though doing so is by no means necessary. Subjects are organized into three major sections:

- **Performing**, which contains general background information and an explanation of the functions you need to know to begin playing the Wave.
- **Sound Design**, which explains everything you need to know about twisting those beautiful knobs - and then some...
- **Wavetable Design**, which gives you all the details on how to create your own Wavetables and Waves - the spectral building blocks that make the sound of the Wave, and for that matter, *your* sound so unique.

These sections are partly built upon each other, so it's a good idea to read them in the order in which we have presented them. You should be especially familiar with the Performing section, which provides basic information on the user interface and disk-drive functions

If, however, you feel like designing Sounds and Wavetables first and foremost, by all means, start with those sections. Once in a while you may have to refer back to topics covered in earlier sections, but our index and your imagination will probably allow you to proceed at a fast pace nonetheless.

We suggest that you begin by reading these chapters, in the following order:

- **Setting up**, which details how cables should be plugged in and, first and foremost, how to boot the Wave safely.
- **Some General Guidelines**, which covers some basic ground
- **Edit Modes**, which covers even more basic ground

Conventions

Throughout this manual, we have used standardized conventions to help clarify the flow of information.

- Most of the text is written in plain English (at least that's what we intended). The best, most detailed explanation of any given function is written in this standard typeface used on this paragraph.

- Any physical input device, such as a button, fader or knob, is indicated by rectangular brackets:

  ⇨ [knob], [fader], [button]

- Any button whose function is determined by the display (in other words, a softkey) and all parameters are indicated by triangular brackets:

  ⇨ <soft button>, <parameter>

- The first time a parameter is explained in detail, it is referenced by a **bold** subhead:

  ⇨ **Parameter name**

- Parameter values are italicized:

  ⇨ *value 1, -64, main*

- Helpful information, hints and potential problems (hopefully coupled with suggested solutions) are printed with a preceding arrow:

  ⇨ That should really help you

- Annual Wave conventions will be held on Walkiki Beach, when technological advancements coast along and the surf's up.

This chapter tells you about the back-panel jacks and how they should be connected. It also describes the procedure for powering-up the Wave.

Making Connections

Life in the world of music would be practically non-existent if it weren't for making the right connections. In that respect, the Wave is no exception. It needs access to some of the good things in life:

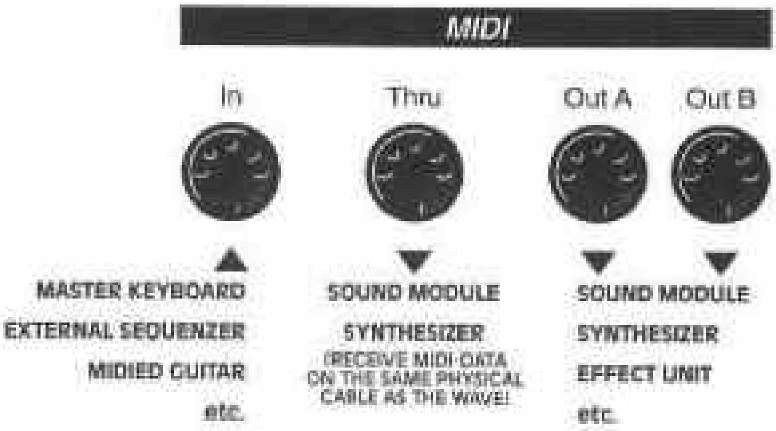
AC-Power

This is the one thing the Wave cannot be without - that is, if you want it to do more than just sit there and look good (actually, not a bad idea). The power connection is made via a detachable three-prong cord. **Important!** Before powering-up for the first time, check the voltage label (located next to the power cord input jack) to make sure the instrument is set for the proper voltage in your area.

Never disconnect the ground pin! This could cause damage to the internal components or even result in dangerous electrical shock if there should ever be a fault in the power supply. If you experience problems with ground hums, use a transformer-balanced direct box in-line between the Wave's audio outputs and your audio mixer.

MIDI

Since the Wave sports a keyboard of its own, you do not have to use MIDI, but it's likely you'll want to integrate the instrument into your MIDI set-up. Before connecting MIDI-cables, we suggest that you turn off all associated equipment to reduce the risk of damage.



MIDI In

Connect this jack to the MIDI out of the device you wish to use to control the Wave. Typical control devices are MIDI master keyboards, digital pianos or MIDIed guitars. If you are using an external sequencer, its MIDI output would be connected to this port.

MIDI Thru

This port echoes the data that arrives at the MIDI in port. The data is output directly, with no processing or time-delay as the result of the CPU workload. Connect sound modules or synthesizers to this port that you want to have receive MIDI-data on the same physical cable as the Wave.

MIDI Out A

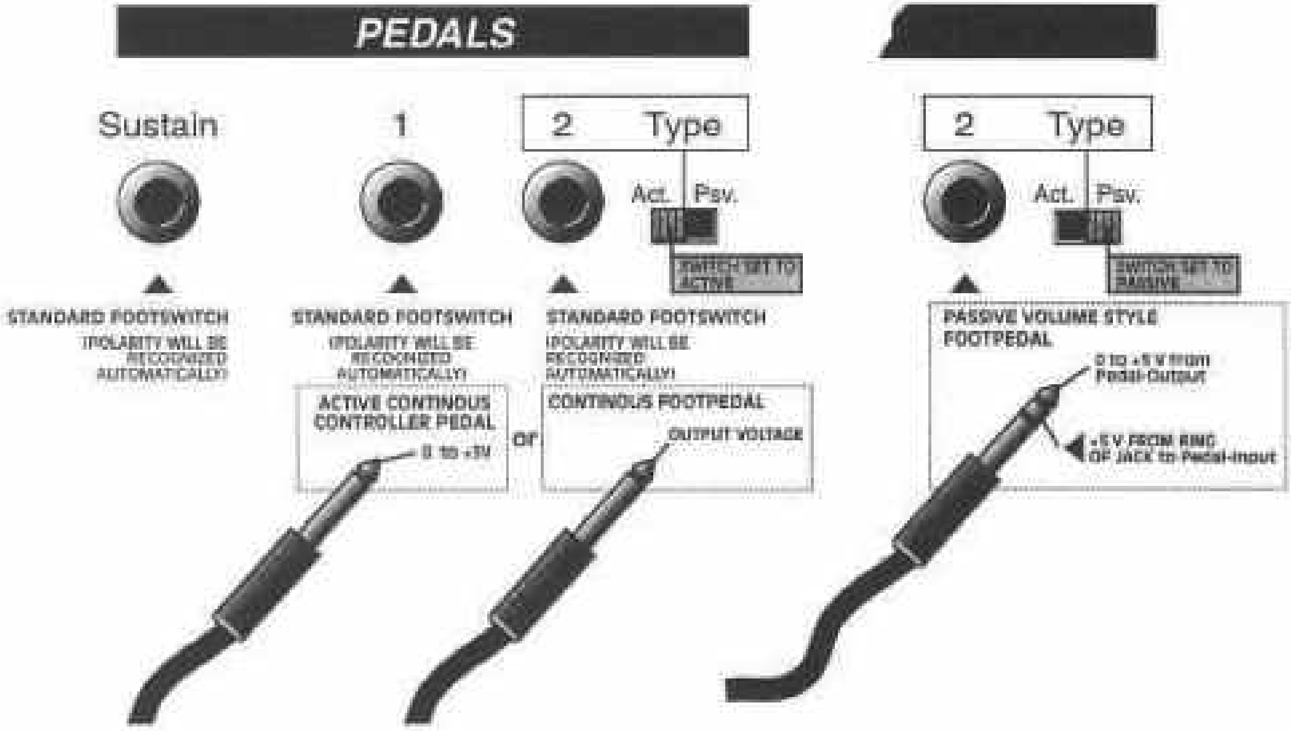
This is one of the Wave's two MIDI outputs. Connect this jack to the MIDI-in of any MIDI equipment (sound module, synthesizer, effect unit, etc.) that you wish to control from the Wave. Typically, you would connect the MIDI-in of your favorite sequencer to this output.

MIDI Out B

Wow! Another one! MIDI output B functions identically to MIDI Out A, but it's totally independent from it. By having two MIDI Outs, you can address 32 (2x16) MIDI channels from the Wave — just one of the features that makes this instrument a very powerful master keyboard. You could use the Wave to address up to 32 different MIDI modules without ever having to change your cabling. Or you could record on two sequencers at the same time (stereo-MIDI!). Or record to a sequencer at the same time you were triggering external MIDI modules.

Control Pedals

The Wave sports a total of three foot-pedal inputs. These can be routed to various parameters within the sound-engine or used to control external MIDI gear.


PEDALS
Sustain
1
2 Type
Act. Psv.
SWITCH SET TO ACTIVE
STANDARD FOOTSWITCH (POLARITY WILL BE RECOGNIZED AUTOMATICALLY)
STANDARD FOOTSWITCH (POLARITY WILL BE RECOGNIZED AUTOMATICALLY)
ACTIVE CONTINOUS CONTROLLER PEDAL
0 to +5V
or
STANDARD FOOTSWITCH (POLARITY WILL BE RECOGNIZED AUTOMATICALLY)
CONTINOUS FOOTPEDAL
OUTPUT VOLTAGE
2 Type
Act. Psv.
SWITCH SET TO PASSIVE
PASSIVE VOLUME STYLE FOOTPEDAL
0 to +5 V from Pedal-Output
+5 V FROM RING OF JACK to Pedal-Input

Sustain

This pedal-input is hard-wired for a sustain switch. Connect a standard footswitch to this input, preferably a piano-like sustain pedal. The switch polarity will be recognized automatically on power-up.

Pedal 1

This jack accepts either an active continuous controller pedal (voltage should range from 0 to +5 Volts to the tip of the jack) or a footswitch. Switch polarity will be recognized automatically on power-up.

The function of pedal 1 is programmable for each performance.

Pedal 2

You may connect either a typical volume-style pedal, an active continuous controller footpedal (0 to +5V at the tip) or a footswitch to this input. When using a footswitch, polarity will be recognized automatically on powering-up.

The function of pedal 2 is programmable for each performance.

Pedal 2 Mode

Set this switch according to the type of foot-pedal connected to the pedal 2 input:

- *Passive*: Connect a standard volume-style foot-pedal to the input. Observe the above wiring diagram to guarantee safe operation

  The *ring* of the pedal 2 jack supplies +5 Volts. This voltage is sent through the pedal, where it is scaled between 0 and 5 Volts. This output is then fed to the *tip* of the pedal 2 jack, where it will be measured and converted into meaningful digital data.

  Never connect anything but a passive, volume-style foot-pedal to this jack when the switch is set to *passive*.
  Otherwise, you could harm either the device connected to the Wave or possibly the Wave itself.

- *Active*: Connect a continuous foot-pedal that supplies its own voltage to the Pedal 2 input when the switch is set to this position. The output voltage of the pedal should be at the tip of its plug. Alternatively, you may connect a standard footswitch in this mode. In this case, footswitch polarity will be automatically determined on power-up.

  In the *active* mode, no voltage will be present at the ring of the Wave's stereo jack.

Audio

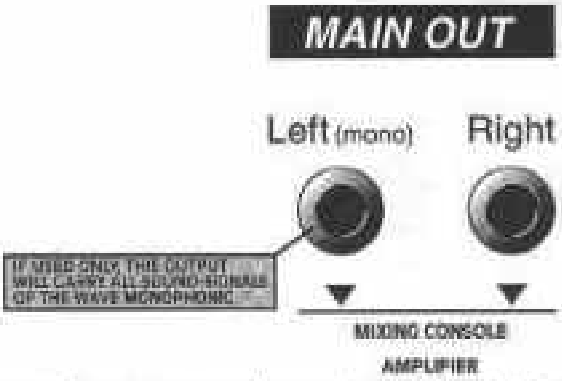
If you want the Wave to be more than just a master keyboard (and yes, you'll want it to be more), you'll undoubtedly want to connect some or all of its audio outputs. When making connections, please turn down the volume of your mixer and/or amp completely to avoid the possibility of damaging your speakers with accidental spikes.

When the Wave is powered-up or down, special circuitry shuts off all audio outputs so that there is limited potential for loud pops and spikes.

Headphones

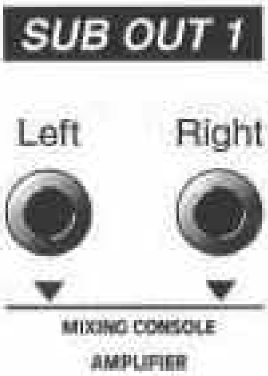
You will find this jack located at the front edge of the Wave, just beneath the mod and pitch wheels. It is stereophonic and carries the same signal as the Main Out.

Main Out


MAIN OUT
Left (mono)
Right
IF USED ONLY, THE OUTPUT WILL CARRY ALL SOUND-SIGNALS OF THE WAVE MONOPHONIC
MIXING CONSOLE
AMPLIFIER

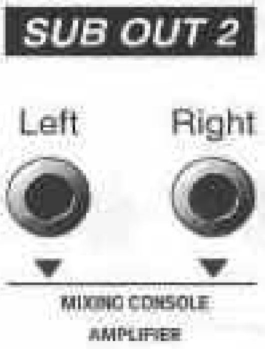
This is the main stereo audio output of the Wave. If you need only a monophonic signal (which would be a shame), use the left output jack only.

Sub 1 Out



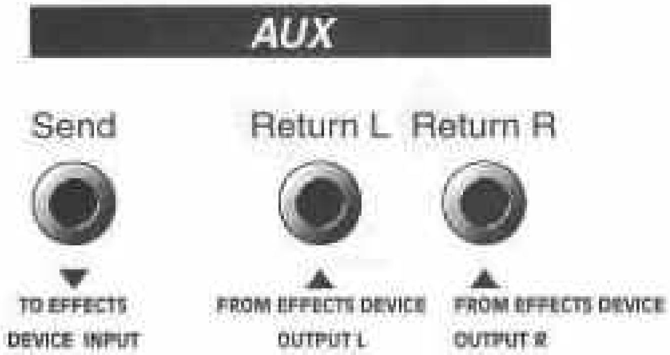
This is an additional stereo output that is totally independent from the Main stereo output. You must change the Performance parameter "Audio Out" to "Sub 1" in order to direct a signal to this output.

Sub 2 Out



Like Sub 1 Out, this is an additional, totally independent stereo output. You must change the Performance parameter "Audio Out" to "Sub 2" in order to direct a signal to this output.

Aux Send Output



This is a secondary output that is independent from the stereo outputs. It carries whatever signal is routed to the Aux-Send from the individual voices. The level of this signal is independent for each instrument (or even each individual voice), and it can be modulated dynamically. Typically, this output would be used in the same way you would use the auxiliary send of a mixing console. For example, the signal from this output could be routed to the input of an external effects device.

Aux-Return Inputs

Use these inputs for the return of the device fed by the Aux-Send. This return signal will be routed to the Main Out and mixed with the signal present there, much the same as an Aux return signal is routed to the main stereo bus on mixing console. The Wave's Aux Send and Aux Returns allow you to route the Wave audio to an effects device completely independently of the effects sends and returns on your mixing console.

Analog In 1...4

ANALOG IN
1
2
3
4
ANY ANALOG AUDIO SIGNAL

These audio inputs are very special. Using them, you can feed any audio signal through the analog processing section of the Wave, *i.e.*, the filter, amplifier, panning and aux modules. This opens up totally new horizons for shaping the sound of your other gear - a track (or four) of your multitrack tape, the sounds of a drum machine or sampler or even other synth sounds. All of these can benefit from the superb sound of our true analog filters and VCAs. See Section 6.13, "Analog In" for all the details.

Loading the Operating System

The Wave can't do anything unless it is given specific instructions. These instructions are contained in the Wave's operating software - OS, for short. To be as flexible as possible, the OS is stored on floppy disk, which makes it easy to provide you with updates and future versions.

The floppy disk that contains the OS is called the *system disk* . Without this disk, the Wave cannot be operated, so keep the disk in a safe place and handle it with care. When you first boot the Wave with the original system disk, your first task should be to make at least one (preferably more) copies of the disk. From then on, only use a copy to boot, and keep the original system disk as a safety backup. See the section below on how to copy it.

The easiest way to boot the Wave is to first insert the system disk into the floppy drive and then turn the Wave on. Alternately, you may turn the Wave on without a floppy in its drive, after which it will ask you to insert the correct system disk. Once it sees the proper disk, it will start the boot-process.

The boot routine takes a little longer this way than if the OS were in ROM, but we are certain that you will appreciate the ease of system updates. However, if you need the boot process to be faster, you may purchase the most current OS in ROM.

Even if your machine has the OS stored in ROM, you still may use a system disk (presumably with a more current OS) to boot. On power-up, the Wave scans the floppy drive even when there is an OS resident in ROM; if it sees a valid system disk, it will use the OS on that disk to boot. It will boot from the disk regardless of the whether OS on the disk is a version that is lower or higher in number than the version in ROM.

Please be aware that the actual loading of the OS is only part of the boot-process. The other part is comprised of test and housekeeping routines. These take the same amount of time to execute regardless of whether the OS was loaded from ROM or disk. These routines insure that the Wave will behave correctly, so please be patient.

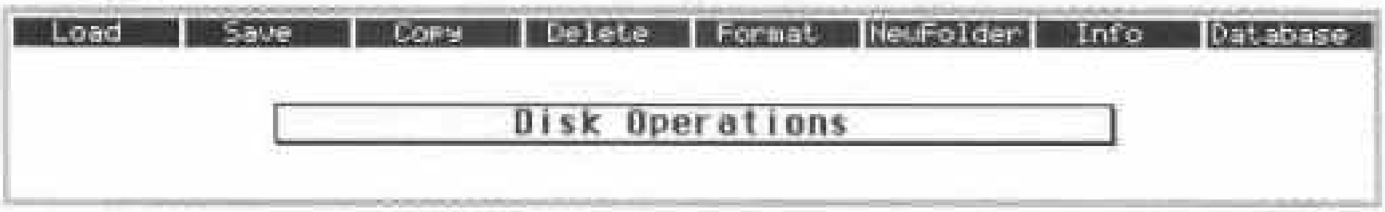
Making a Copy of the System Disk

DO THIS NOW, BEFORE DOING ANYTHING ELSE! It is essential for your own sake and mental well-being that you create a work-copy of the system disk immediately. Should your system disk fail, having a backup will be your only chance of booting and thus using your Wave. So please be smart and make the copy *now*.

A. Format a new DD floppy disk.

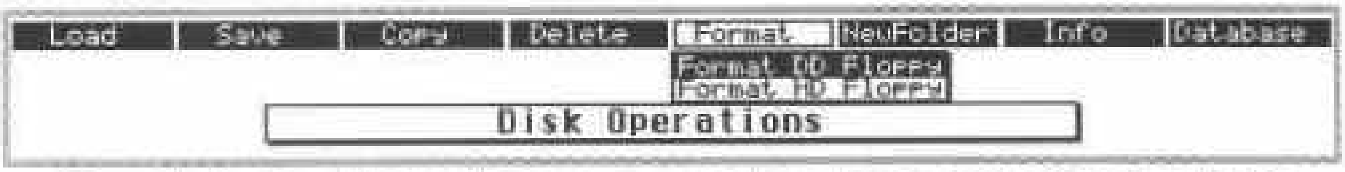
The Wave system disk is a standard double-density disk. In order for the disk copy routine to work, you *must* use a double-density (DD) disk for the copy, not a high-density (HD) floppy. Rather than formatting a disk in the Wave's drive, you may use a double-density, pre-formatted MS-DOS floppy disk instead.

- Make absolutely sure that you have removed the system disk from the disk drive, since otherwise it will be erased - completely and forever!
- Now, insert the *new* disk into the floppy drive. Make sure the write-protection tab of the floppy is covering the hole, thus setting the floppy 's write-protection to "off".



Disk Operations

- Press the [Disk] button, located in the Manager section of the Wave. On the display you will now see the disk-menu.



- Press the button labeled <Format> once. A drop-down menu appears, with the item *Format DD Floppy* selected. Otherwise, repeatedly press the Format button until this item is selected.
- Press the [OK] button below the faders to acknowledge the selection. The formatting process now starts.
- After the format has been completed successfully, the display will ask you to enter a name for the disk. For now, simply press [Cancel], as when copying entire disks, the name of the source disk will automatically be used.

B. Copy the system disk.

- After completing the disk format process, the display should still show the disk menu. If not, press the [Disk] button.
- Press the <Copy> button until the item *Copy Disk* will be selected.
- Press the [OK] button to acknowledge.
- The display now prompts you to insert the source disk. Eject the floppy disk you just formatted and insert the system disk. Make sure that the write-protection tab of the system disk is set to "on" (the hole should be visible).
- Press [OK]. The first part of the system disk will now be read.
- After a while, the display will prompt you to insert the destination disk. Insert the floppy you just have formatted.
- The contents of the system disk will now be copied onto the new disk.
- Repeat steps 4 through 7 until the entire system disk is copied. Usually, the system disk will need to be copied in two steps. However, depending on the amount of available internal memory (which in turn is dependent on what other information currently resides in memory), it might take more steps to copy a DD disk.

Congratulations! You now have a copy of the original system disk. Please store the system disk in a safe place and only use it as a backup. From now on, only boot the Wave only using the copy you have just made.

PERFORMANCE

General Guidelines

waldorf

This chapter gives you some background regarding the philosophy and layout of the Wave. It also explains those aspects of the user-interface that are common for most of the operating system.

Why the Wave?

The Wave has been designed to address the two most important aspects of synthesis - sound quality and user interface - in the best possible manner. A synthesizer that doesn't sound good is not worth investigating any further. A synthesizer that sounds good but has an incomprehensible user interface is likely to be equally unworthy of further investigation.

To achieve the best possible sound, the Wave first and foremost tries to perfect its own synthesis method without trying to be the means to all ends. It derives its specific, unique timbres via a blend of digital and analog technology. Generation of the initial waveforms is done using special digital Oscillators and Wave generators, while the processing of those signals is done in the analog domain, using true analog filters. The result is a sound that has yet to be successfully simulated entirely in the digital domain.

Good sounds are worth only half as much unless they offer the utmost in expressiveness. That's why we included one of the most comprehensive modulation implementations available today. Our goal was to combine a concise, repeatable layout, yet offer enough power to allow for even very far-out modulations.

All this is only of interest, however, if you, the user, can truly access all features in a sensible manner. In today's music production process, this means having a system that unfolds logically as you need to access deeper control. For example, when designing sounds at the Wave, you may start sketching out a rough gesture in Quick-Edit mode, then progress into a common edit mode using the front panel knobs. Less frequently changed parameters can be accessed by pressing an [Edit] button, which brings them immediately onto the display where, thanks to the faders, they can be instantly edited as well.

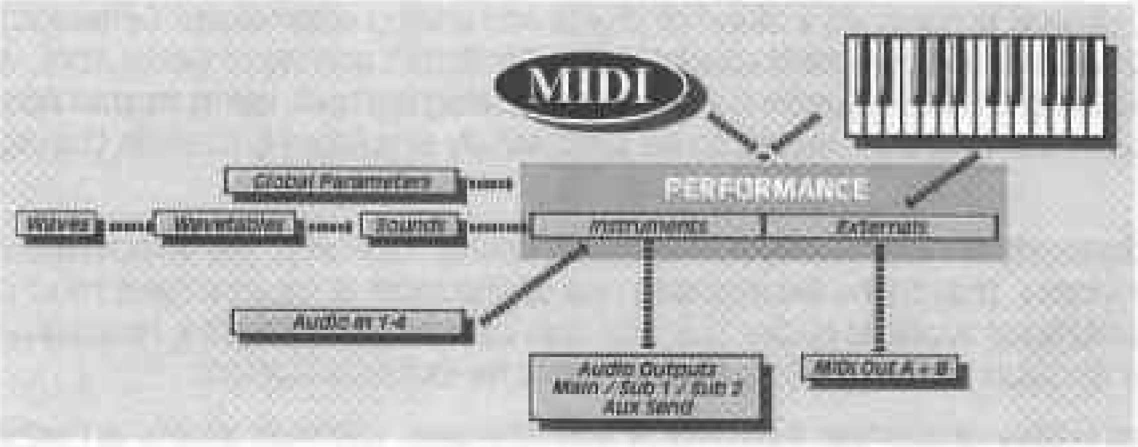
As you see, you will always have the control needed to accomplish your particular task, but without being faced with an overwhelming amount of information that distracts from, rather than supports, your creativity.

The Wave is also meant to function as a master controller for your MIDI system. For that reason, we provided you with a very powerful master keyboard section, complete with lots of zone capabilities and physical controllers, plus the ability to store system-exclusive files on the Wave's floppy drive. A built in sequencer, whose controls might also be used to control your existing MIDI-recorder, further allows the Wave to be the central station of your MIDI setup.

In general, we tried to make everything as easy as possible for you. And part of that is our policy to update the operating system, to introduce new software applications or even to come up with new hardware, all made possible by the various options to expand the Wave. This helps make your investment as future-proof as possible.

The Basic Software Structure

The Wave sports a very concise and defined software structure, which is laid out in a way that's intended to ease the process of understanding the user-interface as well as the entire concept behind the instrument. The following figure to outlines the Wave's basic structure:



On the top level you'll find **Wavetables** and **Global parameters**. Both of these are valid for the entire Wave. Wavetables are the raw material that will be used by Sounds for generating audio, whereas Global parameters govern the behavior of all **Performances** and **Sounds**.

The next level is made up of **Performances**. These comprise the main level for playing the Wave. A total of 256 Performances are stored in internal memory. Each Performance has a group of parameters that covers all aspects of managing the internal **Sounds**, called **Instruments**, as well as a section, called **Externals**, that covers the master keyboard functions.

Each of the eight Instruments in a Performance point to one of the 256 Sounds residing within the Wave. These Sounds make the actual signal you hear at the **Audio Outs** and the **Aux Audio Out**, depending on the setting of those parameters, such as key- and velocity-zones, that are set up in the Instruments. A single Sound may be used by various Instruments in various Performances. If you edit this particular Sound, that change will be reflected in all Instruments in all Performances where that Sound is used.

The eight Externals may each control a different external MIDI device using any of the available physical controllers (which, for instance, might only be the Performance faders to control an effects box, hence the term *External* rather than *key-zones*) to send data to one of the two **MIDI Outs**.

Two possible control sources are currently available: the **MIDI IN** socket and, yes, the Wave's very **Keys** themselves (and associated physical controllers, such as the mod wheels). A Performance's Instruments can receive from any of these sources (separate or in combination), whereas its Externals can only send data from the keyboard.

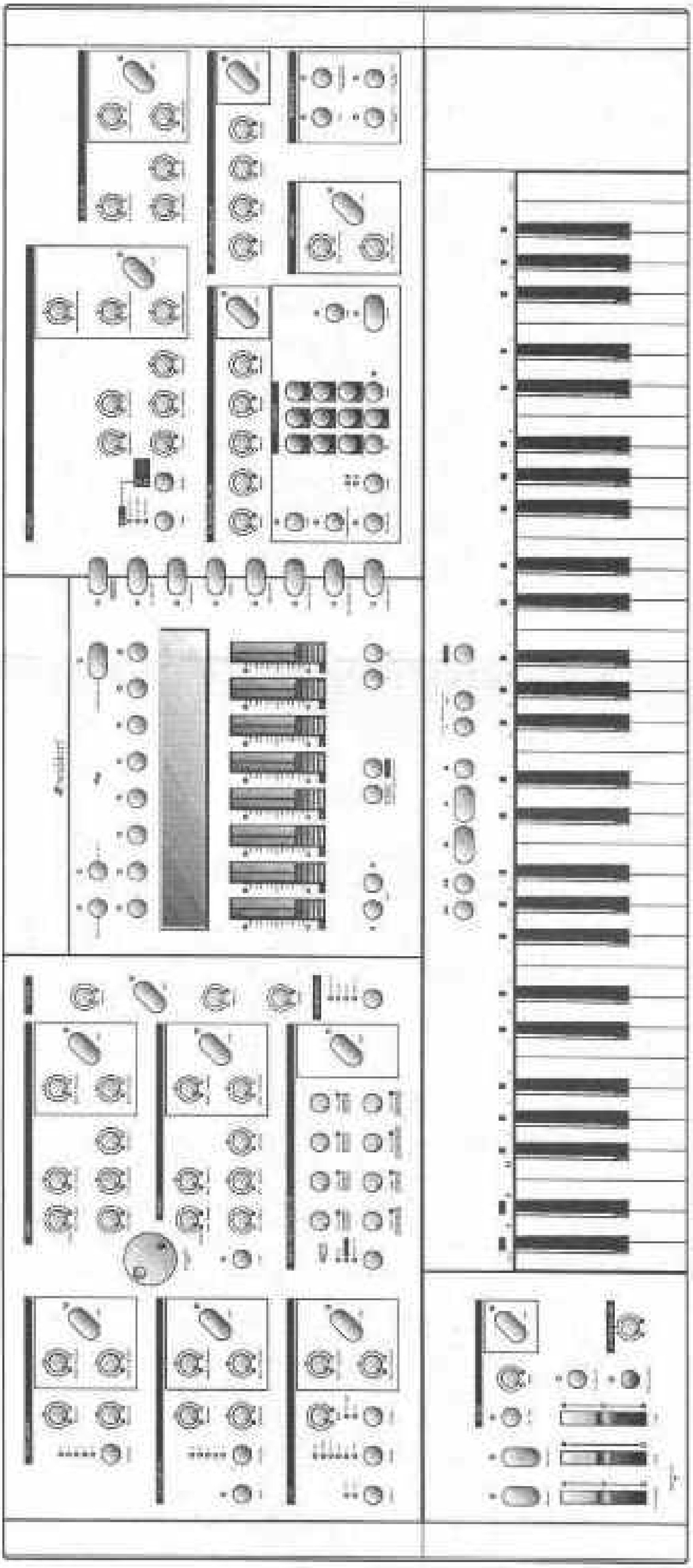
Front Panel Layout

As you have no doubt noticed, the front panel of the Wave is not only quite enormous, but, to make things even more adventurous, it tilts up as well. To lift up the panel, hold it firmly at the top of the display (where it says Waldorf) and lift it up. It takes some force to overcome the shock absorbers, so don't be afraid to use your muscles.

The panel will tilt into its upright position. Only two positions are possible, either lifted up - or not. No intermediate positions are available. The user-interface is designed to be used with the panel in the tilted position, so we recommend that you keep the panel tilted unless you need to transport the unit.

Looking at the front-panel and associated control areas, you can easily distinguish several work-spaces, each covering certain aspects of the Wave. There are six main sections that make up the front panel:

- **Sound Generation**. This section is on the left-hand side of the panel. You will find the Oscillators and Wave-generators here, plus their corresponding envelopes and LFOs.
- **Sound Modification**. This section is located on the right hand side of the panel. Here you will find modules that change the sound of the Oscillators/Wave-generators, their envelopes and the Manager section, which governs general data-management functions. The "Sound Design" chapters of the manual tell you all about the function of theses knobs and those in the Sound Generation section.
- **Display Section**. This is the central workspace of the Wave, encompassing the display and its associated buttons and faders. All Multi-Mode parameters are controlled here, as well as specific applications such as Wave-Edit. Additional parameters of the various sound-modules will be displayed here when an [Edit] button of a module is pressed.
- **Operation-Mode Buttons**. Use these buttons to choose the Mode you want to edit. Read the chapter on *Operation Modes* for more detail.
- **Controller Section**. All physical controllers (wheels, play buttons, etc.) are located here, with the exception of the Performance faders that you find in the display section.
- **Sequencer Transport Buttons**. These are your basic sequencer controls, currently for use with an external MIDI recorder. The [Shift] key also provides access to various other functions.



The physical layout of the front panel is designed in such a way as to clarify the signal-flow of the Wave and, at the same time, offer the quickest access to all functions. Therefore the display section, for example, is located in the middle of the panel, so that you can use either hand to easily reach the controls. The same holds true for the sequencer transport buttons.

You can think of a sound as being generated from left to right, with the signals passing through individual modules in order to define and shape the sound. The display section is where housekeeping chores, such as defining multitimbral setups, are performed.

Operation Modes

The row of blue buttons to the right of the display allows you to select the Wave's various operation modes. These modes, while each dealing with a different, specific aspect of the Wave, all run concurrently in a multitasking fashion (except for Wave Edit). Therefore, you need not intermittently confirm or store any aspect of your work when switching between them. Think of these modes as windows of the same application that allow you to access certain groups of parameters at one time.

Performance

This is the default mode when you power up. It is mainly meant for playing the Wave. You have access to all Sound parameters and to the Performance parameters (via the page buttons).

You may also Mute or Solo Instruments, Externals or the modulations of Sound-modules of active Sounds.

Instrument Edit

This Mode gives you access to all Instrument parameters of the Wave. As in Performance mode, you have access to all Sound Parameters and can mute or solo Instruments and Sound-module modulations.

External Edit

Use this mode to edit all parameters of the Externals of a Performance. You also can edit all parameters of the currently edit-enabled Sounds, but you cannot change the edit selection.

You also may mute or solo Instruments and Sound-module modulations.

Wave Edit

This mode allows for the editing of Waves and Wavetables, the heart of the sound-generation modules. Wave Edit is different from the other modes in that it is not capable of multitasking. The entire processing power of the Wave goes directly to the complex calculations needed to create and manipulate Waves and Wavetables, so you only have access to one Instrument and limited MIDI capabilities.

Wave Edit is primarily meant to be used like a specific application and not as a real-time sound shaping tool.

Option

Anything might happen under the heading of this mode. Anything. But it will happen in the future.

Sequencer

You will be able to control all of the various sequencer parameters in this mode. The transport controls, however, are active all the time, regardless of the mode you are in (except, as mentioned earlier, for Wave Edit mode).

Global Edit

This mode offers you access to all parameters that are valid for the Wave as a whole, rather than for individual Performances or Sounds.

You can also edit all parameters of the currently edit-enabled Sounds, but you cannot change the edit selection. You also may mute or solo Instruments and sound-module modulations.

Quick Edit

This mode allows access to the Quick Edit functions for Sound Edit. These functions either control several parameters of a Sound at the same time for fast access or allow you to copy macro functions for envelopes and modulation routings into the selected Sound.

You also have access to all Sound Parameters and can mute or solo Instruments and Sound-module modulations.

Interaction of Operation Modes

You may change among any of the modes while playing without interrupting the creative flow, or, for that matter, any MIDI reception or keyboard activity. Also, in all of these modes the sound edit knobs will be active on the selected Instruments, even if the display buttons do something other than select Instruments.

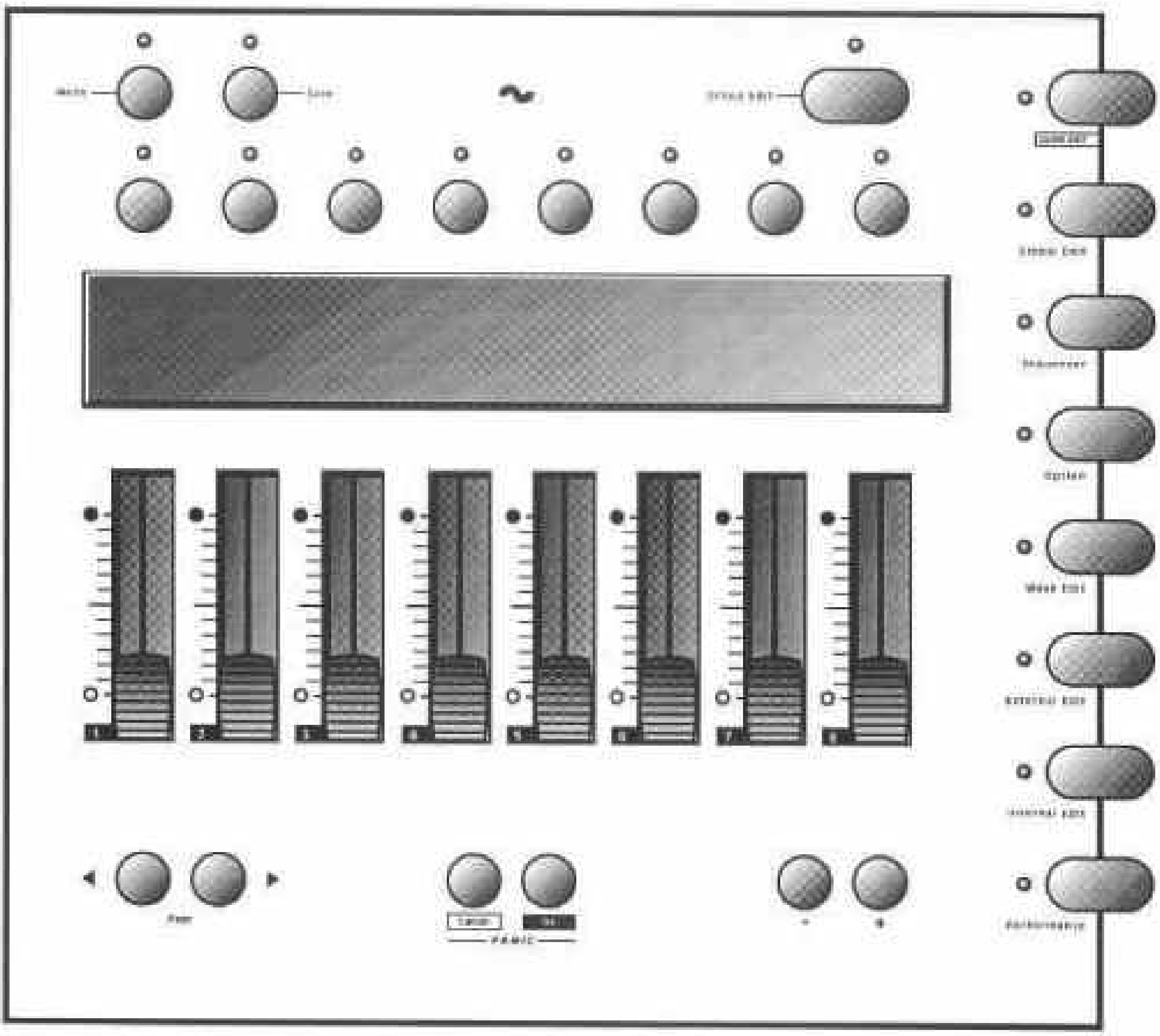
The big exception to the rule is *Wave Edit.* While you won't lose any data when switching into the Wave Edit mode, the Wave will behave differently than in the other modes, with specific initialization routines and functions that set up the best possible working environment for Wave Edit. This, plus the fact that the number crunching power needed for Wave Edit easily uses up all the available computing power, makes it impossible to offer the standard environment at the same time.

Simply think of Wave Edit as an application program that offers specific features, but cannot be used in a multitasking environment.

In the future you may be able to run specific application programs under the Option mode. The nature of this mode will then be determined solely by the application to run.

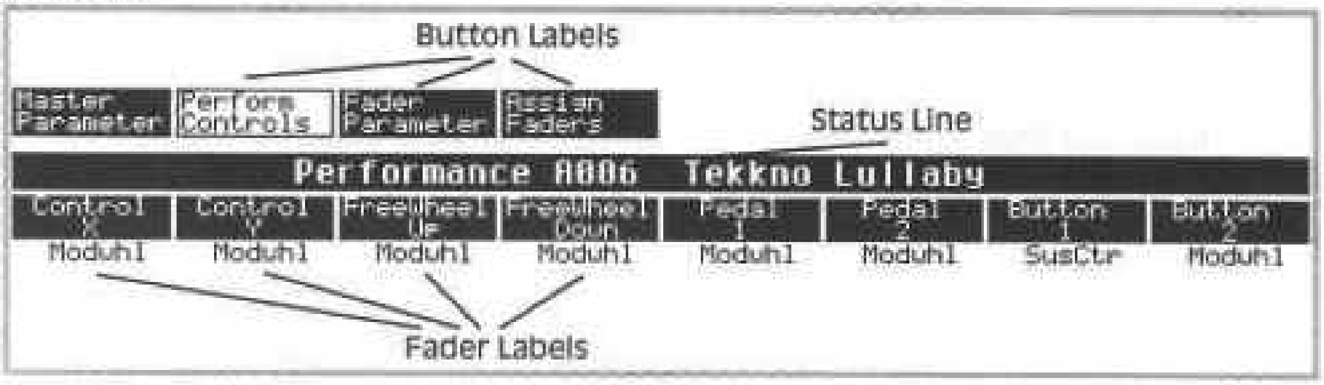
The Display Section

This section of the front panel could be regarded as the central nervous system of the Wave. All information is shown here and Performances - and all their respective parameters - are governed from here. The display buttons and faders are true multi-purpose programming elements and allow this section to accommodate functions that would be impossible to perform with the dedicated knobs and buttons.



Display

The central part of the display section is, as you might have guessed, the display, with its corresponding eight display faders and buttons. The functions of these are software controlled, with the display labeling them according to their respective function.



A standard display usually is composed of three different components:

- **Status Line**. This line is the "headline" of the current active display-page, so to say. It tells you the mode or page you are in within the currently selected mode. Depending on the mode and page, it may give you additional information, such as the name, program bank and number of a Performance in Performance mode.
- **Button Labels**. These labels define the function of the display buttons. In the Performance, Instrument Edit and External Edit Modes they give you information on the available Instruments or Externals of the current Performance.
- **Fader Labels**. These labels define the functions of the display faders and show the current value of a specific function or parameter.

There are, however, other display types to be found in the Wave. As a rule, however, a display-page will always label its faders. Some display pages do not make use of the display buttons. This is especially true in the Edit pages of the various Sound-modules. In that case the display buttons will act as Instrument Select buttons, as in the Performance or Instrument Edit modes.

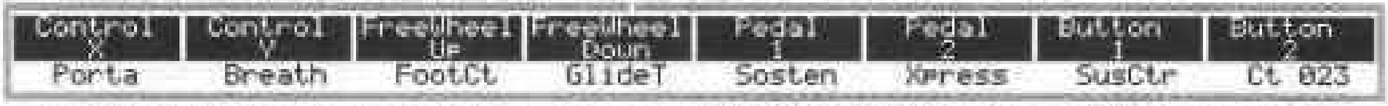
Display Buttons

The buttons main use is to select Instruments or Externals of a Performance for editing (both for Sound- and Performance-parameters). However, depending on the selected function and display page, they will offer different selections. For example, they allow you to select menu items in the disk page, groups of parameters in Global Edit or whatever other functions are required at a given time.

Faders

The faders have different tasks in the various modes:

- in **Performance Mode** they act as assignable MIDI controllers to control parameters of External MIDI equipment or the Wave's own Instruments
- in **Instrument Edit Mode** they usually control the Performance's Instrument parameters
- in **External Edit Mode** they usually control the Performance's External parameters
- when a Sound-module's **[Edit]** button is pressed, they control additional Sound parameters that do not have dedicated controls
- in **Global Edit Mode**, **Wave Edit Mode** and **Sequencer Edit Mode** they control the parameters of the various modes.



Control X	Control Y	FreeWheel Up	FreeWheel Down	Pedal 1	Pedal 2	Button 1	Button 2
Porta	Breath	FootCt	GlideT	Sosten	Xpress	SusCtr	Ct 023

Whenever you call up a new page, each parameter will be assigned to a specific fader. The name of that parameter will be shown as the *parameter name*, while the value of that parameter will be displayed *under* the parameter name.

In order to edit the respective parameter, you need only move the fader. There is no secret select button to press or magical command to whisper. That's the beauty of the display faders: When the parameter you need is shown on the display, just move the respective fader, the same as you would turn a knob on the panel.

This layout combines the best of both worlds: Any parameter on a given display page can be edited instantly, but you view the parameters in sensible groups, and only the information you currently need is shown, thus eliminating screen clutter.

The faders' exact functions are explained in their corresponding manual sections.

Page Buttons

Often a given mode or function allows for the control of many individual parameters. A single display page, however, will usually allow access to only eight parameters at a time. In such cases we have simply provided more than one display-page for the respective function.

To access the other pages of a mode or function you simply have to press one of the [Page] buttons at the lower left of the display section.

➪ Pages will cycle continuously in either direction, so you do not have to step back through all previous pages to get from the last one to the first.

➪ Pressing both [Page] buttons simultaneously will instantly call up the default page (usually the first) of a mode or function.

In some functions the [Page] buttons' use is not quite as obvious, yet it's consistent with the standard usage, e.g.:

➪ In the modifier module Control Shaper the [Page] buttons will select between the negative and positive quadrants of the shape (see Sound Design, chapter 3.37, Control Shaper, for details).

➪ In Harmonic Edit of the Wave Edit mode the [Page] buttons will select the group of harmonics to be edited with the faders (see Wavetable Design, chapter 3.14, Wavetable Harmonic Edit, for details).

Cancel/OK

Whenever there is a function that asks for verification, use this pair of buttons to either acknowledge or cancel. A typical example would be the formatting of a floppy disk: After you have chosen to format a disk, a dialog box appears on the display, asking you to verify your selection.

Pressing the [OK] button verifies your request and will start the formatting process, whereas pressing the [Cancel] button will abort the function.

➪ Whenever the Wave expects you to press either of these two buttons, the LED above the respective button will flash.

➪ In a mode or function that uses drop down menus (such as the disk page), [Cancel] will always close the currently selected menu without selecting an item.

➪ When a function tops an additional page onto the currently active one (such as the [Edit] buttons of the sound modules do), pressing [Cancel] will always remove that page and bring you back to the previously active one.

-/+ (Decrement/Increment) Buttons

These buttons afford you very precise control over any parameter of the Wave. They act on the last parameter you have modified or worked on. Therefore, the parameter you can edit with the [-/+] buttons is determined by whatever knob, fader or dial you last touched or used. In real life, simply work as you normally would using knobs, dials and faders to do what you have to do. When you need program a specific value for a given parameter, use the dedicated controller to get approximately the value you want and then fine tune using the [-/+] buttons.

➪ In Instrument and External Edit, the [-/+] buttons will also scroll through Sounds of the main edit-active Instrument when your last action was calling up a Sound via the keypad.

» **The one exception:**

In Performance mode, the [-/+] buttons will *always* cycle through the Performances. This makes it easy to step through the Performances with only a single button stroke while you are playing.

Mute/Solo Buttons

These buttons at the left top corner of the display section serve one and only one purpose: to either mute or solo those items that are capable of responding to these commands. Chapter 4.1, Mute and Solo, specifically deals with this beautiful asset of the Wave.

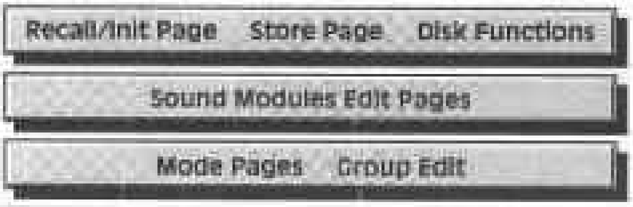
Group Edit Button

By pressing this button, you can switch between the regular edit and Group Edit modes. The status LED indicates if you are in Group Edit mode. Group Edit is a different Edit view from the standard edit modes, yet it offers the same set of parameters as the standard mode does. See chapter 3.4, Group Edit, for details.

Display Hierarchies

As explained earlier, the Wave performs most of its functions in a multitasking environment, so you don't have to stop your creative flow when programming. Physical reality, however, dictates that you only have access to so much information and parameters at one time. Therefore you will frequently need to switch between various functions and call up different display pages. To make this process as smooth as possible, we have implemented certain display hierarchies to streamline the general usage.

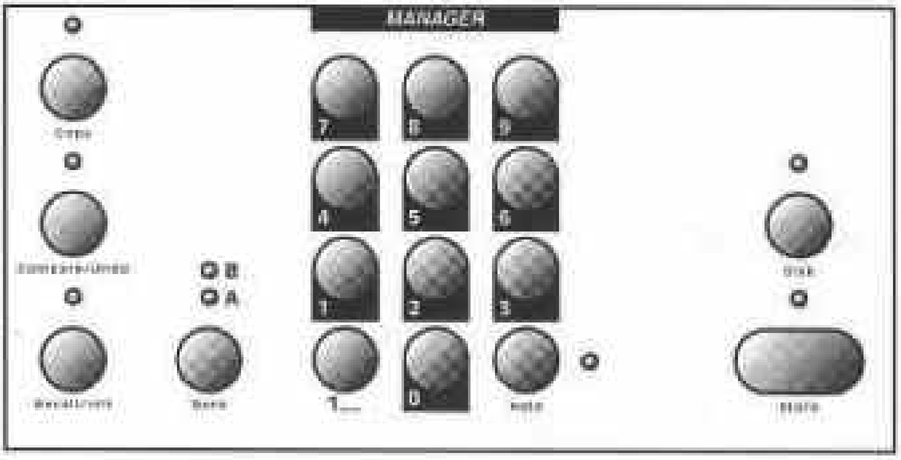
Whenever you call up a different mode, you will automatically switch into the respective group of displays that belong to that mode - just as you would expect. However, to make life easier, certain other pages will be overlaid on the currently selected page, allowing you access to the necessary parameters. The following figure depicts this hierarchy:



Any Sound Module Edit page will be overlaid on any currently selected mode page, while a Recall/Init, Store or Disk page will be overlaid on either of these page-categories. Within each category, pages will not be overlaid, but rather will replace each other.

A page that is overlaid on another page can be easily closed by pushing the [Cancel] button. The original page will be visible again.

The Manager Section



In the Manager section you will find most everything that deals with managing Performances and Sounds, as well as some additional functions. It is very closely related to the display section.

Keypad

The keypad is mainly used to enter a program change. The mode you are in determines the actual result:

- In **Performance** mode, the keypad selects Performances
- In **Instrument Edit** mode, the keypad selects Sounds for the main edit-active instrument
- In **External Edit** mode, the keypad sends MIDI program change commands through the edit-active External
- In **Sequencer** mode, the keypad has additional functions accessed by using the [Shift] or a transport button in conjunction with the keypad.

Bank Button

The [Bank] button is the logical extension to the keypad. It selects one of the two internal Performance- or Sound-banks, depending on the current mode.

Copy Button

Whenever you need to copy something within the internal memory of the Wave, this button will allow you to accomplish the task. Currently you can copy the following items:

- a **Sound Module** from a source Sound to the current Sound
- an **Instrument** from a source Performance to the current Performance
- an **External** from a source Performance to the current Performance

You can also copy disk files or entire disks in the disk menu.

Compare/Undo Button

This button allows you to either compare Performances or Sounds or, depending on the mode, to undo the last action you performed. Undo is very useful when you do not want your edits to permanently alter the data. More info is available in Wavetable Design, chapter 1.12, "About the Undo function".

Recall/Init Button

This button gives you access to the Wave's recall function and most of the initialization functions. See Chapter 9.9, "Recalling Items", 9.12, "Initializing Items", for details of both of these functions.

Disk Button

As you already know from making a backup-copy of your system disk (you *did* make one, didn't you?), this button provides access to all the disk-functions. Chapter 10, "Disk Functions", gives you further information.

Store Button

This button allows you to store something in the Wave's internal memory or to send data (such as system-exclusive data) via MIDI. Chapter 9.2, "Storing Items", tells you exactly what it is you can store and how to do it (and you already know why, we reckon).

Permanent Multi-Mode

Most of the synthesizers or samplers you know have two dedicated modes, one for playing a single sound and another for using the unit multitimbrally. While you may be used to working in these modes, they do force you to switch between them in order to access particular operations. Frequently that means stopping the creative process just to layer one sound on another. Plus, there's the difficulty of having to cope with two slightly - or even not so slightly - different user interface designs, according to the mode you are working in.

At Waldorf, we thought things should be easier on you, so we adopted a permanent multi-mode scheme. The Wave *always* offers you eight Instruments in every Performance, even if you only need one Sound at a time. Think about it: How often have you wished to simply create a split keyboard or layer another sound with the currently selected sound? With the Wave, all you have to do is select another Instrument. You can even do it live, since there is no need to switch modes or access another set of parameters.

And because the Wave was designed from the start with permanent multi-mode in mind, a lot of functions are provided to give you the best possible solutions to all editing problems. You can edit various Sounds simultaneously, adjust a single parameter for all Instruments concurrently or just work on one parameter of one Sound - just as you please.

What is an Arrangement?

Due to the fact that the Wave is always operating in multi-mode, you always deal with more than one type of data. Different data types define different sections of the Wave's operation. There are data types for Sounds, for Wavetables, for Velocity Curves and so on.

A Performance is itself only one type of data type. When you select a Performance, it will automatically select for you various other data types – Sounds, Wavetables used by the Sounds, Tuning Tables and Velocity Curves - since all these items are needed to correctly play the corresponding Performance.

We call this conglomeration of the various data types an *Arrangement*. Arrangements in themselves are not a type of data. Rather, they represent all the data types needed to correctly interpret the selected Performance. An Arrangement therefore might consist of the following data types:

- the **Performance** itself
- the **Sounds** that are used by the Performance
- the **Wavetables** used by the Sounds
- the **Tuning Tables** used by the Instruments of the Performance
- the **Velocity Curves** used by the Instruments or Externals of the Performance

So when we talk about an Arrangement, we mean exactly the above scenario. Of course, if an Arrangement does not need certain data types, these won't be part of that particular Arrangement. Therefore the actual contents and size of an Arrangement will vary from Performance to Performance.

About Edit-Buffers, Storing and Loading

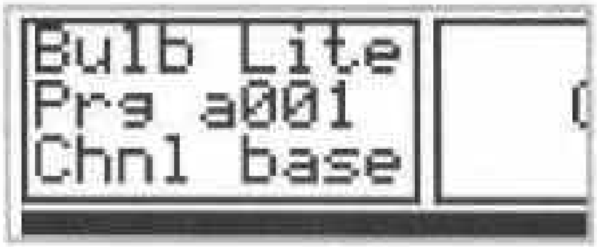
The concept behind the Wave's internal memory is quite different from most other synthesizers. You should be familiar with the various edit buffers and how they work in order to understand memory management as well as to know what you have to do when.

Memory status

Each Performance or Sound of the Wave has a memory status attached to it. This status tells you whether you listen to an original, edited or swapped (compared) version of a Sound or Performance.

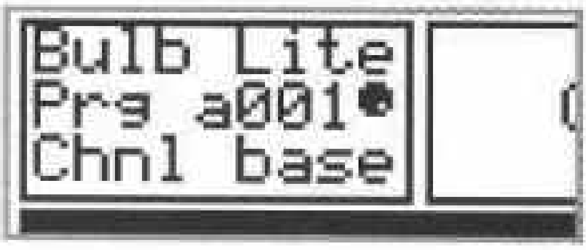
The memory status is always displayed behind the program change number of a Performance or Sound.

The Wave uses the following memory status displays:



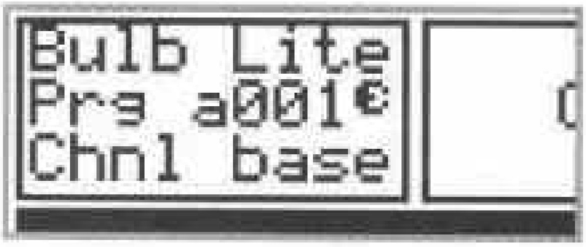
```
Bulb Lite
Prg a001
Chnl base
```

- If there is no special icon visible, you are listening to the original, stored version of a Performance or Sound.



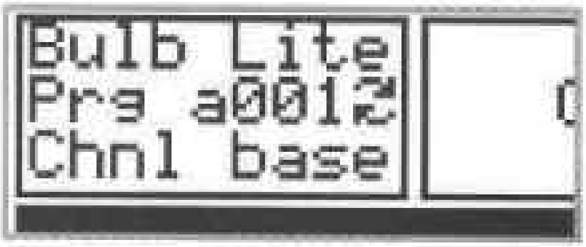
```
Bulb Lite
Prg a001●
Chnl base
```

- This icon tells you that you are listening to an edited version, which is currently residing in the regular edit buffer. This icon could appear both for Performances and Sounds.



```
Bulb Lite
Prg a001€
Chnl base
```

- This icon shows that you are listening to an edited Sound in the Instrument Sound edit buffer. This is a special edit buffer only available for Sounds. You'll find details under the respective topic below.



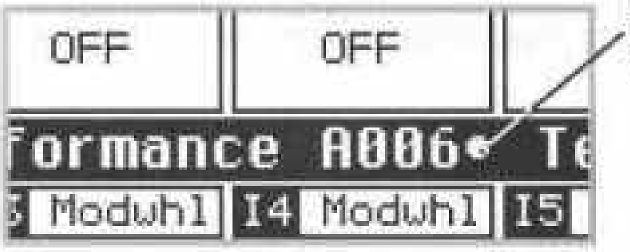
```
Bulb Lite
Prg a001⇄
Chnl base
```

- This icon indicates that you have engaged the compare function and that you are listening to the original version from which your edits are derived.

Performance Edit Buffer

As soon as you change a Performance parameter, the current Performance will be copied into the Performance edit buffer. This allows you to edit to your heart's content, yet change your mind should you prefer the original Performance.

The following icon, called the edit flag, shows up as the memory status behind the Performance's program number when it resides in an edit buffer:



Performance Edit Flag

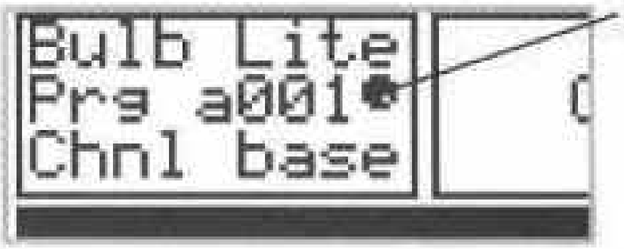
From the edit buffer's point of view, a Performance is only the actual Performance, not a Sound or other data type in an Arrangement.

If you exit Instrument Edit or External Edit, the Performance still will be in its edited stage (unless you have saved it). You may select any other Performance without losing these edits - until you enter Instrument Edit or External Edit from another Performance. Then the newly-selected Performance will be copied to the edit buffer, and the previous edits will be erased. There is only one Performance edit buffer available in the Wave.

Sound Edit Buffers

When you edit a Sound, it too will be copied into an edit buffer as soon as you *change* the first parameter. Again, this allows you to edit a Sound without losing the original version.

The regular edit flag shows up as the memory status behind the program number of a Sound when it resides in a Sound edit buffer:



Sound Edit Flag

Unlike Performances, each Sound of the Wave has its own edit buffer. This means that you can edit every single Sound of the Wave without ever losing an unsaved edit or an original version - a luxury you'll soon learn you can't live without.

Instrument Sound Edit Buffers

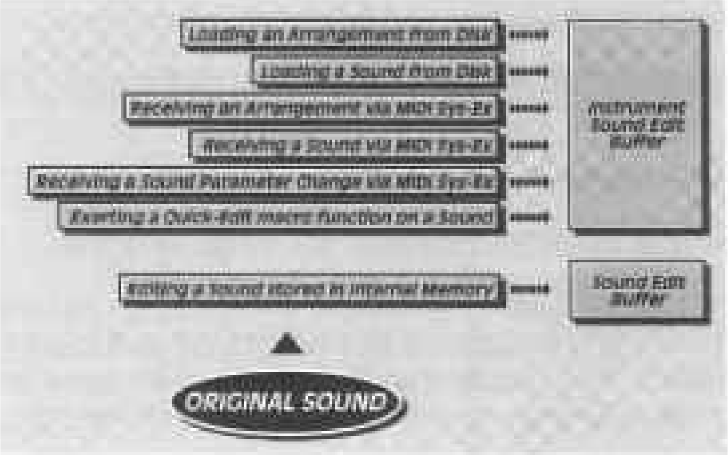
On top of the individual Sound edit buffers, there are a total of eight additional Instrument Sound edit buffers. These buffers are used under the following circumstances:

- Loading an Arrangement from disk
- Loading a Sound from disk
- Receiving an Arrangement via MIDI sys-ex data
- Receiving a Sound via MIDI sys-ex data
- Executing a Quick-Edit macro function on a Sound.

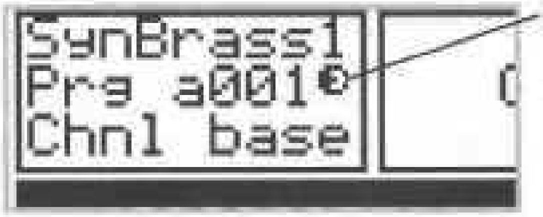
What are these buffers good for? Imagine you are happily editing the Sounds in your Arrangement. You suddenly have the feeling there is an even better Sound in your Sound library on disk. You load it, after which you determine it's really not so great after all.

Under normal circumstances, your previously *edited* Sound would be erased and replaced by the Sound from disk (the original will remain untouched in any case); the same would be true for MIDI dumps. That would render the entire process of having individual edit buffers per Sound pretty useless, since you have a great chance of losing your edits when auditioning Sounds. Thanks to the Instrument Sound edit buffers, life will have meaning even on these occasions.

Look at the figure below to better understand the interaction of the two kinds of Sound edit buffers:


Loading an Arrangement from Disk
Loading a Sound from Disk
Receiving an Arrangement via MIDI Sys-Ex
Receiving a Sound via MIDI Sys-Ex
Receiving a Sound Parameter change via MIDI Sys-Ex
Exerting a Quick-Edit macro function on a Sound
Instrument Sound Edit Buffer
Editing a Sound stored in internal Memory
Sound Edit Buffer
ORIGINAL SOUND

The Instrument Sound-edit-buffer-edit-flag (a phrase to be adored and soon forgotten...) shows up as the Sound's memory status behind the program number when it resides in the respective edit buffer:



```
SynBrass1
Prg a001ⓔ
Chnl base
```

First and foremost this flag tells you that the Sound you're hearing is not the original version. There might be both another edited version and the original version hidden under it.

If you recall this edit, you might actually recall the Sound edit buffer first (to access your first edits). To recall the original, you would have to recall that Sound once more. *Recall all edits*, however, would flush both edit buffers immediately.

If you Compare a Sound in the Instrument Sound edit buffer, you actually will compare it to the version residing in the regular Sound edit buffer, should there be one (which you also would recall), not the original.

When You Select a Performance

When you select a Performance *after* you have edited one, you should determine whether or not you want to keep the edits. If you do, *save*! Otherwise you may accidentally edit another Performance and lose your previous edits.

When you select a Performance to just play it, you might want to check for the following things:

- Check if the **Performance** is an edited one.
- Check if the **Sounds** in the Performance are edited versions.

In either case, the Performance might sound different from what you would expect it to sound like. To hear the Arrangement as it was stored, you must either swap it with the original version using the Compare function (if you don't know which version to keep) or recall the original Arrangement (if you want to flush the edits).

To make life easier when you play (and not do sound design), it is a good idea to first store all the edits you want to keep (or use the *Store all edits* function if you want to keep them all) and then use the *Recall all edits* function to flush all the edits you want to abandon. This will result in the memory containing exactly the Performances and Sounds you intend to play.

See chapter 9.10, Recall all Edits, for details.

When You Select a Sound

When you select a Sound in an instrument of a Performance, you should look for either of the edit flags (Sound edit buffer or instrument Sound edit buffer). If there is an edit flag set, the Sound you hear will most likely be different from the Sound stored in memory.

Use the Compare function to swap the edited version with the original to check if *that* is the Sound you would want, or recall the Sound if you know you want the original. As explained before, the *Recall all edits* function clears all edit buffers, should you want to make sure you only hear the original versions.

When You Store to Disk

When you store a Sound to disk, whatever you hear is what you actually will store, regardless of the edit status. So please make sure that what you store is what you want to hear when the sound is reloaded.

When you store a Performance to disk, you store only the Performance data - nothing else. If you intend to save Sounds, Wavetables, Tuning Tables and Velocity Curves as well (should any be used), you must store the *Arrangement*, not the Performance. The Arrangement will be saved with all edited data types.

When You Load from Disk

When loading a single Sound or Performance from Disk, it will be loaded into an edit buffer (Sounds will be loaded into the Instrument Sound edit buffers). If you load another Sound or Performance from disk, the previously loaded ones will be overwritten. If you intend to keep them, you have to store them to the internal memory.

If you load an Arrangement from disk, the Wave will ask you whether it should also upload any Wavetables, Tuning Tables and Velocity Curves (only if any have been saved with that Arrangement). Since this data would overwrite whatever is currently residing in that particular memory-slot in the Wave's RAM, you must verify the load by pressing [OK] or abandon it using [Cancel]; in the latter case, only the Performance and Sounds will be loaded - probably resulting in a Performance that sounds different from what you would expect.

If you load an entire Soundbank file or Performancebank file from disk, it will immediately be transferred into internal memory. All edit buffers will be flushed along the way, so be careful.

When you Power Down & Up

The simple act of switching off the Wave will have no effect on the internal memory. All edit buffers will remain untouched, thanks to their battery-backup circuitry. When you power up the next time, all Sounds will be there as you left them - edited, in all their twisted glory, maybe a bit haunting or wearing too much make-up, if the night before was too long and sweet surprises too far in between.

The Wave remembers your last moves, so don't be afraid of the next blackout, as they will still all be there. Providing, of course that you took good care of your one and only back-up battery.

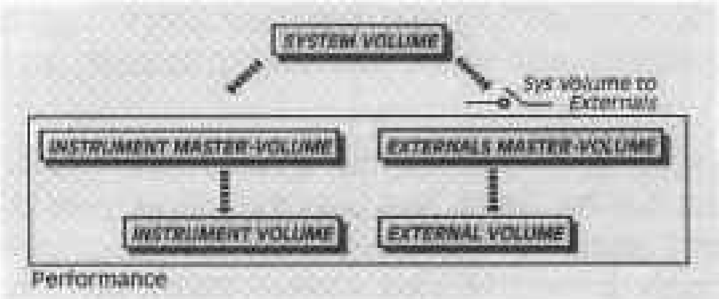
Should you feel intimidated by both this writing and the ever-lasting edit buffers, fear no more: There are solutions. First, you'll never have to read these words of memory-wisdom again. That's good. And second, to discard all edits of the previous session that still reside in memory, simply use the *Recall all edits* function (chapter 9.10 tells you how).

Maybe they should have had this functions for word processors back when these lines were imprinted onto innocent computer-screens.

About Volume

Even though Volume seems to be a pretty straightforward function, the Wave has quite a few places where you can adjust it, and even a few tricks for external MIDI gear up its sleeves.

There exists a clear hierarchy in the various volume stages you will find in the Wave:



All these volume parameters have to be open at least somewhat in order for sound to be output.

System Volume

This is the total master volume of the entire Wave and, if so programmed, of all connected external MIDI gear (provided the gear can respond to MIDI controller 7). All other Volume parameters will be scaled by this parameter.

If the parameter **System Volume to Externals** in Global Edit is set to *on*, the External Master Volume parameter (and thus all connected MIDI devices) will be scaled by the System Volume knob as well. System Volume only attenuates, so that the maximum loudness of a Performance is determined by the master volume settings of that Performance.

Use System Volume for a fast correction on stage, or when your neighbors come to see where all that noise is coming from. Normally, you would leave it as wide open as possible to get the best possible signal-to-noise ratio.

Performance Volumes

As you can tell from the chart above, there are actually two master volume parameters for each Performance: one that controls the Instruments, and another that acts on the Externals. Both of these master volume parameters will scale the volume set at the actual Instrument or External. Therefore, a single Instrument can never become louder than the volume programmed here.

Use the Performance master volumes to adjust for the difference in loudness of various Performances, including the volume of external sound generators.

Instrument Volume

Each Instrument in a Performance has its own Volume parameter, of course. This volume is then scaled by the Instrument master-volume parameter of the Performance and then by the System volume, both of which (we hate to repeat ourselves) can only attenuate, not boost the volume.

Therefore, if you want maximum volume for a given Instrument, you have to start by setting the Instrument volume to maximum. An Instrument whose volume is set to 0 will actually never be heard, regardless of the other volume settings.

Use Instrument volume to set the proper balance for layer- or split-sounds, or to premix parts of a multitimbral MIDI sequence.

Sound Volume

A Sound does not have a volume parameter of its own. A Sound will always output at maximum volume - the settings of the mixer-module permitting. To change the loudness of a single Sound, you have to use Instrument volume.

External Volume

This is the equivalent of instrument volume, only that it adjusts the volume of the individual Externals. The volume value will be transmitted via MIDI continuous controller 7.

About MIDI

Sending MIDI Data

There are several things to send via MIDI from the Wave, and several ways to send them:

- **Keyboard and physical controllers**: The standard way would be to define one or more Externals in a Performance to send MIDI data. Check for possible data filters, and keep in mind that even the key-information can be filtered. Factory Performances have one External defined to send MIDI data on the *base* channel.

  Instruments can transmit MIDI data as well if their parameter **<MIDI Out>** is set to send data at either or both MIDI outs.

- **The base channel**: The actual MIDI channel regarded as the base channel will be set in Global Edit's MIDI parameters. When set to *omni*, it will send on MIDI channel 1.

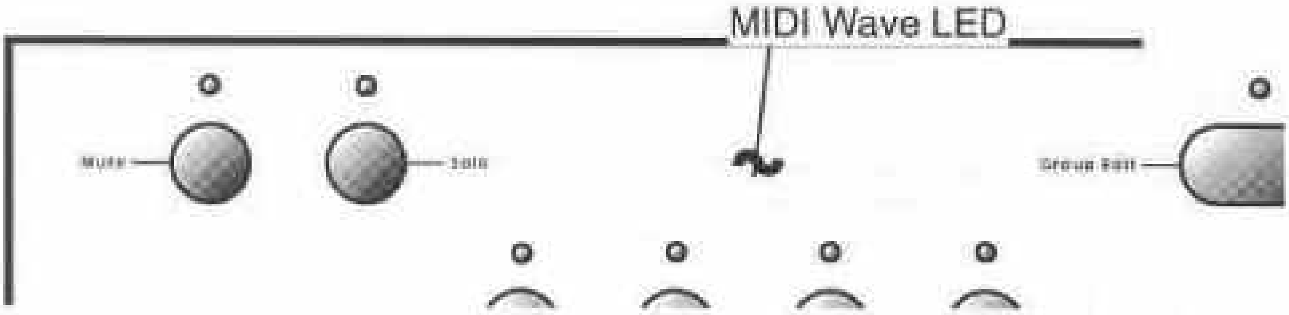
- **Panel knobs, faders and buttons**: To send these, the parameter **<Panel transmit>** must be activated in Global Edit. This MIDI information will be sent as MIDI system-exclusive data.

- **MIDI sys-ex data dumps**: These can be send from the Store page.

Whatever you send via MIDI, be aware that there are *two* MIDI outs on the Wave. One possible reason for not receiving anything at the other end of the line might just be that you're using the wrong MIDI out socket.

Receiving MIDI Data

- **MIDI Channel Voice messages**: The standard Note, controller, etc., messages will be received by the instruments if their parameter **<Source>** is set to receive MIDI data. Each Instrument has its own Source parameter, as well as its own MIDI channel.
- **The base channel**: The actual MIDI channel regarded as the base channel will be set in Global Edit's MIDI parameters. When set to *omni*, it will receive on any MIDI channel.
- **MIDI sys-ex data**: This will always be received. Panel knobs, faders and buttons as well as data dumps are all in the sys-ex format. To avoid data messup when recording Panel sys-ex data, set Local control in the Global Edit's MIDI parameters to the appropriate mode.



Whenever valid MIDI channel voice messages have been received, the little Wave symbol above the display will flash. Ooh, how cute!

About Local Control

Local control determines whether or not the Wave's sound engine can be triggered from its own keyboard and physical controllers. There are actually two different places and ways to set this function.

Global Local Control

This will disconnect the keyboard and the physical controllers completely from the sound engine. No Instrument will receive any MIDI data internally, rendering the Instrument's Source *Keys* useless.

Global Local control also allows you to disconnect the Panel from the internal sound engine, which is useful if you record Panel-changes into an external sequencer and have that data fed back to the Wave via the sequencer's soft thru function.

You find Global Local control in Global Edit. See chapter 8.8 "MIDI Parameters", for details.

Instrument Local Control

Each individual Instrument can be set to receive from either MIDI, the internal keyboard or both. By setting the parameter **<Source>** of an Instrument to *MIDI*, this Instrument will not receive any data from the keyboard or physical controllers of the Wave. However, Panel data will still be received by the Instrument.

See chapter 6.9, "Source", for more information.

Physical Controllers

Throughout this manual, a physical controller is defined as the thing you are actually playing and controlling with your hands and feet, in contrast to *MIDI controllers*, which are defined as a stream of data sent over MIDI, controlling whatever function they are programmed to affect.

The Wave sports the following physical controllers:

Keyboard

Would you have guessed? Depending on the Performance and Local Control settings, the keyboard might control the Instruments and send MIDI data to the outside world – or just sit there doing nothing, no matter how hard you pound.

Transpose Buttons

These will add an offset to the keyboard note-numbers, actually "shifting" the keyboard an octave up or down. Therefore, they have an effect both on Instruments and Externals.

Aftertouch

This is the more common variety of pressure control, channel aftertouch. You can assign it in the Sounds to control various parameters, as well as filter it both for individual Instruments and Externals.

Pitch-bend Wheel

It is hard-wired to always send MIDI pitch-bend data. It can be disabled per Instrument, and scaled and reversed for Externals.

Mod Wheel

It sends MIDI continuous controller 1. It can be disabled per Instrument, and scaled and reversed for Externals.

Free Wheel

The Freewheel is a fully programmable, center-detented physical controller that can send two different MIDI controller signals - one for movements above the center position, and another for movements below center. Both of these signals can be freely assigned to various Sound parameters. The Freewheel can be filtered for each External.

Performance Buttons 1 & 2

These two buttons can send any MIDI controller. Their mode of operation can be set per Performance to either toggle between on and off when pressed repeatedly or to act as a momentary switch ("touch mode"). They can be assigned within Sounds and filtered for each External.

Performance Faders

In Performance mode, the eight display faders double as Performance faders, thus becoming additional physical controllers. They can transmit a variety of MIDI controller signals and be assigned to specific Instrument or External parameters. Each Performance fader can be individually routed to any Instrument or External.

Pedals

The Wave sports three foot pedal connectors.

- **Sustain**: This pedal input is hard-wired as a sustain switch. A control signal input at this jack is automatically transmitted to the assigned Instrument or External as MIDI controller 64, though transmission can be selectively disabled. The switch polarity will be recognized automatically on powering-up.
- **Pedal 1**: Here you may connect either an active continuous pedal (one that transmits a continuous voltage between 0 and 5 Volts) or a footswitch. Switch polarity will be recognized automatically on power-up.
- **Pedal 2**: Connect a typical-style volume pedal here. The little switch next to the socket should be set according to whether you're using a passive pedal or an active one. When set to *active* mode, you may connect a footswitch rather than a pedal.

See chapter 1.7, Control Pedals, for more details on the pedals, and how they should be wired.

Panic - Don´t Panic

Ever played on stage and had the sudden knowledge that, for whatever reason, a certain MIDI note is never going to end? That's what is commonly called *Panic*. But happily, the Wave allows you to relieve your panic with a function so wisely called *Panic*.

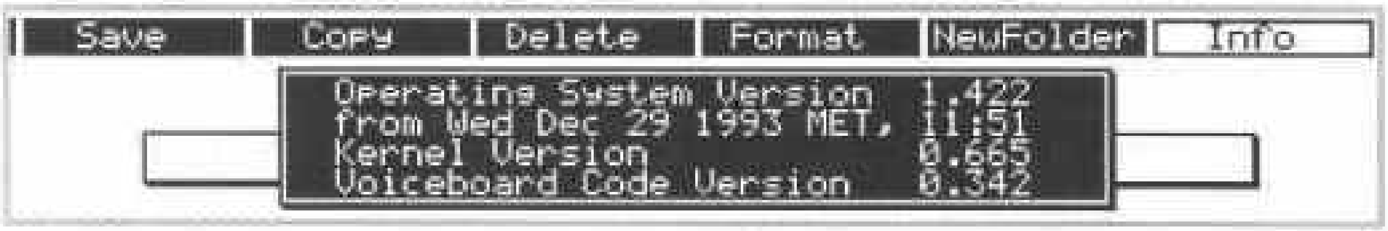
If you're having a panic attack, simply press the **[Cancel]** and **[OK]** buttons simultaneously. The Wave will shut down all voices that are currently playing (including the ones you're holding) and send an All-notes-off plus Reset-all-controllers command on every MIDI channel of both MIDI outs of the Wave. This should silence all connected gear as well as the Wave's own voices.

Getting System Information

If you have a question about the Wave and call the service department of your distributor, it is a good idea to have the system information handy. It gives the version number and date of the OS version you currently use.

- Press the **[Disk]** button to access the disk page.
- Press the **<Info>** button of the disk page.

A message akin to the following will show up:



```
Operating System Version  1.422
from Wed Dec 29 1993 MET, 11:51
Kernel Version            0.665
Voiceboard Code Version   0.342
```

When experiencing irregular behavior or problems, you should include this information when notifying us about it.

Edit Modes

waldorf

This chapter describes the various edit-modes of the Wave, how they work and what they are good for.

The Basic Concept

A synthesizer is only meaningful if you have sensible access to all its parameters. As you will no doubt come to realize, this was our credo when designing the user-interface for the Wave. However, having a huge number of buttons and knobs does not necessarily make for a sensible and easy-to-use interface. The really tricky question is how all these knobs react to what you do and how they interact with each other.

For that reason we've included quite a variety of different edit modes, each one offering a certain path to reach your goal - the exact sound you are looking for. And yes, there are many roads that lead to Rome, and each of them has its specific asset. Rather than making the decision which route to follow *for* you, we leave the decisions up *to* you.

Since the Wave offers permanent multi-mode, we thought about useful ways to edit the various Sounds present at any given time, especially since the Wave sports individual edit buffers per Sound. While you probably will prepare sounds "off-line" when using synthesizers that have limited real-time sound-editing capabilities, the Wave invites you to tweak even while you are playing. This makes it especially necessary to provide sensible means of editing both single Sounds as well as entire layers. *Single-* and *Multi Edit* give you these options.

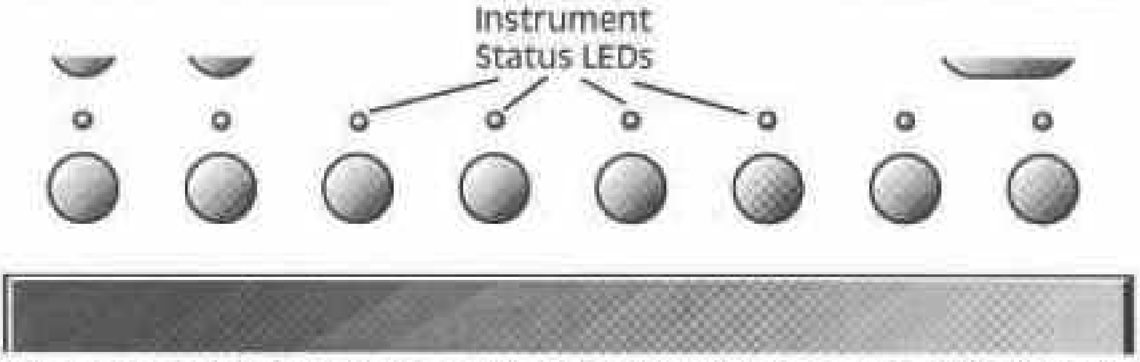
Another common problem is the layout of parameters for a given task. With eight concurrent Sounds at your disposal, at one time you might want to view and edit various parameters of one Sound or Instrument, while at another time it seems more appropriate to edit only a single parameter, but to have the ability to adjust and compare that parameter for every Sound or Instrument simultaneously. You can accomplish the latter with the *Group Edit* function, while the former is the default edit mode of the Wave.

As already implemented in the MicroWave, a *Quick Edit* mode allows for the simultaneous adjustment of several related parameters of a single Sound. This enables you to create a Sound from scratch in only a few seconds, or to modify a certain aspect of a Sound with the twist of only one knob.

And finally, *Knob Mode* lets you decide how the Wave handles parameter-changes when you turn a knob whose physical position is quite different from the actual value of the present parameter.

Different from most other contemporary synthesizers, you never have to activate a specific "Sound Edit" mode. Instead, you can edit a sound or a combination of Sounds in any mode, except for Wave Edit (which does allow you to edit a Sound, but only very specifically). So please feel free to alter your Sounds anytime, be it in Global Edit or the Sequencer. However, you can change your edit selection only in *Instrument Edit* and *Performance* mode.

Instrument Status LEDs



You already are familiar with the eight display buttons on top of the display. Their main use is for selecting Instruments or Externals for editing, even though they are used for other tasks in other modes.

Above each of the eight display buttons, there is a corresponding LED. The main purpose of this LED is to show the status of an Instrument or External.

In Performance mode, there usually is at least one LED flashing. This is the edit-active Instrument, whose Instrument- and Sound-parameters can be changed. However, there are more possible states an Instrument can reside in, all indicated by the Instrument Status LED:

- **Off**: This Instrument is not active. All it allows you to do is to activate it.
- **Steady green**: This Instrument is activated and ready to play. However, it is not edit-enabled, meaning that whenever you change something on the panel, the Sound of this Instrument will not be affected by the change.
- **Steady red:** This Instrument is muted, either by the Mute or the Solo function. It will not play, but it will use up voices - they are simply not sounding. A muted Instrument is not edit-enabled; this is to prevent you from editing something you cannot hear.
- **Flashing orange:** This Instrument is active and edit-enabled. It is actually the *main edit-active* Instrument of the Performance. That means that this Instrument will act as the reference when you are editing several Instruments

simultaneously in Multi Edit. Whatever you program at the panel *and* for the Instrument parameters will affect this Instrument and its corresponding Sound. Also, when changing the Wavetable (the BIG red knob) it will be changed for the main edit active Instrument.

- **Flashing green:** This Instrument is active and edit-enabled. However, it is a *secondary edit-active* Instrument. Its parameter-values will be changed in reference to the main edit-active Instrument when you are in Multi Edit. All edits made at the panel to change the Sound, except changing the Wavetable, will be reflected by this Instrument, but no Instrument parameter will be altered.

Single Edit

Single Edit mode is what you are probably used to from other synthesizers: You can edit one Sound at a time. The Sound you will alter is determined by the display -(here: Instrument-select)- buttons and indicated by the Instrument Status LEDs.

If only a single Instrument is active in a Performance, that will be the one you can edit. An orange flashing Status LED will tell you that this is the *main edit active* Instrument - quite logical, since there is only one Instrument present. You can alter the Instrument parameters as well as the parameters of the Sound attached to the Instrument.

If more than one Instrument is active in a given Performance, you can change the edit selection simply by pressing the Instrument select button of the Instrument whose Sound you wish to edit. The corresponding LED then will flash yellow, while the previously yellow one will simply be a steady green.

Single Edit is the default edit mode when the Wave is powered up. It is always active unless another edit mode is enabled.

Multi Edit

Multi Edit is very simliar to Single Edit. The difference is that it allows you to edit several Sounds at the same time. This is great if you want to edit a sound composed of layered Instruments that use different Sounds. Using Multi Edit, you can control the layer the same way you would edit a single Sound. Need an overall longer release time? Turn the release knob. Want the resonance of all respective Sounds to be slightly higher? Twist that one knob.

The beauty of Multi Edit is that it will adjust the parameters of the individual Sounds in relation to each other. Therefore, if you open the filter slightly, the overall timbre will become brighter, but you will not experience sudden jumps in the cutoff frequency, with all Sounds being set to the same parameter value. Except...

For Multi Edit to work as described above, you must be sure that the Knob Mode is not set to *Jump*. In that case, the parameter's value would indeed be the same for all Sounds, since in Jump mode the value *jumps* to the current physical knob position - which obviously would be the same for all Sounds.

Relative and *Snap* Knob modes work as detailed in chapter 3.6, "Knob Mode". These two modes will likely be your preferred choices in Multi Edit.

In Multi Edit, the yellow flashing Status LED indicates that this Instrument is the *main edit-active* Instrument. There are two important concepts to remember for this Instrument:

- When you edit Instrument parameters, only those of this Instrument will be altered.
- The Sound of the main edit-active Instrument is the reference for all other Sounds you edit. The parameters of all other Sounds will be adjusted in relation to this one. This is most noticeable in the *Snap* knob mode: First, the parameter of the main edit-active Instrument has to snap to the stored value before *any* changes will take place. From then on, the secondary edit-active Sounds will be changed relative to the main edit-active one.

Multi Edit is enabled similarly to Single Edit:

- Press *and hold* the Instrument select button for the Instrument that you want to be the main edit-active one.
- While holding this button, press the Instrument select buttons of the other Instruments whose Sound you wish to edit. These Instruments are called *secondary edit-active*.

A secondary edit-active Instrument will be indicated by a flashing green status LED.

To switch back into Single Edit mode, simply press an Instrument button and let go. All secondary edit-active Instruments will automatically be edit-disabled.

Group Edit

Group Edit is a very specific edit mode. It allows you to view the parameters of an Arrangement from a different angle. Rather than having access to various parameters of one Instrument or Sound, you have access to one parameter for all eight Instruments and Sounds.

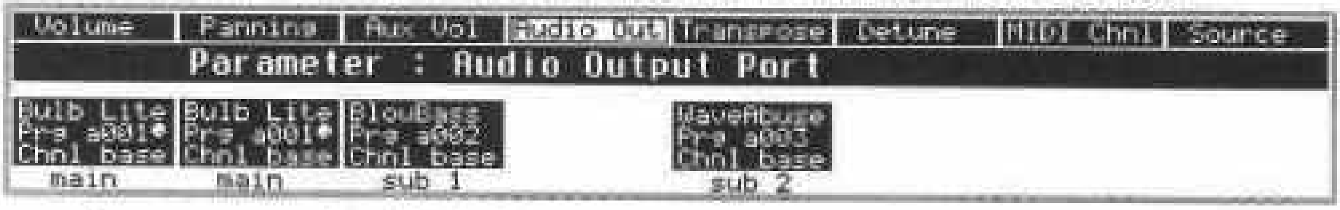
A good example of how to use this mode is volume-balancing of eight Instruments. Instead of selecting each Instrument individually in order to edit its volume, just call up Group Edit and select <Volume>. Now you can adjust the volume of all eight Instruments easily with the display faders.

Group Edit can only be activated in Instrument Edit or External Edit.

It can, however, be activated in Single Edit and in Multi Edit mode. But once Group Edit is activated, you cannot change the edit selection. To do that, you have to exit Group Edit (by pressing the button again), and select the Instruments to edit.

In Instrument Edit, Group Edit allows you to view and adjust all Instrument parameters as well as all Sound parameters that have a dedicated knob on the panel.

- To edit Instrument and Sound parameters, activate Instrument Edit mode.
- To edit External parameters, activate External mode.
- Press the [Group Edit] button. The LED above it should be illuminated.
- The display will change to the following (Instrument Edit mode selected):



```
Volume   Panning   Aux Vol   Audio Out   Transpose   Detune   MIDI Chnl   Source
                 Parameter : Audio Output Port
Bulb Lite  Bulb Lite  BlouBass              WaveAbuse
Prg a001•  Prg a001•  Prg a002              Prg a003
Chnl base  Chnl base  Chnl base             Chnl base
  main       main      sub 1                 sub 2
```

As you can see, the display buttons now select the Instrument parameters you can edit. The faders will adjust the value for the particular Instrument it is assigned to. The order of the Instruments is the same as for the Instrument select buttons. Additionally, the faders are labeled with the Sound name of each Instrument. In essence, the labels normally associated with faders and buttons have been swapped.

- To select the parameter you wish to edit, press the display button that is correspondingly labeled. Change display pages as usual to get to other display parameters.
- The status line of the display indicates what parameters will be edited by the faders.
- In Instrument edit you can also select Sound parameters that have a dedicated knob. Simply turn that knob until you see the parameter name in the display's status line.

⇨ Use the Knob Mode *Knobs off* , so that you won't edit the edit-enabled Instruments' Sounds when simply selecting a parameter.

For the zoning pages of both Instruments and Externals, there is also a Group Edit page, which provides an overview of all eight zones of a Performance's Instruments or Externals.

Quick Edit

Quick Edit mode is a special editing mode that allows you to shape a Sound very quickly by editing a number of parameters simultaneously and by copying various preset envelopes and macros into a Sound.

Quick Edit acts only on the Sound of the main edit-active Instrument (the one whose LED flashes yellow). It has a different parameter set from the other edit modes, which is the reason that it actually has its own operation mode. Therefore, Quick Edit is not a true Edit mode in the sense the other Edit modes are, but rather an operation mode in itself.

Quick Edit will be discussed in detail in chapter 4, "Quick Edit".

Knob Mode

Editing on the Wave poses one problem typical to all synthesizers that have knobs and allow a variety of sounds to be stored in memory: There is most likely a difference between the physical setting of a knob and the actual value of the parameter that corresponds to that knob. This problem arises as you switch from program to program. The parameter values will change, yet the position of the knob won't (unless you have motorized knobs - a luxury too far from financial reality for most of us).

This problem can be dealt with in a couple of ways. Usually, a synthesizer has one and only one way that it updates parameters - like it or not. However, various update modes are useful for various tasks. Therefore, we decided to let you make the choice which update mode for the knobs you prefer at a given time. We called this parameter *Knob mode* because it applies to the knobs (akin to potentiometers) of the Wave, but not to the dials (continuous data-entry-style controllers), faders or buttons.

You'll find the Knob mode parameter to the left of the display section, directly under the mixer module.

There are four Knob modes in all:

- **Relative**: In relative mode the movement of a knob will add to the stored value when you turn the knob clockwise and subtrack when you turn it counter-clockwise. Since there will be an offset added to the parameter's value, the physical position of the knob does not matter. However, there are two not-so-great aspects to relative this mode that you should know when using it:

  1. Depending on the physical position of the knob you might not be able to reach the maximum or minimum value of a parameter. In that case, you first have to turn the knob full swing in the other direction in order to have access to the entire value range.

  2. With bipolar parameters, the center detent of the knobs won't have too much of a meaning most of the time.

  Relative mode is well suited for fine-tuning details and for performing live, since you will never encounter the problem of suddenly jumping to a new parameter value - the latter being especially helpful to destroy that magic moment of lyricism, when a power pitch modulation cuts in at full blast. Relative Knob mode spares you those disasters.

- **Snap**: This Knob mode is rooted exactly between the relative and Jump modes. As you turn a knob, no parameter values are changed until you reach the stored parameter value, at which point the value "snaps" to the knob. From then on, the sound of the main edit-active instrument will change according to the knob, the other edit-enabled sounds will change in relative mode.

  The asset of this mode is that you won't experience any sudden jumps in value, exactly as in relative mode. At the same time you have the full range of values at your fingertips, because the physical position of the knob corresponds exactly to the stored value. Moving a knob until the value "snaps" to it is also called "nulling."

  The down-side of Snap mode is that it might take some time until you hear a change, since you first have to null the knob to the parameter's value. Especially if you move the knob first into the wrong direction, this can seem to take considerable time.

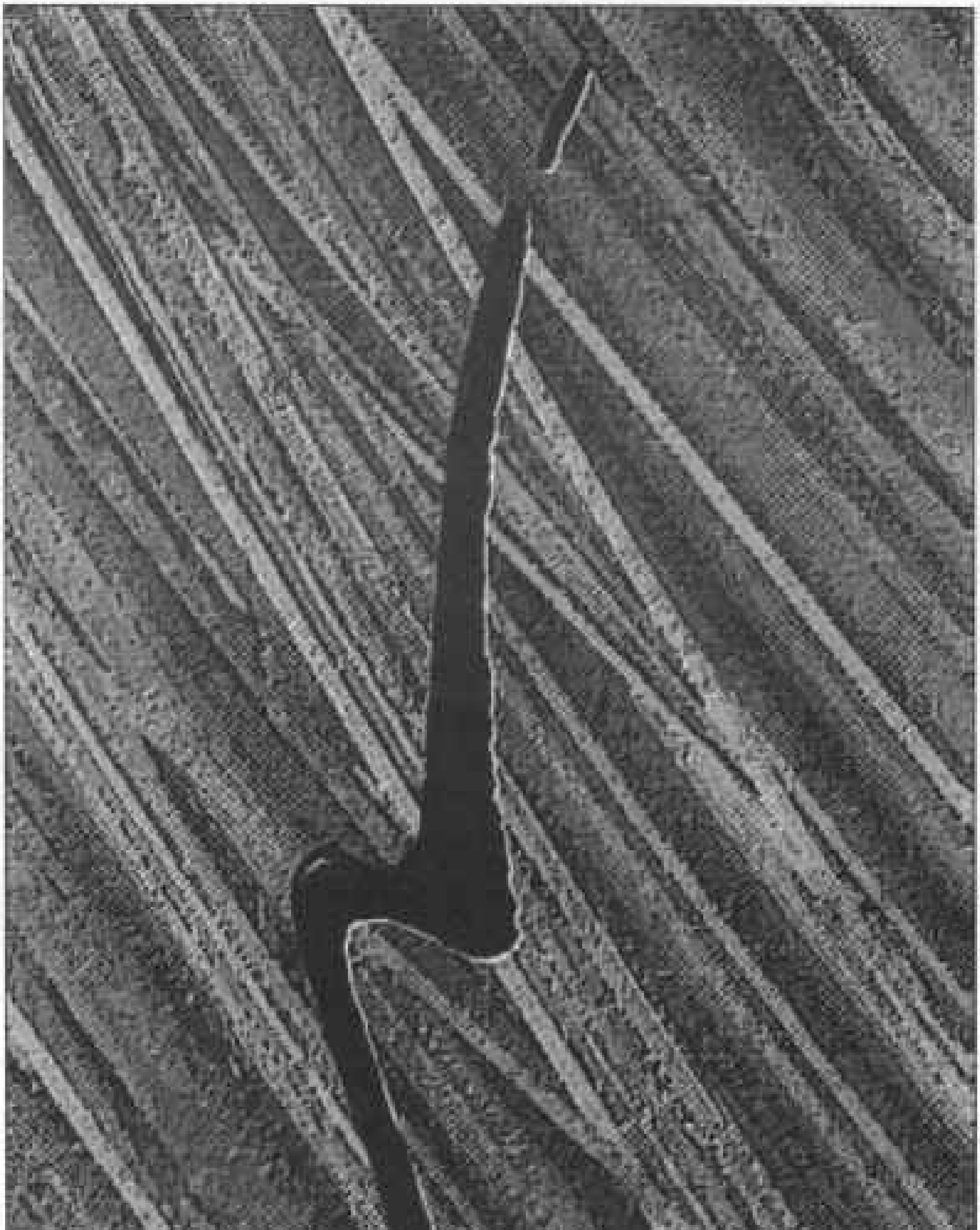
  Snap mode is a compromise between relative mode and Jump mode. Depending on the material, it could be the ideal mode for either live-playing or studio work.

- **Jump**: This mode is the most aggressive one of them all. As soon as you turn a knob, the value of the current knob position will be used for the parameter. This almost always leads to noticeable jumps and discontinuities in the resulting Sound, at least until all knobs have been twisted once for a given Sound.

  Due to its nature, this mode is probably the worst for playing live - unpleasant surprises when editing in real-time during performance are basically guaranteed. However, when you do "off-line" sound design work, this mode is likely the best, because it offers instant feedback as well as a true correspondence of the parameter value by the knob position. This is very helpful with bipolar parameters - especially when you want to disable them by finding the knob's center detent.

- **Knobs Off**: Use this mode when you want to make sure that none of your relatives, friends or record producers change that magic timbre while you're off powdering your forehead. On a slightly more sensible level, use Knobs Off to reposition the knobs if you need more swing for use with relative mode.

Mute and Solo



This chapter explains how the Mute and Solo functions of the Wave work, and to what extent you can apply them.

The Basic Concept

In a complex MIDI arrangement, you most likely feel the need to check for certain sounds or tracks to get a clearer picture of the composition. A proven way is the use of both mute and solo functions, such as those used on mixing desks and some sequencer programs. The Wave incorporates the mute and solo model as found in mixing desks, and even allows you to store the mute settings of Instruments and Externals with each Performance.

Instrument muting is achieved by turning the volume of the respective Instrument off, so you can mute and unmute a held note or chord. External muting, however, is done by sending the respective note off commands, so a held note may be muted, but not unmuted.

You also can mute or solo the modulation inputs of individual Sound modules of Sounds to check for the one modulation that is a bit strange, causes trouble or should be more pronounced.

The Wave has two dedicated buttons for activating the mute and solo functions; for obvious reasons, only one of the two can be active at any given moment.

For both Instruments and Externals, the respective LEDs that show the edit status will also show the Mute status, as explained before.

What to Mute or Solo

The following items can be muted or soloed:

Instruments

Instruments can be muted in the following operation modes:

- Performance mode
- Instrument Edit mode
- Global Edit mode
- Quick Edit mode

The display buttons act as mute buttons for the Instruments. In Performance mode, the Instrument page must be selected to allow for the muting or soloing of Instruments.

A red LED will indicate that an Instrument is active, but muted. If the LED is simply off, the Instrument will be deactivated, not muted.

Externals

Externals can be muted in the following operation modes:

- Performance mode
- External Edit mode

The display buttons act as mute buttons for the Externals. In Performance mode, the External page must be selected to allow for the muting or soloing of Externals.

A red LED will indicate that an External is active, but muted. If the LED is simply off, the External will be deactivated, not muted.

Modulations of Sound Modules

Modulations of Sound modules can always be muted or soloed, when the LED of the [Mute] or [Solo] button is illuminated and thus the respective function is active.

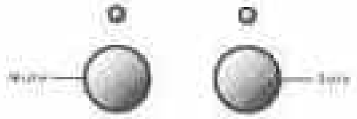
All the Sounds whose instruments are edit-active are enabled for muting or soloing the Sound modules' modulations. When a modulation is muted or soloed, *all* edit-active Sounds will be affected.

The [Edit] buttons of the various Sound modules will double as mute/solo buttons when mute or solo mode is active (but not if the mute status is frozen - see more below). The LEDs of the [Edit] buttons will blink when this Sound module's modulation is muted.

How to Mute

- To mute, press the [Mute] function button and the mute button of the respective item you want to mute, as described above.

  ⇨ You can mute "cross-platform," meaning you can mute a few Instruments *and* some Sound modules' modulations. However, muting both Instruments *and* Externals is only possible in Performance mode.

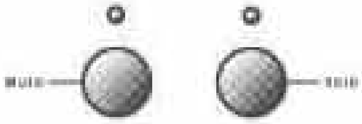


- After you selected the Mute function, you can mute additional items by pressing their respective mute buttons as long as the Mute function is activated, as indicated by the Mute function LED.

- To unmute individual items, simply press again the button that muted the item. While the Mute function is active, all these buttons will toggle between muting and unmuting the respective item.
- To unmute everything, simply press the [Mute] function button again, which should also turn off the corresponding LED. All mutes will be cleared; the mute status of the various items will be flushed.

How to Solo

- To solo, press the [Solo] function button, let go of it and press the mute button of the respective item you want to solo, as laid out above. You can solo "cross-platform," meaning you can solo an Instrument *and, at the same time*, that Sound's modulations.



- To solo another item, simply press its select-button. The previous solo will be overruled and the new item will be soloed exclusively within the same kind of items (Instruments, Externals, Sound modules).
- To exit Solo mode, press the [Solo] function button again. The accompanying LED should extinguish as well.

Normally, soloing an item will cause all other items of the same kind to be muted. However, there are two exceptions:

- **Multiple Solo**. Normally, when you are in Solo mode you can hear only one item of a kind, namely the one you soloed; this is usually what you want. But imagine you want to solo a layered sound. Then you'll want to listen to two or more Instruments at the same time. And yes, it can be done. Welcome to multiple solo.

  To do a multiple solo: While in Solo mode, press *and hold* the mute button of one of the items you wish to solo. Then press the mute buttons of the other items you wish to solo.

  ➪ You can do multiple solos separately for Instruments and Sound modules' modulations, which allows you to easily find that one modulation within a complex Arrangement that seems to be a wee bit off.

- **Global Solo**. Solo usually affects only items of the same kind, such as only Instruments or only Externals. However, there may come the day that you would like to truly solo a single item in your entire setup. To do so (and provided your setup is controlled entirely from the Wave) you can invoke a global solo that mutes all other Instruments *and* Externals except the one you've selected.

You can invoke a global solo *only* in Performance mode, since this is the only mode in which you have sensible access to both Instruments and Externals. To execute the solo, you must press the [Solo] function button *and keep holding it*. Now select the Instrument or External you wish to solo; all other Instruments and Externals will be muted. Once you have selected Global Solo this way, it will be effective until you cancel the solo mode by pressing the [Solo] function button again.

When you select another Instrument or External to be soloed, the previous selection will be overruled, just as in regular Solo mode - however, all other Instruments *and* Externals will still be muted.

To achieve a multiple solo within global solo, you must either keep holding the [Solo] button (rather than letting it go after selecting the first item to globally solo), *or* the button of one of the items you wish to solo, as you would in regular solo mode. To solo both an Instrument and an External, use the [Page] buttons to select the respective page.

Freezing the Mute Status

When the mute function is active, you cannot change the edit selection for Instruments or Externals, and the [Edit] buttons of the Sound modules won't give you access to the additional parameters of the module in question. We found that to be very inconvenient.

Therefore the Wave allows you to *freeze* the current mute status, which gives you access to everything as before, when the mute or solo function was not activated. You can make a different edit selection (with the exception that you cannot edit muted items) and use the [Edit] buttons of the Sound modules to put their respective pages onto the display.

- To freeze the current mute status, press *and hold* the [Shift] button in the sequencer transport controls section and then press either the [Mute] or [Solo] function button, depending on which was previously activated.
- The corresponding LED will go out, but the Instrument and External status LEDs will keep showing the mute status, which is still enabled.
- If you again press the function button you froze, the mute status will still be enabled, but unfrozen and thus editable.

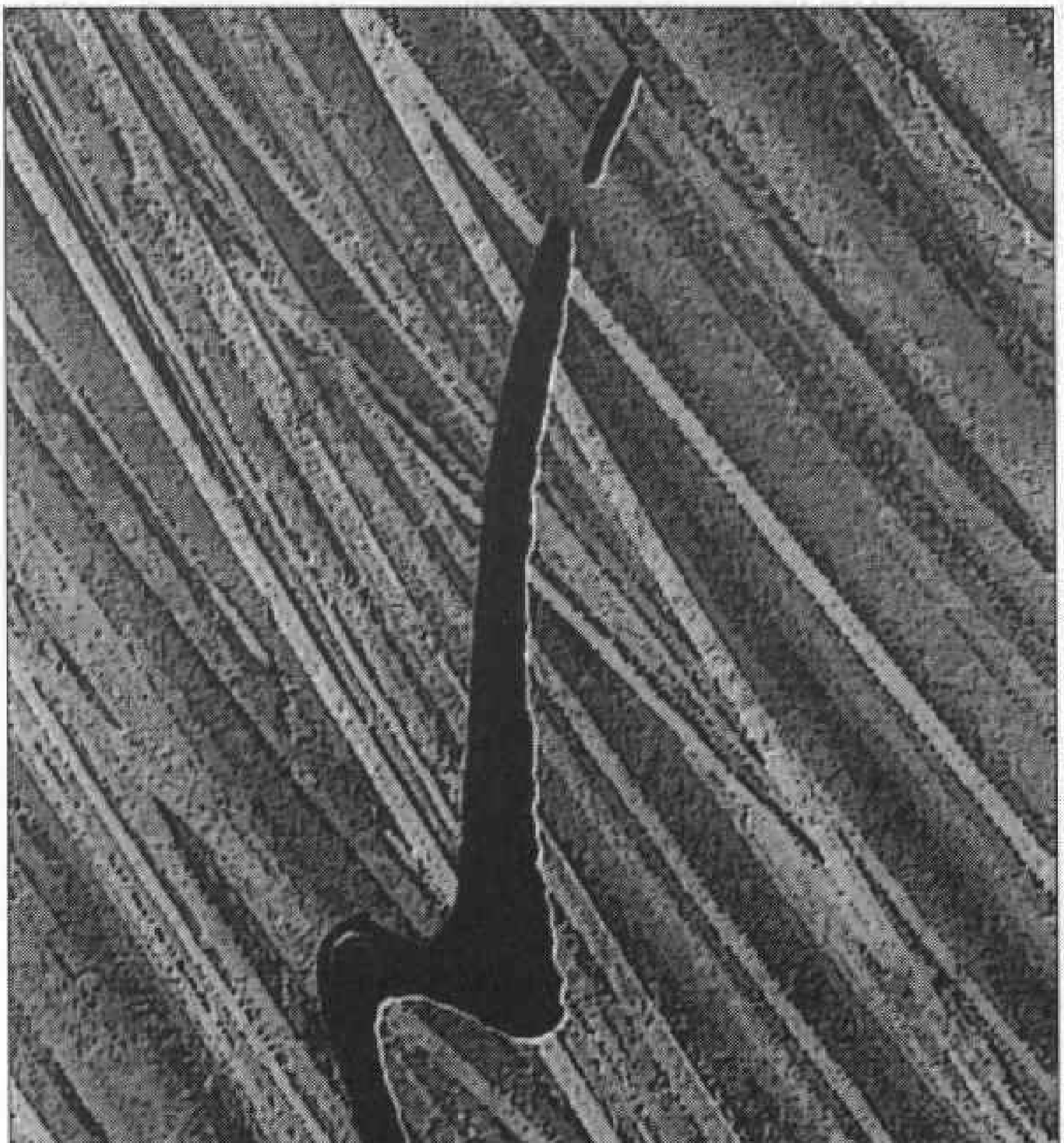
- To completely unmute a frozen mute status, you first have to unfreeze it by pressing either the [Mute] or [Solo] button, and then unmute by pressing that button a second time.

Only the mute status of Instruments and Externals can be frozen.

Storing the Mute Status

When you store a Performance with Instrument or External mutes enabled, those utes will be stored with the Performance, regardless if they originated from muting soloing. When you call up that Performance the next time, the mute status will be stored as well, but in the *frozen* state, so to allow regular editing of the erformance.

Performances



This chapter describes what Performances are, which parameters they address and how to operate them.

What is a Performance?

Performances are the main element in playing the Wave. They govern most of the behavior and sound at a given instant, but the parameters that control them are global. When you call up a "program," that would typically be a Performance; hence, the Performance operating mode is the default mode of the Wave.

A Performance is composed of eight Instruments, eight Externals and the Performance's overall parameters. Each of the Instruments of that particular Performance can play a different Sound of the Wave itself, while each External can control one of up to 32 external MIDI devices.

Each Performance also is a very powerful management system for your playing or sequencing needs. Beyond the Instruments and Externals that control the sounds of both the Wave and your other MIDI gear, you can assign the Wave's physical controllers to send specific MIDI data. Especially powerful is the fact that you can define the eight faders differently for each Performance.

A Performance itself contains no actual sound data. Rather, it remembers the program numbers where the Sounds are stored. Therefore, if you were to exchange the Sounds in memory with different ones (by loading new sound banks from disk, for example), your Performances could sound *radically* different. The same would be true if you exchanged Performance banks, but not the Sounds. Please keep that in mind when storing and loading bank files.

Please understand the difference between an Arrangement and a Performance: The Performance contains all the data needed for housekeeping and addressing other data types, but not the data types itself. See chapter 2.15, "What is an Arrangement?", for a detailed explanation of what an Arrangement is.

Instruments - Your Sounds

The Sounds in the Wave cannot be played by themselves. The only way to gain access to them is via an Instrument in a Performance. This may seem odd at first, but actually there are many advantages:

- You can use the same Sound in various Performances
- You can use the same Sound with different settings for zones, transpositions, aux-send levels etc.

- You can layer and split Sounds very quickly and in a sensible way
- You can easily layer a Sound with itself - up to eight times

The Wave separates the actual data for generating sounds from the data that manages the way these sounds can be used within a Performance. The data for sound-generation is stored in what is - not so surprisingly - called a *Sound* . The instructions for how a Sound will be accessed by the Wave are stored in an *Instrument*, which itself is part of a Performance.

The Instrument does not store the data of the Sound, but rather the program number where it is located. This way, each Instrument can select from a pool of 256 Sounds. That allows each of the eight Instruments of the 256 Performances (a total of 2048 different Instrument-settings!) to use a Sound in a different way, without the need to reprogram these Sounds over and over (not to mention the amount of memory needed for 2048 Wave Sounds).

An Instrument not only stores the program number of a Sound, it also stores certain instructions about how to play that Sound - from which source, in what zones, at what volume and stereo-position and so on. Therefore, the combination of Sounds and Instruments grants you the most flexibility in creating powerful Performances while keeping the memory-size and programming-time at a manageable level.

Chapter 6, "Instrument Edit", gives you all the details about programming and using Instruments.

Externals - Your Master Keyboard

The concept of Instruments and Sounds makes sense not only for the internal sound generation of the Wave itself, but also for managing external gear from the Wave. As you can look at the Wave's Sounds as a pool of data inside the Wave that you have access to via Instruments, you may view your external MIDI gear as a pool of modules and sounds that you can address using the *Externals* - the "natural" brothers or sisters of the Instruments, so to say.

So, obviously, Externals are very similar to Instruments. The main difference is that you select a MIDI device and a program change number rather than an internal Sound. The External will then use that program of the external MIDI module much in the same way as an Instrument would use a Sound. It allows you to specify key- and velocity-zones, volume settings as well as panorama positions and much more. Externals offer some special parameters for controlling external MIDI gear, but overall they behave exactly like Instruments.

Instead of the pool of 256 Sounds Instruments have access to, Externals have access to a pool of 32 MIDI channel devices. Depending on your specific setup, these could address up to 32 different MIDI modules. As a special treat, we've included the ability to name every MIDI channel that Externals transmit on, making the selection of the various MIDI devices much easier for you, since you can refer to a name rather than a number. You'll find more about the naming of the External's MIDI transmit channels in chapter 8.11, MIDI Device Names.

The user interface for both Instruments and Externals is practically the same, so after you know how to deal with Instruments, you can use Externals right away. This way it should be reasonably easy to integrate your existing MIDI gear into the Wave environment.

Externals will send the stored data out via MIDI whenever a new Performance is selected. You may also edit the parameters of an External in real time from an active Performance in External Edit mode.

Chapter 7, "External Edit", gives you all the details about programming and using Externals.

Selecting a Performance

The Wave contains a total of 256 Performances, organized in two banks of 128 each. Each Performance will be identified by the bank and program number it is stored in as well as the name of the Performance. To clarify that it is a Performance, the identifying bank letter will always be a capital letter.

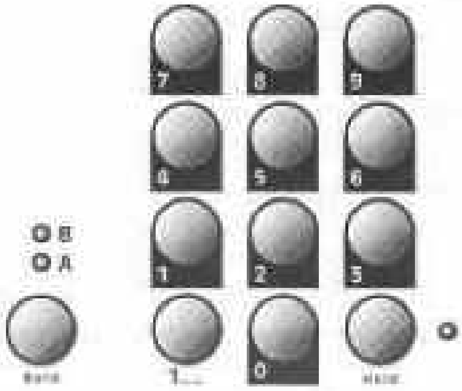
There are three ways to select a Performance: via the Wave's keypad, -/+ buttons or via MIDI.

At the Wave you can select a Performance only in the following operation modes:

- Performance mode
- Global Edit
- Quick Edit

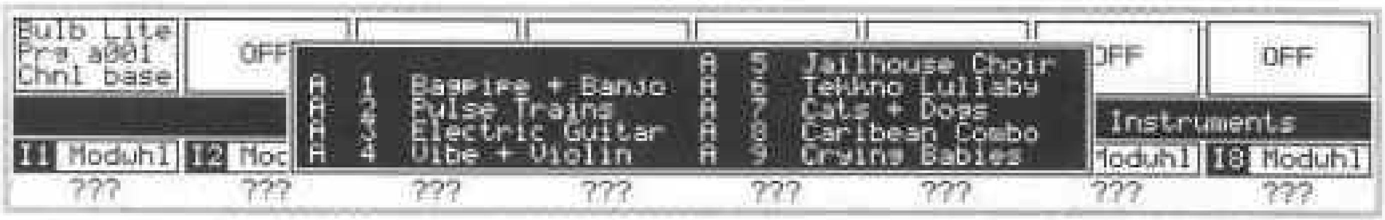
To select a Performance via MIDI, the Performance's parameter <ProgChange Mode> must be set accordingly.

Keypad



The keypad is optimized to quickly call up a Performance with usually only two keystrokes.

- The **[bank]** button selects either of the two Performance banks *A* or *B* .
- The ten **[number keys]** call up the wanted program number of the Performance.
- You can select banks A or B either first or after you have selected the decimal place (*i.e.*, the "10's" group — 30's, 40's, etc.) of the program number. The current bank selection will remain valid until you change it.
- You must enter a two-digit number to call up Performances on program numbers 01 through 99.
- To call up Performances 01 through 09 you must enter a leading zero.
- If a Performance is located between the numbers 100 and 128 inclusive, the **[1__]** button must be pressed first. You must press the [1__] button *every* time you select a program number of 100 or above; this button does not toggle.



```
Bulb Lite        OFF                                                            OFF           OFF
Prg a001
Chnl base
                         A  5  Jailhouse Choir
          A  1  Bagpipe + Banjo      A  6  Tekkno Lullaby
          A  2  Pulse Trains         A  7  Cats + Dogs                    Instruments
          A  3  Electric Guitar      A  8  Caribean Combo
I1 Moduhl  I2 Moc  A  4  Vibe + Violin        A  9  Crying Babies      Moduhl  I8 Moduhl
   ???        ???       ???        ???        ???        ???        ???        ???
```

After you have selected the decimal place of the program number, a dialog-box will appear on the display showing the names of the Performances of that decimal group. This makes it easy for you to find the correct Performance you are looking for.

➪ If the Performance you are looking for is located somewhere in a different decimal group, you can use the [-/+] buttons to change the group. The contents of that group will be displayed immediately.

- The **[Hold]** button will hold and remember the last decimal place you have entered. When activated, you only have to press one [number key] to select any of the program numbers within that decimal group, including the decimal groups above 100. The [Hold] button toggles, so it will be valid until you press it again.
- An illuminated LED next to the [Hold] button indicates if that function has been activated.
- Press the [Hold] button again to deactivate it.

➪ It is a good idea to group Performances you need to call up during live performance into particular decimal groups. Then you can activate the hold function and press only a single [number key] to call up a new Performance.

-/+ Buttons

As a special "convenience feature," you can use the [-/+] buttons to scroll through Performances consecutively, in either direction. However, this feature is available *only* in Performance mode.

The typical use of the [-/+] buttons for parameter value decrement/increment is therefore not available in Performance mode.

MIDI

A program change is a program change is a program change, to paraphrase a well-known phrase. And since the Wave has not only Performances to change over MIDI, but Sounds as well, the procedure could become a bit tricky. But once you have a clear idea of the possible ways the Wave can interpret MIDI program changes, you will appreciate the options.

You can globally determine how a Performance will handle incoming MIDI program changes. This is done via the Parameter <ProgChange Mode> found under the Global Parameters of the Wave. Three scenarios are possible:

- **Only the Performance itself should be changed upon receiving a MIDI PC.**
  In that case, select the parameter value *Perfmnce*.
- **Only Sounds should be changed upon receiving MIDI PCs.**
  In that case, select parameter value *Sounds*.

- **Both the Performance and the Sounds should be changeable via MIDI**
  Select *Perf+Snds* to accomplish this.

Selecting the desired reception mode is only the first part of the procedure. In order to obtain the desired effect, you must send the program change command on the proper MIDI channel, just as is true for all MIDI gear. The above parameter merely determines the procedure the Wave will follow in response to the MIDI PC.

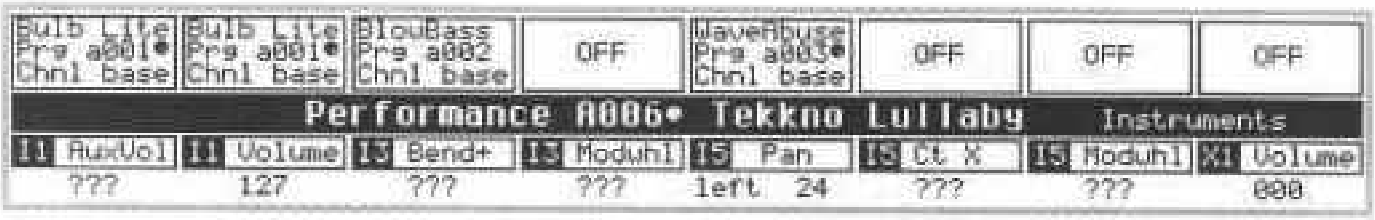
- To change a Performance, you must send a MIDI PC on the *base* channel of the Wave. The base channel can be set in the MIDI parameters of Global Edit.
- To change a Sound over MIDI, you have to send the MIDI PC on the MIDI channel the Instrument that is playing the Sound receives on. If more than one Instrument receive on that MIDI channel, all will be assigned the new Sound.
- If you set the <ProgChange Mode> to *Perf+Snds* and the Instrument's MIDI receive channel is set to *base* (or to the same MIDI channel number as the base channel), a MIDI PC meant for the Instrument would change the Performance, as it takes precedence when receiving a MIDI PC.

⇨ It is a good idea to never use the same MIDI channel for both Instruments and as the base channel, so as to avoid unwanted side-effects when receiving MIDI program changes.

Performance Pages

Performance mode is divided into three separate pages. Use the [Page] buttons to select the appropriate one.

Instrument Page

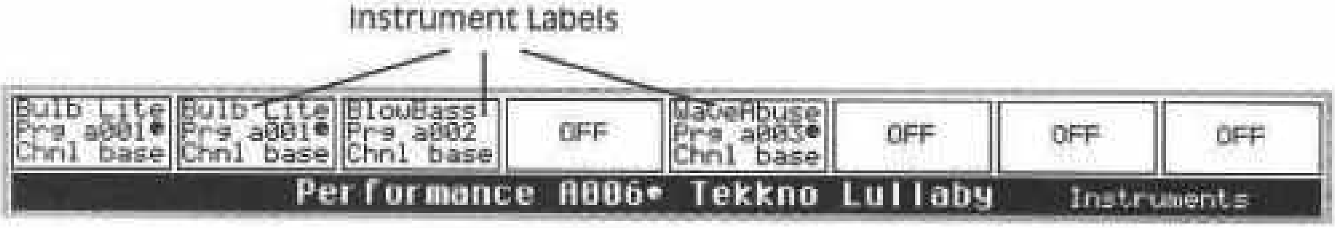


```
Bulb Lite  Bulb Lite  BlowBass              WaveAbuse
Prg a001●  Prg a001●  Prg a002     OFF      Prg a003●     OFF        OFF        OFF
Chnl base  Chnl base  Chnl base             Chnl base
              Performance A006● Tekkno Lullaby                 Instruments
I1 AuxVol  I1 Volume  I3 Bend+   I3 ModWhl  I5  Pan   I5 Ct X    I5 ModWhl  X1 Volume
   ???        127        ???        ???     left  24     ???        ???        000
```

The Instrument page is organized like a typical Wave page:

- The **status line** in the middle of the display shows you the Performance's *bank*, *program change number* , *memory status* and *name*.

- If the Performance has been edited, the *edit-flag* appears as the memory status behind the program change number.
- To the left of the Performance name you'll find the *page-name.*



Instrument Labels

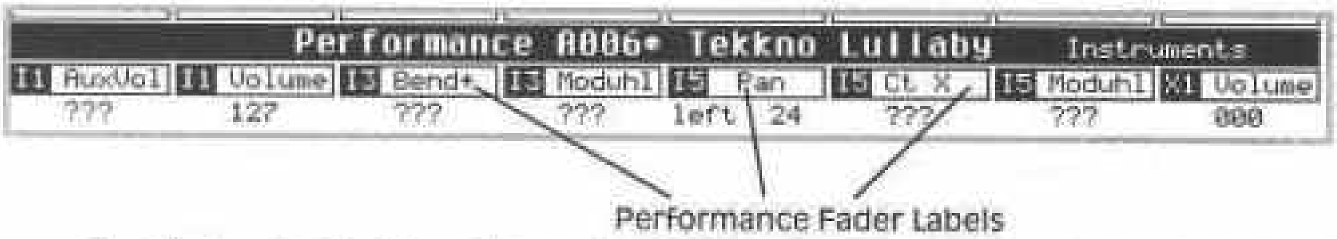
```
Bulb Lite  Bulb Lite  BlowBass!            WaveAbuse
Prg a001●  Prg a001●  Prg a002     OFF     Prg a003●     OFF        OFF        OFF
Chnl base  Chnl base  Chnl base            Chnl base
            Performance A006● Tekkno Lullaby      Instruments
```

At the top of the display there are the labels for the eight Instruments. These labels tell you some details about the Instruments:

- The **Sound name** will be displayed in the top line of the label.
- Line two of the display gives you the **program change number** of the Sound and shows the memory status of the Sound.
- Line 3 indicates the **MIDI channel** this Instrument receives on (if MIDI reception is enabled).
- If a label shows **Off**, the Instrument is not in use

The LEDs above the Instrument select buttons show the Instrument status, as explained in chapter 3.2, Instrument Status LEDs.

The bottom of the display shows the labels for the faders. In Performance mode the faders are called *Performance faders* and are meant to act as additional physical controllers. The labels will give you the following information:



```
            Performance A006● Tekkno Lullaby      Instruments
I1 AuxVol  I1 Volume  I3 Bend+  I3 Moduhl  I5 Pan     I5 Ct X  I5 Moduhl  X1 Volume
   ???        127       ???       ???     left 24      ???       ???        000
```

Performance Fader Labels

- The **Fader destination** tells you to which Instrument (I1...I8) or External (X1...X8) the fader is routed.
- The **Fader parameter** defines the actual parameter that the fader controls or sends MIDI data for.
- The **value field** gives you the current value of the fader parameter.

⇨ If the value field contains three question marks *(???)* it means that the respective MIDI controller has either not been changed during the Performance, or that the actual value might have changed or is simply unknown at the moment.

There are a total of eight Performance faders, which are the same for both the Instrument page and External page. Therefore, it does not matter which of the two pages is currently selected if you want to play the Performance faders.

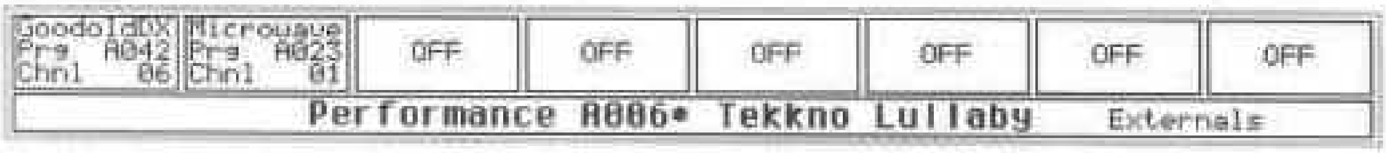
When the Instrument page is active, Mute and Solo will act on the Instruments.

As explained before, you can edit the Sounds by selecting the respective Instrument buttons and turning the knobs you want to adjust - it's as simple as that. If you want to edit the *Instrument parameters*, however, you have to select Instrument Edit mode.

External Page

This page is almost identical to the Instrument page. The differences are:

- The display buttons won't select anything (since Externals cannot be edited with the panel knobs, there is no need to select them).
- The labels for the display buttons label the Externals, not the Instruments.
- The LEDs above the display buttons show the External status. See the section on Externals for details.
- Mute and Solo functions will act on Externals.



```
GoodoldDX  Microwave
Prg  A042  Prg  A023   OFF   OFF   OFF   OFF   OFF   OFF
Chnl   06  Chnl   01
              Performance A006• Tekkno Lullaby    Externals
```

The labels at the top of the display now label the eight Externals:

- The **MIDI channel name**, which identifies the MIDI channel of the External by giving it a useful name, will be displayed in the top line of the label.
- Line two of the display shows you the **MIDI program change number** that has been sent by the External when the Performance was called up.
- Line 3 indicates the **MIDI channel** this External transmits on.
- If a label shows **Off**, the External is not in use.

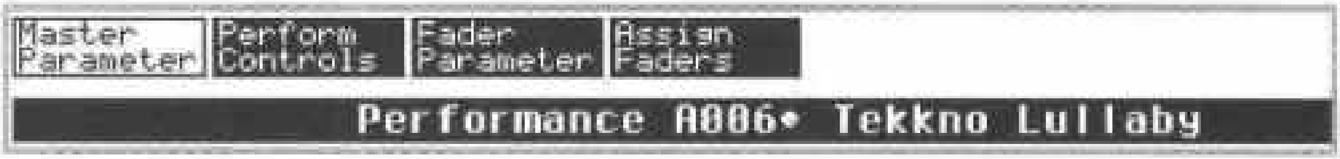
The two main reasons that there is a specific page for Externals in Performance mode are the need to mute or solo Externals as well as Instruments, and to give an overview of the Externals of the selected Performance.

In order to edit the *External's parameters* , you have to select the External Edit operation mode.

Performance Parameter Page

The third page of Performance mode gives you access to the overall parameters of that specific Performance. These are called the Performance parameters (as distinguished from Instrument or External parameters).

At the top of the display you'll find a menu with the following parameter-groups to choose from:



- Press the button labeled with the parameter group you want to edit; the selected group will be displayed as a hollow box rather than in inverse video.
- The faders now allow you to edit the various parameters of that group. See the following topics for explanations of the different Performance parameters.

The LEDs above the display buttons show the current Instrument status. Mute and solo functions can be executed on the Instruments as usual, and the Sounds of the currently edit-selected Instruments can be edited as well. The edit selection, however, cannot be changed, and Externals cannot be muted or soloed.

Master Parameters

Master parameters modify, scale or control the way certain Instrument or External parameters work or behave. They are valid for either all Instruments or all Externals of a Performance.

Instrument Volume

Range: 0...127

Instrument Volume is the master volume for all Instruments in the respective Performance. It will attenuate all individual Instrument Volumes by scaling them according to this parameter value.

A value of *0* will silence all Instruments, while a value of *127* will not attenuate them at all.

External Volume

Range: 0...127

External Volume is the master volume for all Externals in the respective Performance. It will attenuate all individual External volumes by scaling them according to this parameter value.

A value of *0* will silence all Externals, while a value of *127* will not attenuate them at all.

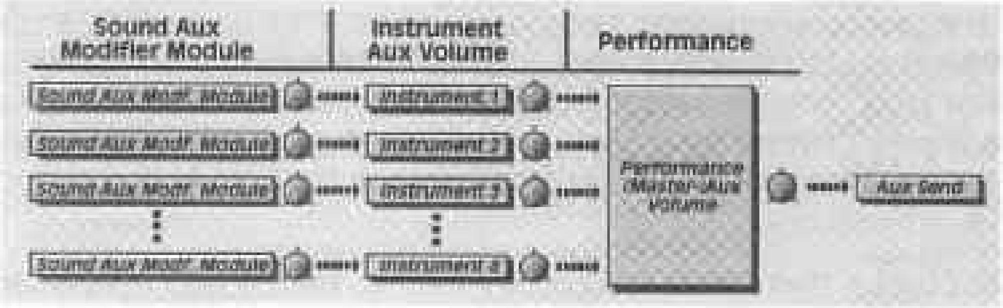
Aux Volume

Range: 0...127

Aux Volume is the master volume for the Aux-Sends of all Instruments in the corresponding Performance. It will attenuate all individual Aux-Send volumes by scaling them according to this parameter value.

A value of *0* will silence all Aux-Sends, while a value of *127* will not attenuate them at all.

See the below figure to understand the routing of the Aux-send:



Performance Controls

The parameters under the Performance Controls parameter-group allow you to define individual MIDI controller numbers for the physical controllers and the two freely-assignable MIDI controllers. Keep in mind that you may define physical controllers differently for each Performance of the Wave.

All physical Controllers can be used in the Sounds via the modifier table. When played from the Wave itself, the MIDI controller number of a particular physical controller is irrelevant, since the physical controller itself will be generating the control data. In theory, all physical controllers might be assigned to the same MIDI controller number, yet the Wave would still know which is which if they were played manually.

However, as soon as you record this data via MIDI to an external sequencer and send it back to the Wave, the actual MIDI controller definition of the physical controllers becomes critical. So keep in mind:

- When you define certain MIDI controllers for the physical controllers, you should use the very same definition when recording and when playing back the data. If you reprogram the physical controllers' MIDI meaning or use a different Performance with a different assignment, the incoming data cannot be mapped correctly to the physical controllers it was meant to represent.

  For example, in the modifier table *Pedal 1* will always be Pedal 1. But data generated by Pedal 1 and sent over MIDI using its specific MIDI controller number can only be recognized as Pedal 1 upon reception if the Pedal 1 assignment in the Performance is still valid.

- Don't use the same MIDI controller number for multiple physical controllers. When receiving the MIDI data, the Wave will route the incoming controller data to all of those physical controllers, yielding results that will most likely be different from the ones you intended. Keep in mind that while each physical controller on the Wave is routed directly (rather than via its MIDI controller) to the Sounds' modifier table, upon reception of MIDI, the incoming MIDI control data is mapped to the Wave's physical controllers. When two physical controllers receive the same MIDI stream, they cannot differentiate between the data each is supposed to receive.
- If it ain't broke, don't fix it: The factory settings for the MIDI assignments of the physical controllers should usually work fine, so only change them if you absolutely have to.

Control X

Range: MIDI controllers 1...120

This is not a physical controller. Rather, it is a freely assignable MIDI controller input that you can use in the modifier table to control Sound parameters via MIDI.

Control X usually only receives MIDI data; however, you can use the Performance faders to send the controller data assigned to Controller X, giving it a physical "handle."

Control Y

Range: MIDI controllers 1...120

This is not a physical controller. Rather, it is a freely assignable MIDI controller input that you can use in the modifier table to control Sound parameters via MIDI.

Control Y usually only receives MIDI data; however, you can use the Performance faders to send the controller data assigned to Controller Y, giving it a physical "handle."

Freewheel Up

Range: MIDI controllers 1...120

This is the MIDI controller number assigned to the upward throw of the physical controller *Freewheel*.

When you move the Freewheel up (towards the front panel), this MIDI controller data will be sent (provided it is not being filtered out by Instruments or Externals). When the MIDI controller data specified here is received, it will be mapped to the *Freewheel up* entry in the modifier table.

Freewheel Down

Range: MIDI controllers 1...120

This is the MIDI controller number assigned to the downward throw of the physical controller *Freewheel*.

When you move the Freewheel down (towards the player), this MIDI controller data will be sent (provided it is not being filtered out by Instruments or Externals). When the MIDI controller data specified here is received, it will be mapped to the *Freewheel down* entry in the modifier table.

Pedal 1

Range: MIDI controllers 1...120

This is the MIDI controller number assigned to the physical controller *Pedal 1*.

When you engage the pedal, this MIDI controller data will be sent (provided it is not being filtered out by Instruments or Externals). When the MIDI controller data specified here is received, it will be mapped to the *Pedal 1* entry in the modifier table.

When a sweep foot-pedal is used, the complete value range for the assigned MIDI controller can be transmitted, whereas a switch-style pedal will only output 0 or 127.

Pedal 2

Range: MIDI controllers 1...120

This is the MIDI controller number assigned to the physical controller *Pedal 2*.

When you engage the pedal, this MIDI controller data will be sent (provided it is not being filtered out by Instruments or Externals).When the MIDI controller data specified here is received, it will be mapped to the *Pedal 2* entry in the modifier table.

When a sweep foot-pedal is used, the complete value range for the assigned MIDI controller can be transmitted, whereas a switch-style pedal will only output 0 or 127.

Button 1

Range: MIDI controllers 1...120

This is the MIDI controller number assigned to the physical controller *Button 1*.

When you press the button, this MIDI controller will be sent (provided it is not being filtered out by Instruments or Externals). When the MIDI controller data specified here is received, it will be mapped to the *Button 1* entry in the modifier table.

Button 1 will only output values 0 or 127 for the MIDI controller it is assigned to.

Button 2

Range: MIDI controllers 1…120

This is the MIDI controller number assigned to the physical controller *Button 2*

When you press the button, this MIDI controller data will be sent (provided it is not being filtered out by Instruments or Externals). When the MIDI controller data specified here is received, it will be mapped to the *Button 2* entry in the modifier table.

Button 2 will only output values 0 or 127 for the MIDI controller it is assigned to.

Button 1 Mode

Range: toggle / touch

The Button 1 Mode determines how Button 1 will react when pressed. There are two different modes:

- *toggle:* In this mode, Button 1 will be activated when pressed once and stay activated until pressed a second time. It toggles between the states "on" and "off." When the LED above is illuminated, the button's state is on, and the current value is 127.
- *touch:* In this mode Button 1 will be activated for as long as you hold the button down. It is active for the time it is held, as indicated by the illuminated LED. When held, Button 1 outputs the value 127, otherwise a value of 0 is output.

Button 2 Mode

Range: toggle / touch

The Button 2 Mode determines how Button 2 will react when pressed. The same two modes as for Button 1 are available here.

Performance Faders

As stated before, in Performance mode the faders act as additional physical controllers, called the *Performance Faders*. Any fader can transmit one of the possible messages to either an Instrument or an External, freely assignable. The values sent by the faders will be routed to the respective Instrument or External the fader is assigned to.

With Instruments, the parameters of the Instrument or Sound will be changed directly, and the fader data will also be sent over MIDI on the Instrument's MIDI channel if it is set to transmit MIDI data (except for sys-ex data, which is independent of a MIDI channel).

When routed to an External, the Fader parameter data will be routed to the External and transmitted over MIDI on the External's MIDI channel.

Fader Parameters

Range: MIDI controllers 1...117 / Bend + / Bend - / Bend ± / Aftertouch / Ctr X / Ctr Y / Detune / Volume / Pan / Aux-Vol

These are the messages the respective Performance Fader can transmit. Most of these messages are MIDI controllers, plus pitch-bend and aftertouch. The latter six values, however, are dedicated parameters of the Wave:

- *Ctr X:* This is the MIDI controller assigned as Controller X in the Performance Controller page. Whatever MIDI controller you have assigned there will be transmitted by the fader when this value is chosen as the fader parameter. This way, you very easily have a physical Controller for *Controller X*.
- *Ctr Y:* The same as for *Controller X* above, only this time for *Controller Y*.
- *Detune:* The Instrument or External parameter Detune will be changed when this value is assigned to a Performance Fader. The corresponding system-exclusive message is sent via MIDI to allow for easy automation.
- *Volume:* Again, the Instrument or External parameter Volume will be changed. Note that there is a difference between sending a MIDI controller 7 message and sending the Instrument volume parameter: When there are two or more Instruments receiving on the same MIDI channel, a controller 7 message will affect all of them. Instrument Volume, on the other hand, will only affect the dedicated Instrument, regardless of MIDI channel assignments. Also, since *Volume* is a MIDI sys-ex message, it needs considerately more time to transmit and eats up more memory in a sequencer.
- *Pan:* Functions in much the same manner as the *Volume* parameter, only this time the panning parameter (not MIDI Ctr. 10) of either an Instrument or External is affected.
- *Aux-Volume:* The Instrument parameter Aux-Volume can be changed using the respective Performance Fader when this value has been selected. Please note that this value is not available if the Performance Fader has been assigned to an External.

To change the parameter you want the Performance fader to transmit, simply use the fader itself after you have selected the fader-parameter "parameter-group" .

Assign Faders

Range: I1...8, X1...8

This page allows you to assign the Performance faders to either an Instrument or to an External. Only one destination can be selected per fader.

- *I1...I8:* These values select one of the Instruments, which are referred to by their number. Instrument 1 is the leftmost Instrument on the display.
- *X1...X8:* Similarly, these values choose one of the Externals, which, again, are referred to by number. External 1 is the leftmost one. Please note that you cannot select an External as a destination if you have assigned *Aux-Vol* as the fader parameter.

To change the destination you want the Performance fader to transmit data to, simply use the fader itself to select the Instrument or External after you have selected the assign fader page.

Naming a Performance

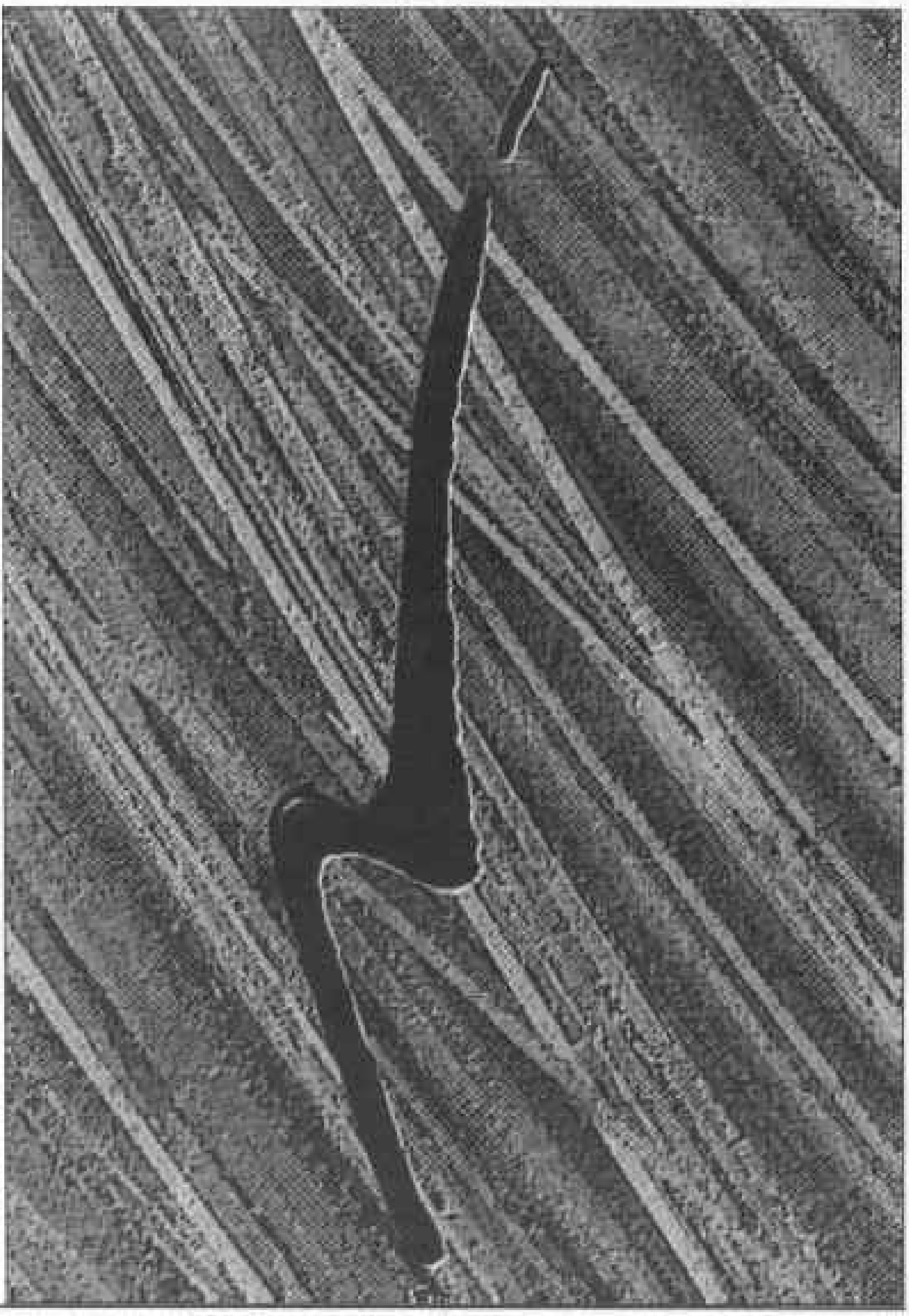
A Performance can only be named when storing it.

- A dialog-box appears, giving you the option to enter a new name before storing the Performance.
- To just change the Performance's name, simply store the Performance at the same location after you have entered the new name.

Chapter 9.5, Naming Items, gives you details about the naming dialog-box.

PERFORMANCE

Instrument Edit

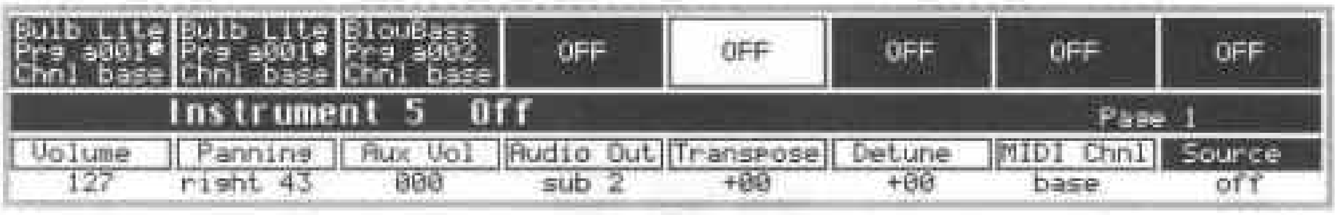


waldorf

This chapter gives you detailed information about instruments, which are an integral part of Performances and govern the internal Sounds of the Wave.

Activating an Instrument

Although a Performance always has access to eight instruments, not all of them need to be active at a given time. In fact, in order to minimize MIDI confusion and maximize processor throughput, it's a good idea to only have active those instruments that will actually be used for a Performance. To activate (or, for that matter, deactivate) an instrument, you have to select Instrument Edit mode.



```
Bulb Lite  Bulb Lite  BlouBass
Prg a001●  Prg a001●  Prg a002     OFF       OFF       OFF       OFF       OFF
Chnl base  Chnl base  Chnl base
          Instrument 5   Off                                       Page 1
 Volume     Panning    Aux Vol   Audio Out  Transpose   Detune   MIDI Chnl   Source
   127     right 43      000       sub 2       +00        +00       base        off
```

- Select *Page 1* of Instrument Edit.

- For an inactive instrument, the only parameter you can edit will be **<Source>**. All other parameters are inactive as indicated by their white background.
- Depending on the source you intend to control that instrument from, set the parameter **<Source>** to one of the following values:
  - *Keys:* selects the Wave's keyboard as a the control-source for that instrument.
  - *MIDI:* selects MIDI as a the control-source for that instrument. You must set the parameter **<MIDI Chnl>** to the desired MIDI receive channel.
  - *Keys&MIDI:* selects both the Wave's keyboard *and* MIDI as the control sources.
  - *Off* will deactivate the instrument.

When deactivated, you cannot edit any parameter of an instrument *except* the Source parameter. This follows our philosophy that you should not be able to edit what you can't hear, in order to avoid inadvertently messing up data.

Selecting a Sound

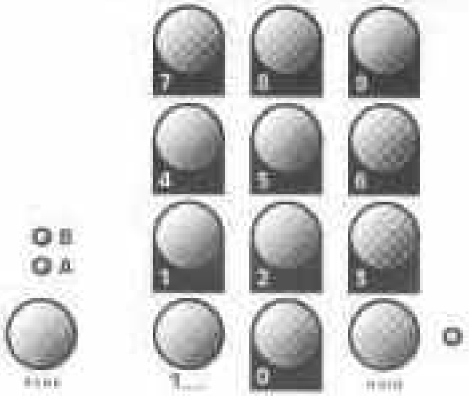
Once an Instrument has been activated, you can edit all of its parameters. The first thing you would most likely want to do is choose the Sound that Instrument will play.

The Wave contains a total of 256 Sounds, organized into two banks of 128 each. Each Sound will be identified by the bank and program number it is stored in as well as by its name. To clarify that it is a Sound, the identifying bank letter will always be a lower case character.

There are two ways to select a Sound: via the Wave's keypad or via MIDI. To change an Instrument's Sound via MIDI, the Performance's parameter <ProgChange Mode> must be set accordingly, as explained in chapter 5.3, Selecting a Performance.

At the Wave you can select a Sound only in the *Instrument Edit* operation mode:

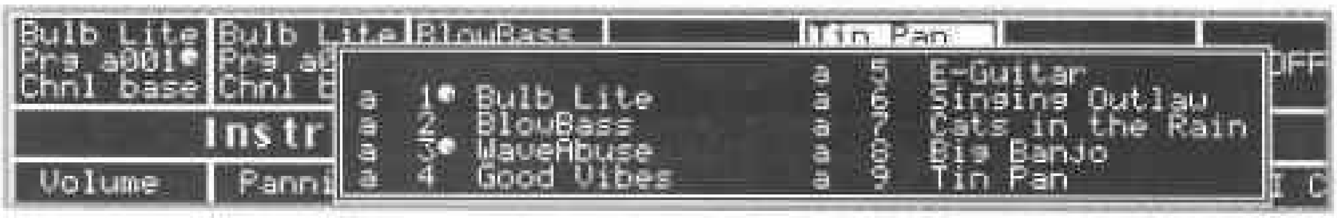
Keypad



The keypad is optimized to quickly call up a Sound, usually in only two keystrokes.

- The **[bank]** button selects either of the two Sound banks *a* or *b* .
- The ten **[number keys]** call up Sound's program number.
- You can select banks a or b either before or after you have selected the decimal place of the program number. The current bank selection will remain valid until you change it.
- You must enter a two-digit number to call up a Sound on program numbers 01 through 99.
- To call up Sounds 01 through 09 you must enter a leading zero.

- If a Sound is located between numbers 100 and 128, the **[1__]** button must additionally be pressed first. You must press the [1__] button *every time* you select a program number of or above 100; this button does not toggle.



```
Bulb Lite  Bulb Lite BlowBass              Tin Pan
Prg a001●  Prg a0                                       OFF
Chnl base  Chnl b        a  5  E-Guitar
                 a  1●  Bulb Lite       a  6  Singing Outlaw
        Instr    a  2   BlowBass        a  7  Cats in the Rain
                 a  3●  WaveAbuse       a  8  Big Banjo
 Volume    Panni a  4   Good Vibes      a  9  Tin Pan           I C
```

After you have selected the decimal place of the program number, a dialog-box will appear on the display showing the names of the Sounds of that decimal group, just as when selecting a Performance

⇨ If the Sound you are looking for is located in a different decimal group, you can use the [-/+] buttons to change the decimal group. The contents of that group will be displayed immediately.

- The **[Hold]** button will hold and remember the last decimal place you have entered. When activated, you only have to press one [number key] to select any of the program numbers within that decimal group, including the decimal groups above 100. The [Hold] button toggles, so it will remain in effect until you press it again.
- An illuminated LED next to the [Hold] button indicates if that function has been activated.
- Pressing the [Hold] button again deactivates it.

MIDI

To change a Sound over MIDI, you first have to set the Global parameter <ProgChange Mode> to either *Sounds* or *Perf+Snds* to enable MIDI program change commands to change the Instrument's Sounds.

Now send the MIDI PC on the MIDI channel the Instrument which shall play the corresponding Sound receives on. If more than one Instrument receives on that MIDI channel, the new Sound will be assigned to all those Instruments.

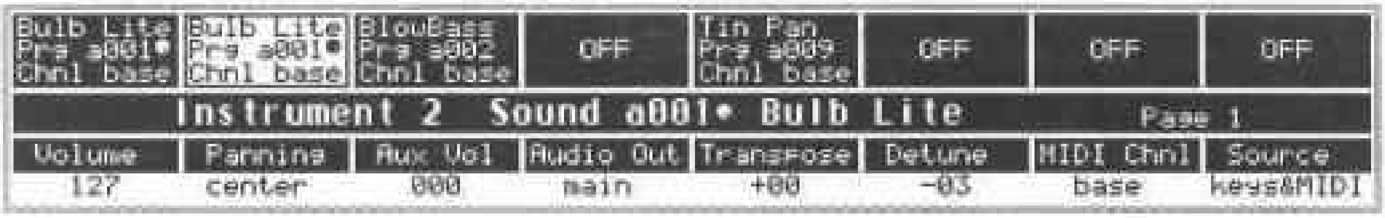
⇨ If the data filter of the Instrument is set to filter out incoming program changes, the Sound of that Instrument will not be changed regardless of the setting of the <ProgChange Mode> parameter.

➪ If you set the <ProgChange Mode> parameter to *Perf+Snds* and assign the same MIDI channel to an Instrument *and* to the base channel, the MIDI PC will change the Performance, *not the Sound*! Therefore, it is a good idea to never use the MIDI base channel of the Wave as an Instruments channel.

Instrument Pages

Instrument Edit mode sports four distinct pages that you select, as usual, with the [page] buttons in the display section.

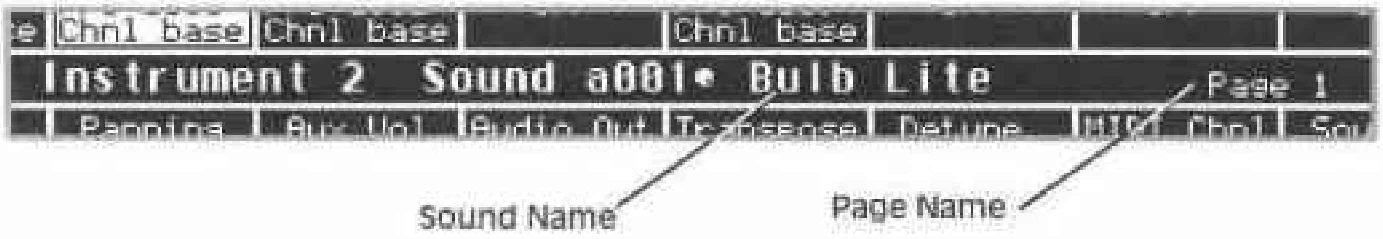
Instrument Page 1



```
Bulb Lite   Bulb Lite   BlowBass                Tin Pan
Prg a001•   Prg a001•   Prg a002       OFF      Prg a009       OFF        OFF        OFF
Chnl base   Chnl base   Chnl base               Chnl base
          Instrument 2  Sound a001• Bulb Lite                        Page 1
 Volume     Panning     Aux Vol    Audio Out   Transpose    Detune    MIDI Chnl    Source
  127       center        000        main         +00         -03        base     keys&MIDI
```

Page 1 looks very much like a typically organized Wave page:

- The **status line** in the middle of the display shows you the Instrument you are editing as well as its Sound's *bank, program change number, memory status* and *name*.
- If the Sound has been edited, the *edit-flag* appears behind the program change number as the memory status.
- To the right of the Sound name you'll find the *page-name*.



At the top of the display are the labels for the eight Instruments. These labels tell you some details about the Instruments and are organized exactly as in Performance mode.

The bottom of the display shows the parameter names and values for the faders.

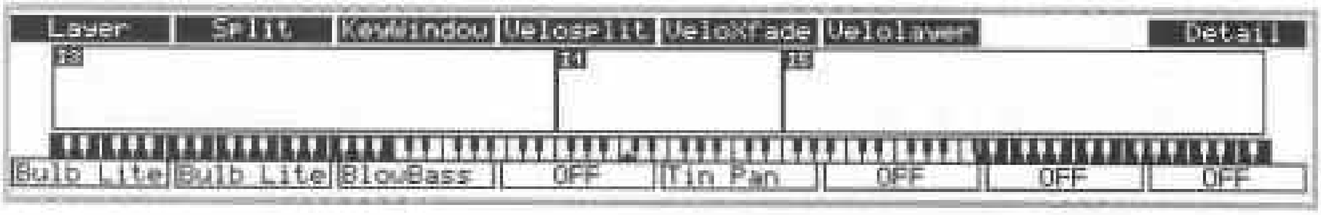
Instrument Page 2

Page 2 is almost identical to Page 1, the difference being the parameters that are available for editing.

Data Filters Page

Again, this page is basically identical to the previous two pages except for the parameter selection, which in this case gives you access to all the data filters of the specific Instrument.

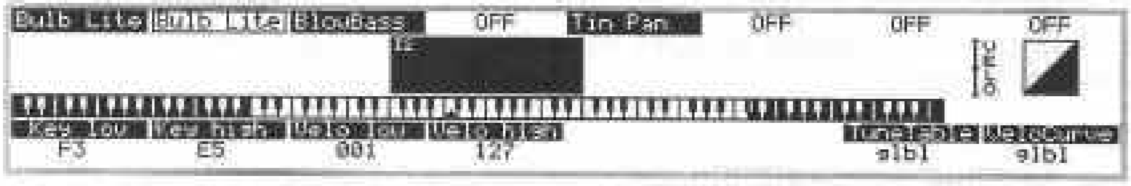
Zoning Page



This page is different from the other Instrument Edit pages. It displays *all* active Instruments simultaneously and allows *only* macro-functions to be executed. You can, however, access a detail page for further editing of the individual Instruments.

- The display buttons select macro functions. You cannot change the Instrument edit selection on this page.
- To access the individual Instrument parameters, press the <Detail> button.
- The middle of the page shows the zoning of the various active Instruments. The horizontal axis shows the key-range, while the vertical axis displays the velocity range. An icon in the upper left corner of each Instrument range box identifies the respective Instrument.
- Instead of Fader labels, you'll find the Sound names of the Instruments to guide you in setting up zone macros.
- Because there is no room for it, no page name is displayed. But we are very sure that you can nevertheless tell the purpose and meaning of this page.

Zoning Detail Page



Bulb Lite | Bulb Lite | BlowBass | OFF | Tin Pan | OFF | OFF | OFF

Key low | Key high | Velo low | Velo high | Tunetable | VeloCurve

F3 | E5 | 001 | 127 | glbl | glbl

This page can only be selected by pressing the <Detail> button on the Zoning page. Think of it as a sub-page of the Zoning page, which simply offers you more detail, should you need it.

- The display buttons show you the Sound-names of the active Instruments and let you select the one you want to edit.
- In the middle of the page you see the key- and velocity-ranges for the selected Instrument, plus the Velocity Curve selected for that Instrument. (Look at the user curves - they actually show the curve you have programmed!).
- The faders are labeled with the parameters they edit, with the parameter's values below.
- To exit back to the Zoning page, press either the [Page] or the [Cancel] button.

Instrument Parameters

These are the basic Instrument parameters *sans* the zoning information. You find them on Instrument Edit's pages 1 and 2. Please note that some of those parameters (such as <Volume> and <Panning>) appear on both of these pages - to make life easier for you.

Volume

Range: 0...127

As you would expect, this is the parameter used to edit the volume of the Instrument.

Panning

Range: left 64...1...center...right 1...63

Panning is used to define the position of the Instrument in the stereo-field. Please note that this parameter does apply regardless of the setting of <Audio Out>, since all audio outputs are stereophonic (well, almost all - aux is monophonic).

To enjoy the full range of panorama, you must make sure that the global parameter <Stereo Width> (in the Global 1 page of Global Edit) is set to *Full*.

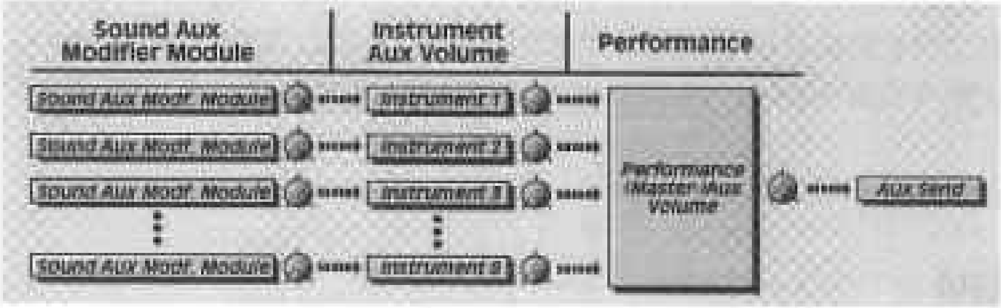
Aux Vol

Range: 0...127

This parameter sets the Volume for the aux-send of the Instrument.

The aux-send is an independent level, post-fader-style submix akin to the aux-send you would find on a mixing desk. The aux-sends of all Instruments will be mixed and send to the Aux-Out of the Wave. If you connect an effects-unit to this output, you can have a different effects-depth for each Instrument.

Furthermore, the send level can be modulated in real time, allowing some very hip things to be done. The aux-modulation, however, is done at the Sound, not the Instrument.



Please be aware that the <Aux Vol> parameter of the Instrument interacts with the Aux modulation setting of the Sound. <Aux Vol> scales the output of the Sound's aux modulation modifier. Therefore, you must program this modifier to output something in order to send it to the aux bus. The Instrument parameter <Aux Vol> will then scale the output coming from the Sound's Aux modifier module.

Audio Out

Range: main / sub 1 / sub 2 / aux only

This parameter selects the audio output to which the Instrument will be routed.

- *main:* selects the audio output main
- *sub 1:* selects the audio output sub 1
- *sub 2:* selects the audio output sub 2
- *aux only:* routes the Instrument *only* to the aux output. Actually, since the Instrument is *not* routed to any of the regular outputs, only the signal that is normally fed to the Aux-Out will be present.

Transpose

Range: -60...0...+60

This parameter allows you to transpose the Instrument up to ± 5 Octaves.

➪ Please note that the <Transpose> parameter will also transpose a Sound whose <Pitch Mode> parameter is set to *fixed*, giving you the option to tune such a Sound over a wide range.

Detune

Range: -50...0...+50 Cents

This parameter detunes the Instrument ± 1 semitone in 1-cent increments.

➪ Please note that the <Detune> parameter will also transpose a Sound whose <Pitch Mode> parameter is set to *fixed*, giving you the option to fine tune such a Sound.

MIDI Chanl

Range: base / 1...16

Use this parameter to set the MIDI channel the Instrument will receive on and, if <MIDI Out> is enabled, on which it will transmit MIDI data.

- *base:* This is the MIDI channel as specified in the Global parameters. By using the base channel, you can change the MIDI channel for the entire Wave (if all Instruments of all Performances are set to receive on the base channel) using a single parameter.

  ➪ Be aware that upon reception of MIDI program changes, setting an Instrument to the base channel (or the MIDI channel that is defined as the base channel) might cause interference with the Performance itself.

  See chapter 5.3," Selecting a Performance", for detail.

➪ An Instrument will receive MIDI data *only* when directed to do so by the <Source> parameter.

Source

Range: off / keys / MIDI / keys&MIDI

This parameter selects the source from which the Instrument will be controlled.

- *Off:* The Instrument is not active.
- *Keys:* selects the Wave's keyboard as the control source for that Instrument.
- *MIDI:* selects MIDI as a the control source for that Instrument. You must set the parameter <MIDI Chnl> to the desired MIDI receive channel.
- *Keys&MIDI:* selects both the Wave's keyboard *and* MIDI as the control sources.

➪ See the topic *Activating an Instrument* for more details.

Velo Curve

Range: global / linear + / linear - / expon + / expon -/ xfade + / xfade - / full / user 1...4

This parameter selects the Velocity Curve the Instrument will respond to.

- *global:* The Velocity Curve specified by the Global parameters will be used.
  ➪ This setting makes it easy to change the velocity response of the entire Wave quickly when programmed universally.
- *linear +:* selects the straightforward Velocity Curve. All velocities will be used as they come without any modification.
- *linear -:* similar to *linear +*, but inverted, so that incoming low velocities will be responded to as though they were high velocities and vice-versa.
- *expon. +:* The incoming linear velocity will be scaled to an exponential velocity.
- *expon. -:* similar to the above, but the response will be inverted.
- *xfade +:* This Curve is especially designed to allow for velocity-crossfaded Sounds that also have an overall response to velocity. Use *this* Curve on one and *the following one* on another Instrument to execute the desired effect.
  Use this Curve for the Instrument that should fade in at higher velocities.
- *xfade -:* This Curve is the counterpart of the previous one for programming velocity crossfades that are still responsive to playing soft and loud.
  Use this Curve for the Instrument that should fade out at higher velocities.

⇨ Use a high setting of <Envelope Velocity> in both Sounds for maximum effect.

- *full:* This curve disables the velocity response by using a fixed velocity value of 127.
- *user 1...4:* selects one of the user definable Velocity Curves. You can program them in Global Edit.

Tempermnt

Range: global / equal + / hmt / equal - / random 1...4 / user 1...4 / MIDI TT

This parameter selects the Temperament used by the Instrument to intonate the Sound.

- *global:* The Temperament specified by the Global parameters will be used.
  ⇨ This setting makes it easy to change the Temperament of the entire Wave quickly when programmed universally.
- *equal +:* good, not-so-old, equal temperament will be used when this setting is selected.
- *hmt:* our unique real-time just intonation algorithm will be used for the Instrument.
  ⇨ Please read chapter 8.16, "Global HMT Parameters", for more details.
- *equal -:* selects equal temperament that is inverted. The scale is mirrored around the E above middle C (MIDI note number 64).
- *random 1...4:* this is basically an equal tempered tuning with little variations each time you press a key. Random 1 introduces very little changes, while random 4 might truthfully emulate a drunken violinist with 2 weeks of playing experience (well, that might be a bit exaggerated).
  ⇨ use random temperments on one Instrument of a layer for non-uniform chorusing effects.
- *user 1...4:* selects one of the four user-definable tuning tables. You can program those in Global Edit.
- *MIDI TT:* selects a tuning table that can be altered exclusively by MIDI-Tuning-Standard-system-exclusive messages. See Appendix for details.

Alloc

Range: dynamic / poly 1...poly 16 /
last ret / low ret / high ret / last sng / low sng / high sng

Alloc is the abbreviation for Allocation. This parameter defines how the Instruments will behave in the voice allocation scheme. Even when fully expanded, the number of voices the Wave offers is limited. Therefore it is of utmost importance to assign the available voices as intelligently as possible to get the most mileage out of your investment.

<Alloc> allows you to closely define the assignment of voices to a specific Instrument. You will find two different allocation schemes: polyphonic voice allocation and - you guessed it - monophonic voice allocation.

In polyphonic voice allocation, each Instrument can play up to the maximum available voices. Since the trouble starts when you need more voices than are presently available, we've provided several different modes to deal with a number of scenarios.

- *dynamic:* This is the default setting for an Instrument and usually the most useful one, too. In *dynamic* allocation the Wave looks at each Instrument and assigns to it as many voices as possible. When the total number of voices exceeds the maximum amount available, it will redistribute the voices, ***but without stealing still sounding voices from other Instruments.***

  First the Wave looks for a voice that is not used by any Instrument anymore and assigns that to the new note. However, if no such voice exists because all voices are currently in use, it looks for the softest and/or oldest voice ***within the voices currently assigned to the Instrument that needs the new note*** and assigns that to the newly-struck key. The Wave is smart enough to continuously scan all voices in all Instruments, so as soon as a voice becomes available, it will be the next one that is used.

  This scheme works very well until a few Instruments (or even only one) use up all available voices and then an unused Instrument needs to play one. Since all voices are occupied by other Instruments, and since one Instrument cannot steal sounding voices from another, you're stuck - the new note simply will not get a voice, and therefore will not sound. This is not a pleasant thought, especially if it is a very important new part.

  But, do not despair, there is a solution:

- *poly 1...poly 16:* At first, these allocation modes function exactly the same as *dynamic*. However, should a situation occur as outlined above, these modes allow a voice to be stolen from another instrument. The first voice stolen will be the oldest and/or softest voice whose allocation is *dynamic*. If there are no *dynamic* voices (because there may be no dynamic allocation mode assigned), the oldest and/or softest *poly* voice will be stolen.

The number behind *poly* simply specifies *how many voices* this instrument may steal at the most from other instruments. When set to *poly 1*, that instrument can, at the most, steal 1 voice from other instruments. Even if it needs four to sound a newly struck chord, only one voice of the chord will sound. On the other hand, *poly 16* would allow an instrument to steal any voice of any instrument in a 16-voice Wave.

Both solutions might be rather radical. When assigning one of the *poly* modes, think carefully how many voices *must be guaranteed* for that instrument and set the *poly* mode accordingly.

The other voice allocation modes are all monophonic. There are two main groups of monophonic allocation modes, which differ in the way envelopes are triggered when playing legato: *retrigger* modes, which will retrigger envelopes each time a new key has been struck, and *single trigger* modes, where envelopes are triggered only if no key is held when a new key is struck. This results in a musical line whose pitches will vary, but whose envelope is that of the first note struck when playing legato.

- *last ret:* the last key you play is the one you will hear. Envelopes are retriggered every time a new key is played.
- *low ret:* the lowest key you play is the one you will hear. Envelopes are retriggered every time a lower key is played when playing legato, and when playing staccato.
- *high ret:* the highest key you play is the one you will hear. Envelopes are retriggered every time a higher key is played when playing legato, and when playing staccato.
- *last sng:* The pitch of the last key you play is the one you hear. However, the currently running envelopes will keep running when playing legato. When playing staccato, envelopes will be retriggered.
- *low sng:* The pitch of the lowest key you play is the one you hear. The currently running envelopes will keep running when playing legato. When playing staccato, envelopes will be retriggered.

- *high sng:* The pitch of the highest key you play is the one you hear.The currently running envelopes will keep running when playing legato. When playing staccato, envelopes will be retriggered.

Instruments set to a monophonic allocation mode *always* have precedence over polyphonic modes. If there is no free voice available, they will steal the oldest and/or softest voice *regardless of the Instrument it is assigned to*, except it belongs to another monophonic Instrument; that voice will never be stolen.

Analog In

Range: off / input 1..4

Here you can select one of the four Analog inputs described in Chapter 1.11. However, if an Analog input is selected, the <Alloc> parameter will jump to the first monophonic allocation mode . Due to hardware restrictions, analog signal routing is only possible with monophonic allocation modes.

MIDI Out

Range: off / Out A / Out B / Out A&B

With this parameter the Instrument can transmit data it receives from the *keyboard* Source via MIDI. The channel this data is sent on will be the same as the receive channel of the Instrument.

Note data will only be transmitted for notes that are within the key- and velocity-ranges of the Instrument. In general, the data transmitted over MIDI is mirrored directly from the data fed to the Wave's internal sound engine, so whatever physical controller the Instrument uses to control a Sound will also be transmitted over MIDI.

Data received at the MIDI input for that Instrument will not be transmitted, regardless of the <Source> parameter.

- *off:* No MIDI data will be transmitted from this Instrument. This is the default setting.

- *Out A:* MIDI data will be transmitted as described above at MIDI Out A.

- *Out B:* MIDI data will be transmitted as described above at MIDI Out B.

- *Out A&B:* MIDI data will be transmitted at both MIDI Outs of the Wave, yet on the same MIDI channel.

☞ Use <MIDI Out> to record what you play on the Wave keyboard into a sequencer to make sure it will be recorded exactly as it is played back by the Wave with the Performance you are using.

Data Filters

Data Filters allow you to filter out certain information from the Source that feeds the Instrument. There is no provision to have separate filters for the *keys* and *MIDI* Source if you use both to control the Instrument.

Volume

Range: ignore / receive

This data filter filters out MIDI continuous controller 7, volume. It does not, however, filter out Instrument volume messages, sent either via MIDI or from the Performance Faders.

Panning

Range: ignore / receive

This data filter filters out MIDI continuous controller 10, panning. It does not, however, filter out Instrument panning messages, sent either via MIDI or from the Performance Faders.

Pan Mode

Range: off / on / inverse

This parameter does not filter out MIDI or keyboard control data, but rather the modulations applied to the Panning module of the Sound used by the Instrument.

- *off:* Panning modulation will be disabled for the Instrument.
- *on:* Panning modulation is enabled for the Instrument as defined by the respective Sound module.
- *inverse:* Panning modulation is enabled for the Instrument, but the sign of the modulation index will be reversed, usually resulting in a flip of the stereo image - what went left to right now goes right to left (and what goes up might come down).

PrgChange

Range: ignore / receive

This data filter filters out MIDI program change commands. It does not, however, filter out program changes made from the keypad while in Instrument Edit.

PitchBend

Range: ignore / receive

This data filter filters out pitch-bend messages, both from the physical controller of the Wave and data received over MIDI.

Modwheel

Range: ignore / receive

This data filter filters out MIDI continuous controller 1 messages, modulation, both from the physical controller Mod Wheel of the Wave and data received over MIDI.

Pressure

Range: ignore / receive

This data filter filters out MIDI channel pressure (aftertouch) as well as polyphonic key pressure, both from the Wave (channel pressure only) and data received over MIDI.

Sustain

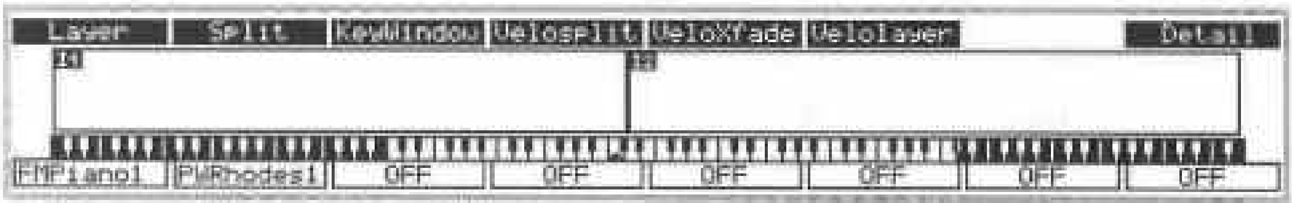
Range: ignore / receive

This data filter filters out MIDI continuous controller 64 messages, sustain pedal, both from the sustain pedal of the Wave and data received over MIDI.

Instrument Zoning

A zone is a range where the reception of note data for an Instrument is activated. Instruments have both a key-zone and a velocity-zone, which initially are set to their respective zone limits.

The Zoning Page



This page allows you to quickly set up an Arrangement with layers and/or splits using powerful macro functions. Rather than having to adjust every individual aspect of all the Instruments' zones that are supposed to make up a certain part of an Arrangement, you can choose the Instruments you want to align and apply the appropriate macro function to them.

To allow you as much flexibility as possible, you can choose the instruments you want to align. Only instruments *that are not muted* will be considered when executing a macro function. All muted instruments will remain untouched.

Select the Zoning page and execute the desired macro function by pressing the corresponding display button. A dialog-box pops up, asking you to verify the macro function you chose, usually followed by instructions on what to do next.

Instead of using a macro function you can press the **<Detail>** button to gain access to the individual parameters of the instrument zones.

You can execute several macros sequentially. If possible, data set by a previously engaged macro will not be altered, so for instance you might invoke the <Layer> macro first, followed by the <VelXfade> macro.

Layer

This macro function automatically creates a layer using the respective instruments. On the basis of the number of instruments chosen to create the layer, specific values for the instrument parameters <Panning> and <Detune> will be used to thicken up the resulting sound.

Split

This macro function will automatically generate a split-keyboard setup for the instruments chosen. You will be asked to input the desired split points by playing them on the keyboard. The key you play will be the lowest key of the next zone.

There will be no gaps or overlapping zones when using this macro. The lowest zone will always start at MIDI key 0, and the highest will extend up to key number 127.

The first instrument (the one below the first split point you entered) will always be the one with the lowest instrument number.

KeyWindow

This macro will generate a key zone for each respective instrument with its own low and high key. A dialog box will ask you to input the low key and high key for the first instrument through the last instrument. The order in which you input low and high key is not relevant - the lower note will always be the low limit.

You can program the zones as you like, including gaps and overlapping areas. This macro is far more flexible than the <Split> macro, but you have to input more data as well.

The first instrument will always be the one with the lowest instrument number.

VeloSplit

This macro function allows you to set up the respective instruments with velocity splits. A dialog box asks you to play any key on the Wave keyboard to input the velocities at which the splits should occur.

The velocity zones generated by this macro will neither overlap nor have gaps.

The instrument with the softest velocity zone will always be the one with the lowest instrument number.

VeloXfade

This macro will process the selected instruments automatically to generate velocity crossfades. It will set the instrument parameter <VeloCurve> and, if needed, the velocity zones of the respective instruments.

The instrument with the softest velocity zone will always be the one with the lowest instrument number.

VeloLayer

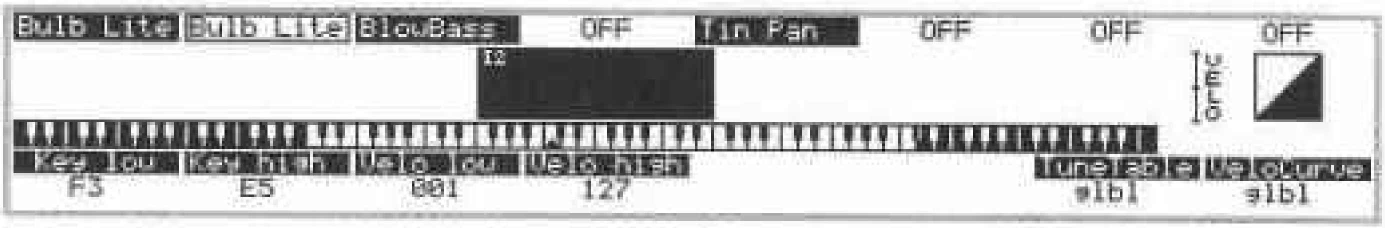
This macro will process the selected instruments automatically to generate a velocity layer, where more instruments will sound at higher velocities and only one at low velocities. The macro will set the instrument's velocity zones.

The instrument with the softest velocity zone will always be the one with the lowest instrument number; the highest-numbered instrument will kick in at the highest velocity.

Detail

This button is not a macro function, but rather calls up the Zoning Detail page, which allows for the editing of the individual zone parameters of one instrument at a time.

The Zoning Detail Page



Bulb Lite | Bulb Lite | BlowBass | OFF | Tin Pan | OFF | OFF | OFF

Key low: F3 | Key high: E5 | Velo low: 001 | Velo high: 127 | TuneTable: ♯1b1 | VeloCurve: ♯1b1

This page allows you to edit the individual zone parameters of Instruments.Use the display buttons to select the Instrument whose zoning parameters you wish to edit using the faders of this page. The graph in the middle of the page displays the key- and velocity-zone as well as the Velocity Curve of the Instrument.

Key low

Range: C-1...G9

This is the lowest note of the key zone of the respective Instrument.

Key high

Range: C-1...G9

This is the highest note of the key zone of the respective Instrument.

Velo low

Range: 001...127

This parameter sets the lowest velocity for the velocity zone of the Instrument.

Velo high

Range: 001...127

This parameter sets the highest velocity for the velocity zone of the Instrument.

Tempermnt

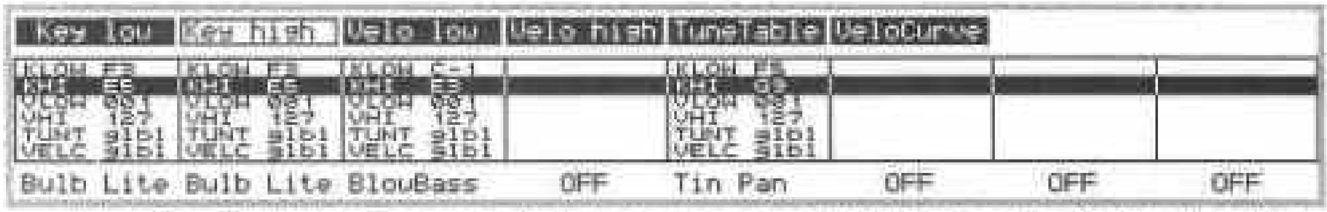
This is the same parameter <Tempermnt> you find on Instrument Edit page 2, repeated here purely for your personal convenience.

VeloCurve

This also is the same parameter that you find on Instrument Edit page 2, repeated here for convenience only.

Zoning Group Edit

Please be aware that you can use Group Edit both in the Zoning Macro page and in the Zoning Detail page. Group Edit in both of these pages will present to you the same page, which is a listing of the individual zone parameters for each instrument:



```
 Key low   Key high   Velo low   Velo high  TuneTable  VeloCurve
KLOW F3   KLOW F3   KLOW C-1             KLOW F5
KHI  E5   KHI  E5   KHI  E3              KHI  G9
VLOW 001  VLOW 001  VLOW 001             VLOW 001
VHI  127  VHI  127  VHI  127             VHI  127
TUNT 91b1 TUNT 91b1 TUNT 91b1            TUNT 91b1
VELC 91b1 VELC 91b1 VELC 91b1            VELC 91b1
Bulb Lite Bulb Lite BlowBass     OFF     Tin Pan        OFF        OFF        OFF
```

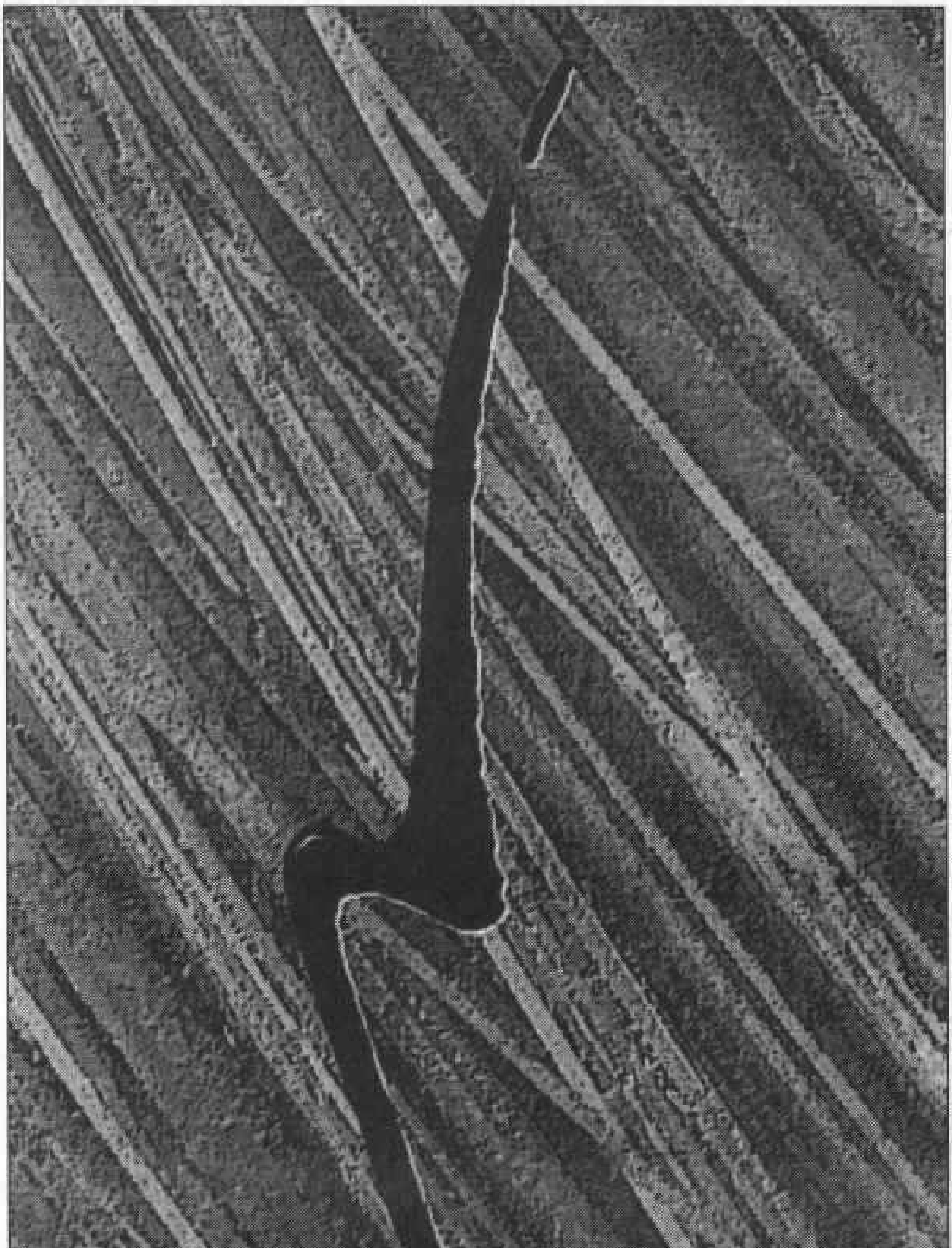
- Use the display buttons to select the parameter you wish to edit. An inverse video bar will guide you in finding the values for that parameter within the listing.

- Use the faders to edit the selected parameter for up to eight instruments in the Performance.

⁘ The Zoning Group Edit page is also a great way of viewing all instrument zones at once as a listing to see how a particular Arrangement is set up.

PERFORMANCE

External Edit



waldorf

This chapter gives you detailed information about Externals, which govern all the master keyboard functions of the Wave and are generally meant for controlling external MIDI gear.

Each External can control one MIDI device on one MIDI channel at either or both MIDI outputs of the Wave. The parameters stored in the active Externals will be transmitted over MIDI when a new Performance has been selected, which offers you a means to automate your external MIDI gear during live performance and in the studio.

Obviously, you may edit all parameters of an External in real time as well adjust them from within a selected Performance in the Wave. Finally, do not forget the potential of using the Performance Faders as real-time controllers to make the most out of the Wave's master keyboard functions.

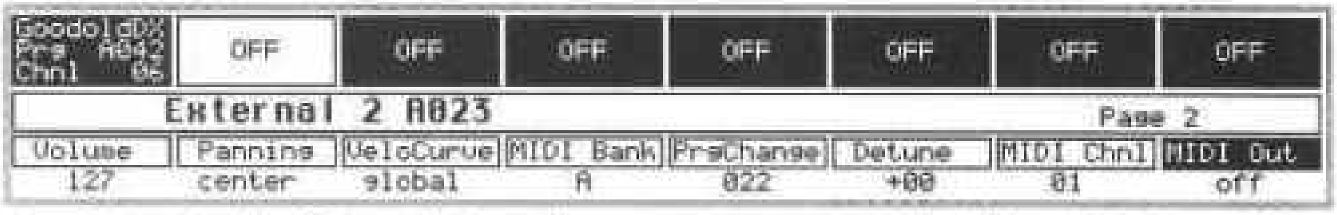
As pointed out before, Externals are very similar to Instruments, so if you are familiar with these, you basically know how to use Externals as well.

Activating an External

You have access to up to eight Externals in a single Performance. As with Instruments, not all Externals have to be active at all times. To use an External that is set to *Off* you first have to activate it.

- To activate or deactivate an External, you have to select *External Edit* mode.

- Select *Page 1* of External Edit.



GoodoldDX Prg A042 Chnl 06	OFF	OFF	OFF	OFF	OFF	OFF	OFF

External 2 A023 Page 2

Volume	Panning	VeloCurve	MIDI Bank	PrgChange	Detune	MIDI Chnl	MIDI Out
127	center	global	A	022	+00	01	off

- For an inactive External, the only parameter you can edit will be <MIDI Out>. All other parameters are inactive as indicated by their white background.

- Depending on the MIDI output you intend to use to transmit MIDI data from the External, set the parameter <MIDI Out> to one of the following values:

- *Out A:* MIDI data from the External will be transmitted at MIDI Out A.

- *Out B:* MIDI data from the External will be transmitted at MIDI Out B.

- *Out A&B:* MIDI data will be transmitted at both MIDI Outs of the Wave (but on the same MIDI channel).

- *off:* No MIDI data will be transmitted from the External.

When deactivated, you cannot edit any parameter of an External *except* the <MIDI Out> parameter.

Selecting an External MIDI-Device

After having activated the External, you can edit all its parameters. Since you most likely intend to control another sound module (or other MIDI-capable device) from the Wave, the first step of setting up the External will likely be to choose the MIDI device you intend to control and select the program it should play.

Choosing the MIDI device means selecting the desired MIDI output and setting up the MIDI channel on which the connected unit should receive. To address several different MIDI channels on a single piece of external equipment, you must use one External per MIDI channel.

- You automatically set the MIDI output from which the data will be transmitted when you activated the External as described above, so that part is already done.
- To address the correct device, you now have to input the MIDI channel it receives on or, more correctly, the respective External will transmit on. This is done at the parameter **<MIDI Chnl>** (well, what a surprise!) next to <MIDI Out>. You have the following well-known choices:
  - *base:* This is the MIDI channel as specified in the Global parameters. By using the base channel, you can change the MIDI channel globally with a single parameter. However, since the base channel will be the same MIDI channel throughout, it makes little sense to use it in more than one External - especially if your other MIDI gear *always* receives on the same MIDI channels. In that case it's better to specify the channels directly.
  - *1...16:* As you have guessed quite reasonably, those are the MIDI channels to choose from.

⇨ Please note that you can assign each MIDI channel of each MIDI output its own name in Global Edit. This simplifies identifying the receiving MIDI devices enormously, so you should take the time to set up those names once for your MIDI setup.

Selecting an External MIDI Program

Selecting the program number for the connected MIDI device can be done in two different ways: via the Wave's keypad and with specific parameters of the External itself.

You can select a program for an External *only* in External Edit mode.

Keypad

This is done in exactly the same way as for the Sound in an Instrument. All the regular features of the keypad apply except for selecting the *bank*, which only can be done from the External's parameter <MIDI Bank>.

☞ Please be aware that the MIDI bank you can address has *nothing* to do with the internal memory banks A and B of the Wave. The <MIDIbank> parameter in Externals always refers to the MIDI bank-select controller.

External's Parameters

Instead of inputting a program change number using the keypad, you may use the fader parameters of page 2 of the External to define the program number to transmit to the connected MIDI device.

- select *page 2* of the External
- The parameter **<PrgChange>** allows you to choose a program change number.
- The parameter **<MIDI Bank>** allows you to select a MIDI bank of the receiving device. The External will send it as the MIDI bank-select-controller.

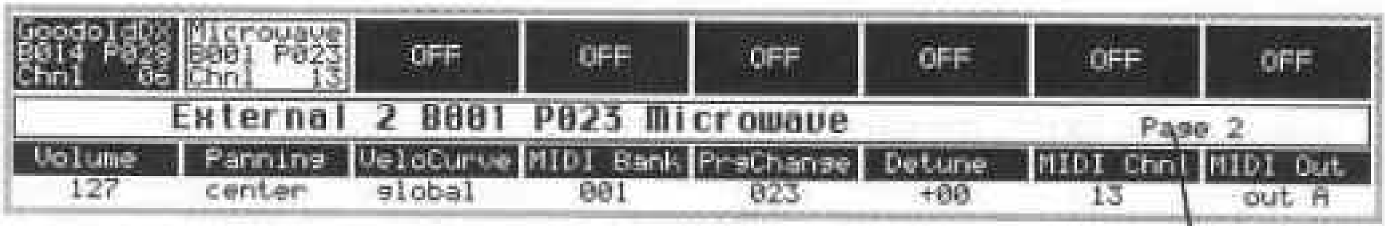
☞ Be aware that the MIDI bank-controller message must be understood by the receiving device - otherwise it will have no effect or, if worst comes to worst, do something else (namely if MIDI continuous controllers 0 and 32 are defined to do something else, which in any event is not a good idea).

☞ The Wave can disable the transmission of the MIDI bank select controller globally. Make sure that the parameter <Send Bank Ctrl> in Global edit is set to *on*.

External Pages

External Edit mode, just as Instrument Edit mode, sports four distinct pages that you select, as usual, using the [Page] buttons in the display section.

External Page 1



GoodoldDX B014 P028 Chnl 06	Microwave B001 P023 Chnl 13	OFF	OFF	OFF	OFF	OFF	OFF

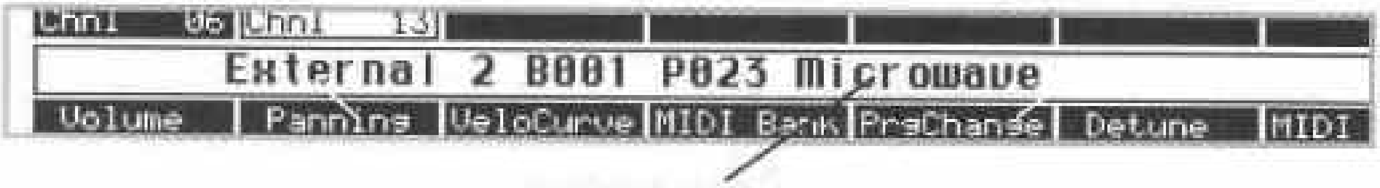
External 2 B001 P023 Microwave Page 2

Volume	Panning	VeloCurve	MIDI Bank	PrgChange	Detune	MIDI Chnl	MIDI Out
127	center	global	001	023	+00	13	out A

Page 1 very much looks like a typically organized Wave page:

Page Name

- The **status line** in the middle of the display shows you the External you are editing; it also tells you the MIDI*bank* and ***program change number*** last sent to the MIDI device plus the ***name*** of the MIDI device itself.
- To the right of the MIDI program change number you'll find the ***page-name.***



Chnl 06 Chnl 13

External 2 B001 P023 Microwave

Volume Panning VeloCurve MIDI Bank PrgChange Detune MIDI

MIDI Device Name

At the top of the display there are the labels for the eight Externals. These labels tell you some details about the Externals, and are organized exactly as in Performance mode.

The bottom of the display shows the parameter names and values for the faders.

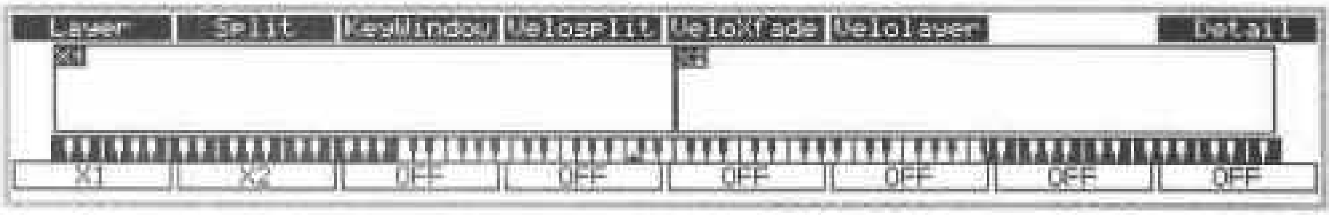
External Page 2

Page 2 is nearly identical to Page 1, the difference being the selection of parameters that are available for editing.

Data Filters Page

Again, this page is basically identical to the previous two pages except for the parameter selection, which in this case gives you access to all the data filters of the specific External.

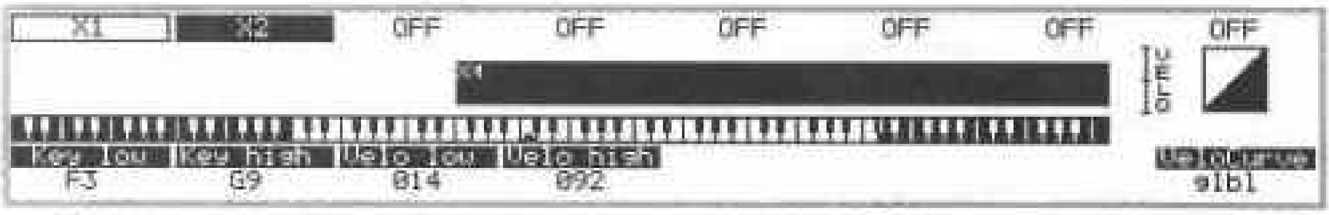
Zoning Page



This page is different from the other External Edit pages. It displays *all* active Externals simultaneously and *only* allows you to execute macro functions. You can, however, access a detail page for further editing of the individual Externals.

It functions exactly as the Instrument Zoning page described in chapter 6.15, The Zoning Page.

Zoning Detail Page



Key low F3
Key high G9
Velo low 014
Velo high 092
VeloCurve ◆lb1

This page can only be selected by pressing the <Detail> button on the Zoning page. Think of it as a sub-page of the Zoning page, which simply offers you more detail in case you need it.

It functions exactly as the Instrument Zoning Detail page described in chapter 6.17, "The Zoning Detail Page".

External Parameters

These are the basic External parameters *without* the zone information. You'll find them on External Edit's pages 1 and 2. Please note that some of those parameters (such as <Volume> and <Panning>) appear on both of these pages - once again to make life a more joyful experience for you.

Volume

Range: 0...127

This is MIDI volume, continuous controller number 7. It must be understood by the receiving device to be effective.

Panning

Range: 0...127

This is MIDI panning, continuous controller number 10. It must be understood by the receiving device to be effective.

MW Scale

Range: off / -200%...0%...+200%

This parameter is unique. It allows you to scale the data output of the mod wheel of the Wave for the respective External. You can set up different scalings for various Externals, which allows you to achieve some interesting results.

- *off:* the mod wheel will be disabled.
- *+x%:* for positive values, the mod wheel's direction will be as usual, with higher values being transmitted when pushed away from the player. However, the exact values being transmitted depend on the *percentage* of the scaling:
  - *100%* outputs the mod wheel data as usual.
  - values *smaller than 100%* will stretch the range of the mod wheel, but will accordingly output only a limited range; e.g., *50%* will output the value 64 at the maximum throw.
  - values *greater than 100%* will compress the mod wheel's range. As such, the maximum value will be output before the wheel reached its maximum throw. For example, *200%* will output the value 127 at half the travel of the wheel.
- *- x%:* In addition to the scaling described above, the mod wheel will also be reversed, so that values will decrease when the wheel is pushed away from the player.

PW Scale

Range: off / -200%...0%...+200%

This parameter is similar to the previous one, <MW Scale>. It allows you to scale the data output of the pitch-bend wheel of the Wave for the respective External.

- *off:* the pitch-bend wheel will be disabled.

- *+x%:* for positive values, the pitch-bend wheel's direction will be as usual, with the pitch bending up when pushed away from the player. However, the exact values being transmitted depend on the *percentage* of the scaling:
  - *100%* outputs the pitch-bend wheel data as usual.
  - values *smaller than 100%* will stretch the range of the pitch-bend wheel, but will accordingly output only a limited range; e.g., *50%* will output the value 96 at the maximum throw and 32 at the minimum throw. The center detent of the pitch-bend wheel will *always* output 64.
  - values *greater than 100%* will compress the pitch-bend wheel's range. As such, the maximum value will be output before the wheel reached its maximum throw; e.g., *200%* will output the value 127 at 3/4 of the wheel's travel and 0 at 1/4.
- *- x%:* In addition to the scaling described above, the pitch-bend wheel will also be reversed, so that pitch will bend down when the wheel is pushed away from the player.

Transpose

Range: -60...0...+60

This parameter allows you to transpose the External up to ± 5 Octaves.

Detune

Range: -50...0...+50

This parameter detunes the External by adding an offset to the pitch-bend wheel data. The actual depth of the detuning depends on the pitch-bend range set at the receiving MIDI device.

☞ You will get best results if you use the same pitch-bend range for all your sound modules, as then the detune value of the External will affect all external MIDI gear the same way.

MIDI Chanl

Range: base | 1...16

This parameter sets the MIDI channel the External will transmit on.

- *base:* This is the MIDI channel as specified in the Global parameters. By using the base channel, you can change the MIDI channel globally using a single parameter.

MIDI Out

Range: off / Out A / Out B / Out A&B

As described before, this parameter activates the External and selects the MIDI output the External will transmit data on.

- *off:* no MIDI data will be transmitted from this External.
- *Out A:* MIDI data will be transmitted via MIDI Out A.
- *Out B:* MIDI data will be transmitted via MIDI Out B.
- *Out A&B:* MIDI data will be transmitted via both MIDI Outs of the Wave (but on the same MIDI channel).

VeloCurve

Range: global / linear + / linear - / expon + / expon -/ xfade + / xfade - / full / user 1...4

This parameter selects the Velocity-Curve the External will use.

➪ Please be aware that the actual velocity response is very much dependent on the velocity response of the receiving device.

- *global:* The Velocity Curve specified by the Global parameters will be used.
  ➪ This setting makes it easy to change the velocity response of the entire Wave quickly when programmed universally.
- *linear +:* selects the straightforward Velocity Curve. All velocities will be sent as they are without any modification.
- *linear -:* similar to *linear +*, but inverted, so that soft keystrokes will result in high velocities and vice versa.
- *expon. +:* an exponential Velocity Curve will be used.
- *expon. -:* similar to the above, but the response will be inverted.
- *xfade +:* This Curve is especially designed to allow for velocity-crossfaded Sounds that also have an overall responsiveness to velocity. Use *this* Curve on one and *the following one* on another External for the desired effect.
  Use this Curve for the External that should fade in at higher velocities.

- *xfade -:* This Curve is the counterpart to the previous one for programming velocity crossfades that are still responsive to playing soft and loud. Use this Curve for the External that should fade out at higher velocities.
- *full:* This curve disables the velocity response by using a fixed velocity value of 127.
- *user 1…4:* selects one of the user definable Velocity Curves. You can program them in Global Edit.

MIDI Bank

Range: 0…127

As described previously, this parameter selects the MIDI bank at the receiving MIDI device by sending a MIDI bank-select-controller message (MIDI continuous controllers 0 and 32) using the value set here.

A bank select message will only be transmitted if the global parameter <Send Bank Ctrl> is set to *on*.

Obviously, the receiving MIDI device must understand this MIDI message; some older devices might actually interpret it incorrectly. In that case, set <Send Bank Ctrl> to *off*.

PrgChange

Range: 1…128

This parameter allows you to enter a MIDI program change command using a fader rather than the keypad.

Data Filters

Data filters for the Externals allow you to disengage data transmission from certain physical controllers.

☞ Be aware that you can disengage both the *mod wheel* and the *pitch-bend wheel* by setting their scaling to *off*.

Pedal 1

Range: off / transmit

This data filter allows you to disengage the Wave's physical controller Pedal 1 for the respective External.

Pedal 2

Range: off / transmit

This data filter allows you to disengage the Wave's physical controller Pedal 2 for the respective External.

Keys

Range: off / transmit

This data filter allows you to disengage the Wave's keyboard for the respective External.

☞ Use this feature to set up an External for a non-note sensitive MIDI device, such as an effects processor, or for simply using the faders as input devices for your favorite sequencer's on-screen faders.

PrgChange

Range: off / transmit

This data filter allows you to disengage transmission of MIDI program changes for the respective External.

FreeWheel

Range: off / transmit

This data filter allows you to disengage the Wave's physical controller Freewheel for the respective External. Both Freewheel up and Freewheel down messages will be affected.

Buttons

Range: off / transmit

This data filter allows you to disengage the Wave's physical controllers Button 1 and Button 2 for the respective External. Both Buttons will be affected.

Pressure

Range: off / transmit

This data filter allows you to disengage the Wave's channel pressure (aftertouch) for the respective External.

Sustain

Range: off / transmit

This data filter allows you to disengage the Wave's sustain pedal for the respective External.

External Zoning

An External's zone defines the keyboard and velocity ranges in which that External will transmit MIDI data.

External zoning is virtually identical to instrument zoning.

The Zoning-Page

This page allows you to quickly set up an Arrangement with layers and/or splits via powerful macro functions.

To allow you as much flexibility as possible, you can choose the Externals you want to align. Only Externals *that are not muted* will be considered when a macro-function is executed. All muted Externals will remain unaffected.

Next, select the Zoning page and execute the desired macro function by pressing the corresponding display button. A dialog box pops up, asking you to verify the macro function you have chosen, usually followed by instructions on what to do next.

Instead of using a macro-function you can press the <Detail> button to gain access to the individual parameters of the External zones. You can exert several macros sequentially.

Layer

This macro-function automatically creates a layer using the respective Externals. On the basis of the number of Externals chosen to create the layer, specific values for the parameters <Panning> and <Detune> will be used to thicken up the resulting sound.

⇨ The exact effect, however, will depend on the pitch-bend range of the respective MIDI devices as well as their acceptance of MIDI panning messages.

Split

This macro function will automatically generate a split-keyboard setup for the Externals chosen. You will be asked to input the desired split points by playing them on the keyboard. The key you play will be the lowest key of the next zone.

There will be no gaps or overlapping zones when using this macro. The lowest zone will always start at MIDI key 0; the highest will extend up to key number 127.

The first External zone (the one below the first split point) will always be the one with the lowest External number.

KeyWindow

This macro will generate one key zone for each respective External with its own low and high key. The order in which you input the low key and high key is not relevant - the lower note will always be the low limit.

You can program the zones as you like, including gaps and overlapping areas.

The first External you work on will always be the lowest numbered.

VeloSplit

This macro-function allows you to set up the respective Externals with velocity splits. A dialog box asks you to play any key on the Wave keyboard to input the velocities at which the splits should occur.

The velocity zones generated by this macro will neither overlap nor have gaps.

The External with the softest velocity zone will always be the one with the lowest number.

VeloXfade

This macro will process the selected Externals automatically to generate velocity crossfades. It will act on the External parameter <VeloCurve> and, if needed, the respective velocity zones.

The External with the softest velocity zone will always be the one with the lowest External number.

VeloLayer

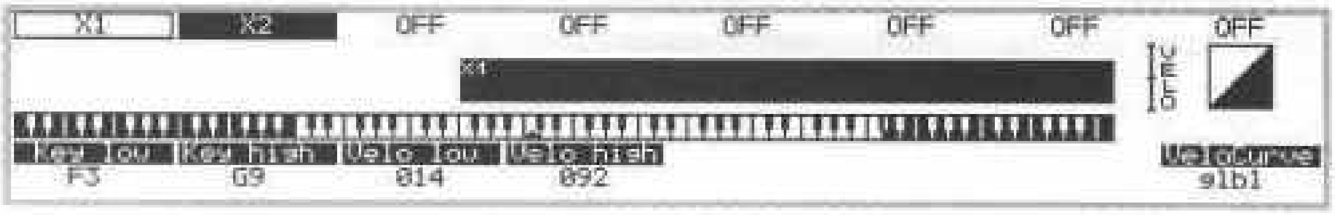
This macro will process the selected Externals automatically to generate a velocity layer, where more Externals will sound at higher velocities and only one at low velocities.

The External with the softest velocity zone will always be the one with the lowest number; the highest-numbered External will kick in at the highest velocity.

Detail

This button is not a macro function, but rather calls up the Zoning Detail page, which allows for the editing of the individual zone parameters of one External at a time.

The Zoning Detail Page



Key low	Key high	Velo low	Velo high	VeloCurve
F3	G9	014	092	91b1

This page allows you the editing of the individual zoning parameters of Externals in the same way as you can edit Instruments in their respective Zoning Detail page.

Key low

Range: C-1...G9

This is the lowest note of the key zone of the respective External.

Key high

Range: C-1...G9

This is the highest note of the key zone of the respective External.

Velo low

Range: 001...127

This parameter sets the lowest velocity for the velocity zone of the External.

Velo high

Range: 001...127

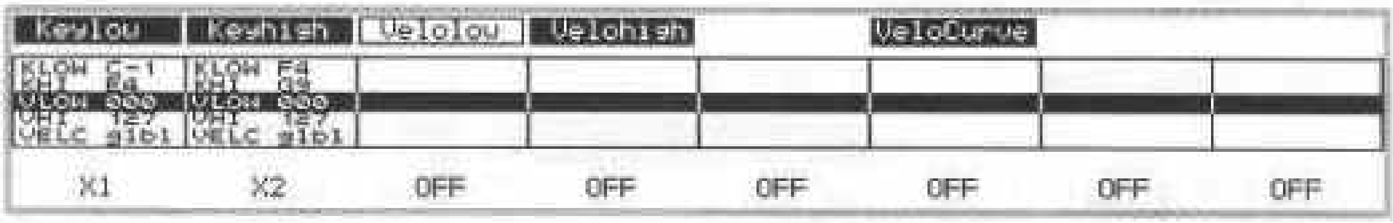
This parameter sets the highest velocity for the velocity zone of the External.

VeloCurve

This is the same parameter that you find on External Edit page 2 and repeated only for convenience.

Zoning Group Edit

Please be aware that you can use Group Edit both in the Zoning Macro page and in the Zoning Detail page. Group Edit in both of these pages will present to you the same page, which is a listing of the individual zone parameters of each External:



```
KLOW C-1   KLOW F4
KHI  E4    KHI  G9
VLOW 000   VLOW 000
VHI  127   VHI  127
VELC glb1  VELC glb1
```

```
X1    X2    OFF    OFF    OFF    OFF    OFF    OFF
```

- Use the display buttons to select the parameter you wish to edit. An inverse video bar will guide you in finding the values for that parameter within the listing.
- Use the faders to edit the selected parameter for up to eight External of that Performance.

➪ The Zoning Group Edit page is also a great way of viewing all External zones at once as a listing to see how a particular Arrangement is set up.

When selecting a Performance

Upon selecting a new Performance, the following initial Parameter values are sent for each External, as set in the respective External's parameters:

- MIDI Bank (unless the transmission of the bank-select message is turned off globally).
- MIDI Program change number (unless filtered).
- MIDI Volume (unless filtered).
- MIDI Panning (unless filtered).
- Pitch-Bend Detune

PERFORMANCE

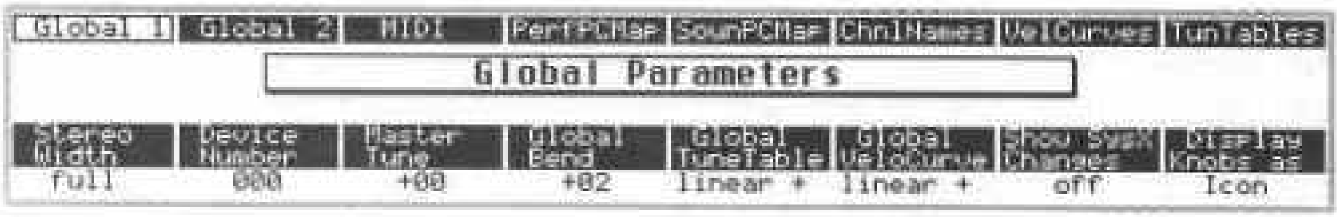
Global Edit

waldorf

This chapter describes all those parameters and functions that affect the Wave globally rather than for individual Performances or Sounds. These functions also include programming user velocity curves and tuning tables.

About Global Edit

All parameters you find in Global Edit will have an effect on the entire Wave, as opposed to Performance or Sound parameters that are valid only for the particular program. You'll find various groups of parameters in Global Edit. These groups are indicated by the menu composed of the display buttons:



Global 1	Global 2	MIDI	PerfPCMap	SounPCMap	ChnlNames	VelCurves	TunTables

Global Parameters

Stereo Width	Device Number	Master Tune	Global Bend	Global TuneTable	Global VeloCurve	Show SysEx Changes	Display Knobs as
full	000	+00	+02	linear +	linear +	off	Icon

While you have direct access to the parameter groups under the display buttons 1...5, the last three menu topics all sport drop-down menus, which offer further selections.

- To select one of the menu items, simply press the respective display button of the menu until the entry you wish to choose is highlighted. The display button will cycle back to the top of the list automatically.
- To acknowledge, press the [OK] button; [Cancel] aborts.

Global 1 Parameters

Stereo Width

Range: mono / 1...126 / full

This parameter sets the maximum width of the stereo image.

- *mono:* Both channels of a stereo pair carry the same information. Use this setting if you connect only one output - it's a shame to do that, but possible nonetheless.
- *full:* the recommended setting, it gives you the maximum stereophonic experience.
- *1...126:* lower values represent a smaller stereo image, *126* is almost the same as *full*.

Device Number

Range: 0...126

This is the identification number the Wave uses for MIDI sys-ex transfers . If more than one Wave is connected in the same MIDI network, giving them different device numbers allows you to address sys-ex messages to a specific device.

➩ However, if you intend to transfer data from one Wave to another via MIDI, both devices must be set to the same device number in order to communicate.

Actually, there is one more device number: *127*. This is a broadcast channel. Any data received with this device number will be accepted by any Wave, regardless of its own device number. However, you cannot set it at the Wave itself. Rather, it is meant as a means to send specific messages via a computer. In your daily life you will probably never experience any need for the broadcast channel.

Master Tune

Range: -50 Cent...+50 Cent

This is the master tune parameter for the entire Wave. It allows you to change the tuning ± one semitone in 1-cent steps. The reference for a setting of *0* is A = 440Hz.

Global Bend

Range: -12...+12

This parameter sets the pitch-bend depth for all those Sounds where the <Bend range> of one or both Oscillators has been set to *global*. Whatever you program here will be valid for all these Sounds.

A negative setting will invert the pitch-bend, resulting in downward bends for increasing values of pitch-bend messages.

Global Tempermnt

Range: equal + / hmt / equal - / random 1...4 / user 1...4 / MIDI TT

This parameter selects the Temperament used by Instruments whose parameter <Tempermnt> is set to *global*.

Global VeloCurve

Range: linear + / linear - / expon + / expon -/ xfade + / xfade - / full / user 1...4

This parameter selects the Velocity Curve those Instruments and Externals will respond to whose parameter <VeloCurve> is set to *global*.

Show SysX Changes

Range: off / on

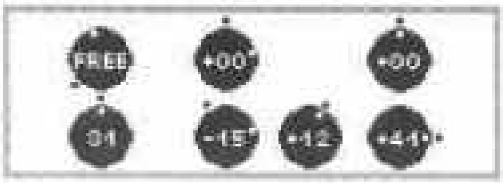
Use this parameter to route incoming MIDI sys-ex messages not only to their respective parameters, but also to the software routine that updates the display.

- *on:* Incoming sys-ex parameter messages will be reflected on the display. It looks nice, you get a good indication of what happens (if the correct display is open), and it takes away processor power so your Wave operates a bit slower.
- *off:* Incoming sys-ex parameter data will do its deed to the parameters and nothing else. This should be your preferred setting except for debugging communications, etc., due to the speedier performance of the Wave.

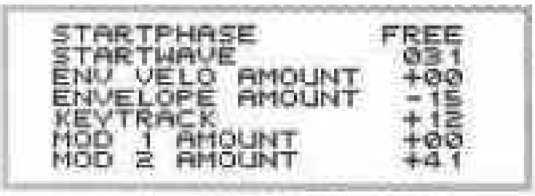
Display Knobs as

Range: Icon / Text

This is one of the "strictly for convenience" parameters.



- *Icon:* When displaying the Edit pages of the Sound modules, the physical knobs on the panel will be shown as icons. The icons themselves are placed according to their physical position on the panel. However, due to restrictions in the real estate of our display (and it is such a big beast!), we had to skip the corresponding parameter names. With the icon, you get:
  - a data readout of the current parameter value
  - the position of where that value would be on the knob as indicated by the outer-ring dot
  - the current position of the knob by the dot within the icon



```
STARTPHASE          FREE
STARTWAVE            031
ENV VELO AMOUNT     +00
ENVELOPE AMOUNT     -15
KEYTRACK            +12
MOD 1 AMOUNT        +00
MOD 2 AMOUNT        +41
```

- *Text:* the parameters in a Sound module's edit page will be displayed as text. This gives you the pleasure of knowing the parameter's name. However, you miss all the info the icon has to offer.

Well, the choice is yours. Have a discussion with your wife and kids about it, consult various experts in the field of parameter reading and do a field test with a representative crowd to find out the ultimate solution.

If it helps: At Waldorf, we use *Icon* mode. Well, most of us. And quite often.

Global 2 Parameters

Voice Ring Mode

Range: ring / shut

This parameter defines what happens to still sounding voices when doing a program change.

- *ring:* This will let the voices ring. With long release times, this might not be ideal. And then again, it may be just what you want.
- *shut:* Still sounding voices will be cut off at a program change.

Once again, the choice is yours.

SystemVol to Ext.

Range: off / on

This parameter defines whether the System volume knob next to the wheels shall also control the MIDI devices connected to the Wave via the Externals. If set to *on*, the programmed MIDI volume of each External will be scaled.

See chapte 2.22, "About Volume", for details of how the volume structure works in the Wave.

Pedal Polarity

Range: pos / neg

This parameter allows you to manually override the polarity of the connected foot pedals. Usually the pedals should be scanned when powering-up and their respective functions set accordingly. But should there be a problem, you might fix it here by trying the *other* polarity.

Glide Window

Range: 01...20

This parameter governs the recognition of chords and intervals that are meant to be a logical entity. The higher the setting of the glide window is, the more accurate chords will be recognized. At the same time, however, the note-on response will be worsened. Therefore you should try to set this parameter as low as possible.

See Sound Design, chapter 3.42, "Glide" , for more information on the specific algorithm and this parameter.

PrgChange Mode

Values: Perfmance / Sounds / Perf+Snds

Program Change Mode determines how a Performance responds to an incoming MIDI program change command. Depending on the programmed value, it will allow the MIDI PC (program change) to change either the Performance itself, the Sounds or both.

No matter how the Program Change Mode parameter is set, the incoming program changes must match the respective MIDI channels they are meant for, otherwise they will be ineffective.

- *Performance:* MIDI PCs will only switch the Performance. The PC must be received on the base channel, otherwise it will be ignored by the Wave.
- *Sounds:* MIDI PCs will only switch the Sounds of the Instruments in the Performance. The received PC must match the MIDI channel of the Instrument it is meant for. If more than one Instrument receives on the same MIDI channel, all will address the Sound specified by the PC upon reception. If no Instrument receives on the MIDI channel on which the PC is transmitted, the PC will be ignored by the Wave.
- *Perf+Snds:* Both Performances and Sounds can be changed via MIDI PCs. A PC meant to switch the Performance must be received on the base channel; PCs

meant to change the Sounds of Instruments must be received on the MIDI channel of the respective Instrument. If an Instrument's MIDI receive channel is set to *base*, or to the same MIDI channel as the base channel, a PC meant for that Instrument would change the Performance, as it takes precedence when receiving a MIDI PC.

Sys-Ex MIDI Port

Range: off / Out A / Out B

This parameter allows you to select the MIDI port from which the Wave's MIDI system-exclusive data will be transmitted. The following data are included:

- Sys-ex dumps done via the [Store] function
- Sys-ex front panel transmission
- Sample dump requests transmitted while in the Wave Edit mode
- Sys-ex data transmitted from disk using the <Generic Sys-Ex> dump function

The following parameter options are available:

- *off:* No system-exclusive messages will be sent. This option should only be used for debugging a complex MIDI system, or when the connected MIDI equipment seems to have trouble receiving a Wave sys-ex message.
- *Out A:* All of the above-mentioned system-exclusive messages will be transmitted from the Wave's MIDI Out A.
- *Out B:* All of the above-mentioned system-exclusive messages will be transmitted from the Wave's MIDI Out B.

➪ In general, you should set this parameter to the MIDI Out that is connected to your sequencer or computer, thus allowing sys-ex transfers and for recording any front-panel changes you make. If you set the parameter to *off*, you will not be able to transmit any sys-ex data.

➪ The Wave will *always* accept incoming sys-ex messages - provided they make sense. See the chapter on receiving sys-ex data for details.

Base Channel

Range: omni / 1...16

This is the channel that all Instruments and Externals whose parameter <MIDI Chnl> is set to *base* will respond to and/or transmit on. Also, this is the channel where MIDI program changes are received for switching Performances.

- *omni:* This is MIDI omni mode. Whenever something has to be transmitted on the base channel and *omni* is selected, the MIDI data will be transmitted on MIDI channel 1.

Send Bank Ctrl

Range: off / on

This parameter allows you to suppress the transmission of MIDI bank-select-controller messages (MIDI controllers 0 and 32). If you have older MIDI equipment connected that doesn't understand the bank controller message, but rather does something totally different (and possibly weird) upon its reception, set this parameter to *off*. Obviously, though, you then lose the ability to transmit bank changes.

Perfmance PC Map

Range: off / on

This parameter defines whether the program change map for Performances should be used or whether incoming MIDI PCs will switch Performances directly.

Sound PC Map

Range: off / on

This parameter defines whether the program change map for Sounds should be used or whether incoming MIDI PCs will switch Sounds directly.

Local Control

Range: off / panl only / keys only / on

This parameter sets the **global** local control state. Use it to set up the best possible working environment with external sequencers. Depending on the MIDI Thru capabilities of your sequencer, it might be necessary or preferable to disconnect the control panel with all the knobs and buttons from the internal sound generation as well. As usual, we give you the choice.

- *off:* (MIDI control value 0) Local control is globally disabled. Neither the Wave's keyboard nor its panel is connected to the internal sound engine.
- *panl only:* (MIDI control value 32) Only the panel is connected to the sound engine, but not the keyboard.
- *keys only:* (MIDI control value 64) Only the keyboard is connected, but not the panel.
- *on:* (MIDI control value 127) Local control is established both for the keyboard and the panel.

➪ Be aware that even though local control for the keyboard is globally enabled, it might be disabled locally in the various Instruments. The panel, however, can only be disconnected from the internal sound engine here.

➪ The MIDI parameter "local control" (MIDI continuous controller 122) unfortunately knows only two states, on and off. We have introduced two more values in between to accommodate our more elaborate scheme, as noted above. Generally, this should not pose a problem when working with other gear.

Panel Transmit

Range: off / on

This parameter determines whether the physical panel controllers will transmit MIDI sys-ex parameter data or not.

➪ Note that you should have this set to transmit when you disable local control from the panel, so that an external sequencer can still receive and redirect this data.

Active Sensing

Range: off / transmit

This parameter allows you to decide whether or not MIDI active sensing will be generated by the Wave.

➪ As a receiver, the Wave conforms to the MIDI protocol regarding active sensing. When active sensing is present, it must be received continuously. If then active sensing messages are missing, the Wave will silence all currently sounding voices so as to prevent stuck notes. After that, even if active sensing is no longer received, the Wave will function normally.

Running Status

Range: off / transmit

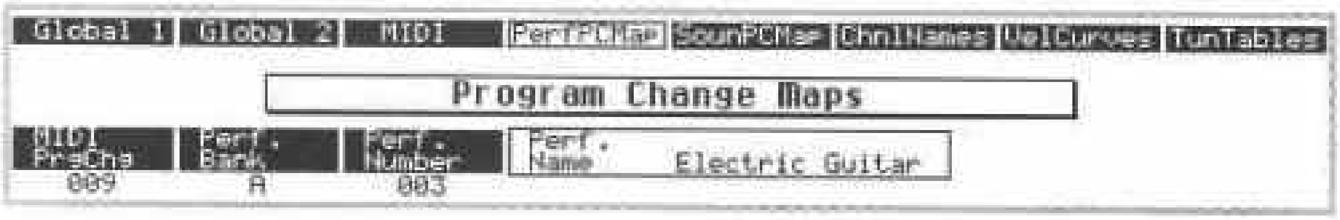
This parameter selects whether running status will be used when the Wave transmits MIDI data. Usually, this will save some bytes along the way, so you should have it enabled unless some of your MIDI gear has problems understanding it.

Performance PC Map

This map allows you to assign each Performance of the Wave its own MIDI program change number. While each Performance would normally be selected using the MIDI program change number that is the same as the Performance's number, this map lets you assign the MIDI program change number you wish to use to select any given Performance.

➪ The Performance PC Map will only have an effect if the parameter **<Perfmance PC Map>** on the **<MIDI>** page of Global Edit is set to *on*. Otherwise, an incoming MIDI program change will select the like-numbered Performance.

➪ In order to be able to select a Performance via MIDI at all, the Parameter **<ProgChnge Mode>** on the **<Global 2>** page of Global Edit must either be set to *Perfmance* or *Perf+Snds*.



Program Change Maps

MIDI PrgChg	Perf. Bank	Perf. Number	Perf. Name
009	A	003	Electric Guitar

- **<MIDI ProgChnge>** Use this fader to choose the incoming MIDI program change number that you want to assign to a Performance.

- **<Perfmance Bank>** This fader allows you to select the bank where the Performance to which you want to assign the MIDI program change number is located.

- **<Perfmance Number>** This fader lets you define the Performance that will be selected when the incoming MIDI program change number is received by the Wave.

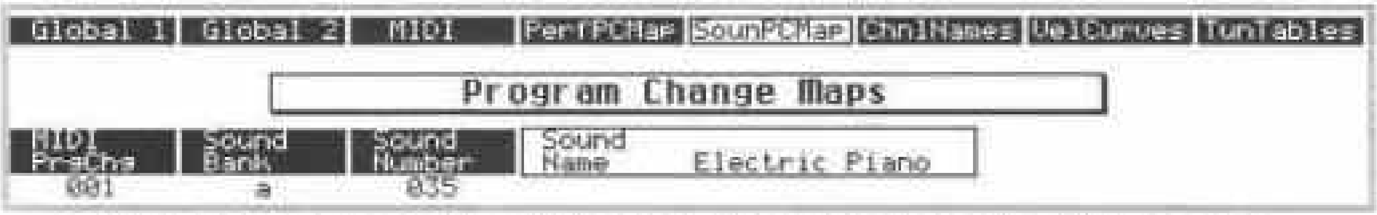
  ⇔ The field next to these three faders displays the name of the Performance whose number you have selected.

Sound PC Map

Similar to the Performance PC Map, this map allows you to assign each Sound of the Wave to its own MIDI program change number. While each Sound would usually be selected using the MIDI program change number that is the same as the Sound's number, this map lets you define any MIDI program change number to be used to select any Sound.

⇔ The Performance PC Map will only have an effect if the parameter **<Sound PC Map>** on the **<MIDI>** page of Global Edit is set to *on*. Otherwise, any incoming MIDI program change will select the correspondingly numbered Sound.

⇔ To be able to select a Sound via MIDI at all, the Parameter **<ProgChnge Mode>** on the **<Global 2>** page of Global Edit must either be set to *Sounds* or *Perf+Snds*.



Program Change Maps

MIDI ProgChg 001
Sound Bank a
Sound Number 035
Sound Name Electric Piano

- **<MIDI ProgChnge>** Use this fader to choose the incoming MIDI program change number that you want to assign to a Sound.

- **<Sound Bank>** This fader allows you to select the bank where the Sound you want to assign to the MIDI program change number is located.

- **<Sound Number>** This fader lets you define the Sound that shall be selected when the incoming MIDI program change number is received by the Wave.

  ⇔ The field next to the three faders displays the name of the Sound whose number you have selected.

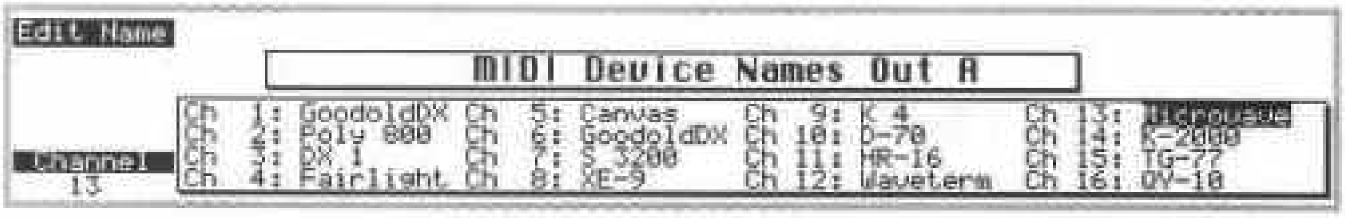
MIDI Device Names

For easier identification of connected MIDI gear, each External uses a MIDI device name in the top line of their display button label. This is the place where you can program these names. Keep in mind that thanks to the two individual MIDI outputs of the Wave you have a total of 32 MIDI channels at your disposal, every single one of them bearing its own name.

Since there are two MIDI Outs, you can select to either edit the MIDI device names for Out A or for Out B by choosing the respective menu item:

- **<Out A>** This menu item selects the MIDI channels that will be transmitted (hopefully somewhere sensible) at MIDI output A.
- **<Out B>** This button selects the MIDI channels that will be transmitted out of MIDI output B.

After selecting either item, the following display page will appear, allowing you to edit the names of the MIDI devices connected to the respective MIDI Out you selected.



```
Edit Name
                  MIDI Device Names Out A
          Ch  1: GoodoldDX Ch  5: Canvas    Ch  9: K 4       Ch 13: Microwave
          Ch  2: Poly 800  Ch  6: GoodoldDX Ch 10: D-70      Ch 14: K-2000
Channel   Ch  3: DX 1      Ch  7: S 3200    Ch 11: HR-16     Ch 15: TG-77
  13      Ch  4: Fairlight Ch  8: XE-9      Ch 12: Waveterm  Ch 16: QY-10
```

- **<Channel>** Fader: Use it to select the MIDI reception channel of the device you want to name. The [-/+] buttons double as selectors.
- **<Edit Name>** After having selected the MIDI channel whose device you want to name, press this button to call up the naming dialog box. As anywhere else where you can name something, the Wave's keyboard will become a typewriter (morphing into one will be included in a future upgrade). You may use the [Data] dial, [Page] and [-/+] buttons as well.

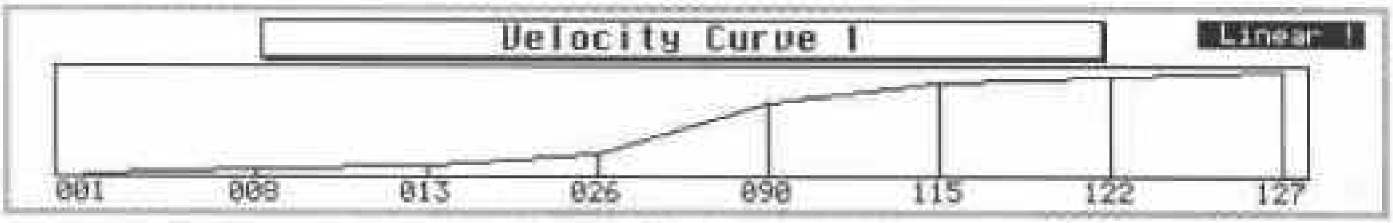
Velocity Curves

Besides the various velocity response curves programmed at the factory, there are four programmable user curves to choose from in the corresponding Instruments or Externals.

You choose the Velocity Curve you wish to edit by repeatedly pressing on the display button <Velocity Curve>. Once you have selected a Velocity Curve, you may select another one by pressing the [Page] buttons.

To leave the Velocity Curve menu, press **[Cancel]**.

To hear *any* edits you make to a user Velocity Curve, you *must* select it at an Instrument of the current Performance. To hear your edits in the best possible way, it is a good idea to solo the Instrument to which you have assigned the Velocity Curve.



Defining the Velocity Response

You define the desired Velocity Curve simply by setting the eight faders to represent the response you desire. Each fader adjusts one of eight equally-spaced breakpoints. The response between these breakpoints will automatically be interpolated linearly. The display will show you the actual result.

This way, it becomes very easy to create a the Velocity Curve you want. Simply adjust the eight faders until the Curve looks and sounds as desired. The numbers above each fader tell you the exact velocity that will be generated at the corresponding breakpoint.

The <Linear!> Button

To create an exact linear Velocity Curve, just press the <Linear!> button. The Velocity Curve will then have the same response as the *linear+* factory response.

Tuning Tables

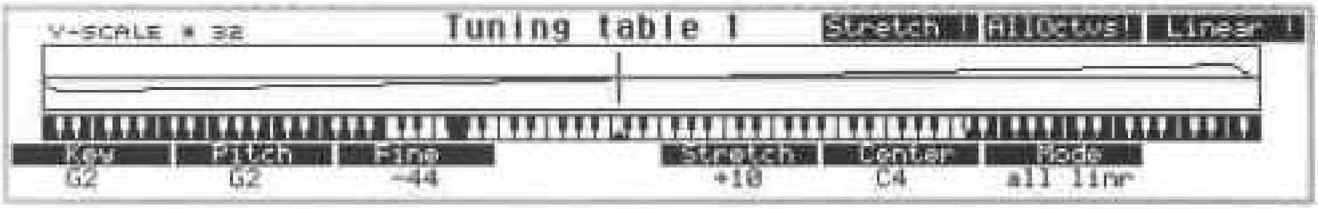
Besides offering a variety of tuning options including our unique real-time harmonic just intonation mode (HMT), the Wave provides you with four user Tuning Tables that you can edit to your heart's desire.

Each Tuning Table allows for the individual tuning of each MIDI note. However, there are ways of achieving equally tuned octaves as well as stretched tunings very easily.

All in all, this is a great field for trying out new and different tunings, so please edit these tables to achieve your favorite intonation. And don't forget that you may assign each Instrument its own Temperament.

You choose the Tuning Table you wish to edit by repeatedly pressing on the display button <TuneTable>. The last menu item, <HMT setup>, deals with global parameters for the real-time just intonation algorithm *HMT*. Alternatively, once you have selected a Tuning Table, you may select another one by pressing the [Page] buttons.

To leave the Tuning Table menu, press **[Cancel]**.



Key G2
Pitch G2
Fine -44
Stretch +10
Center C4
Mode all linr

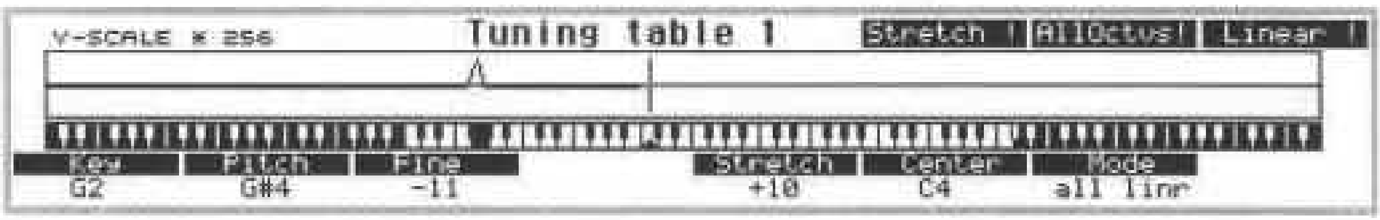
The display buttons allow you to select and execute some functions. The faders allow you to set individual tuning parameters as well as stretch tuning options. The middle of the display shows you the tuning of the respective table as a graph above a keyboard, which represents the MIDI note numbers. The white section in the middle of the keyboard corresponds to the Wave keyboard.

The graph uses an auto-scaling mode to make the best use of the available display space. Therefore, making even very small changes may result in very noticeable jumps in the graph, which, however, uses a high resolution.

To hear *any* edits you do at a user Tuning Table, you *must* select it at an Instrument of the current Performance. To hear your edits in the best possible way, it is a good idea to solo the Instrument you have assigned the Tuning Table to.

Tuning individual Keys

You may tune each key of the entire MIDI scale individually; coarse in semitones and fine in Cents. You can adjust the different parameters using the three leftmost faders.



```
Y-SCALE × 256          Tuning table 1        Stretch ! AllOctvs! Linear !
Key      Pitch    Fine          Stretch   Center   Mode
G2       G#4      -11           +10       C4       all linr
```

- Select the **Key** you want to tune either using the Wave's keyboard or the fader **<Key>**. You can choose any of the 127 available MIDI keys. A blinking Cursor indicates the key on the displayed keyboard.
- **<Pitch>** sets the pitch the selected key shall be tuned to in semitones.
- **<Fine>** allows for the fine tuning of that pitch ± a quarter-tone in cents.

Creating equally tuned Octaves

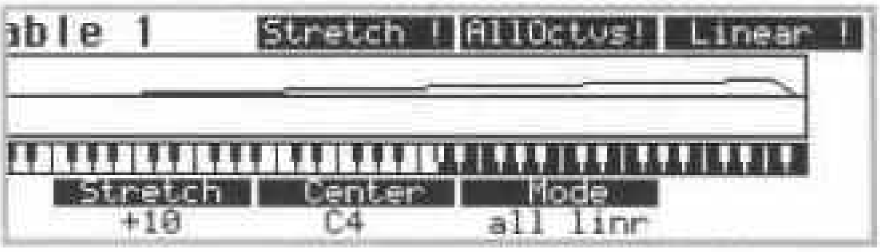
Creating equally tuned octaves is very easy.

- Tune the octave *above middle C* (middle C is indicated with a mark on the display keyboard) to your liking.
- Press the **<All Octvs!>** display button. The edits that occurred in the octave above Middle *C* now are copied to all octaves. At the same time, all previous edits in these other octaves will be erased.

Creating Stretched Tunings

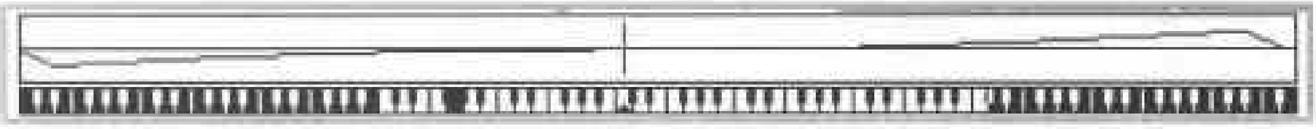
There are quite a few options for creating stretched tunings, not the least being the fact that you can use a stretched tuning on top of another tuning, which, of course, could itself be another stretched tuning.

The faders at the right end of the display will set the desired stretch tuning parameters, while the display button <Stretch!> will execute the function.

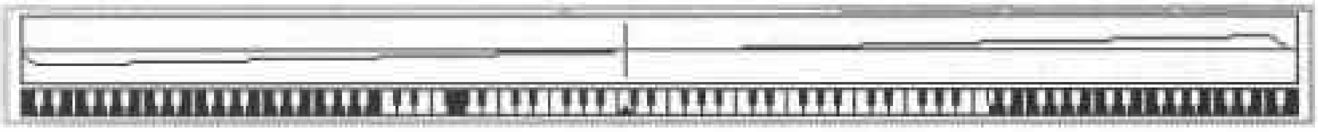


```
able 1        Stretch ! AllOctvs! Linear !
Stretch   Center   Mode
+10       C4       all linr
```

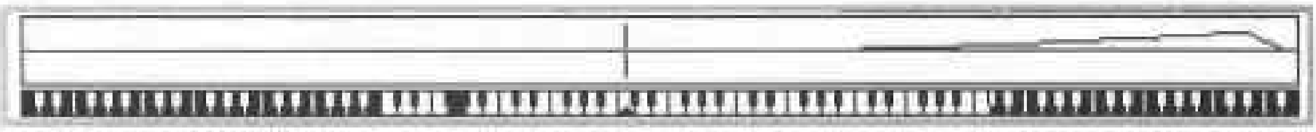
- **<Center>** will select the center key for the stretch algorithm. At this key, stretching will have no effect. The center key is indicated on the display by a thin line in the tuning graph.
- **<Stretch>** is the fader that sets the stretching factor, which is dependent on the stretch mode. Negative values will flatten the pitches above the center-key and sharpen those below it, while positive values will have the opposite effect.
- **<Mode>** selects the way the stretch function will be applied:



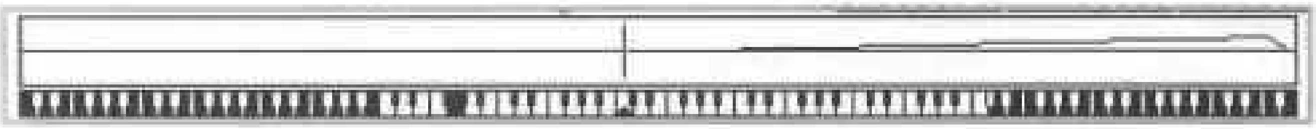
- *all exp*: Pitches both above and below the center key will be stretched exponentially, so that keys that are further away from the center key will exhibit stronger detuning.



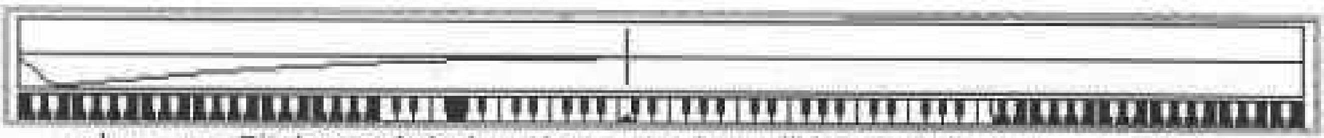
- *all linr:* Pitches both above and below the center key will be stretched linearly, resulting in equal detuning over the entire key-range.



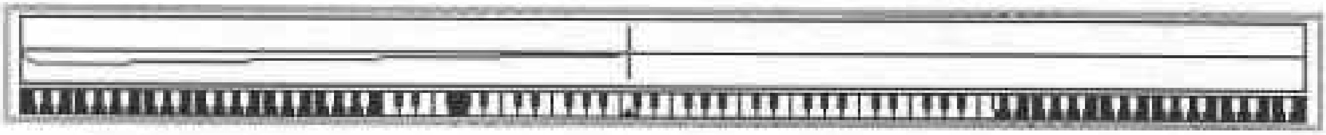
- *up exp*: Pitches only above the center key will be stretched exponentially.



- *up linr.*: Pitches only above the center key will be stretched linearly.



- *low exp*: Pitches only below the center key will be stretched exponentially.



- *low linr.*: Pitches only below the center key will be stretched linearly.
- **<Stretch!>** will invoke the actual stretching. You may stretch multiple times to get the tuning you desire.

➪ To get a perfect 1/4-tone scale, for example, set <Stretch> to -64, <Center> to middle C and <Mode> to *all linr*. Then execute this setting *three times* by pressing the <Stretch!> button three times in a row.

➪ Use a slightly stretched Tuning Table for electric piano sound-alikes, as was often the tuning case in the olden days.

The <Linear!> Button

If you have played around with the Tuning Table until everything is so detuned that even your deaf grandfather starts complaining, this button might come as a godsend. It will establish good old equal temperament for that particular Tuning Table.

Global HMT Parameters

HMT is the name for our unique real-time harmonic just intonation algorithm. In this page you find parameters that will customize this algorithm globally wherever it will be used.

HMT Mode

There are various modes available for the HMT algorithm. Use this fader to choose the one that best suits your needs.

- *standard:* this is the default HMT mode. It yields the best overall results, yet it can introduce noticeable re-tunings under certain conditions. All in all, this mode works very well if your music is primarily interval-based.
- *natural 7:* this mode works in basically the same way as the *standard* mode, but it also offers a true natural seventh in applicable chord- or interval-structures. On the other hand, re-tunings may even be more noticeable than in *standard* mode.

- *horizon:* This mode works similarly to *standard* mode, but introduces less noticeable re-tunings and, as such, is very well-suited for music that emphasizes melodic lines or counterpoint.
- *C/a...#####...bbbbb:* These tunings are based strongly around the respective keys that are selected and shown in the display. *C/a* stands for "white keys only," while the number of sharps or flats displayed indicates the corresponding major/minor key. In essence, the purest intonation will be present when intervals that are natural to the corresponding key are played, while the intonation will be less perfect the further one strays from that key. Use these settings to play music that is very strongly key-based. Baroque music or blues phrases both may benefit from these tuning-algorithms.

In any event, please keep in mind that you may fine tune the basic HMT algorithm of your choice even further using the <HMT purity> parameter.

HMT Purity

Range: 01...10

The HMT Purity parameter is a factor that scales the real-time calculated pitches of the algorithm. It essentially offers less-noticeable retunings of keys still held, but at the same time introduces less purity.

If you experience your sounds being either *too pure* or, in the particular piece of music you perform, that the retuning leads to some pitch-fluctuations that are too noticeable, this is the place to look for rescue.

- *01* will actually completely disable the algorithm. What you will hear is equal temperament.
- *10* is the maximum setting and will yield as pure a tuning as is possible given the HMT mode selected.

Anything in between will yield a result that is situated between more pure and less noticeable.

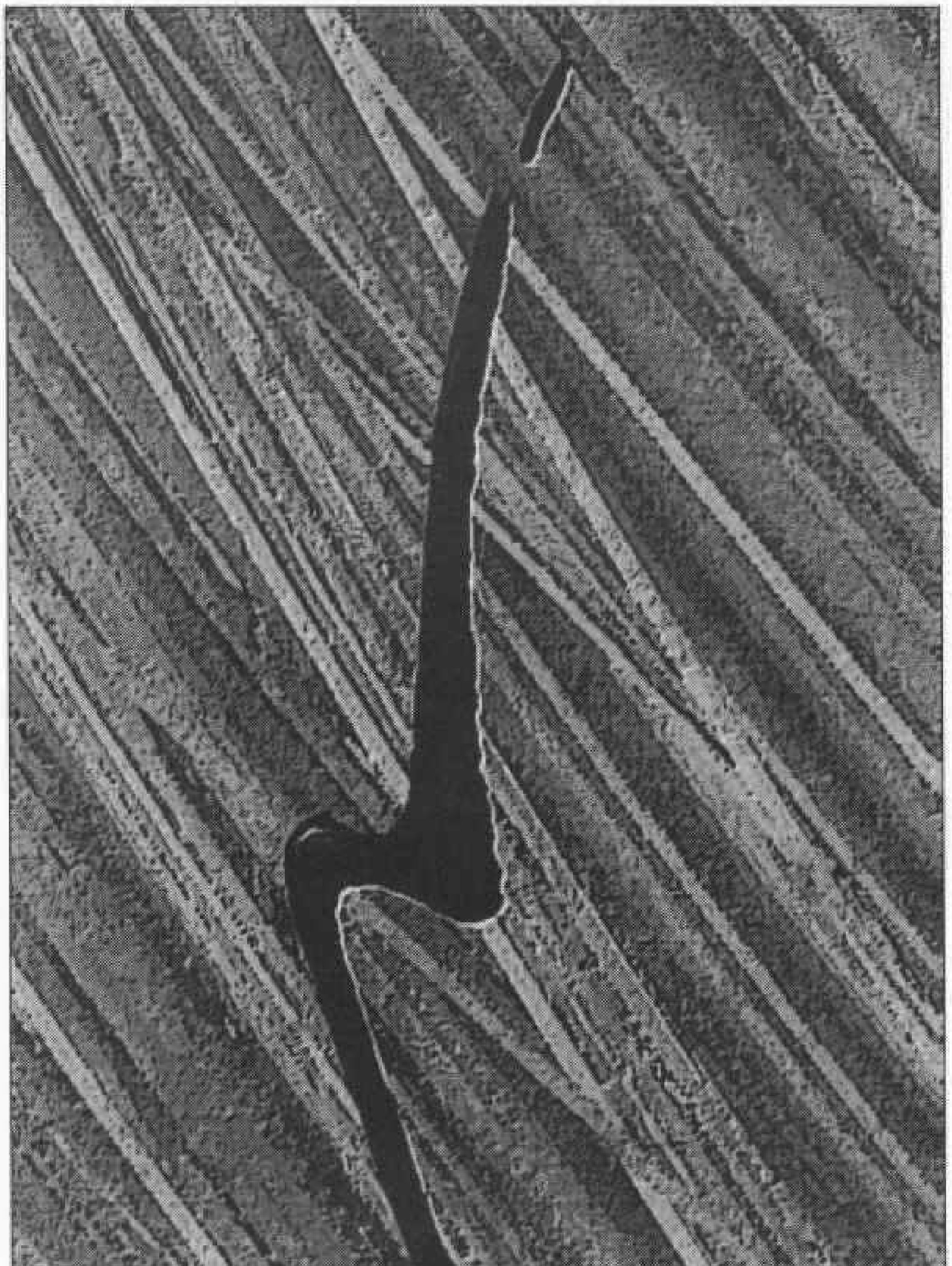
HMT via SysEx

Range: off / on

If this parameter is active, the HMT tuning changes of the notes that use HMT tuning are sent out as Single Note Retuning messages in the MIDI Universal sys-ex Standard Tuning format. Thus any device capable of interpreting these messages can use the HMT tuning. See Appendix for Details.

PERFORMANCE

Memory Management

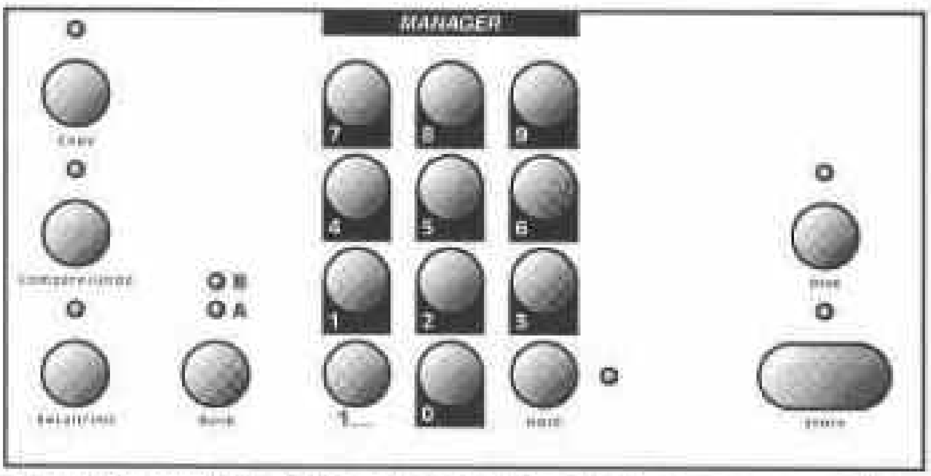


waldorf

This chapter gives you detailed explanations about all functions regarding the internal RAM-memory of the Wave, and how to store, compare and recall items.

The Basic Concept

All memory management within the Wave's internal memory is done from the manager section of the Wave.



Besides the keypad, which is generally used to select program numbers, the manager section offers five more distinctive buttons, four of which we will discuss in this, the fifth - *Disk* - in the next two chapters.

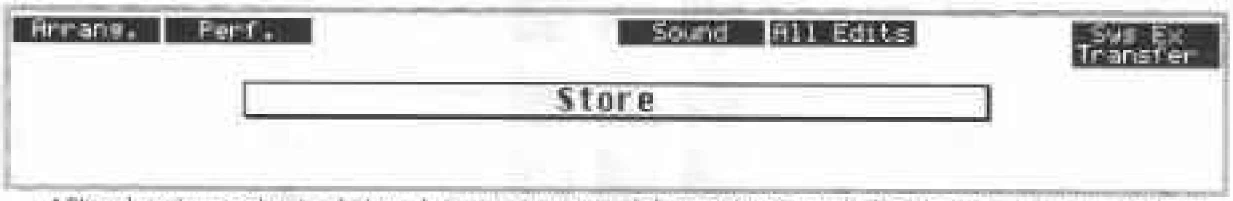
We tried to keep the user interface for managing the various data types and items of the Wave as consistent as possible. Therefore you will find various functions under each of these buttons, depending which mode you are in and what you are doing.

- The big red **[Store]** button is the one you will use for storing anything inside the Wave (sorry, no additional seaside lockers available).
- The **[Disk]** button handles all disk transfers and will not be discussed here.
- The **[Copy]** button handles all copying tasks.
- The **[Compare/Undo]** button will either swap edited versions of Sounds or Performances with their originals or allow you to undo the last action you did - depending on the operational mode you're in.
- **[Recall/Init]** restores an edited item from the original version or initializes various data-types to their (hopefully) sensible default values.

Since you are a well-educated Wave user as a result of reading the introductory chapters, you are familiar with the way the Wave handles edits and the various types of edit-buffers as explained in chapter 2.16, "About Edit Buffers", "Storing and Loading", as well as with the different data types found in the Wave.

Storing Items

Any storage function associated with the internal memory is available via the **[Store]** button in the Manager section.



After having selected the data type you wish to store, a dialog box appears, asking you to confirm your request and select the desired storage location. In most cases you can designate the new location with the [Keypad], including the bank. You may also use the [-/+] buttons to step sequentially through the storage locations.

Additionally, you may edit the name under which to store the item (more on that in the next chapter).

After you have chosen the right location and the name of your desire, press the [OK] button to acknowledge or [Cancel] to abort.

The following data-types can be stored:

Arrangement

This will store both the Performance and its accompanying Sounds. Since all other data of a Performance is global, it does not have to be stored (except for Wavetables, but these must already have been stored internally, otherwise you could not have used them).

You have the choice of storing the Performance to a different location. Use the [Keypad] or the [-/+] buttons to choose the location you want.

Edited Sounds of this Arrangement, however, will be stored under their current program number.

Performance

This will store only the Performance, not its accompanying Sounds.

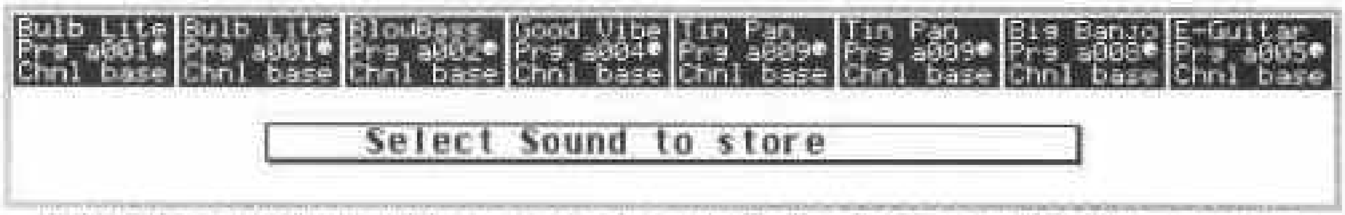
⇨ Be aware that if you do not store edited Sounds of this Performance separately, they might easily be lost forever, resulting in the Performance sounding different next time you call it up.

You have the choice of storing the Performance to a different location. Use the [Keypad] or the [-/+] buttons to choose the location you want.

When choosing a different location, you can listen to the Performance that will be overwritten simply by playing the Wave's keyboard.

Sound

Here you can store as many as all eight of the Sounds used by the current Performance. If more than one Sound has been edited, a second subpage allows you to store each Sound separately.



Bulb Lite Prg a001● Chnl base	Bulb Lite Prg a001● Chnl base	BlouBass Prg a002● Chnl base	Good Vibe Prg a004● Chnl base	Tin Pan Prg a009● Chnl base	Tin Pan Prg a009● Chnl base	Big Banjo Prg a008● Chnl base	E-Guitar Prg a005● Chnl base

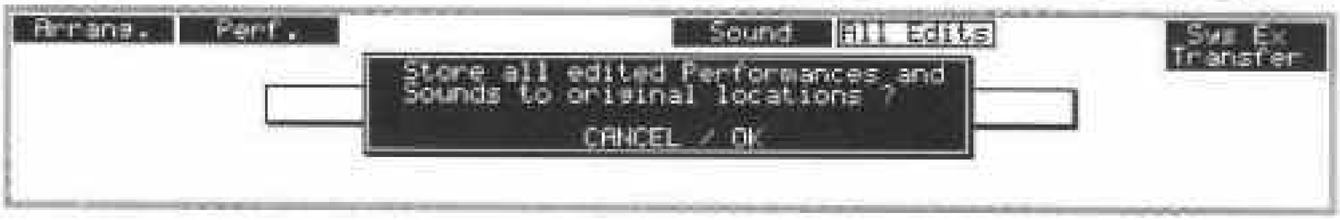
Select Sound to store

Select the Sound you wish to store, after which the dialog-box that allows you to change location and Soundname appears. Use the [keypad] or the [-/+] buttons to choose the location you want.

After you have stored the first Sound, you can repeat the process for all other Sounds in the Performance. If you don't want to change the Sounds' names or locations, storing the Arrangement is an easier and faster way to save your work.

All Edits

Using <All Edits> is the safest way to store all Sounds that are still residing in edit buffers, plus the current edited Performance. You only get the following message:

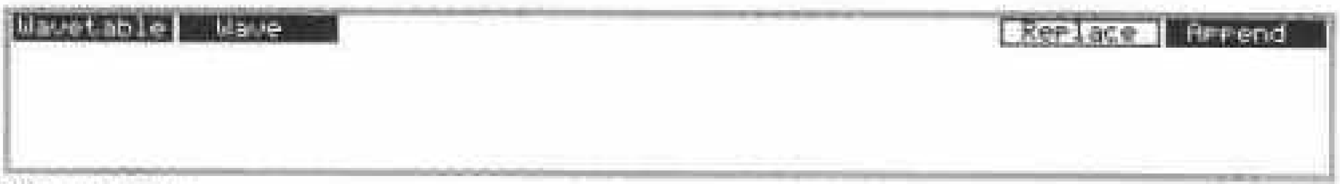


Store all edited Performances and Sounds to original locations ?

All items will be stored to their original location under their original name.

➪ This function is great when you've edited lots of Sounds during a studio-session, roll the tape or sequencer, record it all and are satisfied with the results. Using <All Edits> makes sure that no Edit will be lost. The next logical step, by the way, would then be to store the internal memory contents to disk.

➪ Be aware that truly *every* edited Sound will be stored, regardless of when it was edited. Remember, the Wave does not *automatically* flush all edit buffers when powering down. You might accidentally store an edit you did three weeks ago and never thought about again - only to find out that your most precious Sound has been lost. Our advice: Proceed with caution.



Wavetables

You will see this storage option *only* when in Wave Edit mode. It gives you the chance to store the Wavetable you just have edited.

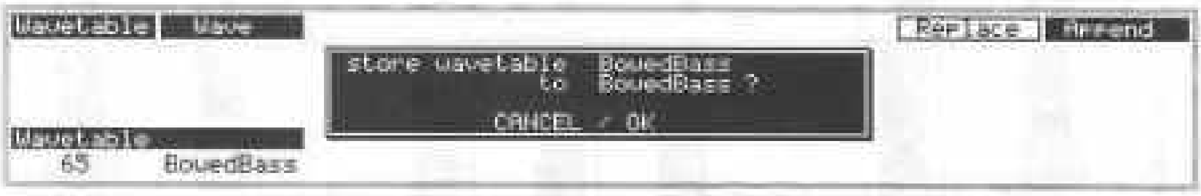
Before you select the one item <Wavetable>, you should check for the save mode, as indicated by the two rightmost <display> buttons. Two choices are available:

- **<Replace>**: all *Waves* (not Wavetables!) that you have *edited* will replace the original Waves. All Waves you have newly generated, as well as edited ROM Waves, will be put into unused memory space.

  ➪ Should the edited Waves be used in another Wavetable as well, this other Wavetable will reflect the edits of the Waves and thus sound different than before - perhaps inadvertently. However, the edited Waves do not use up additional memory.

- **<Append>**: all *Waves* that you have edited as well as those that are newly generated will be put into new memory locations. Thus any other Wavetable using the same Waves will remain unaffected.

After you have chosen the proper mode for storing *Waves* (which you cannot store yourself), press <Wavetable> to continue the storage procedure.



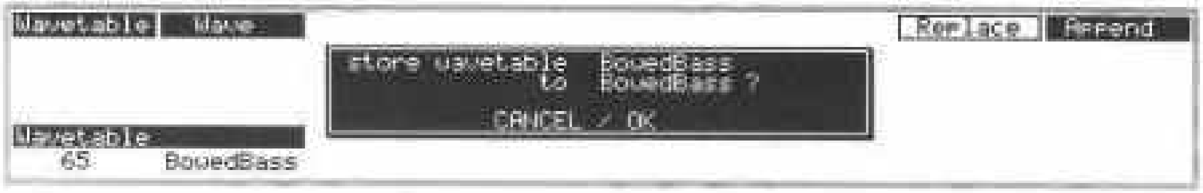
```
store wavetable  BowedBass
             to  BowedBass ?
      CANCEL  ✓ OK
```

You can now select the location at which you want to store the Wavetable using the fader under the dialog box. Change the name as explained below.

There are a total of 64 user Wavetable locations, starting with number 65. As with Sounds or Performances, you will always overwrite the location you store to. However, the *Waves* that compose the Wavetable will be allocated automatically by the Wave to get the most mileage out of memory. There are a total of 1000 memory locations to store Waves to - plenty to play with. However, should you use the maximum possible 64 Waves for each Wavetable you create, you run out of Waves before you run out of Wavetable locations.

Naming Items

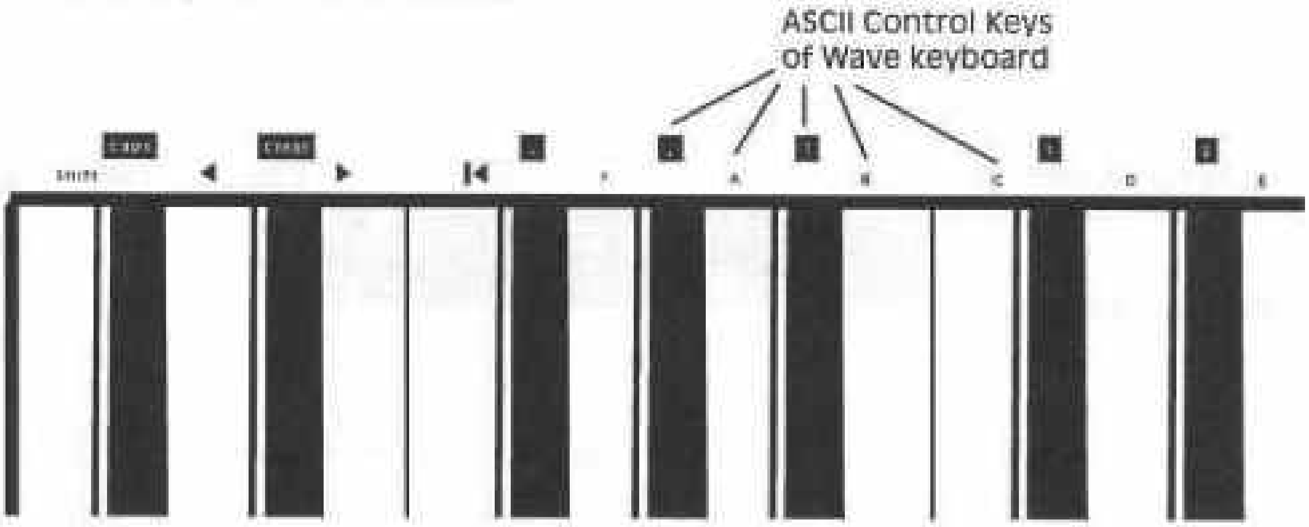
You can name Performances, Sounds and Wavetables when storing them.



```
store wavetable  BowedBass
             to  BowedBass ?
      CANCEL  ✓ OK
```

The easiest way to enter the new name is by using the Wave's keyboard, which, after pressing the <Edit Name> button, turns into an ASCII keyboard... well, sort of (and you thought the numbers and letters were part of an ingenious new keyboard learning method...).

Besides the alphabet, you'll find the most important functions of a word processor on the left side of the keyboard, and the cursor even advances automatically! See the following diagram for an explanation:



If you feel a bit uncomfortable *playing* the title, you also can use the [Data] dial (also known as [Wavetable] dial) or the [-/+] buttons to select the characters and the [Page] buttons to move the cursor back or forth. Of course you may even use a mixed input method. We prefer the keyboard method, as it's possible to generate some interesting melodies by typing in random words and phrases. We especially like "d-e-a-f h-i-l-l" and "a-d-d-e-d- e-g-g."

You *have to* store the item with the newly-input name in order to preserve it for posterity.

Comparing Items

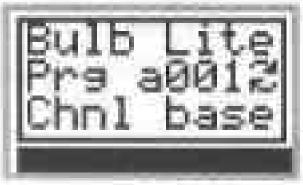
When doing sound design, you may often find yourself wondering whether your last edits will put you in the hall of fame or hall of shame of sound design. To help you ascertain your talents, the compare function has been developed.

To make life not too complicated, you can compare different data types. The procedure is always the same:

- Press the **[Compare]** button. Its accompanying LED will flash quickly.
- Press the button that will swap the item you intend to compare with the original. Now the LED of the Compare button will flash slowly.

- Press another appropriate button to select more items to be compared, as explained below under *Extending the Compare Status* , if needed.
- To exit the Compare status, press the [Compare] button again. The accompanying LED will go out.

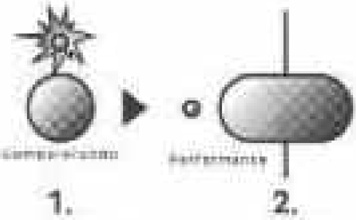
When a Sound or Performance is in Compare status, the edited version will be swapped with the original stored version.



```
Bulb Lite
Prg a0012
Chnl base
```

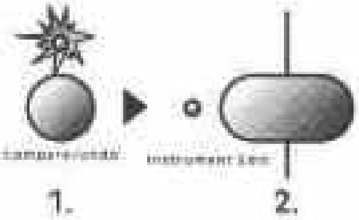
A little swap icon for the memory status indicates the swapped state.

Arrangement



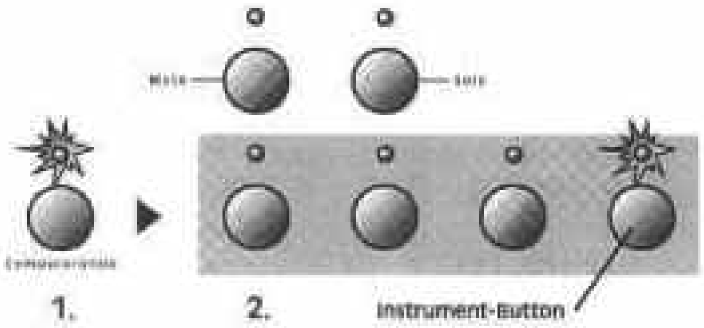
To compare an entire Arrangement (the Performance, including the Sounds of all active Instruments), engage the Compare status and press the **[Performance]** mode button. The Performance and all Sounds will be swapped.

Performance



To compare only the Performance, engage the Compare status and press the **[Instrument Edit]** mode button. The Performance will be swapped, yet the Sounds will remain untouched.

Sound



To compare a Sound by itself, engage the Compare status and press the **[display]** button that corresponds to the Instrument that plays the Sound. The Sound will be swapped.

Extending the Compare-Status

You can always extend the Compare status. Depending on the current state, the following extensions are possible:

- When comparing a Sound, you may select additional Sounds that you wish to compare.
- When comparing Sounds, you also may compare the Performance.
- When comparing the Performance, you may also compare individual Sounds.

You may also switch to a "higher" compare status, for example, from a few Sounds to the entire Arrangement. The previous compare status will then simply be flushed.

Where appropriate, you can un-compare individual items within the compare status by pressing again the respective item's compare button.

About the Undo Function

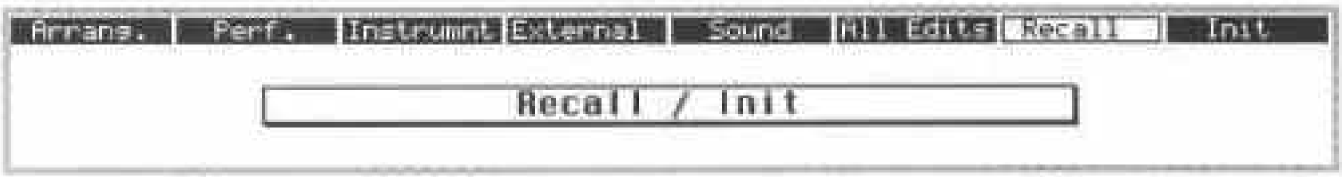
In Wave Edit (and, in the future, in the built-in sequencer section), the [Compare] button doubles as an undo button. See the respective chapters to find out what exactly you can undo.

Recalling Items

Whenever possible, the Wave will retain your edits until you manually recall them, rather than erasing them automatically.

You can recall items using the **[Recall]** button of the Manager section, either in a normal mode or, for the "advanced" user, in the expert mode described below. The normal procedure would be:

- Press the [Recall/Init] button and let go; the Recall/Init page appears on the display.



- Choose the function you wish to perform by selecting either the <Recall> or <Init> display button on the right hand side of the display. Since you want to recall an item, press the <Recall> button, which then will be displayed on a white background.
- Select the item you wish to recall by pressing the appropriate display button.
- Verify your recall by pressing the [OK] button when the dialog box appears or abort by pressing [Cancel].

Arrangement

This selection will recall the Performance, if edited, and all edited Sounds used by that Performance. It is the fastest way to restore the original Arrangement after you have tweaked various buttons and knobs.

Performance

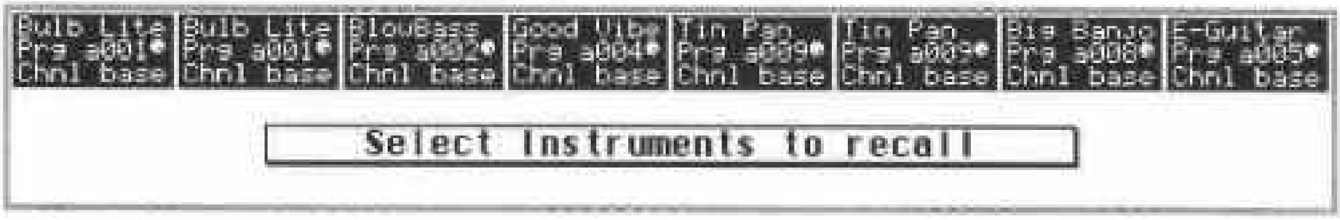
This will recall only the Performance, not the accompanying Sounds.

⇨ Since there is only one edit buffer for the Performance you're currently editing, you usually need to use it only when you want to restore the original immediately after it has been edited, or when you stumble across that one still-edited Performance in Performance mode. As soon as you edit another Performance, the previous edits will be flushed automatically.

Instrument

This allows you to recall a single Instrument in a Performance without having to restore any other aspect of that Performance.

If more than one Instrument is active, a subpage appears, allowing you to select the Instrument you wish to recall.



Bulb Lite	Bulb Lite	BlowBass	Good Vibe	Tin Pan	Tin Pan	Big Banjo	E-Guitar
Prg a001●	Prg a001●	Prg a002●	Prg a004●	Prg a009●	Prg a009●	Prg a008●	Prg a005●
Chnl base	Chnl base	Chnl base	Chnl base	Chnl base	Chnl base	Chnl base	Chnl base

Select Instruments to recall

External

This allows you to recall a single External of a Performance without having to restore any other aspect of that Performance.

If more than one External is active, a subpage appears, allowing you to select the External you wish to recall.

Sound

This selection allows you to recall a Sound used by the currently active Performance.

If more than one Instrument is active, a subpage appears, allowing you to select the Sound of the Instrument you wish to recall.

All Edits

This selection allows you to recall both the Performance and all Sounds that currently reside in an edit buffer.

You should know the state of the various edits you have done so far and be positive that none of the still-valid edits are of use anymore. Once verified, all edits, namely those of Sounds, will have moved into data mystery land.

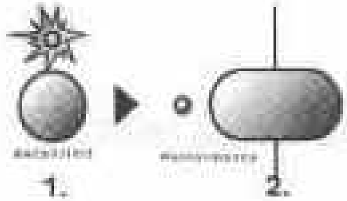
➪ This function is great when you have had your fun with lots of Sounds and want to return to more familiar and proven grounds - especially after you have saved all those edits that are worthwhile.

Expert Mode

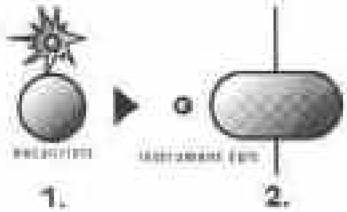
The Recall function is very flexible, mainly because it can offer you various alternatives - thanks to the display pages. However, there are times when you'll want to quickly recall something without too much of a fuss.

For those moments, we've included an expert mode for recalling certain items.

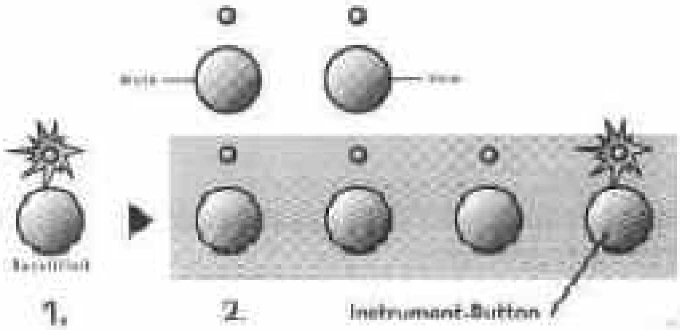
To use the expert recall mode, press the [Recall] button *and keep holding it.* Then press one of the buttons pointed out below to recall the respective item.



- **[Recall] + [Performance]** recalls the entire *Arrangement*



- **[Recall] + [Instrument Edit]** recalls the *Performance*



- **[Recall] + [Display]** button recalls the respective instrument's *Sound*

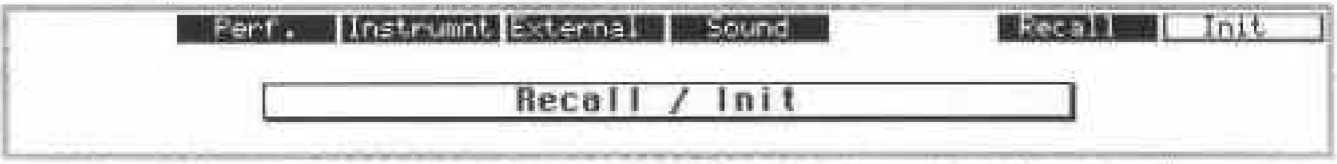
Danger! There is no additional verification when executing the expert recall function. Whatever you select will be history immediately - so know what you are doing before you proceed!

Initializing Items

Whenever you feel like creating something totally new, you might want to start off on a "blank page." The Initialization function will present you with a set of parameters for the item you select that are very basic, but nonetheless provide a good starting point.

Initializing an item is done from the same page that you recall an item - after all, you're recalling the blank piece of paper on which the original item was created.

- Press the **[Recall/Init]** button and let go; the Recall/Init page appears on the display.



Recall / Init

- Choose the function you wish to perform by selecting either the <Recall> or <Init> display button on the right hand side of the display. Since you want to initialize an item, press the <Init> button, which then will be displayed on a white background.
- Select the item you want to initialize by pressing the appropriate display button.
- Verify your initialization request by pressing the [OK] button when the dialog box appears or abort by pressing [Cancel].

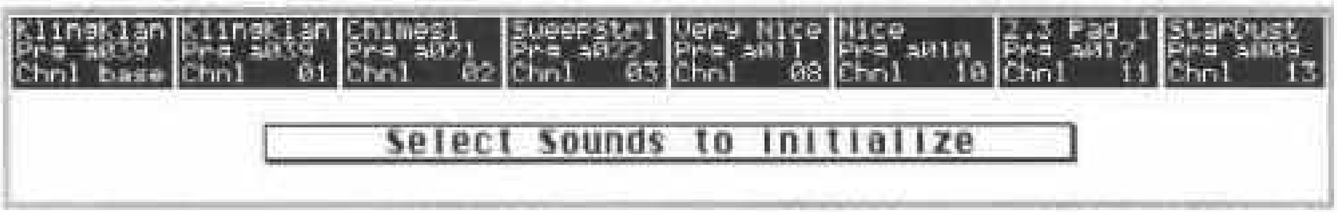
Performance

This selection will initialize the Performance, including all Instruments, Externals and the Performance parameters.

Instrument

This allows you to initialize a single Instrument in a Performance without initializing any other aspect of that Performance.

If more than one Instrument is active, a subpage appears, allowing you to select the Instrument you wish to initialize.

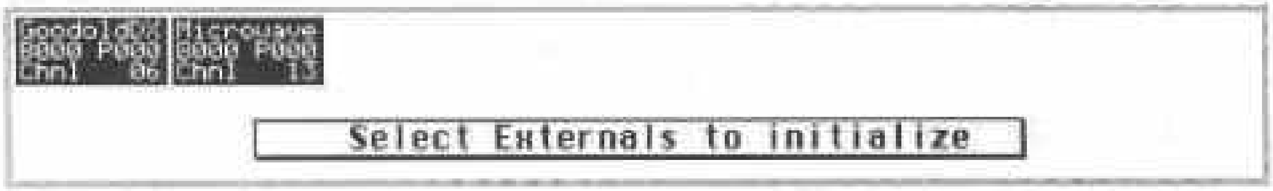

Klingklan Pre a039 Chnl base
Klingklan Pre a039 Chnl 01
Chimes1 Pre a021 Chnl 02
SweepStri Pre a022 Chnl 03
Very Nice Pre a011 Chnl 08
Nice Pre a010 Chnl 10
2.3 Pad 1 Pre a017 Chnl 11
StarDust Pre a009 Chnl 13

Select Sounds to Initialize

External

This allows you to initialize a single External in a Performance without initializing any other aspect of that Performance.

If more than one External is active, a subpage appears, allowing you to select the External you wish to recall.



Select Externals to initialize

Sound

This selection allows you to initialize a Sound used by the currently active Performance.

If more than one Instrument is active, a subpage appears, allowing you to select the Sound in the Instrument you wish to initialize.

Copying Items

Once you have created a masterpiece, chances are you will want to use all the good parts again and again - for what was perfect once cannot be bettered (well, mostly...at least often...once in a while...). When designing sounds, such perfect parts could be, for example, a particular Sound's envelope or an Instrument in a Performance.

To make life easier when editing on the Wave, you don't have to continually set all the parameters by hand. Rather, you can copy the desired items from various sources to their respective destinations.

The concept behind the Wave's copy procedure is that you will most likely want to use an existing part of another Performance in the one that you are currently editing. Hence, the copy procedure always will copy into the currently selected Performance, whereas the source may be chosen freely.

The Copy Procedure

The copy procedure is essentially the same for all items that can be copied.

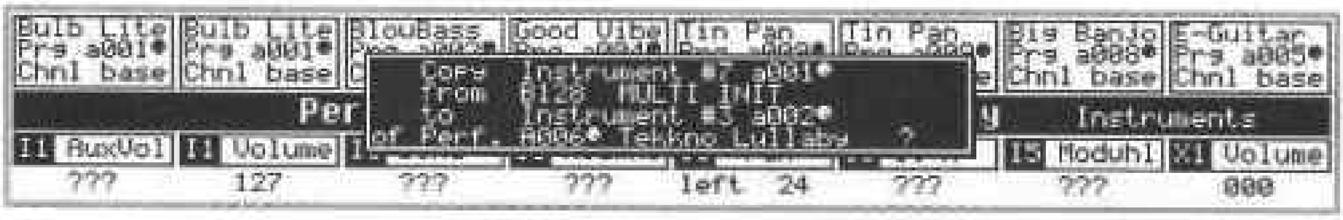
- The **destination Performance** into which something is copied will always be the **currently selected Performance**. Therefore, you will always copy **from** the selected source **into** the currently active Performance.

- To copy a Sound Module, the destination Sound must be assigned to an active Instrument in the current Performance, and that Instrument must be the **main edit-active Instrument** in that Performance.
- The **destination item** into which something shall be copied must always be chosen **first**. It will always be an item in the current Performance and, if it is a Sound Module, in the Sound of the current main edit-active Instrument.
- The **source item** will always be chosen **second**. The Performance and Instrument /External of that Performance or, if applicable, the Sound and certain parts of the Sound Module may be chosen.

To copy an item, follow these steps:

- Select the destination Performance. Usually this will be the Performance you are currently editing.
- If you are going to copy a Sound Module, select the Instrument that contains the Sound into which the item will be copied.
- Press the **[Copy]** button. The copy LED will flash quickly.
- Select the **item** you wish to **copy into**. See below for the various items and how to select them.
- The copy LED will flash slowly.
- You have now selected the destination. A dialog box in the following style will appear and prompt you to specify the source of the item to be copied.

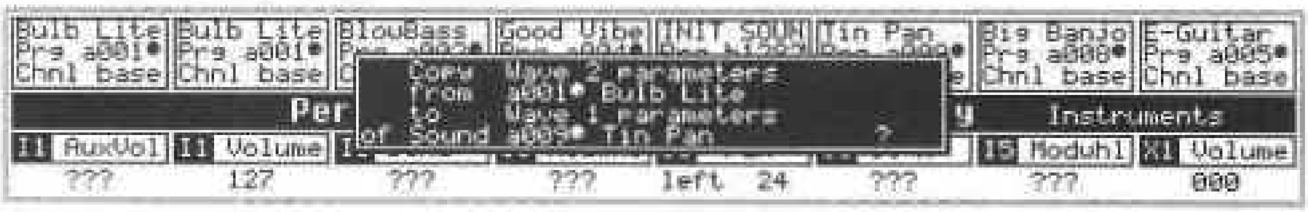
When copying Instruments or Externals:



```
Bulb Lite  Bulb Lite  BlouBass   Good Vibe  Tin Pan    Tin Pan    Big Banjo  E-Guitar
Prg a001●  Prg a001●                                              Prg a008●  Prg a005●
Chnl base  Chnl base                                              Chnl base  Chnl base
                 Copy  Instrument #7 a001●
                 from  B128  MULTI INIT
                 to    Instrument #3 a002●
              of Perf. A006● Tekkno Lullaby   ?
           Per                                          y   Instruments
I1 AuxVol  I1 Volume                                      I5 ModuWhl  X1 Volume
   ???        127        ???        ???     left  24    ???     ???        000
```

- Choose the **source Performance** from which you want to copy . Use the Manager's [Keypad] to select the respective Performance.
- Choose the **source Instrument/External** from which you want to copy.

When copying Sound Modules:



```
   Copy   Wave 2 parameters
   from   a001● Bulb Lite
   to     Wave 1 parameters
of Sound  a009● Tin Pan          ?
```

- Choose the **source Sound** from which you want to copy . Use the Manager's [Keypad] to select the respective Sound.
- Choose the **Sound Module** to copy. See below for details on what Sound Module you may copy where.
- Press **[OK]** to acknowledge or **[Cancel]** to abort the copy process.

Items to Copy:

Instrument

Selection: Press the Instrument button of the Instrument you wish to copy.

Sources: any Instrument of any Performance.

⇨ You may copy Instruments both in *Performance* and *Instrument Edit* modes.

External

Selection: Press the External button of the External you wish to copy.

Sources: any External of any Performance.

⇨ You may copy Externals both in *Performance* and *External Edit* modes.

Sound Modules

All Sound Modules may be chosen as destinations.

Selection: Press the [Edit] button of the Sound Module you wish to copy to select it as either a destination or a source.

Rather than selecting a Performance when copying Sound Modules, you can select a source *Sound* using the [Keypad].

Sources: The same Sound Module that was chosen as the destination can serve as the source, with the following extensions:

- **Oscillators:** Either Oscillator 1 or Oscillator 2 may be chosen as a source.
- **Waves:** Either Wave 1 or Wave 2 may be chosen as a source.
- **LFOs:** Either LFO 1 or LFO 2 may be chosen as a source.
- **Filter Envelope:** Either Filter Envelope or Amplifier Envelope may be chosen as a source.
- **Amplifier Envelope:** Either Amplifier Envelope or Filter Envelope may be chosen as a source.

Sound

There is no explicit provision for copying an entire Sound. Rather, you select the Sound you wish to copy and store it in the desired destination.

Performance

There is no explicit provision for copying an entire Performance. As with Sounds, select the Performance you wish to copy and store it to the desired destination.

Dumping via Sys-Ex

If you want to store the Performances and Sounds you used for a sequenced Song, this function comes in very handy. The Wave allows you to dump a variety of sys-ex data manually from the front panel, making the process as straightforward as possible.

You can also send specific dump requests to the Wave, which comes handy when you have a universal librarian program on your computer for the purpose of archiving patches — though the Wave's disk system is itself very capable of storing and retrieving specific Sounds or Performances.

The Appendix provides details about the Wave's system-exclusive implementation.

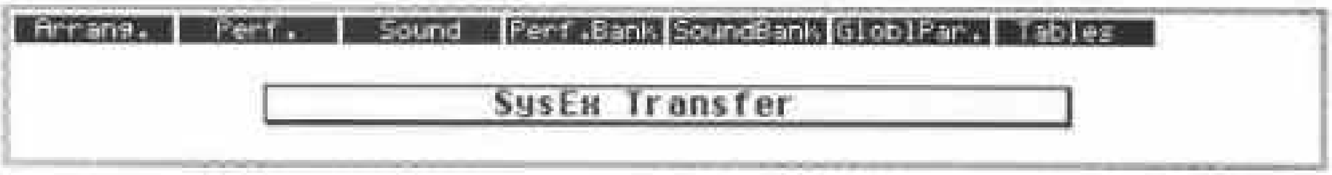
The Dumping Procedure

To dump sys-ex data manually from the Wave's panel, perform the following steps:

- Make sure that you have selected the proper MIDI Out for your desired system-exclusive transfer. You can choose the MIDI Out using the parameter <Sys-Ex MIDI Port> in Global Edit.

  ⇨ If there seems to be no MIDI sys-ex transfer from the Wave, check to see if this parameter is set to *off*.

- Press the **[Store]** button to open the store page.
- Press the display button **<Sys-Ex Transfer>** to get access to the corresponding page:



- Choose the item that you wish to transmit as MIDI sys-ex data. For more information on particular items and what they transmit, see the section below.
- Depending on your choice, you may have to select the specific item, such as a Sound or Table, in the appropriate sub-page or dialog box.
- Press **[OK]** to initiate the dump, or **[Cancel]** to abort.

Single Dump and Bank Dump

The Wave tries to use as few different dump formats as possible in order to streamline the overall archiving procedure. Therefore, only a few basic dump formats are defined; individual dumps are linked as needed when a more complex dump must be performed. For example, if you initiate an Arrangement dump, the various items of the Arrangement, such as Sounds, Tables and the Performance, are linked and sent in consecutive order to form the Arrangement dump.

To allow for the greatest flexibility, there is a specific sys-ex dump command that governs where a dump will be placed in the Wave upon reception. This is especially true for Sounds, since there are two levels of edit buffers plus the original locations to choose from.

This dump command is called the *Bank Dump Switch*. It will automatically be sent when a bank dump is performed, and should not be discarded. Upon reception of the Bank Dump Switch sys-ex string, the Wave knows that it must store all subsequent dumps into the original locations and not into the edit buffers.

Under most circumstances you needn't worry about this process, as the Wave will take care of it automatically.

Items to Dump

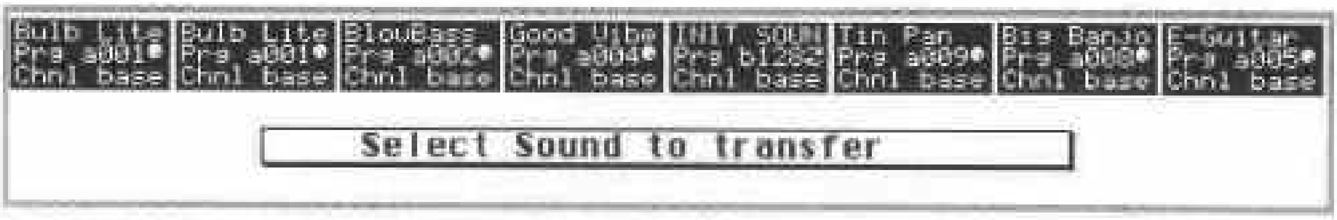
- **<Arrangement>:** You will find a menu with two topics to choose from under this button.

- **<Arrangement without Tables>**: When selected, the current Arrangement will be transmitted, including the Performance and it's Sounds, but without any user Wavetables, user Tuning Tables or user Velocity Curves. Choose this dump to preserve an Arrangement that does not use specific tables. Also, this dump will fit entirely into edit buffers when received by the Wave and hence, it cannot accidentally overwrite any important data - such as a Wavetable.

  - **<Arrangement with Tables>:** When selected, the current Arrangement will be transmitted, *including* all needed user Wavetables, user Tuning Tables and user Velocity Curves. As such, the Arrangement will sound exactly the same when dumped back into the Wave, no matter what resides in the Wave's internal memory at the time. However, important data (namely all tables) may be overwritten when this dump is received, so handle with care.

- **<Performance>:** Pressing this button will transmit the current Performance without any Sounds or Tables.

- **<Sound>:** This item allows you to transfer a single Sound. Only a Sound that is used in the current Performance is selectable and can be dumped. Pressing this button will present you with a sub-page that contains whatever sounds (up to a total of eight) are used in the current Performance.


Bulb Lite Prg a001● Chnl base
Bulb Lite Prg a001● Chnl base
BlowBass Prg a002● Chnl base
Good Vibe Prg a004● Chnl base
INIT SOUN Prg b128C Chnl base
Tin Pan Prg a009● Chnl base
Big Banjo Prg a008● Chnl base
E-Guitar Prg a005● Chnl base

Select Sound to transfer

Select the Sound you wish to transmit by pressing the corresponding display button.

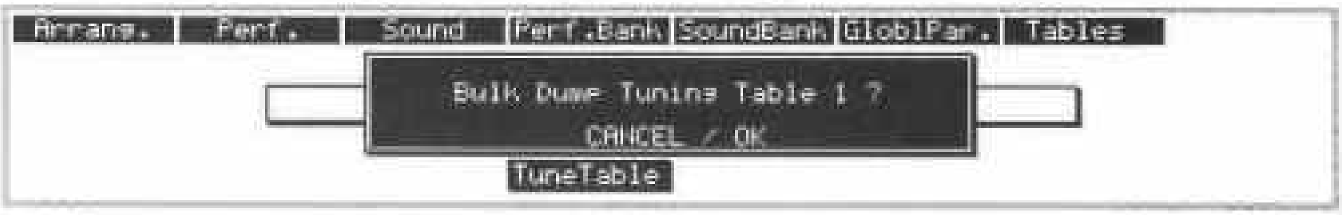
- **<Perf.Bank>:** You will find a menu for selecting which bank of Performances to dump.

- **<Performance Bank A>:** When selected, Performance Bank A will be transmitted . A Bank Dump Switch message will be sent first to signify that this is a bank dump.

- **<Performance Bank B>:** When selected, Performance Bank B will be transmitted. A Bank Dump Switch message will be send first to signify that this is a bank dump.

- **<SoundBank>:** You will find a menu for selecting which bank of Sounds to dump.

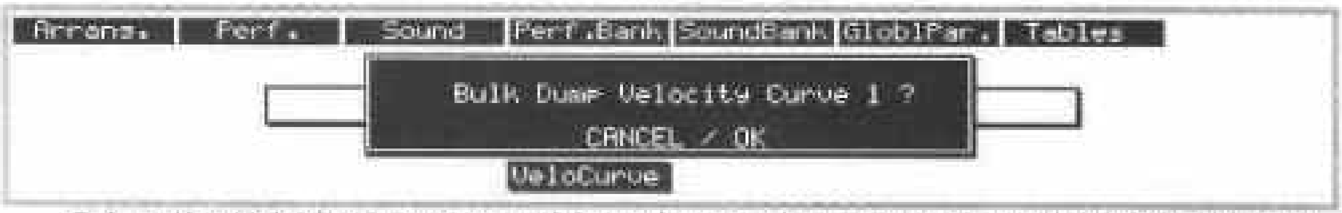
- **<Sound Bank A>:** When selected, Sound Bank A will be transmitted. A Bank Dump Switch message will be send first to signify that this is a bank dump.
  - **<Sound Bank B>:** When selected, Sound Bank B will be transmitted. A Bank Dump Switch message will be send first to signify that this is a bank dump.
- **<Global>:** Press this button to transmit all data in Global Edit, except for any tables.
- **<Tables>:** You will find a menu for selecting which of the following tables to dump.
  - **<Tuning Tables>:** When selected, a dialog box appears in which you can specify which Tuning Table you want to transfer.



Bulk Dump Tuning Table 1 ?
CANCEL / OK

Select the Tuning Table you wish to dump using the fader under the dialog box.

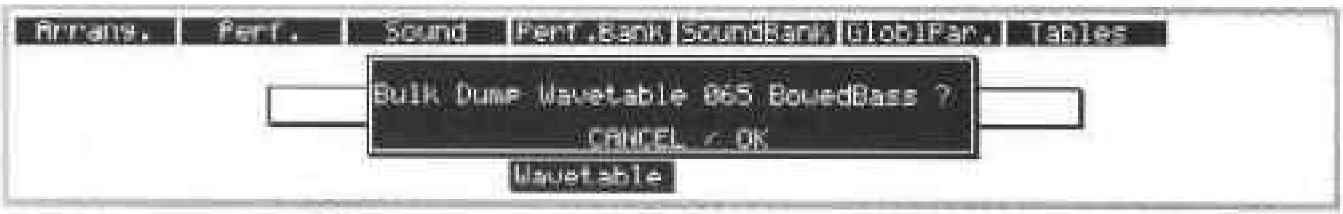
- **<Velocity Curves>:** When selected, a dialog box appears in which you can specify which Velocity Curve you want to transfer.



Bulk Dump Velocity Curve 1 ?
CANCEL / OK

Select the Velocity Curve you wish to dump using the fader under the dialog box.

- **<Wavetables>:** When selected, a dialog box appears in which you can specify which Wavetable you want to transfer.



Bulk Dump Wavetable 065 BowedBass ?
CANCEL / OK

Select the Wavetable you wish to dump using the fader under the dialog box.

- **<Sound PC Map>:** This item allows you to transfer the Sound PC Map via MIDI sys-ex.
- **<Performance PC Map>:** This item allows you to transfer the Performance PC Map via MIDI sys-ex.

Parameter Sys-Ex Data

You may transmit any edits you make on the panel via sys-ex, and thus either record a sound design session into your sequencer for later retrieval or to "play" the Panel into a sequencer for subsequent playback of your moves.

All parameter changes retain the ID of the instrument in the Performance from which they originated - regardless of that instrument's MIDI channel. This way, all sys-ex edits will be assigned properly when this data is received - even if multiple instruments are receiving on the same MIDI channel.

However, be aware that you may easily clog the MIDI data stream even by recording just a few parameter changes. Doing multiple parameter-sys-ex overdubs will almost guarantee a MIDI data stream that is too overloaded to accurately transmit the required data.

⇨ In such cases, try assigning standard MIDI controllers to the various routable modulation inputs of the Wave's Sound Modules and use these to change the Sound in real time.

To transmit sys-ex parameter messages:

- Make sure that you have selected the correct MIDI Out for your system-exclusive transfer. You can choose the MIDI Out using the parameter <Sys-Ex MIDI Port> in Global Edit.

  ⇨ If there seems to be no MIDI sys-ex transfer from the Wave, check to see if this parameter is possibly set to *off.*
- Set the Parameter **<Panel transmit>** on the <MIDI> page in Global Edit to *Sys-Ex.*

Receiving Sys-Ex Data

As you already know from the last chapter, the Wave differentiates between a dump that will be directed to edit-buffers and a dump that will overwrite the data in the Wave's memory. Depending on the data and the reception of the Bank Dump Switch sys-ex string, the Wave will allocate incoming dumps automatically. See below for details regarding the reception of incoming sys-ex data.

In general, there is no provision to turn off the reception of MIDI sys-ex data. However, incoming data must match the [Device ID] (set in Global Edit) of the Wave in order to be allocated to memory. We strongly suggest that you use the default Device ID *000* unless you have to address multiple Waves (you lucky chap!), in which case you should set each Wave to its own Device ID number.

If you want to temporarily disable the reception of sys-ex data, you can set the [Device ID] parameter to a different number than was set when you originally transmitted the sys-ex data. However, be aware that any sys-ex data you transmit from then on will be sent with the new Device ID number, which might make things difficult in the future - especially when you transmit lots of front-panel sys-ex data under a later unknown Device ID. Therefore, we strongly recommend that you disable the transmission of sys-ex data during the time that the Device ID is changed from its normal setting.

Finally, if you own a MicroWave and have amassed a considerable sound library, you'll be pleased to know that the Wave accepts MicroWave Sounds and Multis, and transforms them into a usable format.

Bulk Dumps

Bulk dumps will **always** be allocated to the original RAM locations of the corresponding items and, consequently, may overwrite what is stored at these locations upon reception of the dump.

The following types of data are transmitted as bulk dumps:

- Performance Bank
- Sound Bank
- Wavetable
- Tuning Table
- Velocity Curve
- Sound PC Map
- Performance PC Map
- Global
- The tables that are contained in an "Arrangement with Tables"

Single Dumps

Single Dumps will be allocated to the Instrument Sound Edit buffers or to the Performance Edit buffer. Therefore, when receiving single Sounds via sys-ex, neither an original Sound nor the edited version that resides in the corresponding Sound edit buffer will be lost, making the sys-ex transfer of Sounds both reliable and safe. Remember, however, that a specific Sound might need a specific Wavetable, which is not part of the Sound dump, but rather is a bulk dump that could possibly overwrite an existing Wavetable.

The following types of data are transmitted as a single dump:

- Single Sounds
- Single Performances
- Arrangement without Tables

Parameter Sys-Ex

Any incoming sys-ex parameter data will be regarded as if you have manually changed the corresponding parameter. As such, the Sound will be placed in the Sound edit buffer. A Sound that already resides in the Sound edit buffer will be altered according to the incoming Parameter sys-ex data.

Incoming sys-ex data parameter will always be routed to the Instrument from which it was generated from, allowing even complex edits to be accurately recreated.

MicroWave Sys-Ex Reception and Transformation

You may send sys-ex data from a Waldorf MicroWave to the Wave. The Wave will accept data in this format and transform it into data suitable for the Wave. Both Multis and Singles from the MicroWave will be accepted. None of your old Sounds will be lost - isn't that a comforting thought?

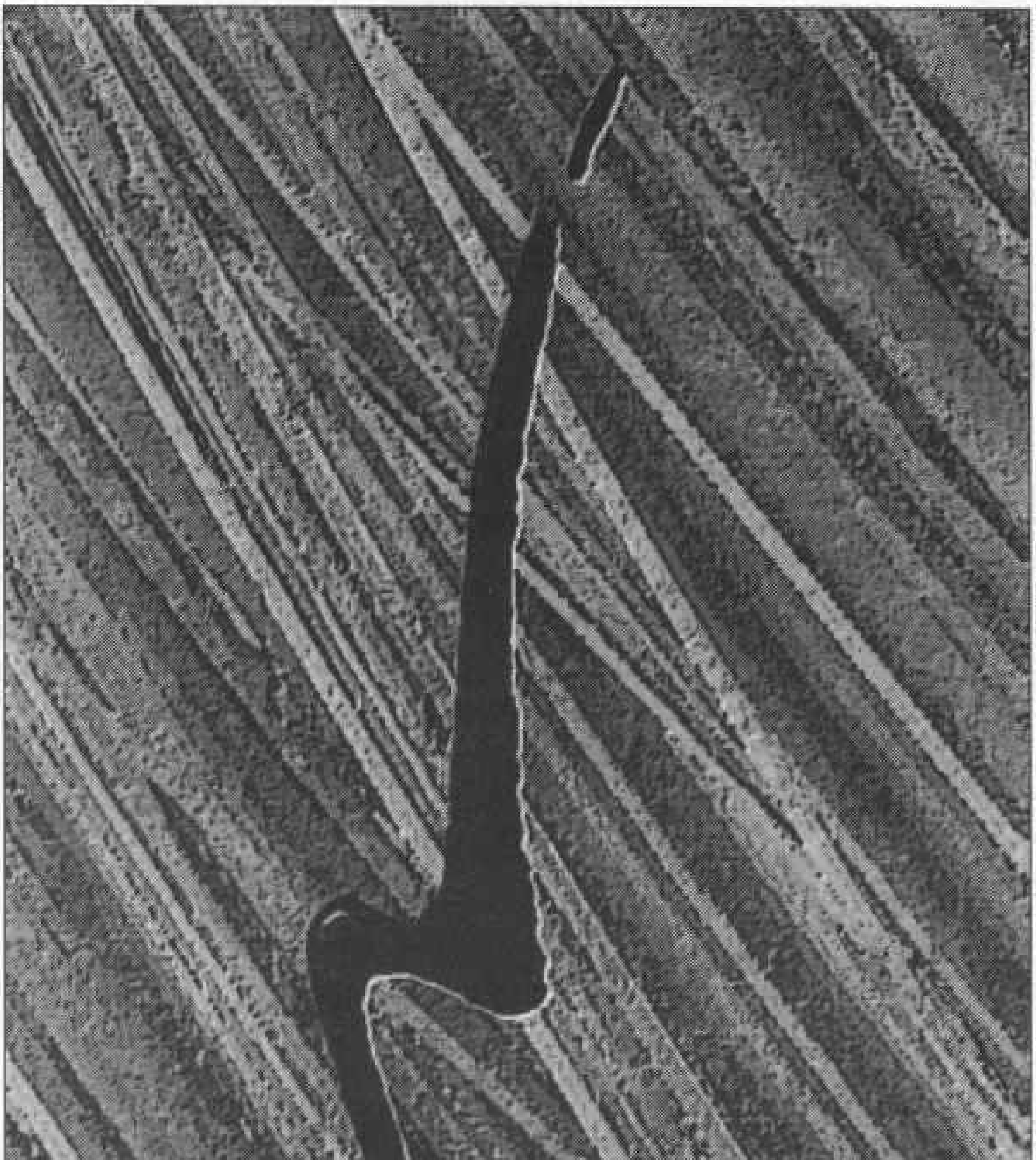
The data transformation process works fairly well, though it's not perfect due to the many differences in the design of both machines. Depending on the nature of your sounds, up to 90% or more of a Sound will carry over from the MicroWave to the Wave.

The following data will be accepted:

- **MicroWave Sound bulk dump**; This will be transformed into Wave Sounds and be placed in the Sound edit buffers, so the Sounds residing in the Wave will not be overwritten.

- **MicroWave Multi bulk dump** This will be transformed into Wave Performances and stored in the original locations, replacing whatever data was stored there before.
- **MicroWave User Table dump** User Tables will be transformed to Internal Tuning Tables, Velocity Curves and PC maps.
- **MicroWave Userwavetable and Waves dump** User Wavetables will replace Wavetables 65.....76 of the Wave; User Waves will replace Waves 300.....360.

Disk Functions



This chapter tells you all about the built-in floppy disk drive, everything you can do with it and how to operate all the associated functions. Please refer as well to the next chapter, *Database Functions*, which covers that specific function of the disk-drive.

About the Disk Drive

The floppy disk drive, located on the left-hand side of the Wave under the physical controllers, is a standard MS-DOS-compatible disk drive. It reads and writes to both double-density (DD) and high-density (HD) diskettes.

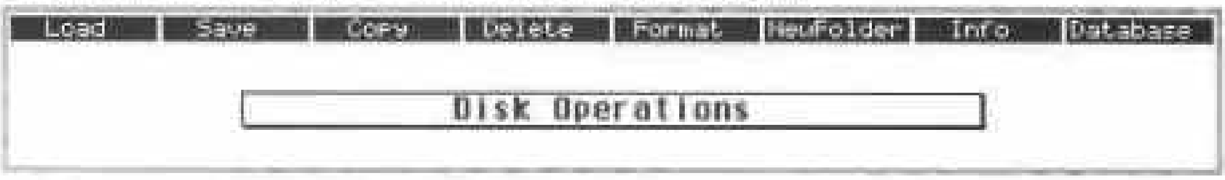
Since the disk drive is MS-DOS compatible, you can use *any* disk that conforms to that format. Most computers store in that format anyway or, as with the Macintosh, allow you to store to an MS-DOS type disk. This interchangability comes in most handy when analyzing samples and exchanging sequencer data. You also might back up all your Wave disks on the hard disk of your PC.

As is true for all drives, you should **never** eject a floppy while the drive is spinning. It is safe to eject the floppy only when the LED on the floppy drive is not lit.

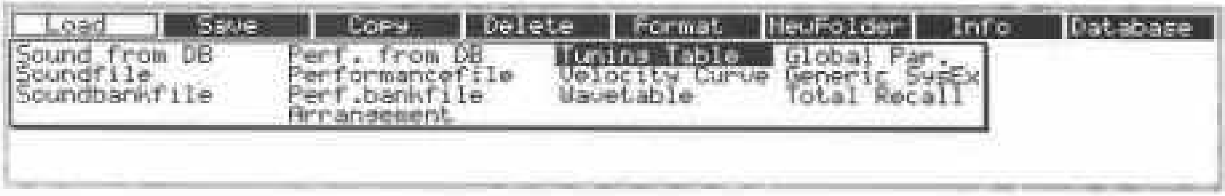
Also, you should **never** change a disk before saving without first telling the Wave. This is done by pressing the <DiskChnge> button in the file-selector box. Otherwise, you could damage the directory of the disk you will be saving to, rendering *all* the data on that disk useless.

Accessing the Disk

You access disk functions by pressing the [Disk] button in the Manager section. The display will then show you the following disk menu page:



So far, you have not selected a function and could exit the disk menu simply by pressing [Cancel]. To select a function, use the [display] buttons. A pull-down menu will appear, offering you various menu items. Choose the item you want in one of the following ways:

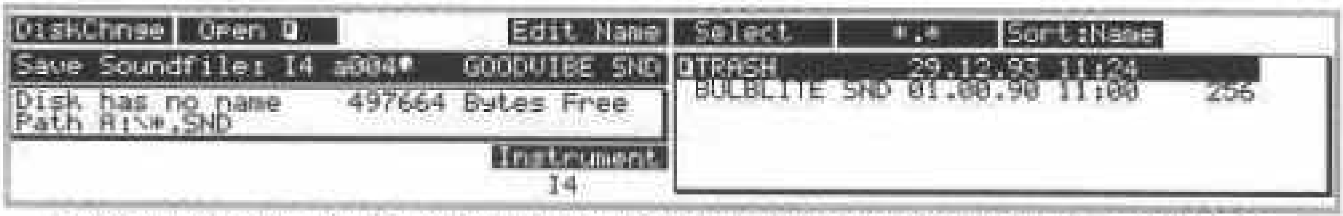


- Repeatedly press the [display] button of the chosen menu to scroll through the available items, as indicated by the moving inverse-video bar. You can only scroll downwards, but when you have reached the last item, the next button-press will bring you back to the top item.
- Use the [-/+] buttons to scroll through the menu items in either direction.
- To change the menu, simply push the corresponding [display] button.
- When the desired menu item is highlighted, you can select it with the [OK] button.
- To close a menu without selecting anything, press the [Cancel] button.

The File Selector Box

After you have selected the desired function, most likely the next page coming up will be the file selector box. It appears any time you select one of the following menus:

- <Save>
- <Load>
- <Copy>
- <Delete>



```
DiskChnge  Open D            Edit Name  Select      *.*      Sort:Name
Save Soundfile: I4 a004*   GOODVIBE SND  DTRASH          29.12.93 11:24
Disk has no name    497664 Bytes Free      BULBLITE SND 01.00.90 11:00    256
Path A:\*.SND
                                Instrument
                                   I4
```

⇨ Depending on the function you've called, certain of the following operations within the file selector box may not be available.

Display Button functions

- **<DiskChnge>** You *must* use this function whenever you exchange disks while the file selector box is open in order to update the directory contents of the file selector box. **Failing to do so may cause disk failure and data loss!** This function tells the disk operating system of the Wave that you have changed a disk while the file selector box was open.

- **<Open [ ]>** Use this function to open a folder in the directory. The icon used also indicates folders in the directory.

  ⇦ Use to open a folder rather than just selecting it and using the [OK] button. Also allows the selection of the entire folder, which comes in very handy for deleting it.

- **<Close [ ]>** Use this function to close a folder in the directory.
- **<Edit Name>** Press this button to edit the name of the current item. Use the Wave's keyboard or the [Data] dial plus [Page] and [-/+] buttons to input a new name, as explained in chapter 9.5, "Naming Items".
- **<Select>** This functions allows you to select an item from the disk's directory. When loading, copying or deleting, this will select the item in question; when saving, the item to be saved would replace the selected entry.
- **<*.*>** This function allows you to swap the display to show all files on disk rather than just the files relevant to the current operation. When saving, however, the Wave will *always* use the factory extension for the respective item or operation.
- **<Sort:...>** This function allows you to sort the directory by the following options:
  - **Name** sorts the files alphabetically.
  - **Date** sorts the files by the date of their creation.
  - **Size** sorts the files by their size.
  - **Type** sorts files by their extension (which only makes sense if you can view more than one extension).
- **<NewFolder>** This function allows you to create a new folder within the currently open directory path. To create a folder within a folder, you must open the original folder before executing this function.

Fader Functions

- **<Instrument>** Whenever you save or load Sounds, this fader allows you to select the relevant Instrument. When saving, the Sound of that respective Instrument will be saved, while during loading the Sound will be loaded into the respective Instrument Sound edit buffer.

- **<Table>** When loading or saving Tuning Tables or Velocity Curves, this fader allows you to select the desired item. When saving, this will be the Table that gets saved, while during loading the selected Table will replace the Table of that number.

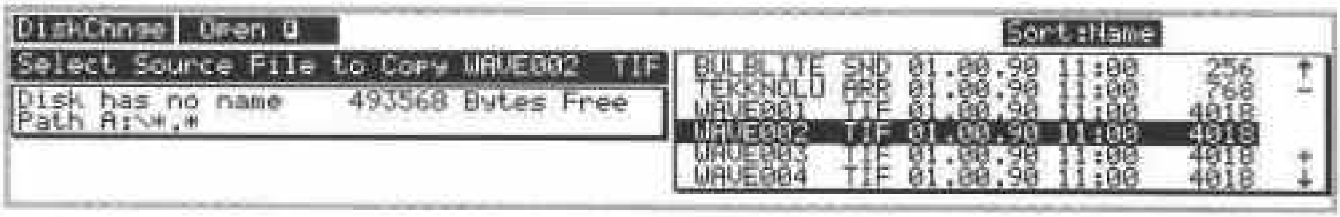
- **<Wavetable>** When loading or saving Wavetables, this fader allows you to select the desired item. When saving, this will be the Wavetable that gets saved, while during loading the selected Wavetable will replace the Wavetable of that number.

Selecting an Item

To select the desired item, you may use either the

- **[-/+]** buttons or

- **Fader 8**



```
DiskChnge  Open Q                                    Sort:Name
Select Source File to Copy WAVE002  TIF   BULBLITE SND 01.00.90 11:00   256  ↑
Disk has no name     493568 Bytes Free    TEKKNOLO ARR 01.00.90 11:00   768  ⊥
Path A:\*.*                               WAVE001  TIF 01.00.90 11:00  4018
                                          WAVE002  TIF 01.00.90 11:00  4018
                                          WAVE003  TIF 01.00.90 11:00  4018  ↑
                                          WAVE004  TIF 01.00.90 11:00  4018  ↓
```

If there are more entries in the directory than are visible on the screen, the arrow icons will guide you in which direction to find them.

To move upward in the respective directory, use either the [-] button or move the fader upwards; to move in opposite direction, either use the [+] button or move the fader downward.

The selected item will always be displayed in inverse video.

Formatting a Disk

Generally you may use any MS-DOS formatted floppy disk with the Wave, so if you are in a hurry, buy pre-formatted floppy disks. But obviously, you can format a disk right at the Wave, too.

- Choose the correct disk-type to format in the **<Format>** menu.
  - Use **Format DD** to format double density disks (720Kb)
  - Use **Format HD** to format high density disks (1.44Mb)

Never try to format a disk intended for DD use as a HD disk or vice versa. Even if you were successful now, chances are extremely high that the disk would soon fail .

- If you are not *positive* that you want to format the disk currently in the drive, press [Cancel] and check again. It usually is better to check a few times too often than one time too few.
- Verify your format request by pressing [OK] in the upcoming dialog box.
- Here you go. Lean back and await a freshly prepared floppy to come your way soon.

Saving Data to Disk

This is not only useful, but also very straightforward. Choose the **<Save>** menu in the disk page, then choose the item you wish to save. The selection is quite comprehensive, with four columns of data types.

Sound data

- **Sound to DB:** Stores a Sound to the database system. Since this is the recommended way to file Sounds, it's the first item in the Sound column. See the next chapter for details about the database functions.
- **Soundfile:** This simply stores a Sound as a standard file to disk. This allows you to view the Sound's name on any MS-DOS compatible system, but you'll have limited search and sorting functions and a maximum of 99 Sounds that can be stored this way on a single floppy.
- **Soundbank file:** Stores an entire Soundbank (either A *or* B) to disk. Use it to easily back up your Sound data.

Performance data

- **Performance to DB:** Stores a Performance to the database system. This is the recommended procedure for filing individual Performances.
- **Performance file:** Stores a Performance as a regular file on disk.
- **Perf.bankfile:** Stores an entire Performance bank (either A *or* B) to disk.

- **Arrangement:** Stores an entire Arrangement to disk. The following items will be included:
  - Performance
  - All Sounds of the Performance
  - All user Wavetables, if any have been used
  - All user Tuning Tables, if any have been used
  - All user Velocity Curves, if any have been used

Tables

- **Tuning Table:** Stores a user Tuning Table.
- **Velocity Curve:** Stores a user Velocity Curve.
- **Wavetable:** Stores a user Wavetable to disk.

Miscellaneous

- **Global Parameters:** Stores the settings of the Global parameters to disk.
- **Generic SysEx:** Stores incoming System Exclusive MIIDI data onto disk.
- **Total Backup:** Stores the complete RAM-memory contents onto disk, this includes: all Sounds, all Sound Edit buffers, Instrument Sound Edit buffers, all Performances, Performance Edit buffers, User Wavetables, User Waves, Global Parameters and machine specific data.

When you have selected the data type to store, press [OK] to acknowledge or [Cancel] to abort. Upon acknowledging, the file selector box appears, giving you the various save-options.

Loading Data from Disk

Loading data from disk is as straightforward as saving it. Choose the **<Load>** menu on the disk page, then choose the item you wish to load. The selection is identical to the Save selection.

Loading Sounds

When loading a Sound from disk, you can choose the Instrument to which you want to load the Sound. Loading several Sounds repeatedly into the same Instrument will overwrite the Instrument Sound edit buffer with each upload; therefore, save a Sound to internal memory if you want to keep it inside the Wave. You can load Sounds into several Instruments at a time.

No matter how a Sound has been saved, when you load it from disk, it will *always* be loaded into the Instrument Sound edit buffer.

Loading Performances/Arrangements

No matter how it is stored on disk, the Performance you load will be placed into the Performance edit buffer. Loading several Performances repeatedly will overwrite the edit buffer with each upload; therefore, save a Performance to internal memory if you want to keep it inside the Wave.

When loading an Arrangement, the Performance will be loaded into its edit buffer and the Sounds will be loaded into the respective Instrument Sound edit buffers. If any tables and/or Wavetables were saved with the Arrangement, the Wave will ask if it should load them into internal memory. Be aware that there are no edit buffers for tables, so those currently stored at the location where the uploaded ones are to be placed will be lost forever.

Loading Tables

All Tables inside the Wave do not possess edit buffers. Therefore, when you upload a table from disk, the table residing in that storage location will be overwritten.

Loading Miscellaneous Items

The same is true for Global parameters as for tables. The data from disk will be written directly into memory, erasing all previous data.

Samples for analysis can only be loaded in the Wave Edit operation mode from the <Analyse> menu on the Wave Edit main page.

Total Recall

Use this function to load a setup saved with the Total Backup function in the Store Menu. Be sure not to load the machine specific data unless it has been saved on your Wave !

Deleting Files from Disk

As soon as you access this menu, the file selector box appears, showing you *all* files on disk. Select the file you wish to delete and press [OK]. You must verify this command by again pressing [OK], or abort using [Cancel].

The contents of a selected folder will be completely erased when you delete the folder. To erase a file within the folder use the <Open Folder> command first.

⇨ Whatever you delete, do it with the knowledge that it will be the last time you have access to that particular file. After being deleted, it will be but a brief memory of times past. Be especially careful when deleting entire folders. That *one* hit-sequence or the Wavetable-of-doom might have been hidden there. **Never** delete a file on the system disk except those you have saved there yourself.

Copying Files from Disk to Disk

This function allows you to copy individual files between disks, and to copy a file from within one folder on a disk to another folder.

- Select *Copy File* from the **<Copy>** menu.
- Press [OK] to acknowledge.
- When the file selector box appears, select the source file you wish to copy; you may select an entire folder, if desired
- Press [OK], the selected file will be read into RAM memory.
- After a short while, the display will prompt you to insert the destination disk. You may also simply change the directory of the source disk to copy data between different paths.
- Press [OK] to start the copy process.

Copying an entire Disk

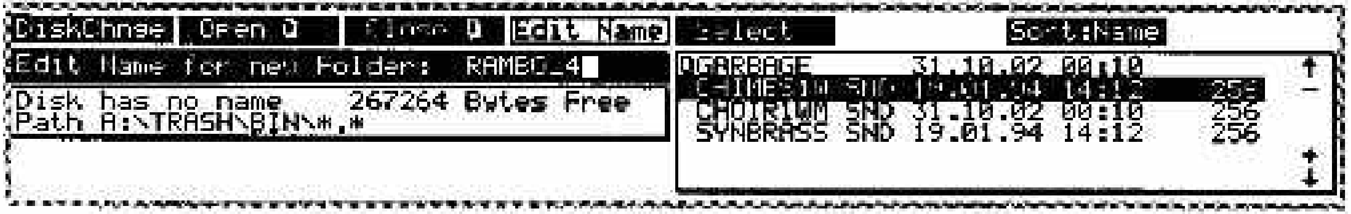
This function comes in very handy if you want to make a backup copy of your system or database disk, or whenever you wish to back up an entire disk.

Important! You can only make a disk copy of matching disk types. If you want to duplicate a double density disk, you *must* use another double density disk; the same is true for HD disks. Also, the destination disk *must be formatted* prior to copying. Once the disk copy process has been started, there is no chance to format a disk in the middle of the routine.

- Select *Copy Disk* from the **<Copy>** menu.
- Press [OK] to acknowledge.
- The display now prompts you to insert the source disk. It is a good idea to have the source disk write-protected (the respective hole of the disk should be visible) to prevent accidental data erasure.
- Press [OK] to start the disk copy process.
- After a while, the display will prompt you to insert the destination disk. Insert a formatted floppy disk.
- Repeat the procedure as indicated by the Wave until the entire source disk is copied. Usually, a DD disk will be copied in two steps; an HD disk in will be copied in three passes. However, depending on the amount of available internal memory (which in turn is dependent on what other information currently resides in memory), it might take more steps to copy a disk.

Creating a new Folder

Folders offer a great way of organizing your data. You may use one folder to store Wavetables, another to store sound-banks and a third for Arrangements, thereby keeping your disk files nice and tidy.



```
Edit Name for new Folder:  RAMBO_4
Disk has no name      267264 Bytes Free
Path A:\TRASH\BIN\*.*

DGARBAGE        31.10.02 00:10
 CHIMES1W SND  19.01.94 14:12      256
 CHOIR1WM SND  31.10.02 00:10      256
 SYNBRASS SND  19.01.94 14:12      256
```

- Select the menu topic **<NewFolder>** to create a new folder.
- The file selector box appears, allowing you to give the new folder a name.
- You may also open another folder to create nested folders.
- Press [OK] to create the folder, or [Cancel] to abort.

Other Functions

Info

Ever wondered what day the guys finished the software your Wave runs on? Wondered about the version number secretly tucked away in some dark silicon corner of your mystery RAM? Have we got news for you!

To see all this and more, push the <Info> button of the disk menu. This will reveal the deepest secrets of them all: When was your Wave... made?

And beyond that, when you're talking to the friendly staff at the service department, this info might give them a clue as to why something doesn't happen as supposed to. As we said, *might*. (Then again, it's unlikely that you'd ever have to call the service department....)

Database

This menu lets you select the active Sound or Performance database. The next chapter gives you all the necessary information.

Storing other Vendor's Sys-Ex Data

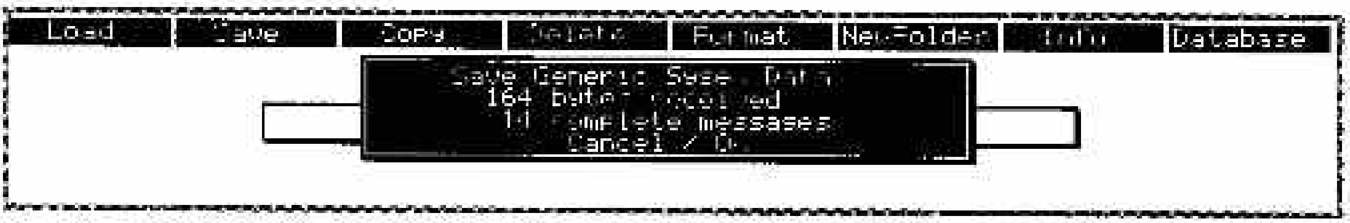
You can use the disk drive of the Wave to store MIDI sys-ex data from manufacturers other than Waldorf. This feature comes in very handy when you need to archive all the patch data for a particular song for later recall in a different studio or live on stage.

Thanks to the Wave's large RAM memory, very long sys-ex messages can be archived. Additionally, you may archive more than just one sys-ex message in a single file, up to the amount of available memory. This allows you to store the entire sys-ex data for a song or even an entire gig in one file, which you would then simply transmit via MIDI to your gear. Since sys-ex data is always labeled for specific equipment, you can automatically recall an entire setup with only one file.

To save generic sys-ex data, the device whose data you want to save must be capable of manually initiating a sys-ex dump. Currently, there is no provision to generate a dump request from the Wave.

Saving Generic Sys-ex Data to Disk

- Press the **[Disk]** button to select the disk page.
- Select the menu item **<Generic Sys-Ex>** from the **<Save>** menu.
- The following dialog box appears:



```
Save Generic Sysex Data
164 bytes received
14 complete messages
Cancel / Ok
```

- The second line of the dialog box shows you how many bytes of data have been received, and the third line displays the total number of complete separate messages received.
- You can now send any sys-ex dump to the Wave via the Wave's MIDI In port. The size in bytes as well as the number of messages should be displayed accordingly.

⇨ Some MIDI equipment sends its sys-ex data in separate packets. The Wave will recognize each packet as an individual complete message, so the number of messages received might be higher than you would expect at first glance.

- You can continue to send sys-ex data to the Wave. Each additional incoming message will be appended to the messages that are already stored. Thus, you may create a single file that contains all the sys-ex data you might need to recreate a particular song or live gig.

- When all sys-ex data has been sent to the Wave, press **[OK]** to store it to disk or **[Cancel]** to abort.

- All consecutively received messages will be saved as one file under one name. When saving, you may give that file any MS-DOS compatible name you wish.

Loading Back Generic Sys-ex Data

- Make sure that you have selected the correct MIDI Out for the generic system-exclusive transfer. You can choose the MIDI Out using the parameter <Sys-Ex MIDI Port> in Global Edit.

⇨ If there seems to be no MIDI sys-ex transfer from the Wave, check to see if this parameter has possibly been set to *off*.

- Press the **[Disk]** button to select the disk page.

- Select the menu item **<Generic Sys-Ex>** from the **<Load>** menu.

- Choose the file that contains the sys-ex data you wish to transmit to your MIDI equipment.

- Press **[OK]** to start the transfer or **[Cancel]** to abort.

⇨ If you want to save sys-ex data that must later be sent out of different MIDI Outs when it is reloaded into your MIDI equipment, either create two files labeled *A* and *B* for the respective MIDI Outs, or transmit one file that contains all the data two times in a row - once via MIDI Out A and a second time via MIDI Out B.

Database Functions

waldorf

This chapter covers all of the parameters and functions of the database system, which is part of the disk operating system. You should be familiar with the concepts presented in the chapter on disk functions to get the most out of this section of the manual.

The Basic Concept

Ever searched for that one magic sound? Let's see, it was some sort of electronic string, created around six weeks ago. If you only could find it, it would be the perfect complement to your current production. But chances are it's hidden somewhere under an eight-character name in a folder you wouldn't even want your mother to look into.

A familiar scenario? Well, at Waldorf we have thought about a way of giving you a better tool to find your work when you need it. And although we still did not manage to develop the floppy disk that buzzes when you're looking for it, we did the next best thing: We developed a built-in database system for storing and retrieving Sounds and Performances.

The Wave's database system truly makes the most out of your floppy disk system. Rather than being limited to the 99 items you can store on a standard floppy, the database system allows you to store nearly 5000 Sounds on a single HD floppy.

And to make it all even more worthwhile, you can assign a Sound or Performance to one of twenty groups that help you keep the database organized. Assign strings to "strings," percussive hits to "percHits" or bad Sounds to "Uargh!" - you decide the naming. You can sort by name or date, search for a certain name and generally keep things organized.

Creating a Database

The first thing to understand is that databases for Sounds and Performances are independent of each other. Therefore, if you want to file both Sounds and Performances using a database, you actually must create *two* databases.

When you insert a blank disk that doesn't contain a database, all you have to do to save a Sound to a database is to use the **Sound to DB** function.

- Since there is no database on the disk, the Wave will ask you if it should create a new Sound database (called "Sounds").
- Press [OK] and *presto!* You've created a Sound database.

Creating a Performance database works exactly the same, only this time you must save a Performance as **Performance to DB** to a disk that has no Performance database on it; the new Performance database will be named "Performs."

If, however, you want to create a second database on a floppy, the procedure is slightly different.

- Select <Database> from the disk menu.
- Select the menu item **Select Sound Database** to create a database for Sounds or choose the entry **Select Perf. Database** to create a database for Performances.
- The file selector box appears. Enter the name for the new database you wish to create and press [OK].
- Since the disk menu will have vanished, press the disk button again.
- Save either a Sound or a Performance to the database, depending on which database you want to create.
- A dialog box appears, informing you that a database under the name you specified in <Database> cannot be found. Press [OK] to instruct the Wave to create it.

Selecting a Database

If only a single database of a certain kind is present on a floppy disk (as we strongly recommend), the Wave will select that database automatically. If more than one database resides on a single disk, it will select the first one it finds - usually the one that was created first.

In such a case you might want to select the database you want to use yourself. To select a database:

- Select <Database> in the disk menu.
- Choose either the menu entry **Select Sound Database** or Select **Perf. Database**, depending on what kind of database you want to select.
- The file selector box appears. Select the databases on disk you want to work with and press [OK].
- At this stage you might create a new database, too, as explained above.

Managing the Database

Creating a database is easy. Managing it is, unfortunately, a bit more time consuming, but well worth it.

First, you should decide if you need more than one database to work with. This should only be necessary if you have to manage more than about 5000 Sounds/2500 Performances and/or need more than 20 groups for basic sorting. In any event, before starting to set up a database, decide the structure it should have and its function; this will have a particular impact on the names of the groups.

When you plan to install several databases, it's a good idea to have one disk for each database. First, you can easily tell by the disk's label what database it contains, and second, you do not have to manually select a database to work with it. Rather, you only have to insert the correct floppy, and the Wave will open the database automatically.

The big exception: If you have both a Sound *and* a Performance database on one disk, the Wave will be able to see their difference in data types and regard each as the only database of its kind on disk.

Having several databases allows you to manage *lots* of data, but has one serious drawback: there is no way that you can search for that one name in the entire database and be sure to find it - it could always be in another database.

The next step is to determine the function of the groups within the database. That will most likely determine their names. A lot depends on the way you do sound design, and what kind of Sounds you use. If you *never* need synthetic strings, categories such as "SlowStrings" or "LushStrings" could be totally useless, whereas "HiShrieks" and "MetalAlert" might be perfect. It is up to you.

But do not fear: You may rename a group at any time, and even change the group assignment of an item after it has been stored (though that may be no simple task when dealing with hundreds of Sounds).

Before storing your first Sound or Performance to a database (or, for that matter your second), you should also check that the Wave's built-in clock is set to the proper time. It might seem a bit simple now, but in three months you'll be happy being able to search for that Sound you did in this studio session on day X. And it was the one you did in the morning, wasn't it?

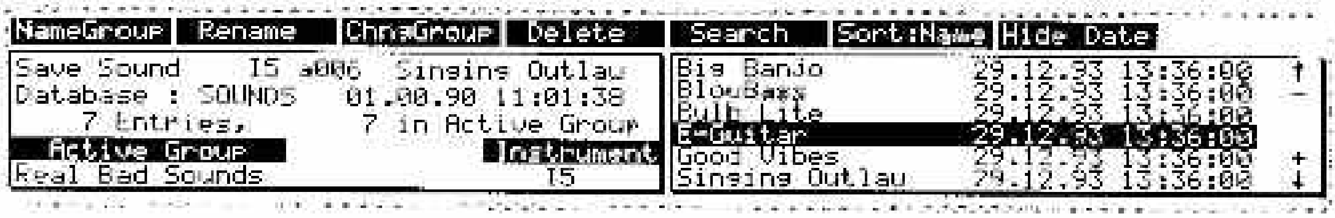
Finally, when storing, be *positive* that the group currently selected is the group that the Sound belongs to. Having wrong Sounds in the wrong groups is about the most devastating thing possible when you're searching for a particular item.

Well, now you are all set to start your own database system. If you want some inspiration, look at the databases that came with your Wave — maybe they're just what you are looking for.

Database Functions

To load from or save to a database, use the respective commands in the Disk <Load> and <Save> menus. The <Database> menu is purely for selecting the currently active database, as explained above.

When accessing either database via <Load> or <Save>, you will always get prompted with the following display:



```
Save Sound      I5 a006  Singing Outlaw   Big Banjo        29.12.93 13:36:00  ↑
Database : SOUNDS   01.00.90 11:01:38     BlowBass         29.12.93 13:36:00  −
   7 Entries,         7 in Active Group   Bulb Lite        29.12.93 13:36:00
  Active Group                 Instrument E-Guitar         29.12.93 13:36:00
Real Bad Sounds                    I5     Good Vibes       29.12.93 13:36:00  +
                                          Singing Outlaw   29.12.93 13:36:00  ↓
```

This is the database selector. It is quite similar to the file selector box, but offers different functions.

Display Button Functions

- **<NameGroup>** This function allows you to give any Group within the database an appropriate name. You may change the name of a Group regardless of whether or not there is data within the Group. Use the Wave's keyboard or the [Data] dial plus [Page] and [-/+] buttons to input a new name, as explained in chapter 9.5, "Naming Items".
- **<Rename>** This function allows you to rename an item in the database. Select the item you wish to rename before pressing this button.
- **<ChngGroup>** At any time you may move an item from one Group to another:
  - First select the item you want to move between Groups.
  - Invoke the function <Change Group>.
  - Select the new Group for the selected item with the <Active Group> fader.
  - Verify with the [OK] button.
- **<Delete>** This function deletes the selected item from the database.

- **<Search>** This function allows you to search for specific items in the database by their name. After selecting the <Search> function, you may input a search mask. The Wave now will only display those items that fit the search mask. To view all entries again, press the <Search> button once again.

  You may use the character * (star) as a wild card. When used, the search mask allows any character in the place of the wild card. As such, a search mask consisting entirely of wild cards will show the entire directory, as if no search mask were used.

  The search mask is filled originally with wild cards. Therefore, to view only items whose name starts with a certain letter, you only have to enter that letter into the search mask. Then, all items that begin with this letter will be displayed, regardless of the following characters. The more specific you are in setting up a search mask, the closer the items must match to be included.

  You may either search in only one Group or in all Groups, depending on the setting of the <Active Group> fader.

- **<Sort:...>** This function allows you to sort the directory by the following options:

  - **Name** sorts the items alphabetically.

  - **Date** sorts the items by the date of their creation. However, it is only available if the date is being displayed.

- **<Show/Hide Date>** You have two choices to view the contents of the database:

  - **Show Date** will display one column of data, where each line shows the name of the item followed by the date of its creation.

  - **Hide Date** will display two columns of data with names only. You see more items at once, but without knowing the dates of their creation. You can always swap modes if you need to see it.

Fader Functions

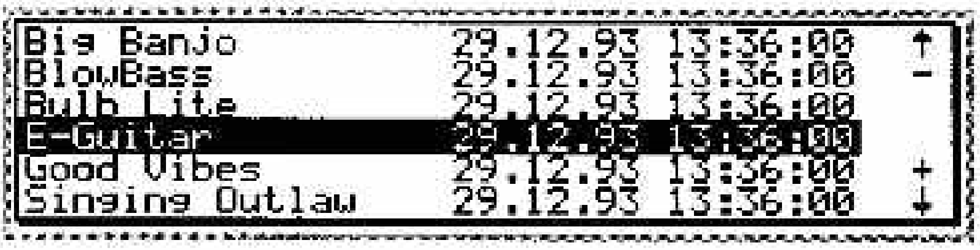
- **<Active Group>** This fader selects the Group you are currently viewing. In addition to the 20 distinct Groups, you may choose to see the entire contents of the database. Choose the entry *All Groups* at the top of the fader range to do so.

- **<Instrument>** In the Sound database, select either the instrument whose Sound you wish to save (when saving), or the instrument into whose Instrument Sound edit buffer you wish to load the selected Sound (when loading).

Selecting a Database Item

To select the desired item, you may use either the

- [-/+] buttons or
- Fader 8



```
Big Banjo          29.12.93 13:36:00  ↑
BlowBass           29.12.93 13:36:00  -
Bulb Lite          29.12.93 13:36:00
E-Guitar           29.12.93 13:36:00
Good Vibes         29.12.93 13:36:00  +
Singing Outlaw     29.12.93 13:36:00  ↓
```

If there are more entries in a Group than are visible on screen, the arrow icons will show you in which direction to find them.

To move upward in the respective directory, use either the [-] button or move the fader upwards; to move in opposite direction, either use the [+] button or move the fader downward.

The selected item will always be displayed in inverse video.

Sound Design

1.1 - 1.16 Sound Architecture

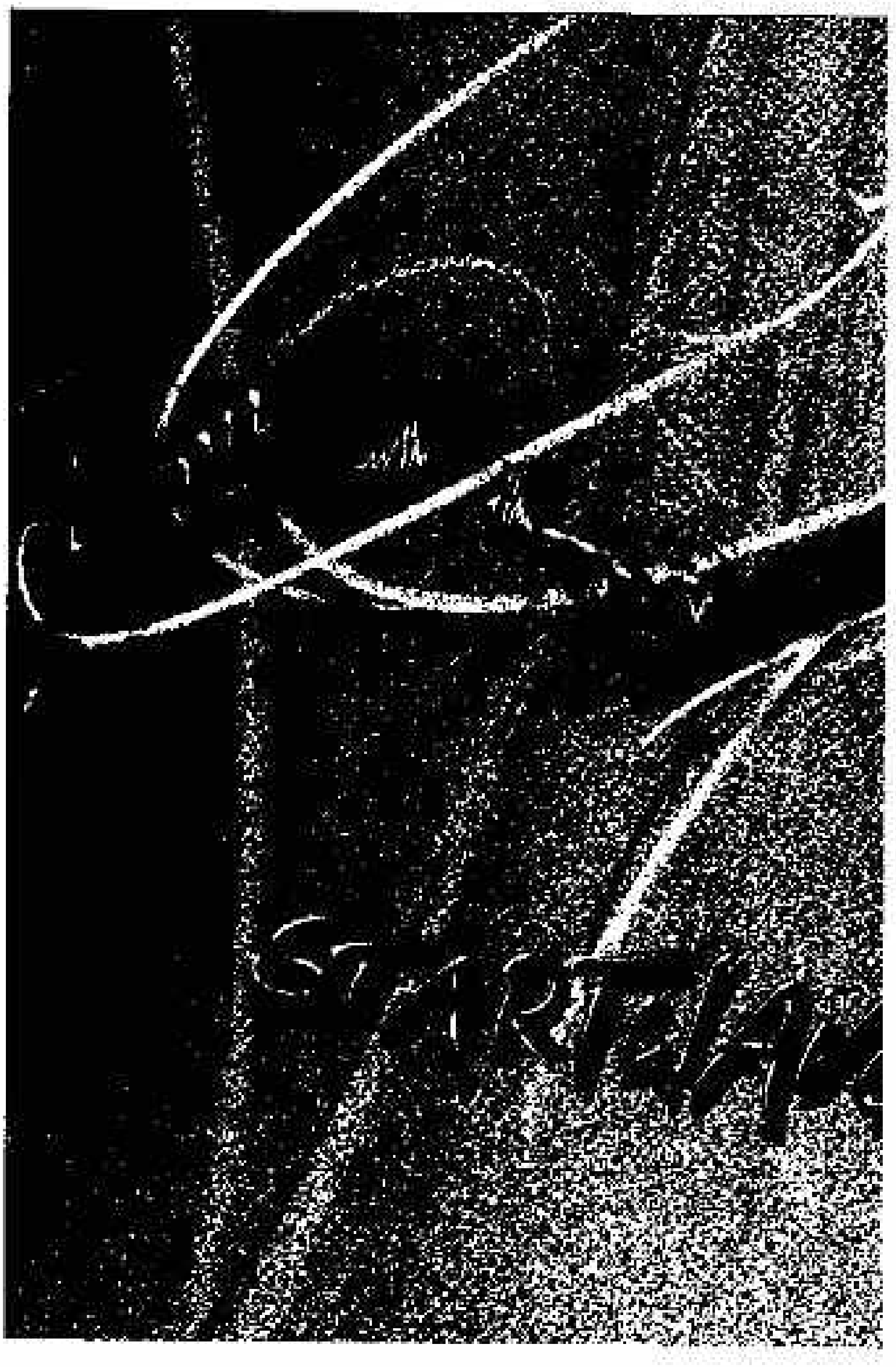
2.1 - 2.48 Audio Modules

3.1 - 3.46 Modifier Modules

4.1 - 4.9 Quick Edit

waldorf

Sound Architecture



waldorf

This chapter describes the basic architecture and signal flow of the Wave's sound generation engine. It also tells you about the synthesis concept used and offers insights into the modulation possibilities.

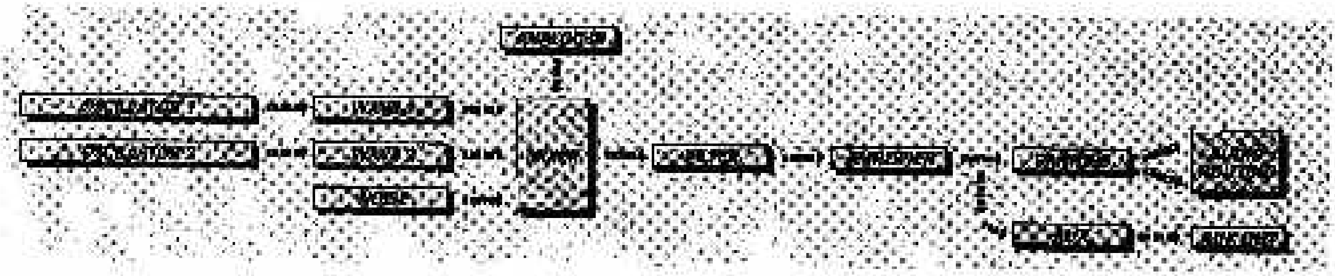
The Basic Concept

The Wave employs a number of different modules to generate its sound, each of which has a distinct function. There are essentially two types of modules:

- Audio modules
- Modifier modules

Audio Modules: Audio modules produce the actual sound you hear. All Audio modules are configured in a predefined manner. This configuration cannot be changed, as it is determined by the way the electronic components of the Wave are connected.

The general signal flow of these audio modules is depicted on the figure below:



- Two *Oscillators* with no sound of their own each drive one of
- two Wave *generators* that output the actual waveform. Both of those waveforms are fed to a
- *Mixer*, where they are joined by an additional Noise source and optionally by an external Audio-signal. The summed signal in the mixer is sent through a
- *Filter* module that processes the harmonic content of the signal that's put out by the Wave generators, after which the signal is passed through the
- *Amplifier* module, which shapes the sound's overall loudness. The amplifier module's output is connected to a
- *Panning* module, which sends the signal to the stereophonic outputs.

- Additionally, you find an *Aux* module that can be used to feed the signal to the Aux-bus and its related output.

There are but a few exceptions to the above layout:

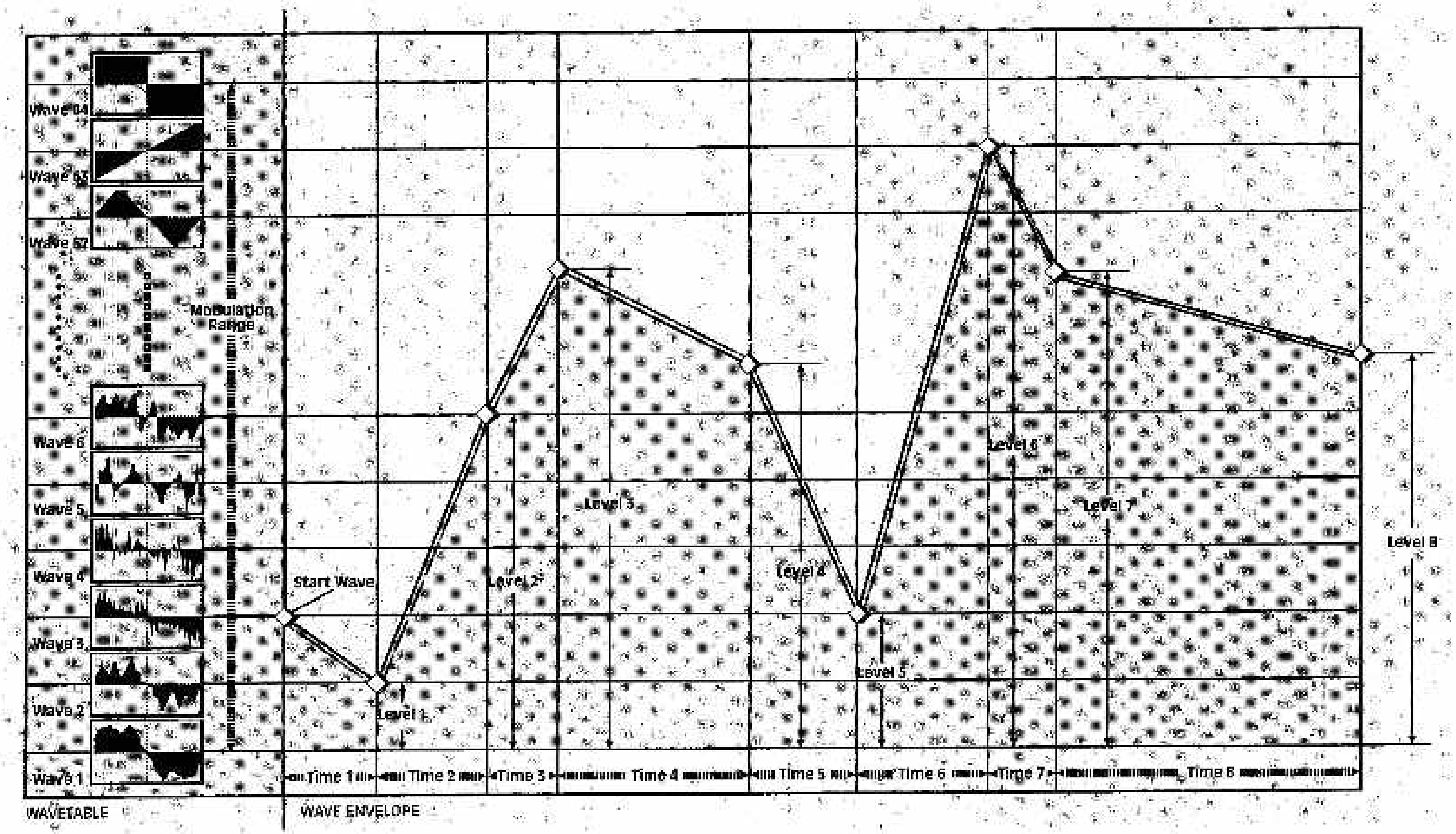
- If the <Stereo Width> parameter of Global Edit is set to *mono*, the panning module will be inactive. Instead, the same monophonic signal will be sent to the left and right outputs equally.
- If an Instrument is not routed to any of the three stereo outputs as a result of the Instrument's <Audio Out> parameter set to *Aux only*, **only** the signal fed to the Aux-bus can be heard.

Modifier Modules: When Audio modules produce sound, they do it according to rules set by the modifier modules. Such a rule might be, for example, "*start the volume softly and gradually fade it up to the maximum value*". That would be a typical rule as defined by the Amplifier envelope, which in turn adjusts the loudness of the amplifier module.

Almost every one of the Sound modules, be they Audio or Modifier modules, has certain modulation inputs. In the figure above these are indicated by the arrows pointing towards each module. You will find modulation inputs that are either *preconfigured* or allow for the connection of *routable* modifiers. These modifiers are available in a list called, not too surprisingly, the *modifier table*.

As mentioned above, modifier modules shape the sound produced by the audio modules. An LFO, for instance, might shape the pitch to produce vibrato, whereas the filter envelope might control the cutoff frequency of the filter.

See the topic on the Modifier table for an annotated listing of all available Modifier modules.


Wave 64
Wave 63
Wave 62
Modulation Range
Wave 6
Wave 5
Wave 4
Wave 3
Wave 2
Wave 1
Start Wave
Level 1
Level 2
Level 3
Level 4
Level 5
Level 6
Level 7
Level 8
Time 1
Time 2
Time 3
Time 4
Time 5
Time 6
Time 7
Time 8
WAVETABLE
WAVE ENVELOPE

Dynamic Spectral Wavetable Synthesis

This synthesis method and the flexible modulation possibilities are the key ingredients to producing the Wave's unique and delicate timbres. You can control the harmonic content right at the source where the sound will be produced: the Wave generators. Moreover, you have the ability to change the timbre dynamically.

In Dynamic Spectral Wavetable Synthesis you start with a *Wavetable*. The Wave can hold up to 128 Wavetables in memory. Each Wavetable is a compilation of 64 *Waves*, each of which represents a particular harmonic spectrum.The Waves in most of the factory Wavetables are compiled in such a way that the spectrum of each successive Wave bears some relation to the preceding one.

You could think of each Wave as a specific, unique spectrum that will yield a distinct timbre when processed with the other modules of the Wave. This alone would yield a huge array of interesting tone colors; that, however, by itself would not be too revolutionary.

What really sets the Wave apart from all other synthesizers is its ability to scan a Wavetable, interpolating between the different Waves of the table, and thus to dynamically change the waveform and spectrum itself.

The process of changing the waveform in real time is done by the Wave's unique wavescan technology. As stated above, a Wavetable has 64 different positions, each representing a certain spectral identity. When a key is pressed, the Wavetable will output a spectrum according to the setting of the parameter [Start Wave]. If no modulation is used for scanning the Wavetable,this spectrum will remain static throughout the duration of the note-on.

If, however, one or more modulation sources are applied, the Wavetable will be scanned at different positions according to the modulations that have been defined. Thus, if the multi-segment Wave envelope is used (as pictured above), it will change the position within the Wavetable over time as defined by its parameters.The spectrum of the Wave generator will change dynamically, resulting in either subtle or dramatic timbral evolutions depending on the settings programmed in the modulators.

You can scan the Wavetable with up to four different modulation sources per Wave module, two of which are routable modulation inputs. This gives you tremendous power for creating rich, moving sounds. Consider all other available means for processing the Wave modules, such as Filter or Panning, and you'll begin to understand the vast capacity the Wave has for creating unique sounds.

But we didn't stop there. You can actually create you very own Wavetables on the Wave by applying a host of various techniques. These include Sample Analysis and

Spectral Extraction, a method that yields stunning new Wavetables by recreating the spectrum of a sample, allowing for very musical *and* very different ways to manipulate acoustic timbres.

About Modulation Inputs

As mentioned earlier, modifier modules shape the sound, whereas audio modules produce it. Thus, a modifier module can be regarded as a control source whose outout controls a destination, namely the audio module.

Throughout the Wave you will find that the *amount* of modulation exerted by a modifier will be programmed at the destination (although in complex modulations, a destination might actually be another module's source). This allows you to use the same modifier with several destinations, each of which uses different modulation amounts.

There are essentially two different modulation architectures used in the Wave:

- preconfigured modulation inputs
- routable modulation inputs

Preconfigured Modulation Inputs

Preconfigured modulation inputs have specific sources connected to their inputs. These sources cannot be changed, rather they are hard-wired or ***preconfigured*** at the factory. Only the modulation amount can be programmed. A value of *0* will effectively disable each modulation input, if you should decide that you do not want any modulation from the specific preconfigured source.

All audio modules except for the Panning and Aux modules offer some preconfigured modulation inputs. Oscillators, for instance, have pitch-bend as a preconfigured modulation-inputs, and the Filter envelope is normally assigned to the Filter.

The following modules bear preconfigured modulation inputs:

- *Oscillators:* Pitch-bend range
- *Waves:* Wave envelope (amount and velocity)
Keytracking
- *Amplifier:* Amplifier envelope (amount and velocity)
Keytracking

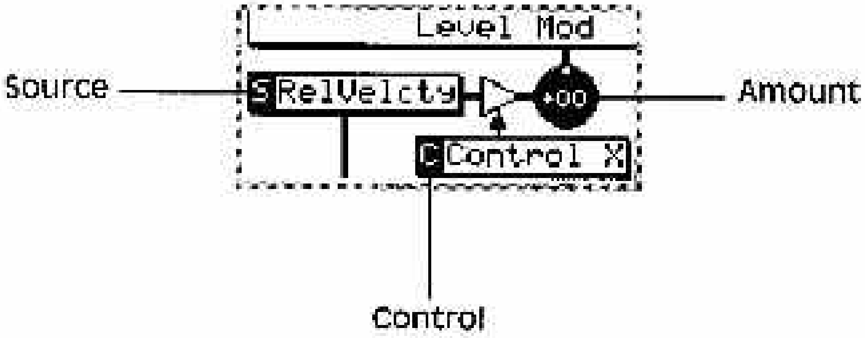
- *Filter:* Filter envelope (amount and velocity), except for the Dual High Pass module: Keytracking

Routable Modulation Inputs

Routable modulation inputs allow you to determine the modulation source and amount. Most Sound modules have routable modulation inputs; this is true for both the audio modules and the modifier modules. To afford you even more creative freedom, we've provided two different kinds of routable modulation inputs:

Sidechain Modulation Input: This type allows you to cross-modulate two modifier modules, one being the source, the other the control input of the modulation input in question. This way you can control the effect of the source modifier module by using a different control modifier module.

The figure below depicts how this works:

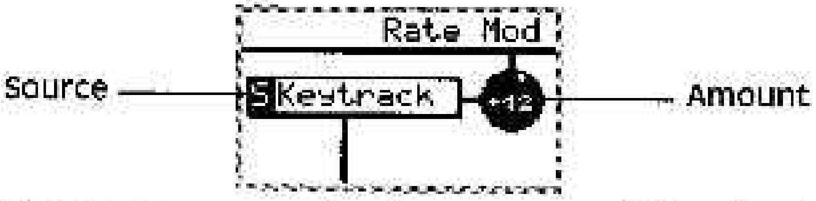


The *source* is the modifier module that actually modulates the module according to the *amount* programmed. It bears a modulation input of it's own, the *control* input, that allows the amount to be scaled in real time by another modifier module. Technically speaking, the source and control inputs will be multiplied by one another.

Possible applications include:

- LFO modulations controlled by velocity, mod wheel, or aftertouch
- the creation of complex envelopes by scaling the envelope at the source input with another envelope at the controller input
- scaling envelope amount by velocity, keytracking or a MIDI continuous controller

Regular Modulation Input: This type works straight-forwardly, as you would expect:



The modifier module programmed as the *source* modulates the destination module with an amplitude set as the *amount*.. Depending how the modulation source is being programmed, the actual amount of the modulation may vary according to other modifiers and/or your playing.

You might use regular modulation inputs for example as:

- constant LFO modulations
- additional regular envelope inputs
- MIDI continuous controller inputs
- and much more.

All routable modulation inputs share two basic functions:

Modulation Amount: This can be set to either positive or negative values. The amount sets the peak of the modulation; for an ADSR envelope, that would be the maximum level that will be reached after the attack time.

A negative value then inverts the output of the respective modifier module. An ADSR envelope, for instance, would be turned upside down, starting and ending at the highest level. An LFO would be 180 degrees out of phase with the non-inverted signal produced by the modifier module.

Modifier Table: This table encompasses all modifier modules, physical controllers and MIDI modifiers that can be used by the modulation source and the control inputs of both the sidechain and regular modulation inputs. The next chapter gives you more detail.

Basic Concept

The entries in this table encompass all of the possible modifier sources the Wave has to offer, regardless of their origin. The table allows you to choose the modifier that will be used by a specific source or control input of a Sound module's modulation input.

There is a close analogy to old modular synthesizers or the patchbay of your studio: You could think of the table entries as a bunch of patch-cords, each one coming from a specific source. At the destination in question, you may use any of these cords as a modifier. However, you only have a fixed number of modulation inputs available, so at any given time you only can use a subset of all available modifiers.

This scheme allows for a large number of modifiers, yet it keeps the overhead required to compute the actual modulations for each Sound module at a manageable level. Also, you always know where to check for a possible modulation, since the modulation layout for all the destinations is always concise.

For debugging while doing sound design, don't forget to use the option for muting or soloing the routable modulation inputs. It's a great tool for checking Sounds whose modulations have become rather complicated.

Unipolar and Bipolar Modifiers

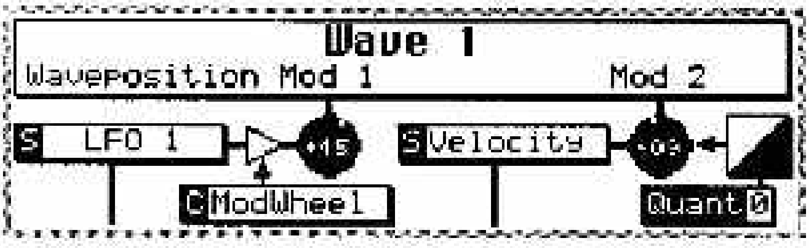
The output ranges of all modifiers used in the Wave are normalized to meet the MIDI specification in the best possible way. But to understand the modulation concept of the Wave, you should be familiar with the two available modifier classes: unipolar modifiers and bipolar modifiers.

Unipolar modifiers output positive values *only* ; these will usually be added to the parameter value at the destination. Typical unipolar modifiers are velocity and the Filter envelope.

Bipolar modifiers output *both* positive *and* negative values, thus affording the possibility to add or subtract from the value of the destination parameter. Typical bipolar modifiers are the LFOs and the pitch-bend wheel (though the latter is shifted into the positive range with +64 representing 0 for MIDI transmission reasons - but for now, never mind those little nuisances of MIDI data representation).

In the list of modifiers that follows, you can see which modifiers are unipolar and which ones output data in a bipolar fashion.

Now, let's take a look at the typical modulation input of a Wave.



As you can see, such a typical input can either be set to a positive or negative value. When set to a positive value, the modulation source will be added to the respective parameter to be modulated, whereas a negative setting would subtract the value of the incoming modulation source.

This, however, is true only for *unipolar* sources that only output positive values. But the Wave also offers *bipolar* modifiers, that output both positive *and* negative values. With such a modifier, setting a modulation input to a negative value will invert the modifier's output, so that all negative values coming from the bipolar modifier will become positive and vice-versa.

Internal Modifier Modules

- **LFO 1** *(bipolar)*
- **LFO 2** *(bipolar)*
- **Amp Env** *(unipolar)*
  The Amplifier Envelope, with maximum possible peak.
- **FilterEnv** *(unipolar)*
  The Filter Envelope, with maximum possible peak.
- **Wave Env** *(unipolar)*
  The Wave Envelope, with maximum possible peak.
- **Free Env** *(bipolar)*
  The Free Envelope, with maximum possible peak; this envelope is *only* available in the Modifier Table.
- **Ctr Ramp** *(unipolar)*
  The modifier module Control Ramp, whose output is *only* available in the Modifier Table.

- **CtrMixer** *(bipolar)*
  The modifier module Control Mixer, whose output is *only* available in the Modifier Table.
- **CtrDelay** *(bipolar)*
  The modifier module Control Delay, whose output is *only* available in the Modifier Table.
- **CtrShaper** *(bipolar)*
  The modifier module Control Shaper, whose output is *only* available in the Modifier Table.
- **Ctr S&H** *(bipolar)*
  The modifier module Control Sample & Hold, whose output is *only* available in the Modifier Table.
- **Comp pos** *(unipolar)*
  The positive output of the Control Comparator, which outputs the value *127* when the threshold of the Comparator has been met or exceeded. Otherwise, it outputs *0*. This output is *only* available in the Modifier Table.
- **Comp neg** *(unipolar)*
  The negative output of the Control Comparator, which outputs *0* when the threshold of the Comparator has been exceeded, and *127* as long as the threshold has not been reached by the source-value that is being compared. This output is *only* available in the Modifier Table.

Physical Controllers

- **Keytrack** *(bipolar)*
  Linear keyboard position, from either the Wave's keyboard or MIDI.
- **Velocity** *(unipolar)*
  Linear key-down velocity, from either the Wave's keyboard or MIDI.
- **RelVelcty** *(unipolar)*
  Linear Release Velocity, from either the Wave's keyboard or MIDI.
- **Aftertch** *(unipolar)*
  Channel Pressure, as generated by the Wave's keyboard or received via MIDI.

- **Poly Press** *(unipolar)*
  This cannot be generated by the Wave itself, but it can be received via MIDI, making it, in effect, a MIDI modifier. However, for logical reasons it succeeds Aftertouch in the Modifier table.

- **Playspeed** *(unipolar)*
  Generates a value between 0 and 127 depending on the speed of incoming notes. It does not make a difference whether these notes originate from the Wave's own keyboard or are received via MIDI.

  The slower the succession of notes, and hence the speed of playing is, the smaller the value of Playspeed. In a way, Playspeed is similar to MIDI Clock, only that here it is the actual speed of incoming notes, rather than the speed of a song in bpm, that generates the respective modifier value.

- **More Keys** *(unipolar)*
  Measures the number of keys currently held and outputs a value accordingly.

  The more keys you play, the higher the value of this modifier. If you hold no keys at all, the modifier value will be 0.

  Please note that More Keys will actually only sense the number of *keys held*, not the number of voices that are still sounding. You'll note the difference with long-release Sounds - even though you here lots of voices when playing staccato, only one key will be measured unless you hold the respective keys. Pressing the sustain pedal, by the way, will have no effect either - you must physically hold the keys.

- **Less Keys** *(unipolar)*
  This is the counterpart to More Keys, only that it works exactly the other way around: The more keys you play, the *lower* the value of the modifier. The value will be 127 when you play only one key, and decrease when more keys are played.

  As with More Keys, Less Keys looks for the actual number of held keys, not for voices that are still sounding.

- **PitchBnd** *(bipolar)*
  Regular pitch-bending, from either the Wave's physical controller or MIDI.

- **ModWheel** *(unipolar)*
  Modulation, from either the Wave's physical controller or MIDI controller 1.

- **FreeW up** *(unipolar)*
  The up-throw of the Free Wheel, originating either from the respective physical controller of the Wave or from the MIDI controller assigned to the parameter <Free Wheel up> in the Performance parameters.

- **FreeW dwn** *(unipolar)*

  The down-throw of the Free Wheel, originating either from the respective physical controller of the Wave or from the MIDI controller assigned to the parameter <Free Wheel down> in the Performance parameters.

- **FreeW bi** *(bipolar)*

  A bipolar implementation of the physical controller Free Wheel, where:

  - the center detente equals 0
  - the up-throw adds values
  - the down-throw subtracts values.

  The modifier will always be accurately read from the physical controller of the Wave; for this control to be sensibly interpreted over MIDI, however you *must* program different MIDI controllers for the Performance parameters <Free Wheel up> and <Free Wheel down>.

- **Sustain** *(unipolar)*

  The Sustain Pedal of the Wave and MIDI controller 64.

- **Pedal 1** *(unipolar)*

  The physical controller Pedal 1 whose connector you'll find on the back panel. Whatever MIDI controller has been assigned to <Pedal 1> in each respective Performance will also act as this modifier.

- **Pedal 2** *(unipolar)*

  The physical controller Pedal 2 whose connector you'll find on the back panel. Whatever MIDI controller has been assigned to <Pedal 2> in each respective Performance will also act as this modifier.

- **Button 1** *(unipolar)*

  The physical Play button controller to the left of the keyboard above the wheels. Whatever MIDI controller has been assigned to <Button 1> in each respective Performance will act as this modifier.

  Also note that there is a parameter <Button 1 Mode> in each Performance that permits you to program this Play button to act either as a toggle or a momentary switch.

- **Button 2** *(unipolar)*

  The physical Play button controller to the left of the keyboard above the wheels. Whatever MIDI controller has been assigned to <Button 2> in each respective Performance will also act as this modifier.

  Also note that there is a parameter <Button 2 Mode> in each Performance that permits you to program this Play button to act either as a toggle or a momentary switch.

MIDI Modifiers

» Naturally, the MIDI modifiers will respond as programmed only if the MIDI device that is transmitting to the Wave is capable of generating the particular controller messages. If, for instance, your external master keyboard does not support release velocity or poly pressure, it is useless to program these modifiers in the Wave, since they never will be transmitted.

» When assigning a MIDI modifier, be certain that the control message is not being filtered in the data filters page of the respective Instrument that is playing the Sound in question. If a MIDI controller is filtered, it is useless to assign it, since the controller data will be ignored upon reception.

- **PolyPress** *(unipolar)*

  Polyphonic key-pressure, which succeeds Aftertouch in the table (and is therefore located in a different position in the table). Since it can only be received and not generated, it is considered a MIDI modifier.

- **Vol Ctr** *(unipolar)*

  The controller that is defined for MIDI volume, MIDI controller 7.

- **Pan Ctr** *(unipolar)*

  The controller that is defined for MIDI panning, MIDI controller 10.

- **BreathCtr** *(unipolar)*

  The controller that is defined as breath controller, MIDI controller 2.

- **Control X** *(unipolar)*

  A freely assignable MIDI controller whose MIDI controller number can be defined per Performance.

- **Control Y** *(unipolar)*

  A freely assignable MIDI controller whose MIDI controller number can be defined per Performance.

- **MIDIClock** *(unipolar)*

  Generates a control signal from the MIDI clock. To achieve best results, you should apply this modifier while you are designing or fine-tuning the Sound. The MIDI clock should closely reflect the speed of your composition; when creating a "generic" Sound, use 120 bpm. Now, when the MIDI clock changes, the parameter it is assigned to as a control source will change according to the signal derived from the MIDI clock. If the clock becomes slower, the value will will drop, if it gets faster, the value will increase.

  Note that MIDI clock will actually generate a signal between 0 and 127, thus being normalized with respect to all other Wave modifiers. The actual pulse of the MIDI clock will generally not be used.

Fixed Modifiers

- **Minimum** *(unipolar)*

  Outputs a constant value of 0. Use it to quickly disable a modulation input without having to change the modulation amount.

- **Maximum** *(unipolar)*

  Outputs a constant value of 127. Use it as a control input with sidechain modulation inputs to convert them to regular modulation inputs.

"Hidden" MIDI Modifiers

These MIDI modifiers are always fed to the corresponding modules, except when filtered in the data filter page of the respective instrument.

- **Volume Controller** (Ctr. 7) to Instrument Volume
- **Panning Controller** (Ctr. 10) to Instrument Panning
- **Glide time Controller** (Ctr. 5) to Glidetime when MIDI Glide is selected
- **Glide switch Controller** (Ctr. 65) to Glide on/off when MIDI Glide is selected
- **Sustain switch** (Ctr. 64) to sustain played voices
- **Sustenuto switch** (Ctr. 66) to sustain currently pressed keys

Performance / Sound Interaction

Since a Sound can never be played by itself, but rather must be played from an Instrument in a Performance, certain parameters of the Performance and the Instrument might interact with parameters of the respective Sound.

- **Volume**

  A Sound has no volume parameter of it's own; only the Instrument has the ability to control volume. However, some modules may provide a way to adjust volume, namely the Aux module. Please note that this is the Instrument volume nevertheless and is only offered in the respective module for convenience.

- **Panning**

  The same is true for the basic panning position of a Sound. Although you will find the parameter <Instrument Panning> in the Pan module, this is exactly the same parameter labeled as <Panning> in the Instrument in which Sound is used. It is offered in the Pan module strictly for convenience.

  At the same time, be aware that the success and effect of any panning modulation depends on the static panning position set in the Instrument. And finally, the Instrument parameter <Pan Mod> allows for the inversion or nulling of the Sound's panning modulations.

- **Aux**

  As mentioned in the Performing section of this manual, a signal will only be sent to the Aux bus if the parameters of the Sound's Aux module are programmed to output an Aux signal.

  Similarly, the Instrument parameter <Aux Vol> must be set to a value higher than *0* to allow an Aux signal from the Sound to be sent to the Aux bus.

  » As you see, these parameters can easily become mutually exclusive, so you should follow a usual programming routine to allow for a signal to be sent. We recommend that you program every Sound to output as much Aux signal as possible, either by programming the Modulation Inputs or by setting the <Minimal Aux Level> parameter as high as possible. You then always can attenuate the actual Aux signal to be sent from that Instrument at the Instrument parameter <Aux Vol>.

- **Keytrack**

  In addition the keyboard itself, the Transpose buttons will add to the MIDI note-number and hence have an effect on the <Keytrack> parameter, whether it has been activated at the preconfigured Modulation Inputs or via the Modifier Table.

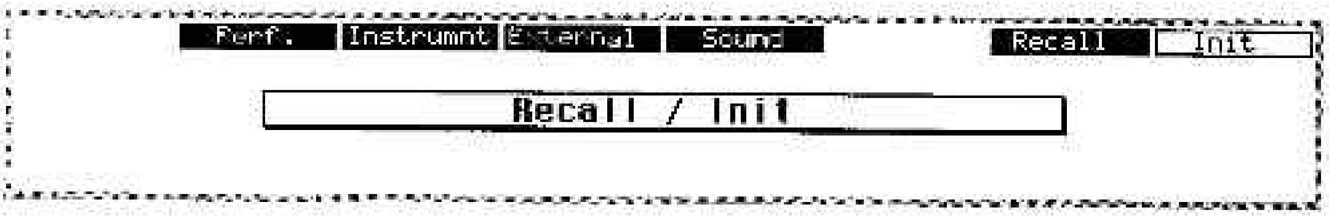
  The Instrument parameter <Transpose>, on the other hand, has no effect on keytracking.

Sound Initialization

Are you one of those adventurous people who are always looking for new challenges, new horizons and new surprises? Not satisfied with any brand-name marmalade, but always cooking up your own? Still searching for the mysterious C-28 chord (C-7 times Csus)?

Then you must belong to that group of folks who love to do sound design from the fabulous init sound level. For your ears only we have incorporated a way to initialize a Sound:

- Press the **[Recall/Init]** button and let go; the Recall/Init page appears on the display.



- Press the <Init> button, which then will be displayed hollow.
- Press the display button <Sound>.
- If more than one Instrument is currently active, a subpage appears, offering you the choice of which Sound to initialize. Make your choice by pressing the corresponding display button.
- Verify your initialization request by pressing the [OK] button in the dialog box that appears, or abort by pressing [Cancel].

That's it. The initialized Sound automatically resides in an edit buffer, so feel free to try any knob-twists you like; you can always recall the original Sound.

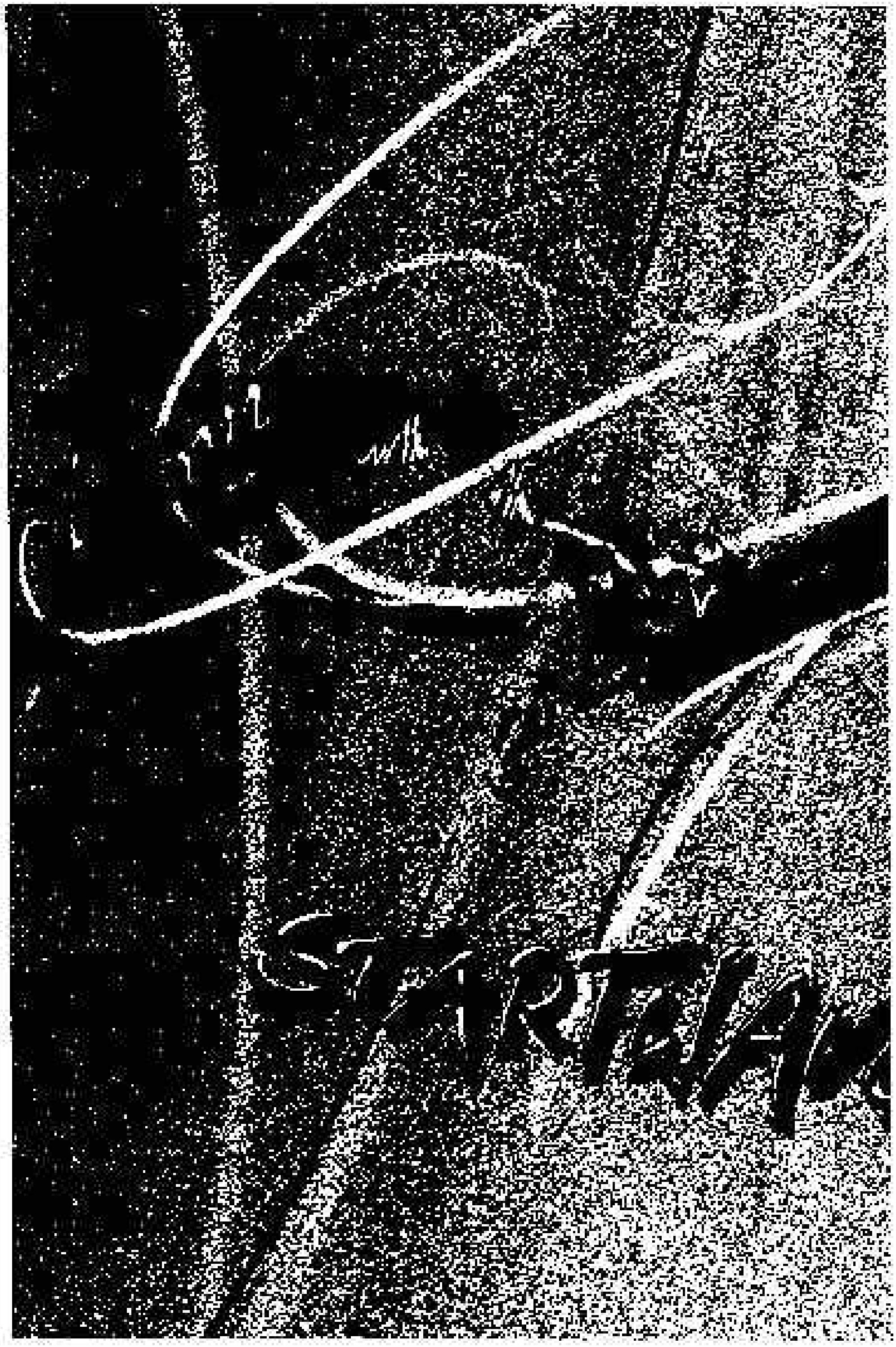
Naming a Sound

A Sound can only be named when storing it.

- After having called the display page by pressing the [Store] button, a dialog-box appears in which you're given the option to enter a new name before storing the Sound.
- To just change the Sound's name, simply store the Sound at the same location after you have entered the new name.

Chapter 9.5, "Naming Items", gives you details about the naming dialog-box.

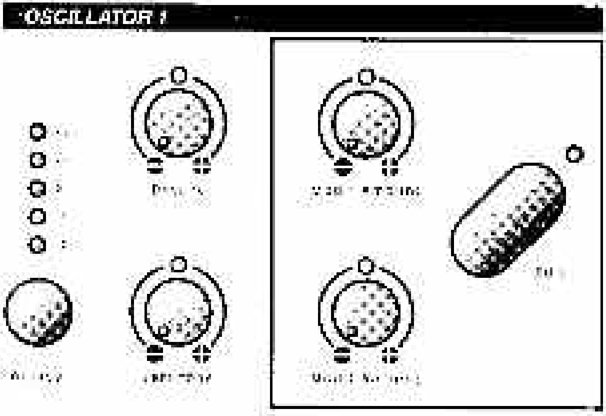
Audio Modules



SOUND DESIGN

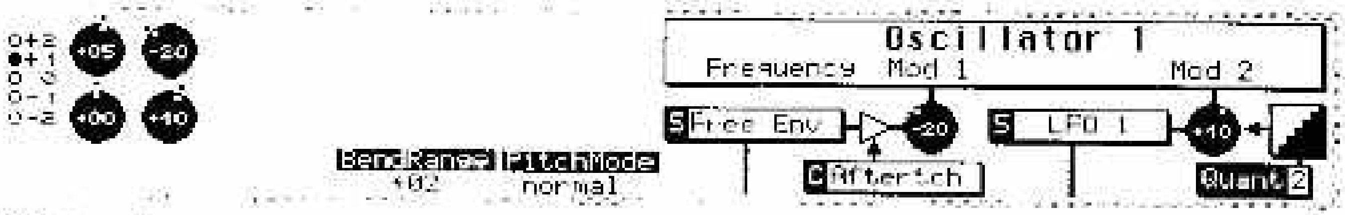
This chapter gives you all the information necessary to understand and program the audio modules of the Wave's sound engine. Audio modules produce and manipulate the actual audio signal of the Wave.

Oscillators



Oscillators are simply a source of pitch. They do not output any sound of their own; rather, they drive the Wave generators, which in turn produce the desired frequency spectrum.

The two oscillators are identical. They contain the same parameter sets except for one minute detail: Oscillator 2 has an additional [Link] parameter button that disables most of its own modulation parameters and replaces them with those of Oscillator 1.



[Octave]

Range: -2...+2

Octave sets the octave range of the oscillator's pitch.

- *0* will yield 'unity' pitch. If the key C4 is struck, the oscillator's pitch will be C4 (except for the effects of modulations and Tuning Tables).
- -2 will transpose the pitch down two octaves.
- +2 will transpose the pitch up by two octaves.

[Semitone]

Range: -12…+12 semitones

Semitone lets you transpose the oscillator's pitch in semitones. You can transpose either up or down.

- *0* means the oscillator's output will correspond directly to the MIDI note received.
- *-12* will output the oscillator's pitch an octave lower than the MIDI note received.
- *+12* will output the oscillator's pitch an octave higher than the MIDI note received.

[Detune]

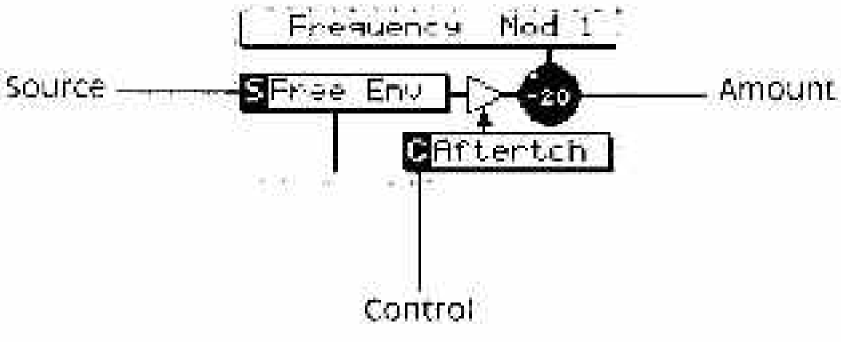
Range: -50…+50 cent

Detune lets you fine tune each oscillator separately in 1-cent increments.

- *-50* will detune the oscillator a semitone down.
- *+50* will detune the oscillator up by a semitone.

» Be aware that you can detune both oscillators independently. This might come in handy for creating lush chorus sounds; detune one oscillator up and the other down by the same amount. Thus the perceived pitch will not drift upward but will remain approximately in tune with other sounds.

Modulation Input 1



Modulation Input 1 is a sidechain modulation input. It consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier for the Modulation Input 1 to alter pitch.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **<Control>**

Range: modifier table

This defines the control modifier to scale the source modifier of Modulation Input 1

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Mod 1 Amount] to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount
- *+63* applies the source as programmed in its full amount.

» The amount parameter only determines the maximum possible value of the modulation; the actual value is set in real time by the control modifier module. In any case, the actual amount of modulation will be determined by the control input:

- If the modifier that is connected to the control input is set to output its full amount, the source modifier will modulate the pitch as set by the amount parameter
- If the control modifier outputs nothing, the pitch will not be modulated at all.

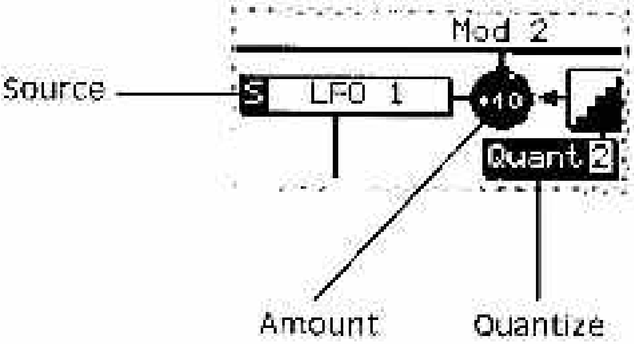
Some possible applications:

- Connect an LFO to the source and the mod wheel to the control input to control vibrato from the mod wheel.
- Connect an envelope at the source and velocity to the control input for velocity-sensitive pitch envelopes.

SOUND DESIGN

- Connect an LFO at the source and an envelope to the control input to obtain envelope-controlled vibrato effects.

Modulation Input 2



Modulation Input 2 is a regular modulation input. It consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier for Modulation Input 1 to alter pitch.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Mod 2 Amount] to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.

- *+63* applies the source as programmed in its full amount.

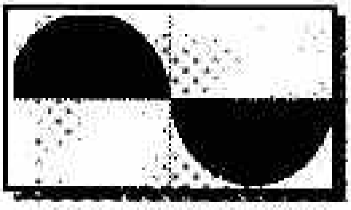
- **<Quantize>**

Range: off..7

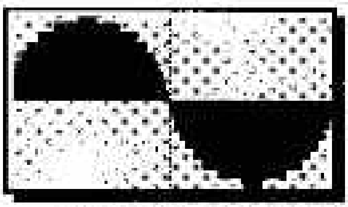
Quantize gradually transforms continuous modulation functions into discrete steps.

You can program this parameter using the respective display fader by pressing the Edit button near the modulation amount knobs.

- *off* does not introduce any quantization into the original signal. The modifier module's output curve will remain unaltered.
- *1..7* introduces different levels of quantization, thus changing the modifier's output from a continuous function into a quantized staircase of discrete steps. See the figure below to understand the relation:



Unquantized waveform



Quantized waveform

Use <Quantize> to achieve regular musical intervals:

- <Quantize> value *4* yields quartertone intervals
- <Quantize> value *5* yields semitone intervals
- <Quantize> value *6* yields whole-tone intervals
- <Quantize> value *7* yields major third intervals

Some possible applications:

- Use velocity as a source to alter the pitch according to how hard you strike a key; good for percussion imitation.
- Use a slight amount of keytracking on one oscillator only for pitch-dependent detunings. Use the detune parameter of that oscillator to shift the major detuning toward either the bass or treble region, according to the desired effect.
- Use an LFO for vibrato. Program the LFO's level modulation input to be scaled by the mod wheel or aftertouch to control vibrato depth.
- Use pitch-bend as a source and apply some quantizing to achieve guitar fretboard-like glissandi.

<Bend Range>

Range: global / -12…+12

Bend Range sets the pitch-bend range for the oscillator in semitones.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- *global* sets the Bend Range to the value specified by the parameter <Global Bend Range> in Global Edit.
- *0* will disengage any pitch-bend reception.
- *-12* will bend the oscillator up to one octave in either direction, but the direction of the Pitch-bend wheel is inverted; when you move the wheel to bend-up, the pitch of the Oscillator will drop.
- *+12* will bend the oscillator up to one octave in either direction. The direction of the Pitch-bend wheel will correspond to the bend direction.

» Be aware that the bend range may be different for each oscillator, allowing for guitar-like "one string only" bends and other spectacular effects.

<Pitch Mode>

Range: normal / random 1…4 / fixed

Pitch mode defines how the keyboard or incoming MIDI notes will change the Wave's pitch.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- *normal* will change the oscillator's pitch as defined by the incoming note-ons, just as you would normally expect.
- *random 1…4:* is essentially an equal-tempered tuning with small variations each time you press a key. Random 1 introduces very subtle changes, while random 4 yields pronounced differences.
- *fixed* disconnects the note-ons from the oscillators, resulting in no pitch change whatsoever, regardless of what notes are played.

» Use random temperaments on a single Oscillator for non-constant chorusing effects.

» Use fixed Pitch Mode for percussion or effects sound. Set the desired pitch using the <Octave> / <Semitone> and the Instrument's <Transpose> parameters. If all of them are set to 0, all keys will play C4.

Oscillator 2 [Link]

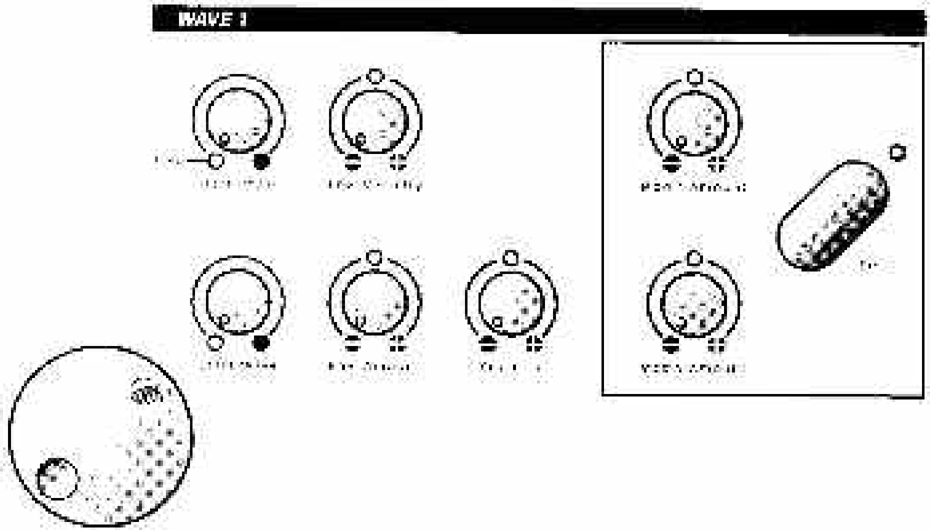
Range: off / on

Oscillator Link determines if both oscillators will use the same modulation settings or if they use their individually programmed settings.

- *off* won't link the Oscillators. Each one will be modulated according to its own parameter settings.
- *on* will link Oscillator 2 to Oscillator 1. Each of the following parameters of Oscillator 2 will be discarded and replaced by the same parameters of Oscillator 1:
  - Bend Range
  - Modulation Input 1
  - Modulation Input 2

Whenever you switch back to the *off* setting to allow for independent modulation parameters of each Oscillator, the last programmed parameter values of Oscillator 2 will again be valid. Therefore, if you want to check to see if a uniform modulation setting works better than an individual one, simply toggle between *on* and *off* to find the one that best suits your needs.

Waves



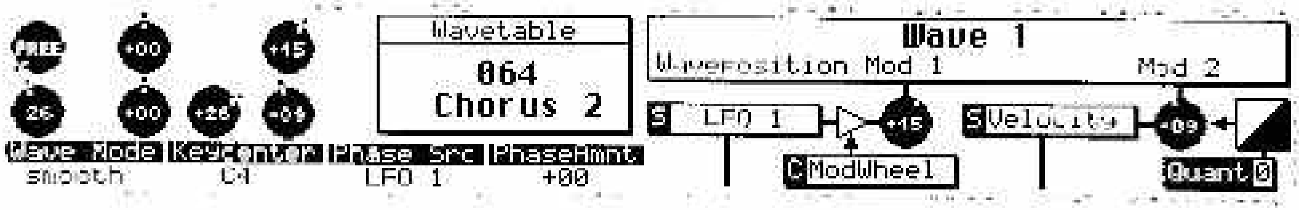
Waves, short for *Wave generators*, produce the basic spectrums used to develop a timbre on the Wave. They do not possess any pitch-related parameters of their own, but rather they are directly linked to their respective Oscillators, where the Waves' pitches are defined.

The two Waves are nearly identical. They contain the same parameter sets except:

- Wave 2 has an additional Link parameter that disables most its own modulation parameters and replaces them with those of Wave 1.

» Please note that the selected Wavetable will be used by both Waves. To obtain completely independent Wavetables for each Wave, program Wavetables that contain two different spectral evolutions for the first and second half of the Wavetable, respectively.

» Remember that each Wave is driven by it's respective oscillator to output the waveform at the desired pitch. Therefore, if you want to change the pitch of a Wave you must do it at the corresponding Oscillator. Wave 1 is driven by Oscillator 1, Wave 2 by Oscillator 2.



[Wavetable]

Range: Wavetables 1...128

The big red knob named [Wavetable/Data] will select the Wavetable that will be valid for both Wave generators. There are a total of 128 Wavetables available, 64 of which are factory preset Wavetables, while the remaining 64 locations can be filled with your own creations.

User Wavetables can be designed in the Wave Edit operation mode. Depending on the number of different Waves used within a Wavetable, you may not be able to use up all 64 user Wavetable slots, though most likely you will. All the details for creating your very own timbral palette will be discussed in the section *Wavetable Design*.

The 64 factory Wavetables are listed with descriptive comments in Appendix.

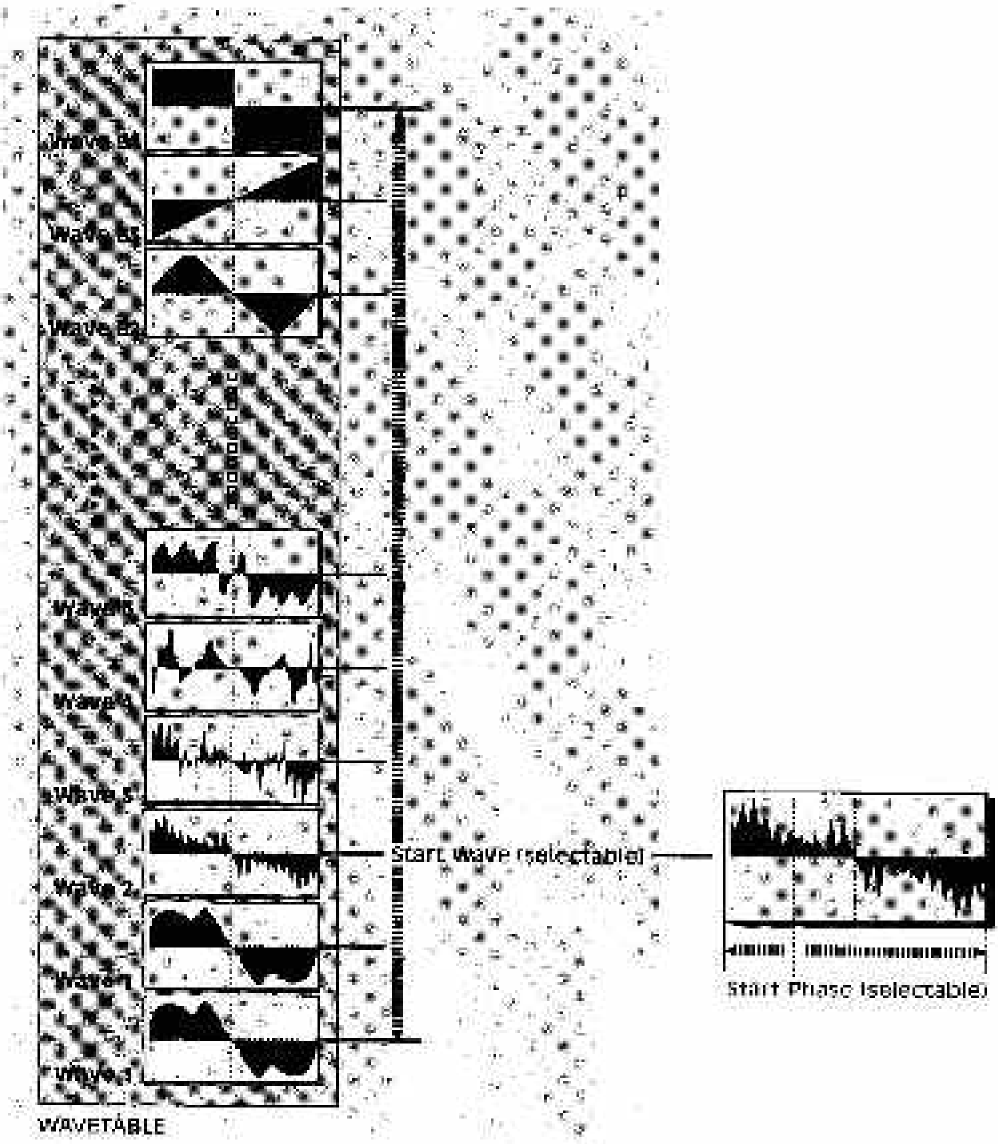
» Please note that the first 32 Wavetables are identical to those found in our MicroWave synthesizer.

[Start Wave]

Range: 0...60 / triangle / square / saw

Start Wave selects the first Waveform of the Wavetable that is to be played by the Wave. If you do not use any modulation at all to scan the Wavetable, this will be the waveform and spectrum the Wave will produce.

The Figure below illustrates a Start Wave and the Start Phase.



The Start Wave defines the position within the Wavetable that the Wave generator will output first. This waveform may remain static, resulting in an uniform spectrum, or it may be altered using one or more of the Wave-modules' modulation inputs, which would result in a dynamically varying spectrum.

Each Wave module may use a different Start Wave.

- *00...60* selects one of the unique spectrums of each Wavetable as a Start Wave. These spectrums may vary drastically, depending on the selected Wavetable.
- *triangle* selects a triangular waveform. This is the same for all Factory Wavetables, and allows you to select a static wave that is a standard synthesizer wave, thus facilitating the creation of traditional analogue sounds.
- *square* selects a square wave. This is the same for all factory Wavetables.
- *saw* selects a sawtooth waveform. This is the same for all factory Wavetables.

» All user Wavetables may have the three last Wave spectrum locations filled with any waveform, without being constrained to the above-mentioned basic waveforms.

[Start Phase]

Range: free / 1 ...127

Start Phase defines the exact phase position within a Start Wave at which the Wave generator will start playing. See the figure above to understand the relation of a Wavetable, a Start Wave and the Startphase.

As you can see, each parameter allows you to define in great detail the exact position where a Wave generator will start playing.

Start Phase is especially useful if both Waves are set to a value other than *free*. This lets you determine a phase relationship between the two Wave modules, which essentially multiplies the number of waveforms that are actually available within a Wavetable. By setting one Wave to a Start Phase value of 1 and altering the other Wave's Start Phase parameter, comb filter effects will be produced that yield harmonic structures not inherent in one waveform alone. Try this by selecting the same Start Wave and disabling all modulations for each Wavemodule; the *saw* spectrum is a good candidate for experimentation.

- *free* selects a Start Phase value at random. Use this setting to change the sound slightly on each successive keystroke. This works best if one Wave-generator's Start Phase parameter is set to a fixed value while the other is set to *free*.

- *1...127* selects a Start Phase value that will cycle between 0 degrees and nearly a full 360 degrees.

» Be aware that wherever you use similar Start Waves and set the difference between both Start Phase values at around 64, the resulting sound - depending on the actual Start Waves used and their respective level - might be very soft, as many of the harmonic components will be at near zero amplitude due to phase cancelation.

<PhaseSrce>

Range: modifier table

This defines the source modifier of the Start Phase modulation input, which alters the Start Phase. The parameter allows you to change the actual value for the Start Phase by any modifier available in the modifier table, which can result in some intriguing and subtle changes in timbre.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

» Please note that this modulation input does not work in a continuous fashion as the other modulation inputs do. Rather, it detects and samples the value of the source modifier every time a key is pressed. Therefore, if you apply an LFO as a source, you will hear timbral changes as introduced by the LFO when you play a few consecutive notes. If, however, you only play and hold one key, you will notice no changes during the course of the note. This is due to the fact that phase and frequency are closely correlated parameters. To actually change the phase continuously would result in a pitch change as well.

<PhaseAmnt>

Range: -64...+63

Phase Amount sets the maximum amount of modulation for the Start Phase modulation input.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- *-64* inverts the source's output signal and applies the full modulation amount.

- *+63* applies the source as programmed, at the full amount.

[Envelope Amount]

Range: -64…+63

Envelope Amount sets the basic amount of modulation for the Wave envelope. It is a preconfigured modulation input that you cannot change, but you can disable it by setting it to *0*. The value programmed for the amount will always be applied, without regards for velocity. Envelope modulation results in a dynamic wavescan process.

- *-64* inverts the Wave envelope's output signal and applies the full modulation amount.
- *+63* applies the Wave-envelope's output as programmed, at the full amount.
- *0* disables any constant, non-velocity-dependent Wave-envelope modulation.

[Envelope Velocity]

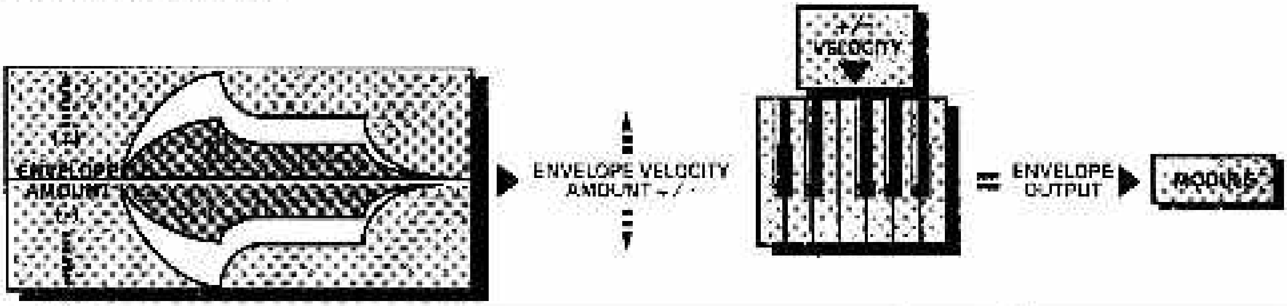
Range: -64…+63

Envelope Velocity sets the velocity amount of the Wave envelope that's modulating the respective Wave generator. This is a preconfigured modulation input that you cannot change, but you can disabled it by setting it to *0*. The value programmed here is applied in direct proportion to the received velocity value.

- *-64* inverts the Wave envelope's output signal and applies the modulation proportional to the received velocity. A velocity value of 127 will apply the full amount set here.
- *+63* applies the Wave-envelope's output as programmed in direct proportion to the received velocity. A velocity-value of 127 will apply the full amount set here.
- *0* disables any velocity-dependent Wave envelope modulation of the Wave module.

Interaction of [Envelope Amount] and [Envelope Velocity]

Look at the graph below to see how the [Envelope Amount] and [Envelope Velocity] parameters interact.



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The value set as [Envelope Amount] will always apply, no matter what velocity is received. The value set at [Envelope Velocity] will also apply , but it will be scaled according to the velocity received. Both values are summed before they are applied to the module.

You might think of the interaction of the two parameters as working similarly to a compressor: At low velocities, the entire modulation of both Envelope parameters will be at least as strong as the value set by the [Amount] parameter. The higher the velocity is, the more the value set at the [Velocity] parameter determines the modulation.

However, the sum of the values of both parameters can *never* surpass *+63* or *-64*, which is also the maximum range of each individual parameter. When both parameter values are added, the [Amount] value will take precedence over the [Velocity] value.

Therefore, if you set the Amount to *+63*, the modulation value cannot be raised any higher - regardless of how high the incoming velocities might be. This would be the same a having a non-velocity-sensing envelope. If, however, you set the [Velocity] amount to a negative value, the sum of both parameters will decrease according to the incoming velocities, resulting in an inverted velocity-sensitivity, where the harder you strike a key, the smaller the total envelope modulation becomes.

[Keytrack]

Range: -64...+63

Keytrack Amount sets the amount of modulation according to the position on the keyboard or the MIDI note received. This is a preconfigured modulation input that you cannot change, but you can disable by setting it to 0.

The center key for the [Keytrack] parameter can be set with the parameter <Keycenter> on the display page. No matter what value you set as [Keytrack] amount, the <Keycenter> key will remain unaltered.

By routing keytracking to the Wave module, you will change the Start Wave value according to the keyboard position or the MIDI note received.

- *-64* inverts the received key number and applies it to the Wave module. This results in a lower-numbered Start Wave when higher notes are played on the keyboard or received via MIDI.

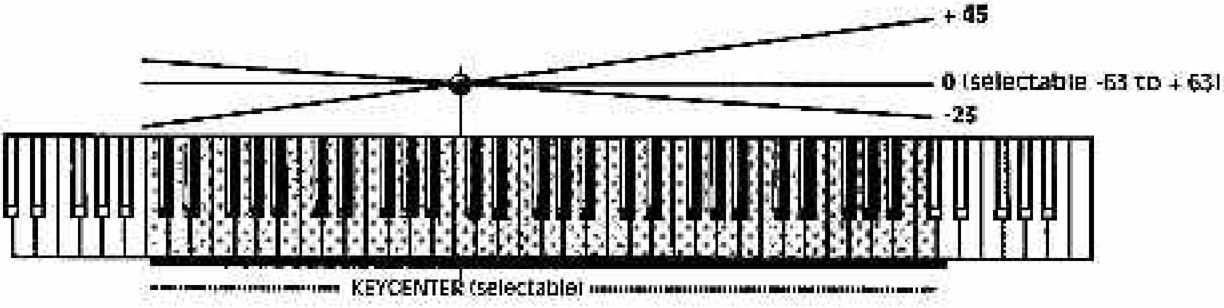
- *+63* applies the received key number as generated to the Wave module, resulting in an higher-numbered Start Wave when playing higher keys.
- *0* will disable any keytracking modulation from the Wave module.
- *±32* will yield the next consecutively-numbered Start Wave for every key. This is the value to use for formant Wavetables if you want to achieve an accurate reproduction of the formants programmed.

<Keycenter>

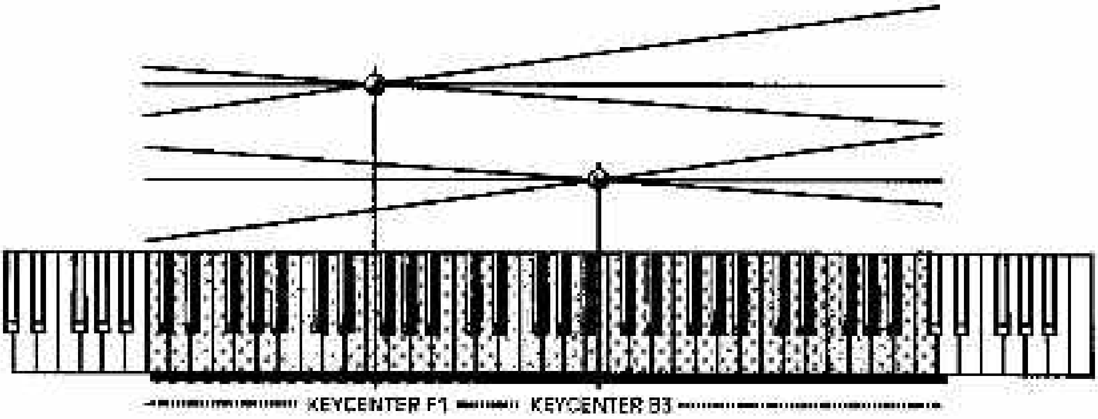
Range: C-1...G9

This parameter defines the center key for the preconfigured modulation input [Keytrack].

The center key will be the key that will not be affected by the [Keytrack] parameter. The linear Keytrack function will cross this key as its zero-point, with the steepness and direction being defined by the [Keytrack] parameter.



When changing the <Keycenter>, you can program the size of the upper and lower ranges of the [Keytrack] parameter to be different:

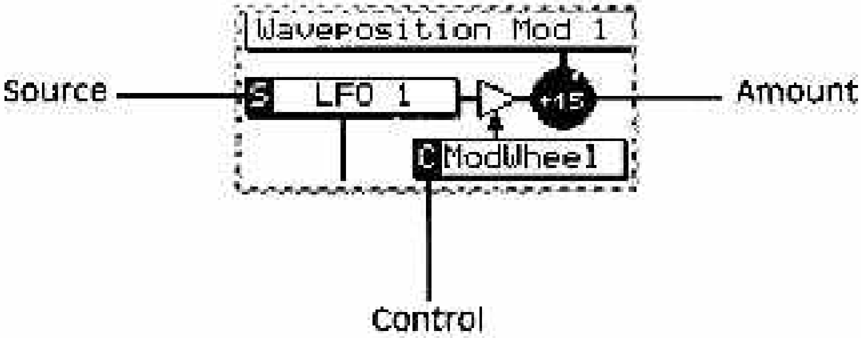


With a <Keycenter> of *C4*, both halves of the keyboard will encompass the same range, resulting in an even and symmetrical [Keytrack] modulation.

When <Keycenter> is set to be a higher key, the lower range of the keyboard will be emphasized, resulting in steeper changes toward that direction as opposed to the higher range. If, however, the <Keycenter> is a low note, the opposite will be true.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

Modulation Input 1



Modulation Input 1 is a sidechain modulation input. It consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier for Modulation Input 1 to alter the Start Wave.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **<Control>**

Range: modifier table

This defines the control modifier to scale the source modifier of Modulation Input1.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

This sets the maximum possible amount of modulation for the Modulation Input.

Use the front panel knob [Mod 1 Amount] to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.

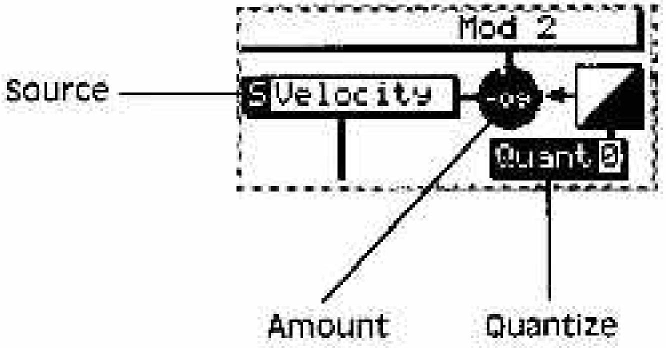
- *+63* applies the source as programmed at the full amount.

» The amount parameter only determines the maximum possible modulation value; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input is programmed to output its full amount, the source modifier will modulate the Start Wave as set by the [Amount] parameter.

- If the control modifier outputs nothing, there will be no modulation of the Start Wave.

Modulation Input 2



Modulation Input 2 is a regular modulation input. It consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier for Modulation Input 1 to alter the Start Wave.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Mod 2 Amount] to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed, at the full amount.

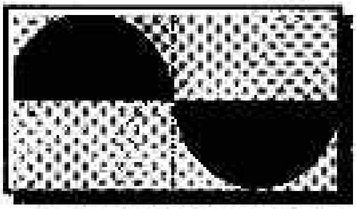
- **<Quantize>**

Range: off..7

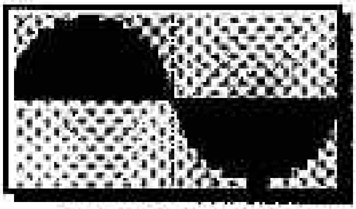
Quantize gradually transforms continuous modulation functions into discrete steps.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- *off* does not introduce any quantization into the original signal. The modifier's output curve will remain unaltered.
- *1..7* introduces different levels of quantization, thus changing the modifier's output from a continuous function into a quantized staircase of discrete steps. See the figure below to understand the relation:



Unquantized waveform



Quantized waveform

Some possible applications:

- Use velocity as a source to alter the Start Wave according to how hard you strike a key. This is a good alternative to opening the filter using velocity.
- Use keytracking only one Wave to constantly change overtones of one basic waveform.
- Use a small amount of LFO 1 for gentle phasing-like effects.

<Wave Mode>

Range: stepped/smooth

Wave Mode determines the interpolation mode of the wavescan process.

As long as you do not apply dynamic wavescan techniques, such as using an envelope, LFO or continuous MIDI controllers, you won't notice any difference between the two modes.

If, however, you do use continuous changing modifiers to scan the Wavetable, this parameter comes in effect.

- *stepped* uses a hard interpolation algorithm that produces noticeable pops and clicks, the energy of which will vary according to the Wavetable used. If you strive for a raw, aggressive sound, this mode might be just what you're after.
- *smooth* uses a soft interpolation algorithm that attempt to change the waveform as smoothly as possible, for a true gradual change in timbre. If you're using rapidly changing modulation sources with large amounts, you may still notice certain rough changes. These are due to very fast amplitude changes in complex harmonics - physical properties that even the Wave must obey.

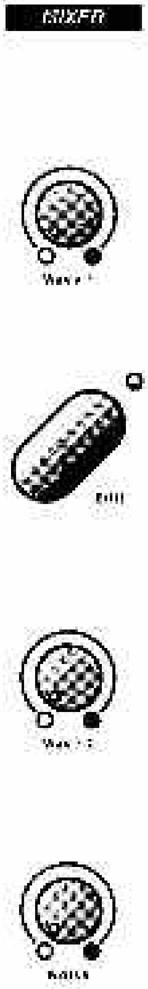
Wave 2 [Link]

Range: off / on

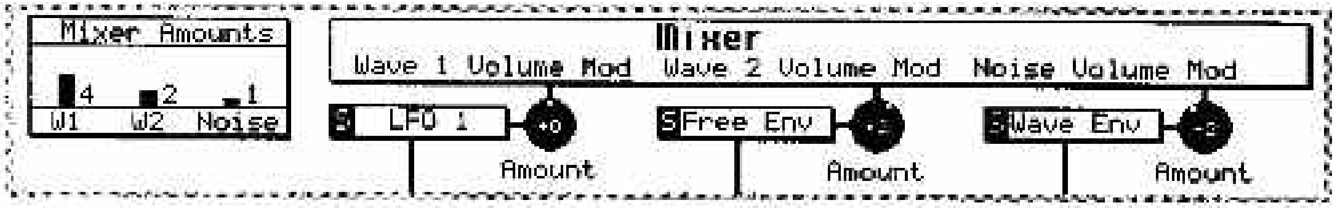
Wave Link determines if both Wave generators will use the same modulation settings or if they use their individually programmed settings.

- *off* won't link the Waves. Each one will be modulated according to its own parameter settings.
- *on* will link Wave 2 to Wave 1. Each of the following parameters of Wave 2 will be ignored and replaced by the corresponding parameters of Wave 1:
  - Modulation Input 1
  - Modulation Input 2

Whenever you switch back to the *off* setting to allow for individual modulation parameters of both Wave generators, the last programmed parameter values of Wave 2 will again be valid. Therefore, if you want to check if a uniform modulation setting works better than an individual one, simply toggle between *on* and *off* to find the one that best suits your needs.



The Mixer allows you to mix the levels of both Wave generators and the noise generator. The level of all three inputs can be modulated in real time.



Mixer Amounts

4 2 1

W1 W2 Noise

Mixer

Wave 1 Volume Mod | Wave 2 Volume Mod | Noise Volume Mod

S LFO 1 +0 Amount

S Free Env Amount

S Wave Env Amount

[Wave 1]

Range: 0...7

This parameter adjusts the output level of Wave generator 1.

- *0* mutes the Wave output.
- *7* outputs the Wave at full volume.

[Wave 2]

Range: 0…7

This parameter adjusts the output level of Wave generator 2.

- *0* mutes the Wave output.
- *7* outputs the Wave at full volume.

[Noise]

Range: 0…7

This parameter adjusts the output level of the Noise generator .

- *0* mutes the Noise generator's output.
- *7* outputs the Noise at full volume.

Considerations when Setting the Mixer Levels

To prevent distortion, the sum of all mixer inputs should generally not exceed a value of *8*, although this depends very much on the actual spectrums mixed and the setting of the [Start Phase] parameter. The following basic rule is therefore very much dependent on the actual waveform produced by the Wavetable. Certain waveforms can be set to higher volumes than others.

If you only use a single Wave generator, set its Mixer level to 7 to enjoy full gain. If you combine both Waves at equal volume, start by setting each one to a value of 4 to prevent distortion.

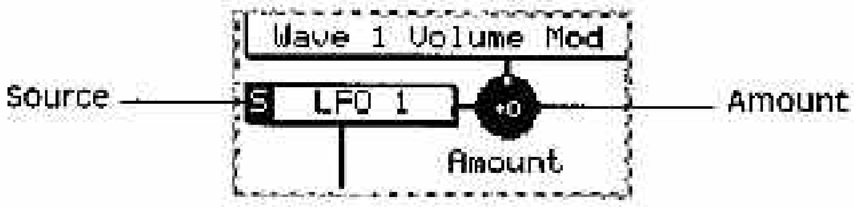
On the other hand, you can create very interesting and powerful distortion sounds by deliberately overloading the mixer. The resulting timbre is somewhat akin to one produced using AM (amplitude modulation) or ring-modulation effects, due to the way this distortion is produced in the custom chips.

To achieve this distortion, set the output of one Wave to a value of 7 and the other output to between 5 and 7. If you wish to create an even more powerful sound and need only a limited keyrange, adding some noise might produce an even more convincing result, depending on the keyrange and the filter setting.

Be careful when detuning either of the Oscillators, since that may introduce level changes caused by phase cancelations. This will alter the distortion by canceling it out now and then, resulting in a sound that switches from clean to distorted at the rate of the detuning value.

Nevertheless, employing pitch shifts on one Oscillator alone might yield very interesting results. All in all, experimentation is truly everything in electronic music, and definitely the case when doing sound design on the Wave.

Wave 1 Modulation Input



Wave 1 Modulation Input is a regular modulation input that allows for modulating the level of Wave generator 1. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Wave 1 level Modulation Input.

You can program this parameter using the respective display fader by pressing the [Edit] button located between the Wave level knobs.

- **<Amount>**

Range: -7...+7

Amount sets the maximum possible amount of modulation for this Modulation Input. Modulations will be added to or subtracted from the level of the respective generator.

You can program this parameter using the respective display fader by pressing the [Edit] button located between the Wave level knobs.

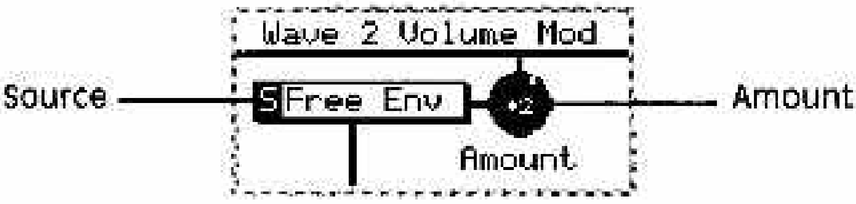
- -7 inverts the source's output signal and thus subtracts the full modulation amount.
- +7 adds the source as programmed at the full amount.

» The modulation amount reflects the Wave level resolution. Still, depending on the <Source> and the rate at which it changes, very sensible modulations are possible.

Some possible applications:

- Program positive velocity response to modulate Wave 1's level and negative velocity response to modulate the level of Wave 2 to create velocity crossfade sounds.
- Use an LFO whose <Humanize> parameter is set fairly high to continuously fade one Wave generator in and out to produce a constantly changing timbre.

Wave 2 Modulation Input



Wave 2 Modulation Input is a regular modulation input that allows for modulating the level of Wave generator 2. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Wave 2 level Modulation input.

You can program this parameter using the respective display fader by pressing the [Edit] button in between the Wave level knobs.

- **<Amount>**

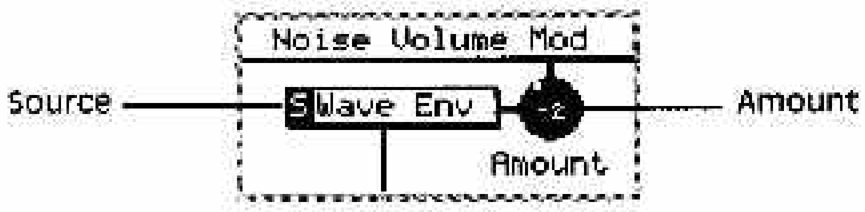
Range: -7...+7

Amount sets the maximum possible amount of modulation for this Modulation Input. Modulations will be added to or subtracted from the level of the respective generator.

You can program this parameter using the respective display fader by pressing the [Edit] button located between the Wave level knobs.

- -7 inverts the source's output signal and thus subtracts the full modulation amount.
- +7 adds the source as programmed at the full amount.

Noise Modulation Input



Noise Modulation Input is a regular modulation input that allows for modulating the level of the Noise generator. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Noise level Modulation Input.

You can program this parameter using the respective display fader by pressing the [Edit] button located between the Wave level knobs.

- **<Amount>**

Range: -7...+7

Amount sets the maximum possible amount of modulation for this Modulation Input. Modulations will be added to or subtracted from the level of the respective generator.

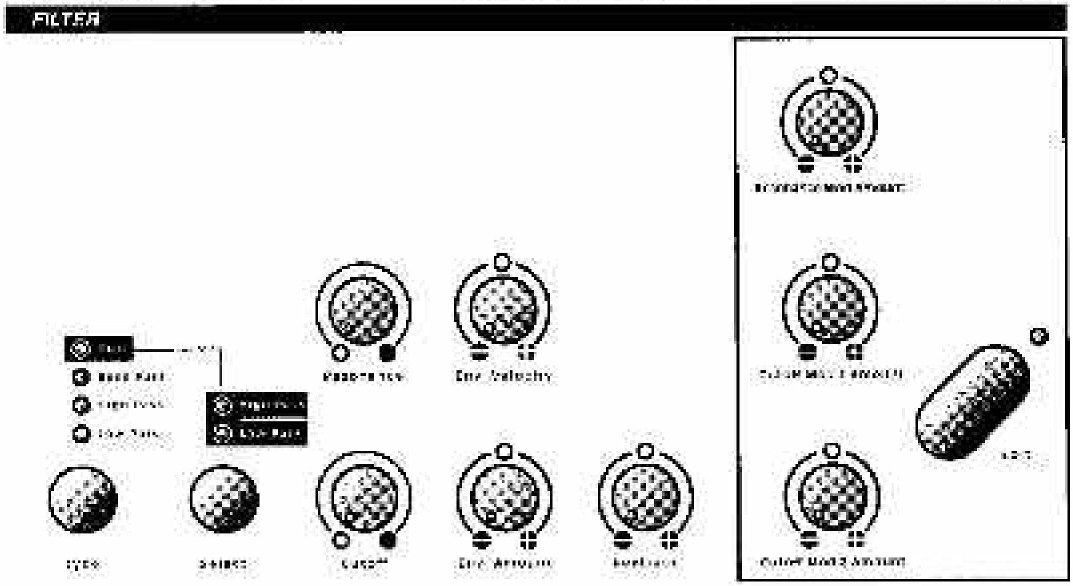
You can program this parameter using the respective display fader by pressing the [Edit] button located between the Wave level knobs.

- -7 inverts the source's output signal and thus subtracts the full modulation amount.
- +7 adds the source as programmed at the full amount.

Some possible applications:

- Use a short envelope or the Control Ramp to add some noise to the attack of a percussive timbre.
- Use the envelope that opens the filter to counterbalance the noise level by applying it here inverted. This compensates for the psychoacoustic level increase when more high end passes through the filter.

Filter



The Filter in the Wave is a good ol' analog filter - well, actually it is *two* good ol' analog filters, a four-pole 24dB/octave low-pass filter and a 12dB/octave high-pass filter. Both filters can be used either by themselves or in combination with each other, yielding a variety of possible filter types that you can select under [Type]. Note that in [Type] *Dual*, all filter parameters - if applicable - are independently available for both filters. The user interface can be switched between the two filters in that [Type] using the [Select] button on the front panel.

The [Filter Envelope] is permanently routed to the Filter module's Envelope modulation inputs, except for the High Pass in filter [Type] *Dual*, which sports an assignable envelope input.

Please note that certain parameters are not available for every filter type. The exceptions are as follows:

High Pass

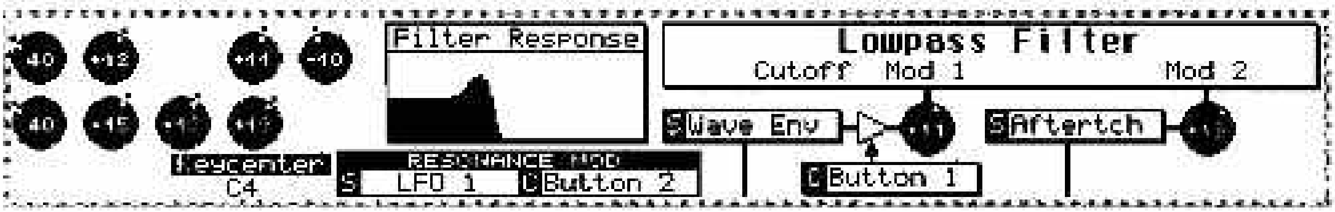
- Resonance is not available.
- Resonance modulation is not available.

Band Pass

- Bandwidth is also available.
- Resonance modulation has been eliminated in favor of Bandwidth modulation.

Dual Type High Pass

- Resonance is not available.
- Resonance modulation is not available.
- Envelope Select for the preconfigured modulation inputs [Envelope Amount] and [Envelope Velocity] is also available.



[Type]

Range: Low Pass / High Pass / Band Pass / Dual

This parameter allows you to select one of the four possible filter characteristics.

- *Low Pass* is a classic four-pole 24dB/octave implementation - fat and warm.
- *High Pass* is a not so steep (12dB/octave) and therefore more musically useful implementation. Resonance is not available.
- *Band Pass* is the classic mixture of both, with additional control over the Bandwidth.
- *Dual* allows you to program the High Pass and Low Pass filters independently of each other.

» The filter [Type] *Dual* allows you to program each filter independently.Each of the filters in this mode has its own parameter sets, allowing independent programming of all parameters, including the Modulation Inputs. This should keep you busy designing interesting filters for quite some time.

[Select]

Range: Low Pass / High Pass

This parameter is available only when the Filter parameter [Type] is set to *Dual*. It allows you to switch between the two filters. Note that both filters share the same knobs in Dual type, so if you want to fine tune the individual Modulation Inputs or Cutoff frequencies, for example, make sure that you have selected the filter you want to change.

[Cutoff]

Range: 0...127

Cutoff sets the frequency at which the Filter will begin to work. All frequencies below or above the cutoff point (depending on the Filter [Type] selected) will pass unaltered, while all other frequencies will be attenuated by 24dB (Low Pass) or 12dB (High Pass) per octave.

- *0* sets the filter to the lowest possible [Cutoff] frequency. At this value the High Pass will filter out nothing while the Low Pass will be closed almost completely.
- *127* sets the filter to the highest possible [Cutoff] frequency. With this value the High Pass will filter out everything while the Low Pass will be opened completely, filtering out nothing.

[Resonance]

Range: 0...127

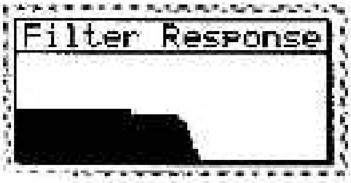
Resonance adjusts the Q factor of the Low Pass Filter at the Cutoff frequency. It is not available for the High Pass.

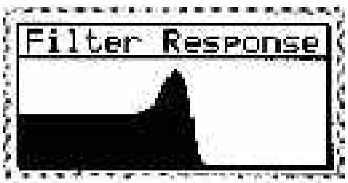
The higher you set Resonance, the more pronounced the frequencies around the cutoff point will be, resulting in a more nasal quality in the audio signal. At high Resonance values, the Filter will begin to oscillate, producing a sine wave pitched at the cutoff frequency.

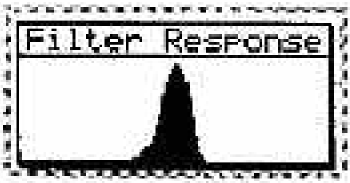
- *0* means no Resonance is added.
- *127* is full Resonance; self-oscillation begins around *80*, depending on the Cutoff value and the pitch being fed into the filter by the Waves.

If there is no input to the filter at all, self-oscillation starts just under *100*. Set the [Keytrack] parameter to *+32* to have the oscillation's pitch track the keyboard in a standard 12-tone scale. Use the Cutoff parameter to set the approximate pitch, then fine-tune using the Resonance parameter.

The graph below depicts the Cutoff and Resonance relationships:







As you see, if Resonance is not used, the Low Pass Filter's response is uniform up to the Cutoff-frequency (curve A). If a little Resonance is applied, there is a bandpass-like quality to the frequencies around the Cutoff frequency (curve B). Finally, if Resonance is set to a high value, the Cutoff frequency is prominent over all other frequencies, resulting in self-oscillation.

[Envelope Amount]

Range: -64...+63

Envelope Amount sets the basic amount of modulation for the Filter envelope. It is a preconfigured modulation input that you cannot change, though it can be disabled by setting it to *0*. The value programmed here for the amount will always be applied, without regard to velocity modulation. Envelope modulation results in a dynamic filter sweep.

- *-64* inverts the Filter envelope's output signal and applies the full modulation amount.
- *+63* applies the Filter envelope's output as programmed at the full amount.
- *0* disables any Filter envelope modulation.

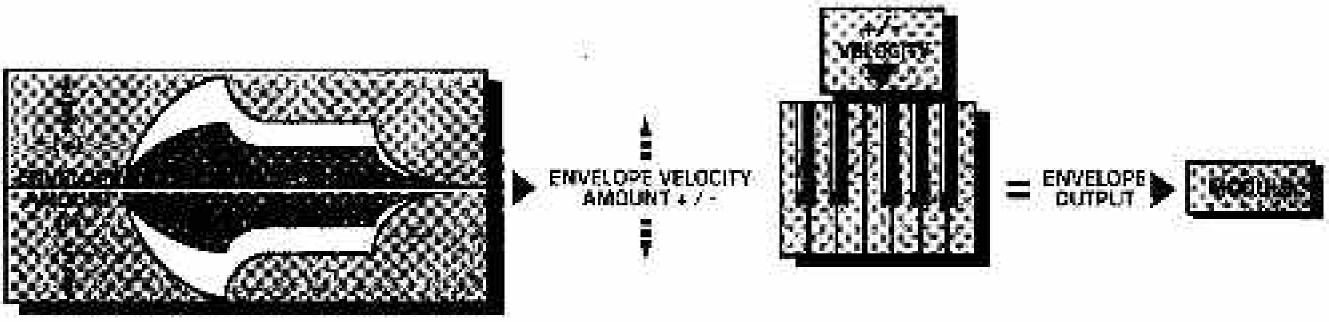
[Envelope Velocity]

Range: -64...+63

Envelope Velocity sets the velocity amount of the Filter envelope. This is a preconfigured modulation input that you cannot change, though it can be disabled by setting it to *0*. The value programmed here applies in direct proportion to the received velocity value.

- *-64* inverts the Filter envelope's output signal and applies the modulation proportional to the received velocity. A velocity value of 127 will apply the full amount set here.
- *+63* applies the Filter envelope's output as programmed in direct proportion to the received velocity. A velocity value of 127 will apply the full amount set here.
- *0* disables any velocity dependent Filter envelope modulation of the Filter module.

Interaction of [Envelope Amount] and [Envelope Velocity]



The value set for [Envelope Amount] will always apply, no matter what velocity is received. The value set for [Envelope Velocity] will also apply, but it will be scaled according to the velocity received. Both values are added before they are applied to the module.

You could think of the interaction of the two parameters as working similarly to a compressor: At low velocities, the entire modulation of both Envelope parameters will be at least as strong as the value set by the [Amount] parameter. The higher the velocity is, the more the value set at the [Velocity] parameter determines the modulation.

However, the *sum* of both parameters can *never* surpass *+63* or *-64*, which also is the maximum range of each parameter alone. When both parameter values are added, the [Amount]'s value will be prominent over the [Velocity]'s value.

Therefore, when you set [Amount] to *+63*, you will have a non-velocity-sensing envelope, as no velocity value is capable of raising [Amount] beyond its maximum value of +63. If, however, you set the [Velocity] amount to a negative value, the sum of both parameters will decrease according to the incoming velocity, which will result in inverted velocity-sensitivity where the harder you strike a key, the lower the total envelope amount applied will be.

[Keytrack]

Range: -64…+63

Keytrack Amount sets the amount of modulation according to the keyboard position or the received MIDI note. This is a preconfigured modulation input that you cannot change, though it can be disabled by setting it to *0*.

The center key for the [Keytrack] parameter can be set with the parameter <Keycenter> on the Filter's display page. No matter what value you set as [Keytrack] amount, the <Keycenter> key will remain unaltered.

By routing keytracking to the Filter module, you can change the [Cutoff] frequency according to the keyboard position or the received MIDI note.

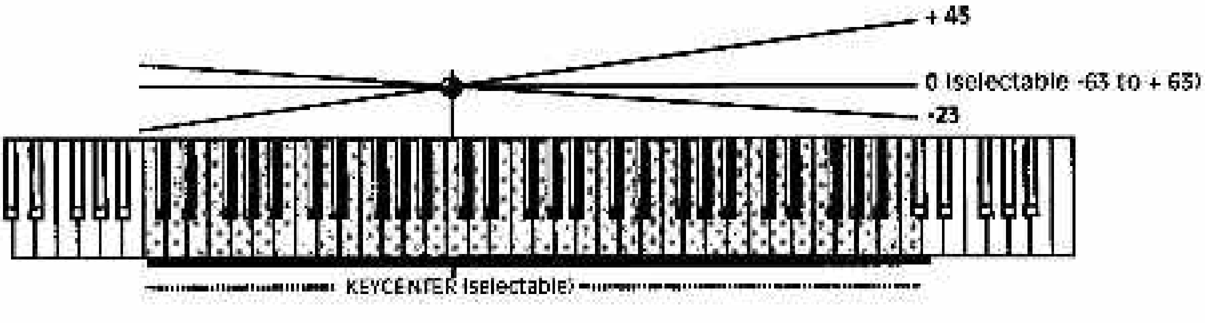
- *-64* inverts the received key number and applies it to the Filter module. This results in a lower [Cutoff] frequency when higher notes are played on the keyboard or received via MIDI.
- *+63* applies the received key number as programmed to the Filter module, resulting in a higher [Cutoff] frequency when playing higher keys.
- *0* will disable any keytracking modulation to the Filter module.
- *±32* will yield an equal-tempered [Cutoff] frequency scale, which is most useful when using high [Resonance] settings with the Low Pass filter.

<Keycenter>

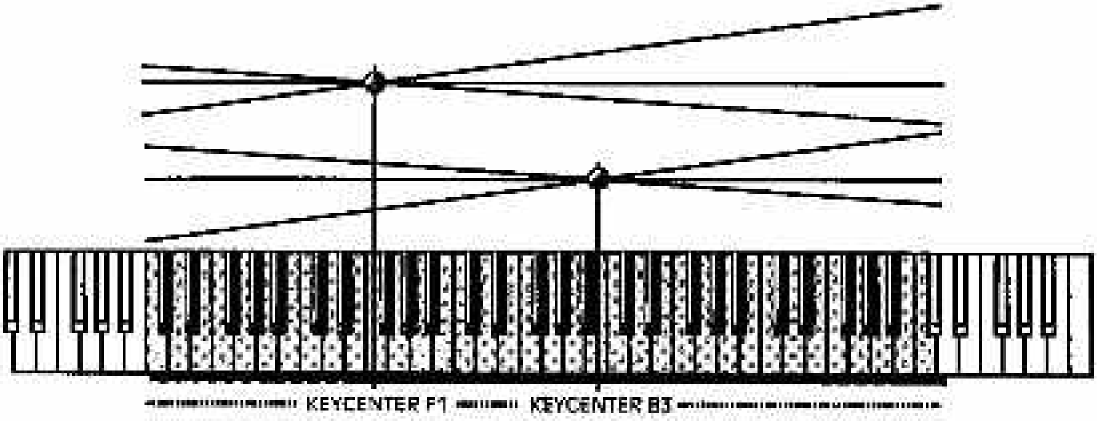
Range: C-1...G9

This parameter defines the center key for the preconfigured modulation input [Keytrack] of the Filter modules.

The center key will be the key that will not be affected by the [Keytrack] parameter. The linear Keytrack function will cross this key as its zero-point, with the steepness and direction being defined by the [Keytrack] parameter.



When changing the <Keycenter>, you can program the size of the upper and lower ranges of the [Keytrack] parameter to be different:

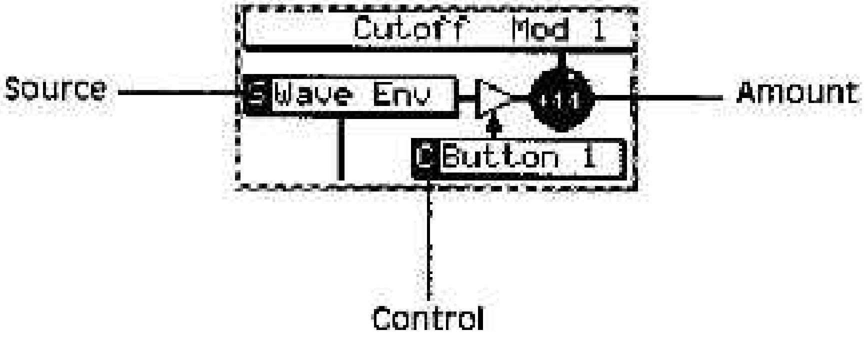


With a <Keycenter> of *C4* both halves of the keyboard will comprise the same range, resulting in even and symmetrical [Keytrack] modulation.

When <Keycenter> is set to be a higher key, the lower range of the keyboard will be emphasized, resulting in steeper changes toward that direction as opposed to the the higher range. If, however, the <Keycenter> is a low note, the opposite will be true.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

Cutoff Modulation Input 1



Modulation Input 1 is a sidechain modulation input and consists of three parameters:

• <Source>

Range: modifier table

This defines the source modifier of Modulation Input 1 to alter the [Cutoff] frequency.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs. When using the [Type] *Dual* , make sure that you have selected the correct filter.

• <Control>

Range: modifier table

This defines the control modifier to scale the source modifier of Modulation Input 1.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs. When using the [Type] *Dual* , make sure that you have selected the correct filter.

• [Amount]

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

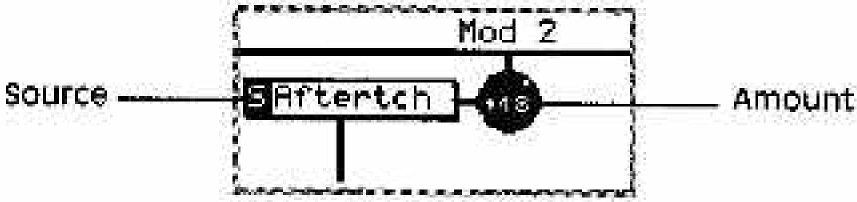
Use the front panel knob [Mod 1 Amount] of the Filter module to adjust this parameter. When using the [Type] *Dual* , make sure that you have selected the correct filter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

» The amount parameter only determines the maximum possible value of modulation; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input outputs its full amount, the source modifier will modulate the [Cutoff] frequency as set by the [Amount] parameter.
- If the control modifier outputs nothing, there will be no modulation of the [Cutoff].

Cutoff Modulation Input 2



Modulation Input 2 is a regular modulation input. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of Modulation Input 2 to alter the [Cutoff] frequency.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs. When using the [Type] *Dual* , make sure that you have selected the correct filter.

- **[Amount]**

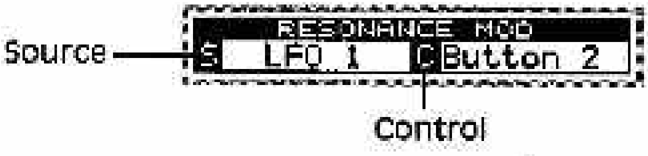
Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Mod 2 Amount] of the filter module to adjust this parameter. When using the [Type] *Dual* , make sure that you have selected the correct filter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

Resonance (Bandwidth) Modulation Input



Resonance (Bandwidth) Modulation Input is a sidechain modulation input that allows the modulation of the filter [Resonance] in the Low Pass and Dual Low Pass filter types, and of the parameter [Bandwidth] in the filter [Type] Band Pass. It consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of Modulation Input 1 to alter the [Resonance] amount.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **<Control>**

Range: modifier table

This defines the control modifier to scale the source modifier ofModulation Input 1.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Resonance Mod Amount] to adjust this parameter. Please be aware that in the [Type] Band Pass, even though this parameter is labeled Resonance Mod Amount, it will set the amount of [Bandwidth] modulation.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

» The amount parameter only determines the maximum possible value of modulation; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input outputs its full amount, the source modifier will modulate the [Resonance] amount as set by the [Amount] parameter.
- If the control modifier outputs nothing, there will be no modulation of the [Resonance] amount.

Some possible applications:

- Use the mod wheel or poly-pressure to drive the Filter into self-oscillation to create guitar-like feedback effects. Don't use much envelope, or the feedback's pitch will change.
- Use an envelope to change from a narrow, nasal sound to a broader, warmer sound.
- If you use high Resonance in conjunction with an envelope that modulates the Cutoff, apply that same envelope, only inverted, to the Resonance modulation input to suppress the typical "high-Q-wow" that's produced by a sweeping resonant low pass.

Band Pass <Bandwidth>

Range: 0...127

This parameter allows you to vary the bandwidth at which frequencies will be able to pass the Bandpass filter.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs. It is exclusively available in the Filter [Type] Band Pass.

- *0* sets the narrowest band, allowing only frequencies close to the [Cutoff] frequency to pass.
- *127* sets the broadest band, where [Cutoff] frequency has almost no effect.

» Please be aware that for this filter type, [Bandwidth] can be modulated instead of [Resonance]. Nevertheless [Resonance] is available in the Band Pass filter type.

Dual High Pass <Filter Select>

Range: Amp Env / Filtr Env / Wave Env / Free Env

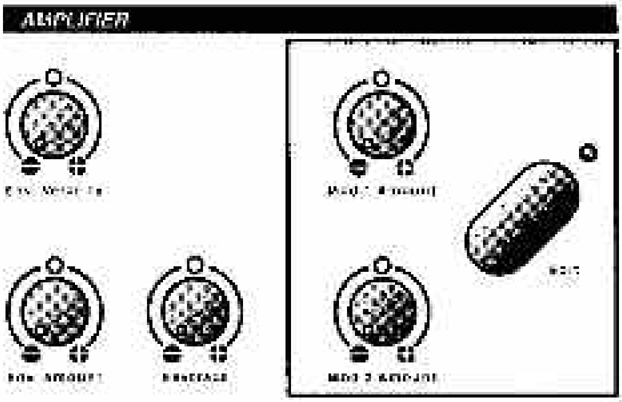
This parameter allows you to select the actual envelope that will be applied by the preconfigured modulation inputs [Envelope Amount] and [Envelope Velocity] of the High Pass filter in the filter [Type] *Dual*.

In a way, this makes the preconfigured modulations partially routable, even though envelopes are the only available selection. This parameter makes it easy to use two different envelops for the two filters available in [Type] Dual, without losing the familiar user interface controls

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs. It is available exclusively in the Filter [Type] Dual High Pass.

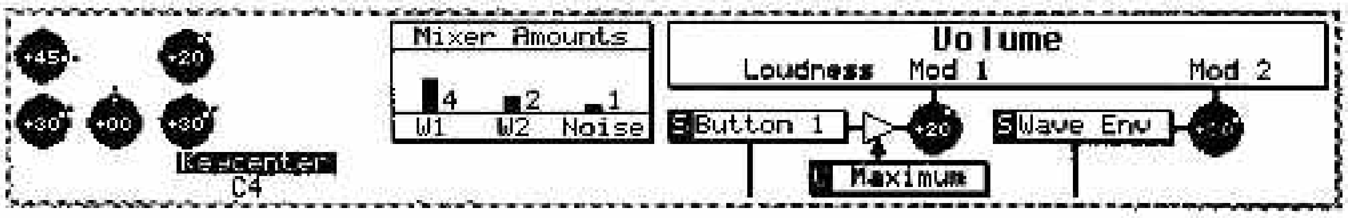
Use the fader to select the envelope of your choice. As a default, the Filter envelope is assigned.

Amplifier



The Amplifier module is used to shape the volume of a Sound. You have various options for creating interesting loudness contours.

The [Amplifier Envelope] is permanently routed to the Amplifier module's Envelope modulation inputs.



[Envelope Amount]

Range: -64…+63

Envelope Amount sets the base amount of modulation for the Amplifier envelope. It is a preconfigured modulation input that you cannot change, though it can be disabled by setting it to *0*. The value programmed here as amount will always be applied, without regards to velocity modulation. Envelope modulation shapes the basic loudness of a Sound.

- *-64* inverts the Amplifier envelope's output signal and applies the full modulation amount.
- *+63* applies the Amplifier envelope's output as programmed at the full amount.
- *0* disables any constant, non-velocity-dependent Amplifier envelope modulation.

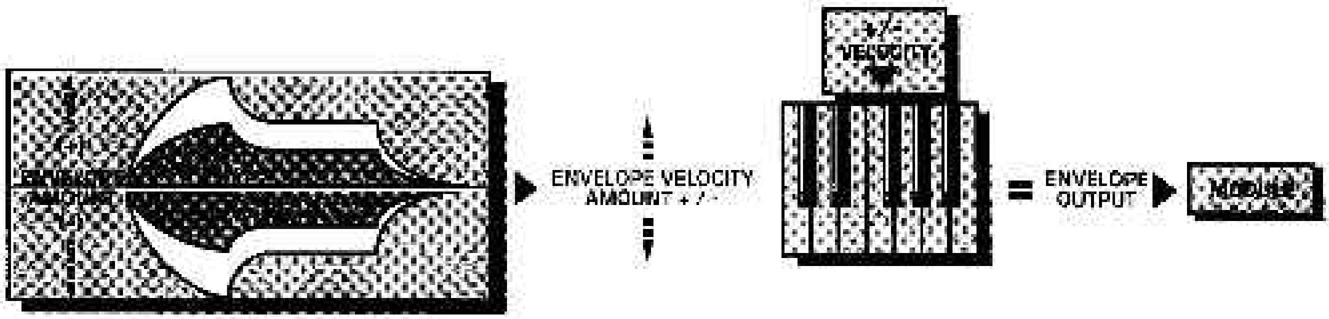
[Envelope Velocity]

Range: -64...+63

Envelope Velocity sets the velocity amount of the Amplifier envelope. This is a preconfigured modulation input that you cannot change, though it can be disabled by setting it to *0*. The value programmed here applies in direct proportion to the received velocity-value.

- *-64* inverts the Amplifier envelope's output signal and applies the modulation proportional to the received velocity. A velocity-value of 127 will apply the full amount set here.
- *+63* applies the Amplifier envelope's output as programmed in direct proportion to the received velocity. A velocity-value of 127 will apply the full amount set here.
- *0* disables any velocity-dependent Amplifier envelope modulation of the Amplifier module.

Interaction of [Envelope Amount] and [Envelope Velocity]



The value set as [Envelope Amount] will always apply, no matter what velocity is received. The value set at [Envelope Velocity] will also apply, but it will be scaled according to the velocity received. Both values are added before they are applied to the module.

However, the *sum* of both parameters can *never* surpass *+63* or *-64*, which is also the maximum range of each parameter alone. When both parameter values are added, the [Amount]'s value will be prominent over the [Velocity]'s value.

You must set a value other from *0* for either one or both Envelope parameters in order to hear a sound at all. If you want to use an envelope other than the [Amplifier Envelope], select it at one of the routable modulation inputs.

In such a case set the sustain level of the [Amplifier Envelope] to maximum and use an [Envelope Amount] of *+63*. Since the Amplifier envelope amount will actually be scaled according to all other modulation inputs, this procedure simply provides a basic setting for applying modulation. The actual loudness will be set by the other modulation inputs.

[Keytrack]

Range: -64...+63

Keytrack Amount sets the amount of modulation according to the keyboard position or the received MIDI note. This is a preconfigured modulation input that you cannot change. It can be disabled by setting it to *0*.

The center key for the [Keytrack] parameter can be set with the parameter <Keycenter> on the display page. No matter what value you set as [Keytrack] amount, the <Keycenter> key will remain unaltered.

By routing keytracking to the Amplifier module, you can change the loudness according to the keyboard position or the received MIDI note.

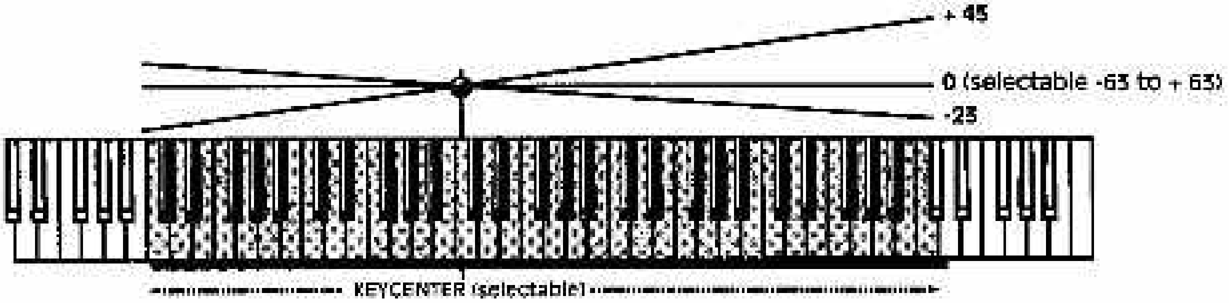
- *-64* inverts the received key number and applies it to the Amplifier module. This results in a decrease in loudness when higher keys are played on the keyboard or received via MIDI.
- *+63* applies the received key number as programmed to the Amplifier module, resulting in an increase in loudness when playing higher keys.
- *0* will disable any keytracking modulation from the Amplifier module.

<Keycenter>

Range: C-1...G9

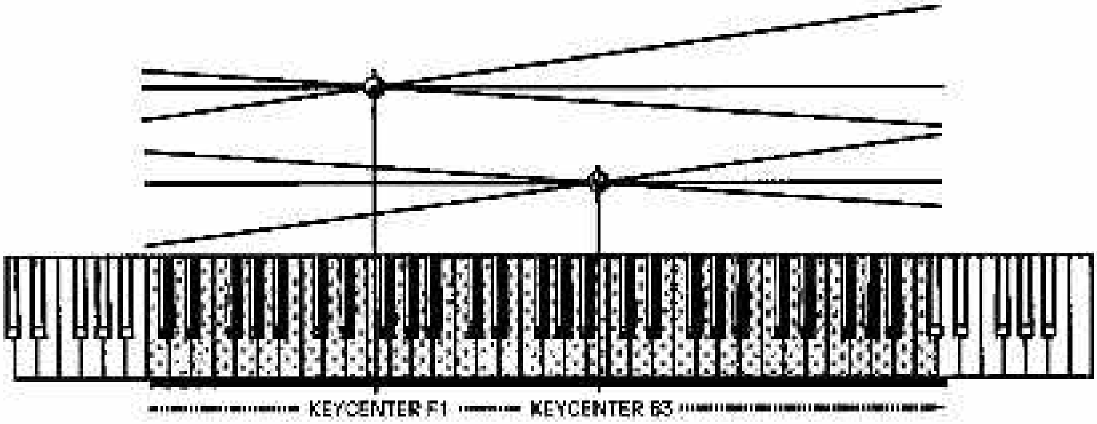
This parameter defines the center key for the preconfigured modulation input [Keytrack]

The center key will be the key that will not be affected by the [Keytrack] parameter. The linear Keytrack function will cross this key as its zero-point, with the steepness and direction being defined by the [Keytrack] parameter.



When changing the <Keycenter>, you can program the size of the upper and lower ranges of the [Keytrack] parameter:

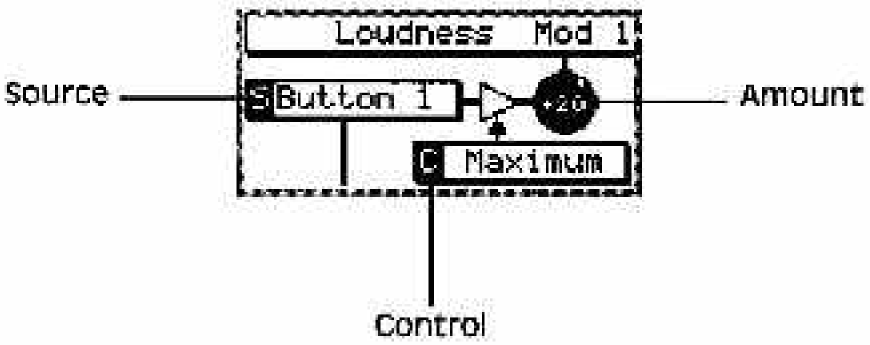
With a <Keycenter> of *C4* both halves of the keyboard will comprise the same range, resulting in even and symmetrical [Keytrack] modulation.



When <Keycenter> is set to a higher key, the lower range of the keyboard will be emphasized, resulting in steeper changes toward that direction as opposed to the higher range. If, however, the <Keycenter> is a low note, the opposite will be true.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

Modulation Input 1



Modulation Input 1 is a sidechain modulation input. It consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of Modulation Input 1 to alter the loudness.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **<Control>**

Range: modifier table

It defines the control modifier to scale the source modifier of Modulation Input 1.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Mod 1 Amount] in the Amplifier module to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

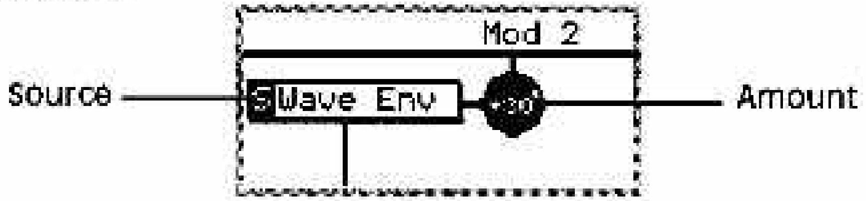
➪ The amount parameter only determines the maximum possible value of modulation; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input outputs its full amount, the source modifier will modulate the loudness as set by the [Amount] parameter.
- If the control modifier outputs nothing, there will be no modulation of the loudness.

Some possible applications:

- Connect an LFO to the source and the mod wheel to the control input to adjust tremolo with the mod wheel.
- Connect the [Wave Envelope] to the source and Velocity to the control input to create a complex velocity-sensitive loudness contour.
- Connect an LFO at the source and an envelope to the control input to achieve envelope controlled tremolo effects.

Modulation Input 2



Modulation Input 2 is a regular modulation input. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of Modulation Input 2 to alter the loudness.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

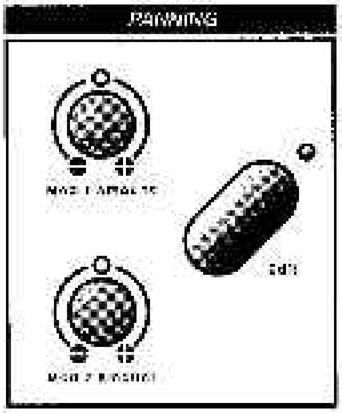
Use the front panel knob [Mod 2 Amount] in the Amplifier module to adjust thisparameter.

- *-64* Inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

Some possible applications:

- Use keytracking as the source to scale the loudness according to the key range. Create two sounds, one of which uses positive amounts and the other negative amounts, and layer them to achieve positional crossfade sounds.
- Use the mod wheel as a source to fade sounds in or out. If you're using negative amounts, -32 will fade out the sound completely at the maximum upward throw of the wheel.

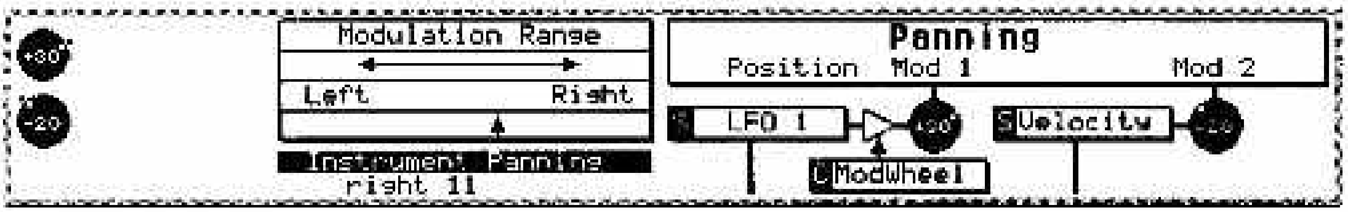
Panning



The Panning module defines the position of a sound in the stereo-base. Panning is, of course, applied individually to each voice, thus allowing you to create stunning polyphonic panorama effects.

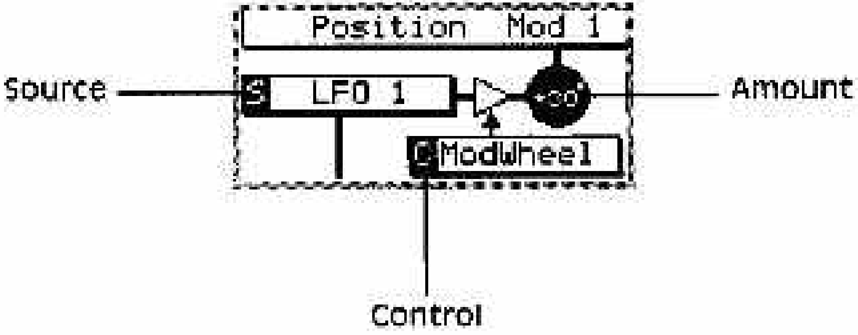
☞ If you have set the Stereo Width parameter of the Global parameters to mono, Panning will be disabled completely. Instead, a mono signal will appear at equal volume at both the Left and Right outputs of the selected audio output.

☞ Panning is available at any of the three audio outputs, be they the *main*, *sub 1* or *sub 2* outs.



Instrument Panning
right 11

Modulation Input 1



Modulation Input 1 is a sidechain modulation input. It consists of three parameters:

• <Source>

Range: modifier table

This defines the source modifier of Modulation Input 1 to alter the pan position.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

• <Control>

Range: modifier table

This defines the control modifier to scale the source modifier of Modulation Input 1.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

• [Amount]

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

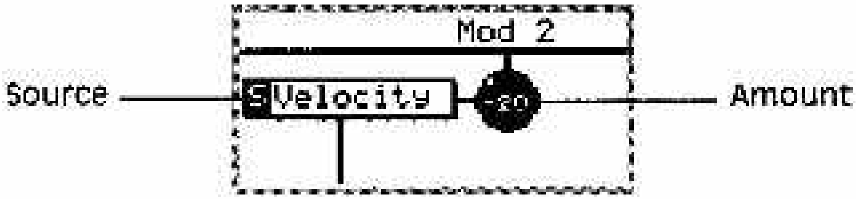
Use the front panel knob [Mod 1 Amount] of the Panning module to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

⇨ The amount parameter only determines the maximum possible value of modulation; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input outputs its full amount, the source modifier will modulate the pan position as set by the [Amount] parameter.
- If the control modifier outputs nothing, there will be no modulation of the pan position.

Modulation Input 2



Modulation Input 2 is a regular modulation input. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of Modulation Input 2 to alter the pan position.

You can program this parameter using the respective display fader by pressing the [Edit] button near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Mod 2 Amount] to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

Some possible Applications:

- Use Keytracking to pan the Sound according to the keyboard position. Set the Instrument [Panning] parameter to *Center* and set a positive amount to the modulation input.

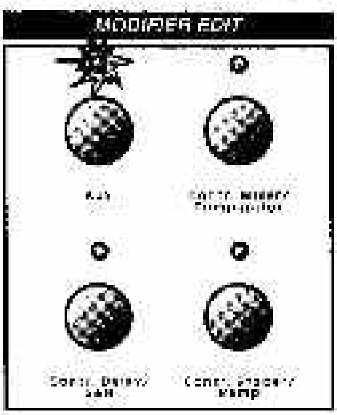
- Use an LFO to achieve auto-panning. Use the Symmetry parameter of the LFO to achieve more adventurous effects.
- Use velocity to pan each individual note you play to its own position according to how hard you play.

<Instrument Panning>

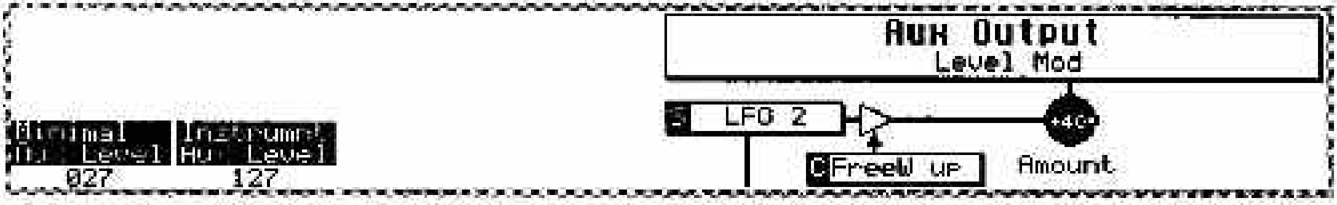
Range: left 64…1…center…right 1…63

This is the Instrument parameter [Panning], repeated here merely for your convenience. It defines the position of the Instrument in the stereo field.

Aux-Send



The aux module provides an independent send level in a post-fader-style submix akin to the aux send you would find on a mixing desk. The send level can be modulated in real time, which allows some very hip things to be done. The modulations take place on a per-voice basis, so stunning polyphonic effects are within your reach. Experiment with this module in conjunction with various effects processors; you'll undoubtedly come up with some outstanding dynamic effects.



Aux Output
Level Mod

S LFO 2

C FreeW up

+40

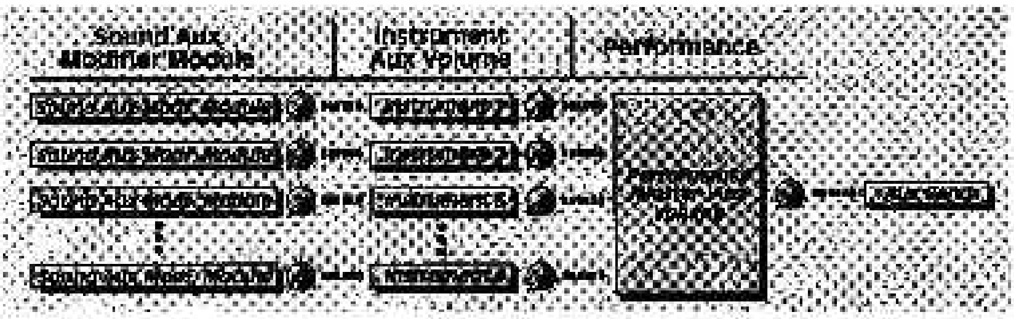
Amount

Minimal Au. Level 027

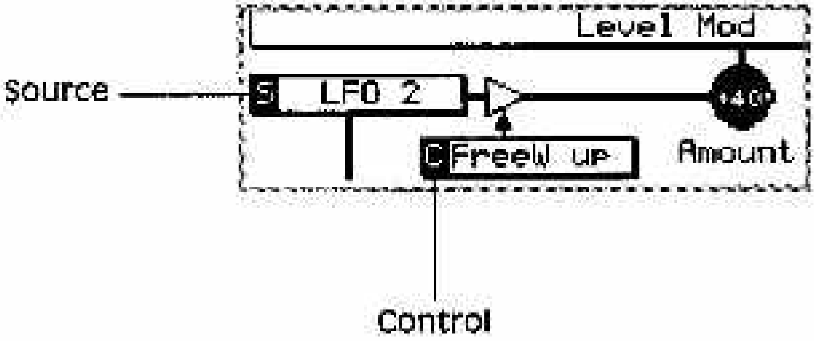
Instrumnt Au. Level 127

➪ The actual level going to the Aux bus is set by the Instrument parameter [Aux Vol] and by the Performance parameter [Aux Vol], which controls the overall volume sent by the Aux bus.

The figure below demonstrates the interaction of the various Aux volume settings.



Aux Modulation Input



The Aux Modulation Input is a sidechain modulation input and consists of three parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Modulation Input to alter the Aux send level.

You can program this parameter using the respective display fader by pressing the [Aux] button in the Modifier Edit section.

• <Control>

Range: modifier table

This defines the control modifier to scale the source modifier of the Modulation Input .

You can program this parameter using the respective display fader by pressing the [Aux] button in the Modifier Edit section.

• <Amount>

Range: -64…+63

Amount sets the maximum possible amount of modulation for this Modulation input.

Use the fader <Mod Amount> to adjust this parameter. You can access the respective display fader by pressing the [Aux] button in the Modifier Edit section.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

⇨ The amount parameter only determines the maximum possible value of modulation; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input outputs its full amount, the source modifier will modulate the Aux send as set by the [Amount] parameter.
- If the control modifier outputs nothing, there will be no modulation of the Aux send.

Some possible applications:

- Use aftertouch to control the Aux send amount so that you can bring effects in and out via pressure.
- Use release velocity with sounds that offer some release time to give them an adjustable "wash-of-reverb" as you let go of the keys.
- Use an envelope to apply external effects in perfect sync with other modulations that are taking place within the Sound.

<Minimal Volume>

Range: 0...127

This parameter sets the guaranteed minimum volume that will always be sent to the Instrument. This parameter allows you to route a minimum constant level to the Aux bus regardless of whether or not there is an active modulation.

If you do not use dynamic modulation via the Modulation Inputs, set this parameter to *127* to allow for the full range to be scaled by the Instrument Aux send.

<Instrument Aux Vol>

Range: 0...127

This is the same parameter [Aux Vol] you find in the Instrument of the Sound. It is repeated here for your convenience, to allow for the easier level matching of the Aux send modulation parameters and the scaled signal sent to the Aux bus.

<Instrument Volume>

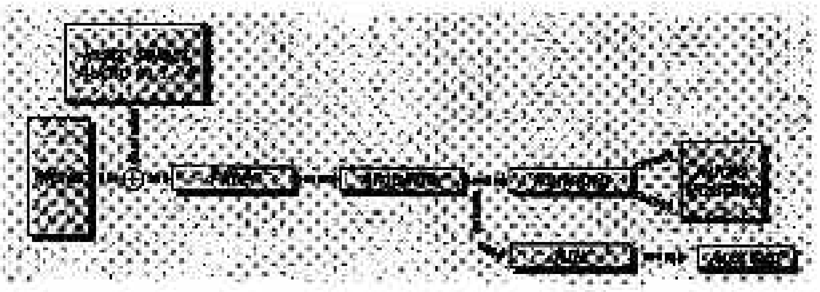
Range: 0...127

This is the same parameter [Volume] you find in the Instrument of this Sound. It is repeated here for your convenience, to allow for the fine-tuning of the overall volume of the Sound and the level sent to the Aux bus.

Processing External Audio Equipment

The Wave allows you to route external audio signals through the internal sound engine in much the same way that modular analog synthesizers allowed you to process external audio material.

You can enable any of the four external inputs of any Instrument by programming the Instrument parameter [External In] accordingly. The external signal will be added to the signal coming from the Mixer module. It will travel through all the same audio modules as the output of the mixer module:

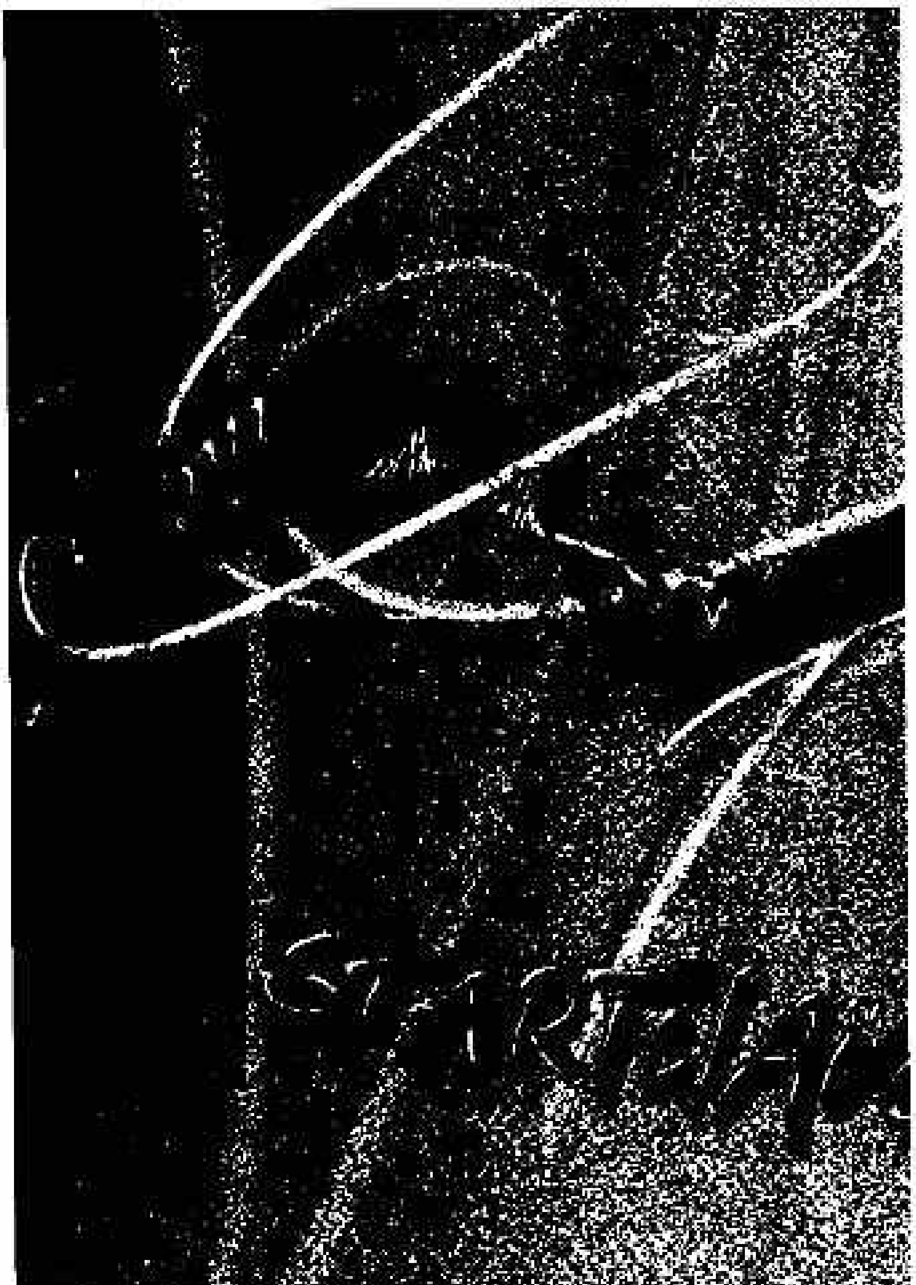


- Filter module
- Amplifier module
- Panning module
- Aux module

If you do not want to mix the internally-generated voice with the external signal, simply turn the level of the three modules being summed in the Mixer module to *0*.

You can use any available modifier at any available modulation input for those audio modules through which the external signal passes, exactly as you can for an internal voice. To use envelopes in the same manner as you would for internal voices, select the correct *monophonic* voice allocation modes in the Instrument's [Alloc] parameter.

Modifier Modules

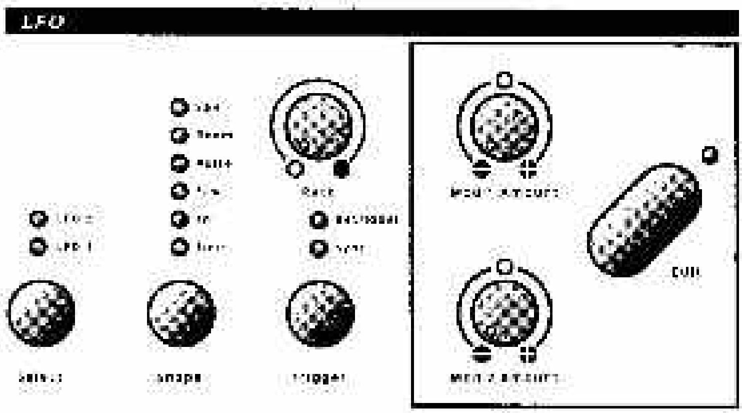


SOUND DESIGN

waldorf

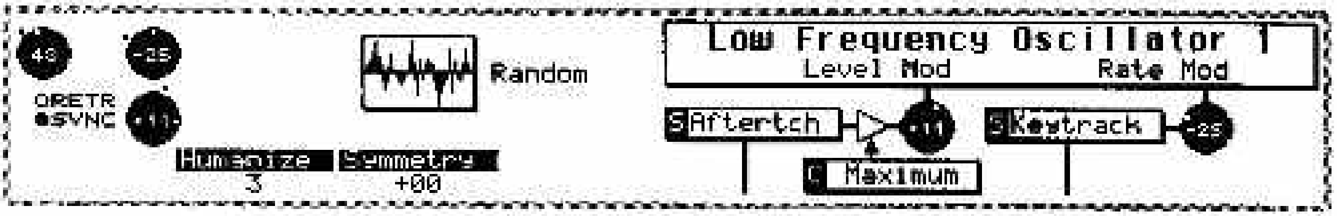
This chapter covers all functions with regards to the use of modifier modules. These modules control the behavior of the audio modules by *modifying* the parameters of the audio modules. However, they can also control each other, so one modifier module might modify another modifier module, which in turn acts on an audio module.

LFOs (bipolar)



Both Low Frequency Oscillators are created equal. They are also rather elaborate in nature, allowing you to create some unique effects. Neither LFO is used at a preconfigured modulation input. Rather, they are found exclusively in the modifier table. If you want to use one of them, you must assign it to a routable modulation input.

In general, you may program a certain LFO waveform at a certain rate, set various trigger options and modulate both rate and level



[Select]

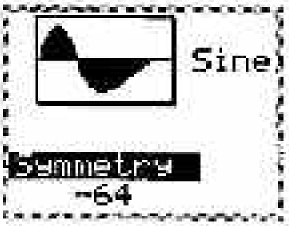
Range: LFO 1 / LFO 2

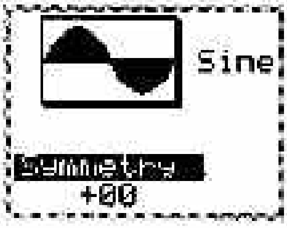
Both LFOs of the Wave share the same physical user interface controls. The [Select] button allows you to switch between the two LFOs; the corresponding LED indicates which LFO you are currently programming. The corresponding display page will also be switched when you choose to view the LFO parameters by pressing the [Edit] button.

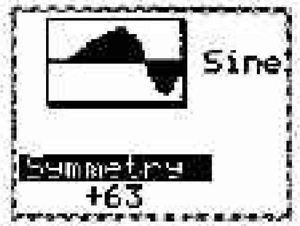
[Shape]

Range: Sine / Tri / Saw / Pulse / Random / S & H

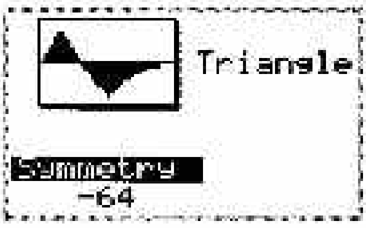
[Shape] lets you choose one of six basic waveforms.

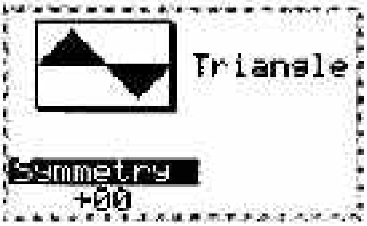

Sine
Symmetry
-64

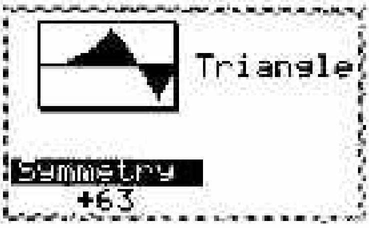

Sine
Symmetry
+00


Sine
Symmetry
+63

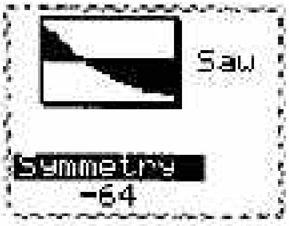
- *Sine* selects a sine wave. Use negative amount at the destination to change the phase 180 degrees.
  <Symmetry> will distort the shape as shown above.

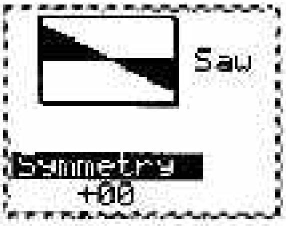

Triangle
Symmetry
-64

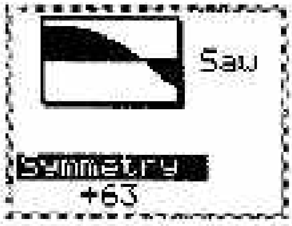

Triangle
Symmetry
+00


Triangle
Symmetry
+63

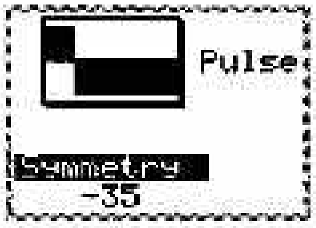
- *Tri* selects a triangle waveform, which is more linear than a sine wave. Use it to modulate panning or filter cutoff.
  <Symmetry> changes the shape more toward a sawtooth-like waveform.


Saw
Symmetry
-64

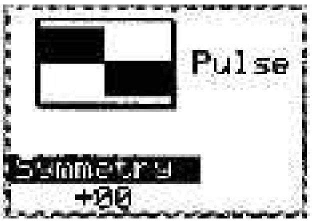

Saw
Symmetry
+00


Saw
Symmetry
+63

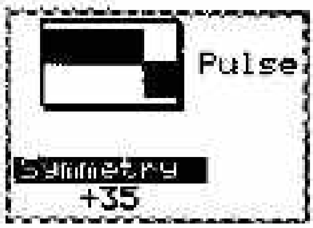
- *Saw* selects a sawtooth wave. Use *positive* amount at the destination for a rising and *negative* amount for a falling sawtooth.
  <Symmetry> changes the sawtooth shape to be more exponential.



Symmetry
-35

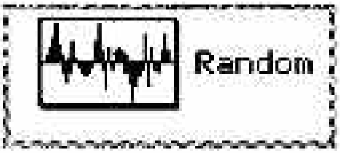


Symmetry
+00

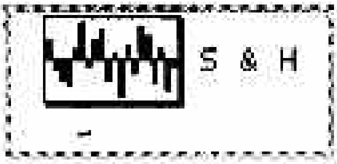


Symmetry
+35

- *Pulse* is a pulse wave, whose duty-cycle is set by the <Symmetry> parameter:
  - at *00* it is a square wave with a 50% duty-cycle
  - at *+63* it is a pulse with about a 95% duty cycle
  - at -64 it is a pulse with about a 5% duty cycle.



- *Random* is a continuous random waveform, akin to very low-frequency noise. Use Rate to adjust its intensity.
  <Symmetry> has no effect on the *Random* shape.



- *S & H* is a sample-and-hold waveform. It samples a random signal as often as set by the [Rate] parameter and holds that value until the next sample is taken. A random staircase function is the resultant shape.
  <Symmetry> has no effect on the *S & H* shape

[Trigger]

Range: off / Sync / Retrigger

[Trigger] offers three options as to how the LFO will react when new keys are played:

- *off* (no LED is lit) leaves the LFO independent for each triggered voice. In this mode you will achieve a very natural sounding LFO modulation, since the LFOs of different voices will start at different phases. Use <Humanize> to further enhance this effect.
- *Sync* synchronizes the LFOs of all voices assigned to the Instrument playing that Sound. This is great for recreating analog synthesizer effects from the days when there was only a single LFO available for modulating all voices simultaneously. Use a modest <Humanize> value to imitate bad circuit design...
- *Retrigger* will start each voice's LFO at the initial phase of the respective [Shape] for the key being struck, yielding predictable LFO modulations that behave the same way for each key played.

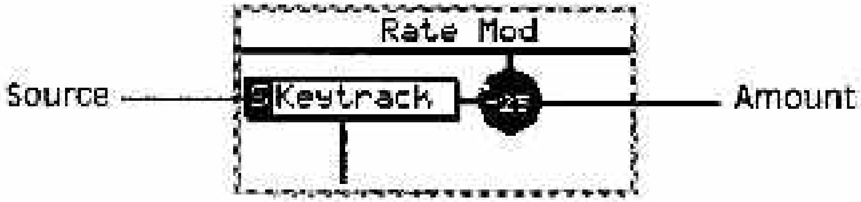
[Rate]

Range: 0...127

[Rate] sets the speed of the LFO.

- *0* disables any repetition of the wave. Instead, for each successive keystroke a different randomly generated static value is output. Use this, for example, to modulate pitch a small amount with each successive keystroke.
- *1* sets the slowest sweep speed - and we mean slooooow.
- *127* sets the highest possible rate. It is nearly as fast as the lower end of the audio range; useful for "flutter-tongue" effects.

Rate Modulation Input



Rate Modulation Input is a regular modulation input acting on the LFO's [Rate] parameter. Two parameters are available:

- **<Source>**

Range: modifier table

This defines the source modifier of the Rate Modulation Input to alter the [Rate] parameter.

You can program this parameter using the respective display fader by pressing the [Edit] button located near the modulation amount knobs.

- **[Amount]**

Range: -64...+63

[Amount] sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Rate Mod Amount] to adjust this parameter.

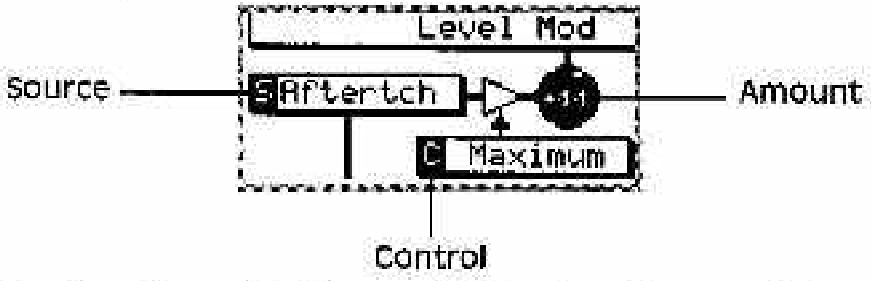
- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set by the [Rate] parameter. Therefore, a negative value will slow down the [Rate], whereas a positive value will speed it up.

Some possible applications:

- Use the mod wheel to increase the [Rate] while applying vibrato, enhancing its intensity.
- Use the LFO itself to modulate the [Rate] to achieve different wave shapes and effects.

Level Modulation Input



Level Modulation Input is a sidechain modulation input that modulates the output level of the LFO. Three parameters are available:

- **<Source>**

Range: modifier table

This defines the source modifier of the Level Modulation Input to alter the LFO output level.

You can program this parameter using the respective display fader by pressing the [Edit] button located near the modulation amount knobs.

- **<Control>**

Range: modifier table

This defines the control modifier used to scale the source modifier of the Level Modulation Input.

You can program this parameter using the respective display fader by pressing the [Edit] button located near the modulation amount knobs.

- **[Level Mod Amount]**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

Use the front panel knob [Level Mod Amount] to adjust this parameter.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as as programmed at the full amount.

☞ The Amount parameter only determines the maximum possible modulation value; the actual value is set in real time by the control modifier. In any event, the actual amount of modulation will be determined by the control input:

- If the modifier connected to the control input is programmed to output its full amount, the source modifier will modulate the LFO output level as set by the [Amount] parameter.
- If the control modifier outputs nothing, there will be no modulation of the output level.

Some possible applications:

- Use a mod wheel or other MIDI controller to adjust the LFO level in real time.
- Use LFO 2 to alter the waveform of LFO 1.

<Humanize>

Range: 0...7

<Humanize> imposes random variations upon the Rate of the LFO.

- *off* keeps the Rate absolutely constant at the value set.
- *7* imposes rather large random variations on the Rate.

<Symmetry>

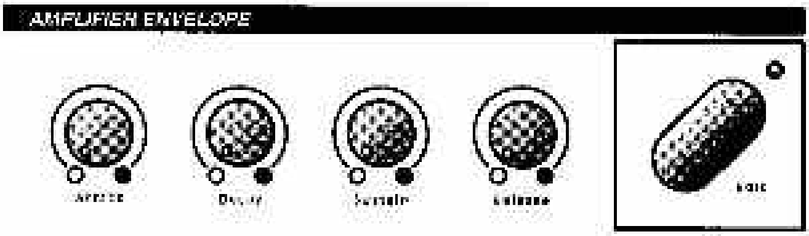
Range: -64...+63

<Symmetry> changes the shape of the LFO by adjusting the ratio of the positive and negative halves of the waveform.

- *-64* will shift the symmetry axis of the waveform toward the beginning of the waveform. See <Shape> for details.
- *00* leaves the symmetry axis of a waveform in the middle. This yields, for example, a perfect sine wave.
- *+ 64* shifts the symmetry axis of the waveform toward the end. Again, see <Shape> for details.

➪ Please note that <Symmetry> settings above *50* will produce non-linear side effects; the same will be true when using <Symmetry> at high [Rates]. However, these effects can be of interesting musical value, so we have left these extremes in for your sound designing pleasure.

Amplifier Envelope (unipolar)

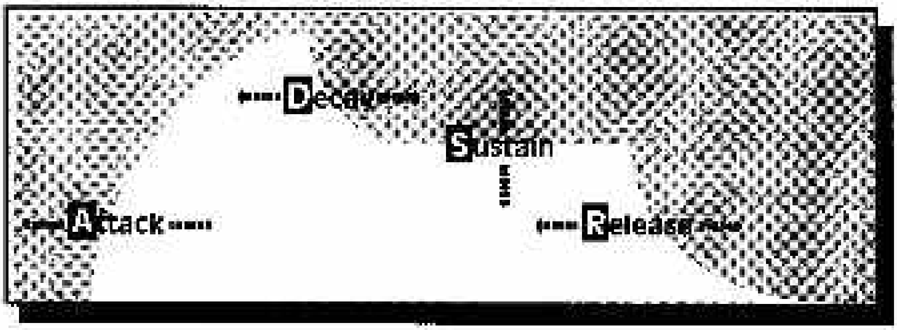


The Amplifier envelope is a standard ADSR-type envelope. It is used at the preconfigured modulation inputs [Envelope Amount] and [Envelope Velocity] in the Amplifier module.

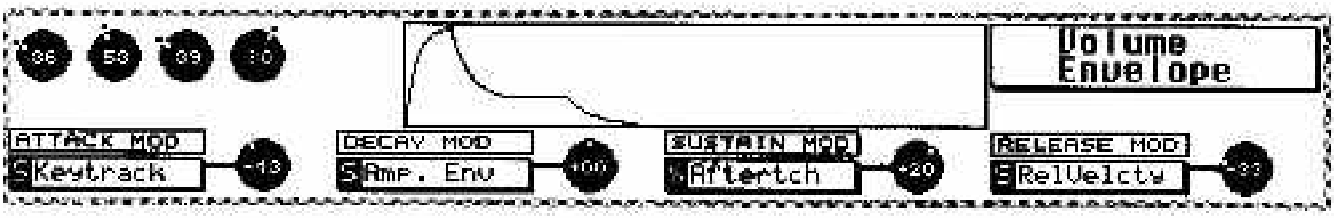
You must assign the Amplifier envelope in the Amplifier module, or there will be no audio output at all. Therefore, you must define the Amplifier envelope in a useful way, even if you intend to use another envelope to shape the sound's loudness.

The Amplifier envelope will also determine the status of the respective voice with regards to the voice-allocation scheme. It is here where the processor looks at the level of a currently-sounding voice to see if it is still "alive" or available for use somewhere else. Even if you have not assigned the envelope, the Wave will scan it to determine voice availability, so you must *always* use values in this envelope that are musically compatible with your sound.

The Amplifier envelope, as stated above, is a standard ADSR envelope. See the figure below for details about the associated parameters:



By pressing a key, the envelope opens at the rate set in [Attack]. The attack level is determined by the maximum amount of envelope modulation, which comprises both the fixed amount and the velocity-controlled portion as programmed at the envelope's destination. After reaching the attack level, the envelope will fall according to the time set by [Decay] to the level programmed as the [Sustain] value. After the key is released, the envelope will fade to zero in the time programmed in the [Release] parameter.



[Attack]

Range: 0...127

[Attack] sets the attack time of the Amplifier envelope.

- *0* equals instant attack; the envelope opens immediately to the level set by the envelope amount.
- *127* is the longest attack time; it takes about 8 minutes and 45 seconds (honest!) until the attack level is reached.

[Decay]

Range: 0...127

Decay sets the decay time of the Amplifier envelope.

- *0* means instantaneous decay to the [Sustain] level.
- *127* is the longest decay-time; it takes about 5 minutes and 45 seconds for the [Sustain] level to be reached.

[Sustain]

Range: 0...127

Sustain adjusts the level to which the Amplifier envelope will fall after the [Decay].

- *0* disables any [Sustain], resulting in a percussive envelope that will fade away to zero according the programmed [Decay] or [Release] time, depending on when the key is released.
- *127* keeps the envelope at the programmed attack level once it is reached. The setting of the [Decay] parameter is ignored, since the attack and sustain levels are equal.

[Release]

Range: 0...127

Release sets the time it takes the envelope to fade to zero after a key has been released.

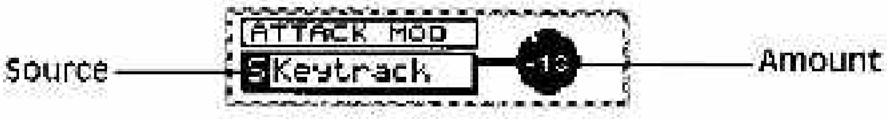
- *0* shuts off the envelope immediately upon release of the key or as soon as a MIDI note-off command is received.

- *127* allows the envelope to fade gradually to zero in about 5 minutes and 45 seconds.

➪ The [Release] parameter is very much dependent on the [Sustain] level. The higher the [Sustain] level is, the more pronounced the [Release] will be.

➪ If you set the [Sustain] to *0*, the [Release] will start at the level the envelope has reached when the note-off command is received.

Attack Modulation Input



Attack Modulation Input is a regular modulation input that modulates the [Attack] time parameter of the Amplifier envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Attack Modulation Input to alter the [Attack] time.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

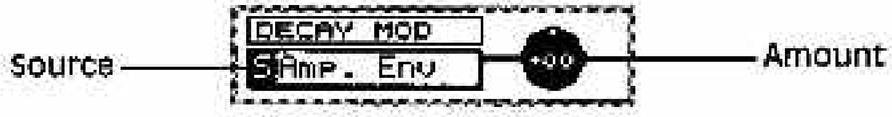
- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set by the [Attack] parameter. Therefore, a negative value will shorten the [Attack], whereas a positive value will lengthen it.

Some possible applications:

- Use this modifier to alter the attack time according to the desired effect. Use velocity for changes due to playing style (e.g.legato versus marcatto attack) and Keytracking for attack-times that vary according to pitch, etc.
- Experiment with other modifiers; an LFO, for instance, might produce attack times that constantly vary from one to another, a MIDI controller allows you to create delicate phrasing by manually altering the Attack as needed. There are many more possibilities; be adventurous!

Decay Modulation Input



Decay Modulation Input is a regular modulation input that modulates the [Decay] time parameter of the Amplifier envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Decay Modulation Input to alter the [Decay] time.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

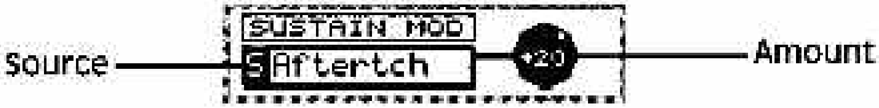
- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set by the [Decay] parameter. Therefore, a negative value will shorten the [Decay], whereas a positive value will lengthen it.

Some possible applications:

- Use the same modulation techniques described for [Attack].
- Use negative Keytracking to mimic the pitch-dependent decay characteristics of most natural percussive instruments.

Sustain Modulation Input



Sustain Modulation Input is a regular modulation input that modulates the [Sustain] level parameter of the Amplifier envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Sustain Modulation Input to alter the [Sustain] level.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

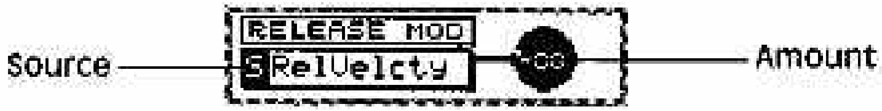
All modulation values will be added to the actual value set by the [Sustain] parameter. Therefore, a negative value will decrease the [Sustain] level, whereas a positive value will increase it.

☞ Please note that all modulation level changes will be gradually faded-in according to the envelope's [Decay] time setting in order to provide a smooth response to the incoming data. Set the [Decay] time to achieve the best desired results.

Some possible applications:

- Use velocity to change between a sound that is more percussive or more sustained in nature depending how hard you strike a key.
- Use aftertouch to change the amplitude of a sound after you hit a key. By using it as a [Sustain] modifier rather than applying it directly at a destination, you can achieve a natural release that is dependent on how much aftertouch you applied. Otherwise a sudden jump in level might be introduced due to the difference between the aftertouch value and the sustain value.

Release Modulation Input



Release Modulation Input is a regular modulation input that modulates the [Release] time parameter of the Amplifier envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Release Modulation Input to alter the [Release] time.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Amplifier envelope's [Edit] button.

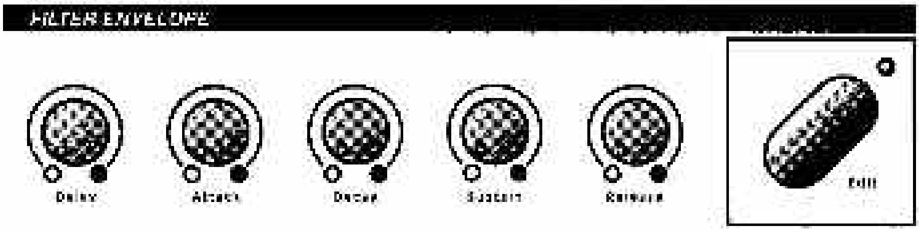
- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set by the [Release] parameter. Therefore, a negative value will shorten the [Release], whereas a positive value will lengthen it.

Some possible applications:

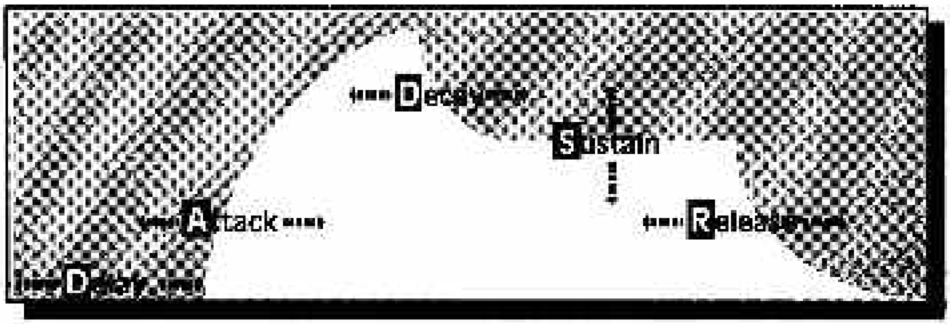
- Use release velocity to alter the [Release] according to how fast you let go of a key.
- Use an LFO to slightly alter the [Release] in order to create more variation in the overall sound.

Filter Envelope *(unipolar)*

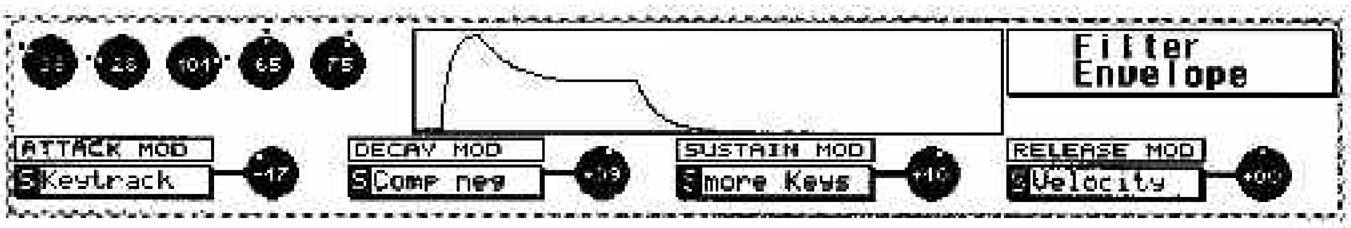


The Filter envelope is a standard ADSR-style envelope with an added delay segment before the attack segment. It is used at the preconfigured modulation inputs [Envelope Amount] and [Envelope Velocity] in the Filter module.

See the figure below for details on the associated parameters:



When a key is pressed, the onset of the envelope is delayed by the time programmed in the [Delay] parameter. The envelope then opens in the time set by [Attack]. The attack level is determined by the maximum amount of envelope modulation, which consists of the fixed amount plus the velocity-controlled portion as programmed at the envelope's destination. After reaching the attack level, the envelope will fall at the rate set by [Decay] to the level programmed in [Sustain]. After the key is released, the envelope will fade to zero in the time programmed by the [Release] parameter.



[Delay]

Range: 0...127

[Delay] introduces an initial delay before the [Attack] begins; it is completely independent from the value set as [Attack]. However, should a note-off arrive during the delay segment, the attack segment will never be activated. The envelope will therefore output nothing.

- 0 disables the [Delay] segment completely, resulting in a regular ADSR envelope.
- 127 introduces the maximum delay (about 36 seconds) before the [Attack] begins.

[Attack]

Range: 0...127

[Attack] sets the attack time of the Filter envelope.

- *0* equals instant attack; the envelope opens immediately at the level set in [Envelope Amount].
- *127* is the longest attack time; it takes about 8 minutes and 45 seconds for the attack level to be reached.

[Decay]

Range: 0...127

[Decay] sets the decay time of the Filter envelope.

- *0* means instantaneous decay to the [Sustain] level.
- *127* is the longest decay time; it takes about 5 minutes and 45 seconds for the [Sustain] level to be reached.

[Sustain]

Range: 0...127

[Sustain] adjusts the level to which the Filter envelope will fade after the [Decay].

- *0* disables any [Sustain], resulting in a percussive envelope that will fade away to zero according to the programmed [Decay] or [Release] time, depending on when the key is released.
- *127* keeps the envelope at the programmed attack level once it is reached.The setting of the [Decay] parameter is ignored, since the attack and sustain levels are equal.

[Release]

Range: 0...127

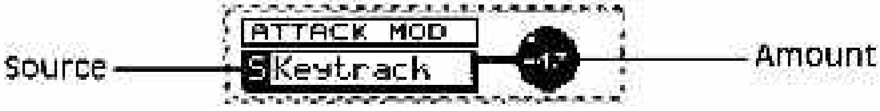
[Release] sets the time it takes the envelope to fade to zero after a key has been released.

- *0* shuts off the envelope immediately upon release of the key or as soon as a MIDI note-off command is received.
- *127* lets the envelope fade gradually to zero in about 5 minutes and 45 seconds.

➪ The [Release] parameter is very much dependent on the [Sustain] level. The higher the [Sustain] level is, the more pronounced the [Release] will be.

➪ If you set the [Sustain] to *0*, the [Release] will start at the level the envelope has reached when the note-off command is received.

Attack Modulation Input



Attack Modulation Input is a regular modulation input that modulates the [Attack] time parameter of the Filter envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Attack Modulation Input to alter the [Attack] time.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

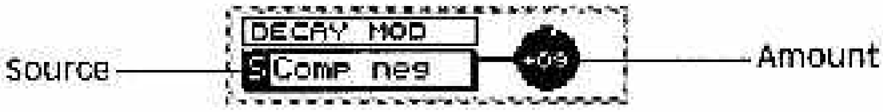
Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set by the [Attack] parameter. Therefore, a negative value will shorten the [Attack], whereas a positive value will lengthen it.

Decay Modulation Input



Decay Modulation Input is a regular modulation input that modulates the [Decay] time parameter of the Filter envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Decay Modulation Input to alter the [Decay] time.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

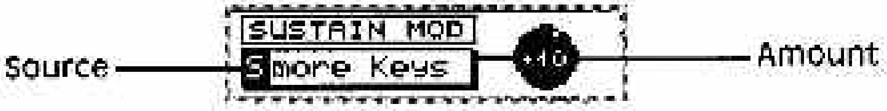
Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set at the [Decay] parameter. Therefore, a negative value will shorten the [Decay], whereas a positive value will lengthen it.

Sustain Modulation Input



Sustain Modulation Input is a regular modulation input that modulates the [Sustain] level parameter of the Filter envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Sustain Modulation Input to alter the [Sustain] level.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

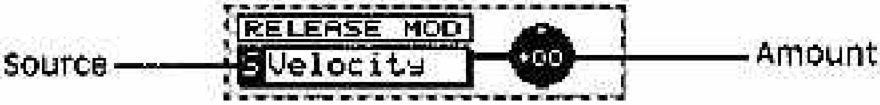
You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation-values will be added to the actual value set at the [Sustain] parameter. Therefore, a negative value will decrease the [Sustain] level, whereas a positive value will increase it.

➪ Please note that all modulation level changes will be gradually faded-in according to the [Decay] time setting in order to provide a smooth response to the incoming data. Set the [Decay] time to achieve the best desired results.

Release Modulation Input



Release Modulation Input is a regular modulation input that modulates the [Release] time parameter of the Filter envelope. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Release Modulation Input to alter the [Release] time.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

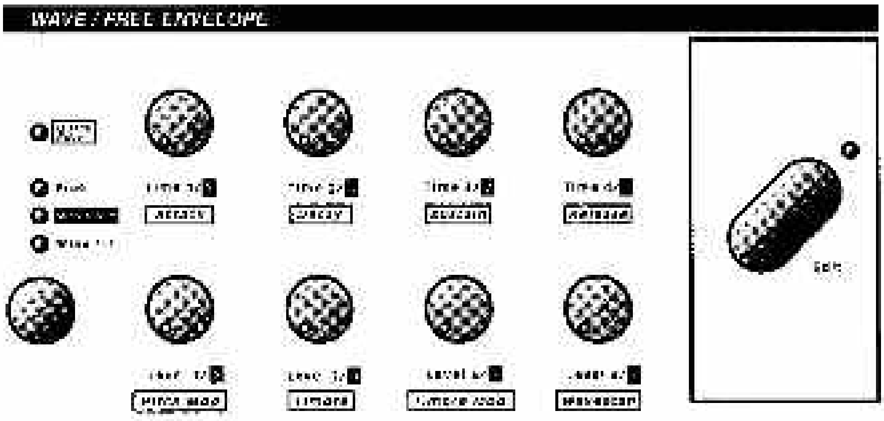
Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Filter envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual value set at the [Release] parameter. Therefore, a negative value will shorten the [Release], whereas a positive value will lengthen it.

Wave Envelope *(unipolar)*



The Wave envelope is used at the preconfigured modulation inputs [Envelope Amount] and [Envelope Velocity] for the Wave-modules.

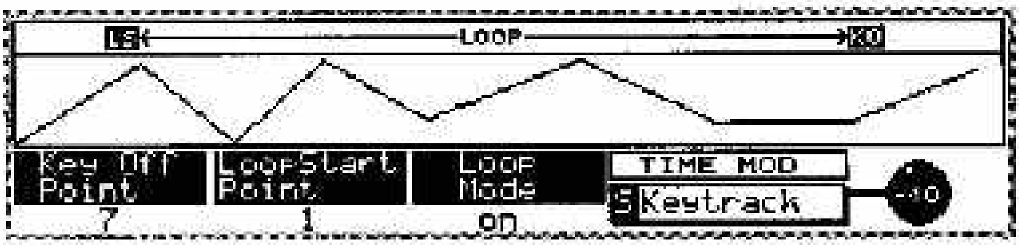
The Wave envelope shares the same user interface that controls the Free envelope. To program the Wave envelope, you must first select it using the [Envelope Select] button in the Wave/Free envelope module. To program [Time 1...4] and [Level 1...4] using the eight dials, the LED labeled "Wave 1-4" must be lit; the LED labeled "Wave 5-8" must be illuminated to program [Time 5...8] and [Level 5...8]. In both instances the [Edit] button will call up the Wave envelope display page with the envelope graph and additional fader parameters.

The Wave envelope differs very much from the previous two envelopes. It is an eight-stage multi-segment envelope that can be split into key-on and key-off (release) portions as desired. Additionally, you may program a loop in either the key-on or the release portion.

Please note that the Wave envelope is a true time/level envelope. The value set at [Time X] is independent of the [Levels] that immediately precede and follow it. This is different from other rate/level envelopes, where the values of the start and destination levels directly affect the time it takes to move from one level to another at the programmed rate.

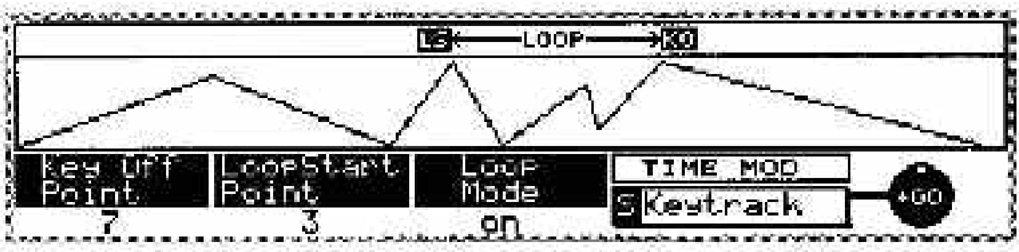
A time/level envelope allows you, for instance, to program a delay segment in the middle of the envelope - something that's usually impossible to do in a standard rate/level envelope.

See the below figure for further details:



Key Off Point 7
LoopStart Point 1
Loop Mode on
TIME MOD
S Keytrack -10

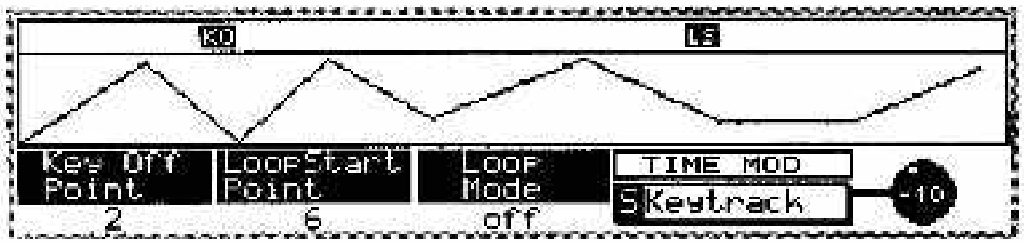
You see one possible application above: Seven segments of the Wave envelope are defined for the key-on period, while one segment governs the release. A loop is programmed between segments 1 and 7.



Key Off Point 7
LoopStart Point 3
Loop Mode on
TIME MOD
S Keytrack +60

The above figure shows what actually happens when you play the envelope described earlier. If the key is held longer than the combined key-on segment times last, the envelope will jump back to segment 3 and repeat segments 3 through 7 until the key is released, then finish as programmed in segment 8, which is the release segment. Note that the time of the <Loop Start> segment is used to crossfade the last segment's [Level] into the <Loop Start> [Level].

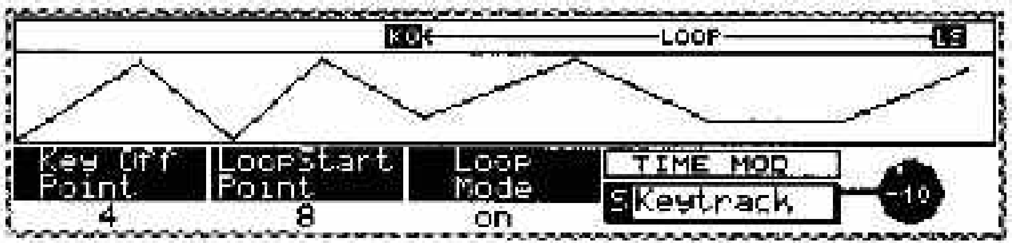
Below is a Wave envelope with two key-on segments and six release segments defined, with no loop:



Key Off Point 2
LoopStart Point 6
Loop Mode off
TIME MOD
S Keytrack -10

When a key is pressed, the first two segments are played until [Level 2] is reached. The envelope will remain at this level until the key is released, since there is no loop defined. Upon release of the key, envelope will cycle through the other six segments.

Finally, you might program a loop that occurs during the release portion of the envelope:



Key Off Point 4

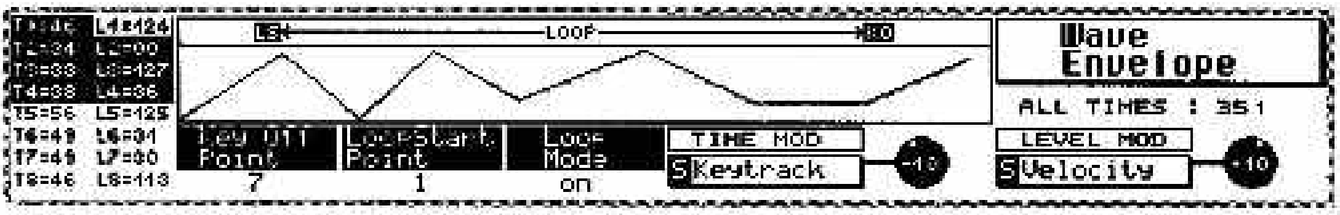
LoopStart Point 8

Loop Mode on

TIME MOD

S Keytrack

In this example the envelope will pass through the four key-on segments until [Level 4] is reached. On key-up, the four release segments will be continuously repeated.



T1=[illegible] L1=124
T2=34 L2=00
T3=33 L3=127
T4=38 L4=36
T5=56 L5=125
T6=49 L6=31
T7=49 L7=00
T8=46 L8=113

Key Off Point 7

LoopStart Point 1

Loop Mode on

TIME MOD

S Keytrack

Wave Envelope

ALL TIMES : 351

LEVEL MOD

S Velocity

⮌ Please note that the envelope graph in the display uses an auto-zoom function for the time axis, which always will use the *entire* display space to show the envelope. The zoom magnification will adjust according to the information that must be displayed. At first this might look irritating; but after a few tries you will find it helpful for visualizing the relative proportions of the various segments of the envelope.

[Time 1]

Range: 0...127

[Time 1] sets the time it takes for segment 1 of the Wave envelope to travel to [Level 1].

- *0* jumps immediately to [Level 1].
- *127* sets the maximum time it takes for segment 1 to reach [Level 1].

[Level 1]

Range: 0...127

[Level 1] sets the level that will be reached by [Time 1]. The Wave envelope always starts at a level of *0*, which is actually the non-adjustable [Level 0].

Each Time/Level pair makes up one segment of the multi-segment Wave envelope.

A [Time] parameter will always determine the time it takes to reach the corresponding [Level].

- *0* is the minimum [Level].
- *127* is the maximum value, equal to the maximum value that comprises both the [Envelope Amount] and [Envelope Velocity] portions set in the envelope modulation input.

[Time 2…8 / Level 2…8]

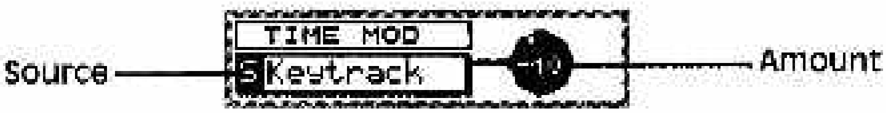
[Time 2…8] / [Level 2…8] define segments 2 through 8 respectively. They are identical in function to the first segment-pair. One pair follows another in numerical succession.

There can be no unused segments in the Wave envelope.

To imitate a standard ADSR envelope:

- Only use segments 1 to 3 without a loop to recreate a standard ADSR envelope.
- Set [Level 1] to *127*.
- Set Level 3 and all succeeding Levels to 0
- [Time 1] will be the attack time, travelling to the attack level [Level 1]
- [Time 2] is the decay time.
- [Level 2] is the sustain level.
- [Time 3] is the release time, travelling to [Level 3] = 0.

<Time Modulation Input>



Time Modulation Input is a regular modulation Input that scales all [Times] of the Wave envelope equally. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Time Modulation Input to scale all the [Times] of the Wave envelope concurrently.

You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

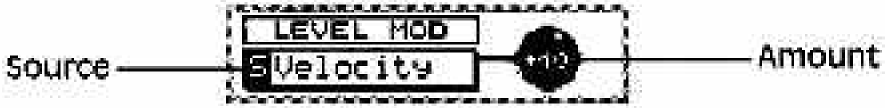
- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual values set at the [Time] parameters. Therefore, a negative value will shorten the [Time] values, whereas a positive value will lengthen them.

Some possible applications:

- Use the Time Modulation Input to change the Wave envelope's characteristic according to your playing by using velocity, aftertouch or a MIDI controller to change the [Time] values in real time.
- Use the Maximum fixed-modifier module as the source to scale all [Time] values equally. This speeds up the process of shortening or lengthening the entire Wave envelope by a considerable amount.

<Level Modulation Input>



Level Modulation Input is a regular modulation input that scales all [Levels] of the Wave envelope equally. It consists of two parameters.

- **<Source>**

Range: modifier table

It defines the source modifier of the Level Modulation Input to scale all the [Levels] of the Wave envelope concurrently.

You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation input.

You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

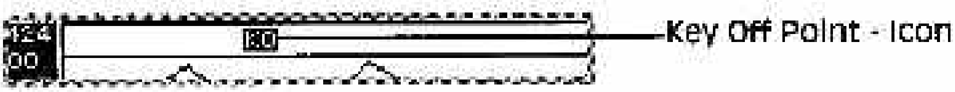
- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual values set at the [Level] parameters. Therefore, a negative value will decrease all [Levels], whereas a positive value will increase them.

Some possible applications:

- Use the [Level] modulation to change the Wave envelope's characteristic according to your playing by using velocity, aftertouch or a MIDI controller to change the [Levels] in real time.
- Use the Maximum fixed-modifier module as the source to scale all [Level] values equally. This speeds up the process of increasing or decreasing the Wave envelope's [Levels] by a considerable amount.

<Key Off Point>



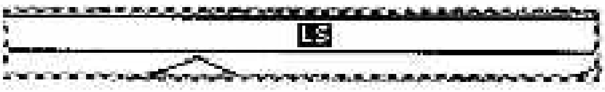
Range: 1...8

<Key Off Point> defines the border between the key-on and the release portion of the Wave envelope. The <Key Off Point> is the **last** segment of the key-on portion. If there is no loop defined, the [Level] of the <Key Off Point> is the sustain level at which the envelope will remain until the key is released or a MIDI note-off command is received; at that point, the release portion, of the Wave envelope, which consists of the remaining Wave envelope segments, will begin.

You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

The <Key Off Point> is indicated in the display by the icon atop the envelope graph.

<Loop Start Point>



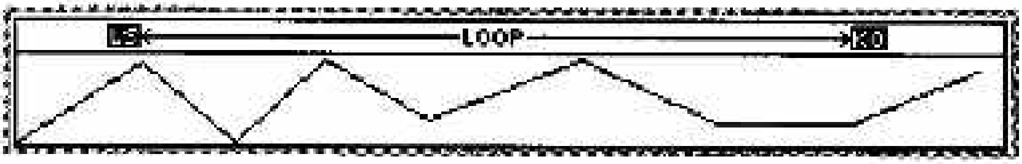
Range: 1...8

<Loop Start Point> defines the segment where the loop will start if <Loop Mode> is set to *on*..

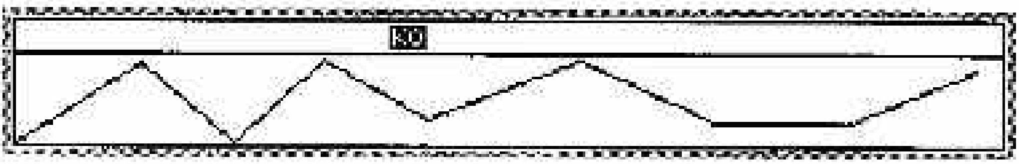
You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

The loop will always cycle between the <Loop Start Point> and the <Key Off Point>. There are three different algorithms that can apply when using a loop:

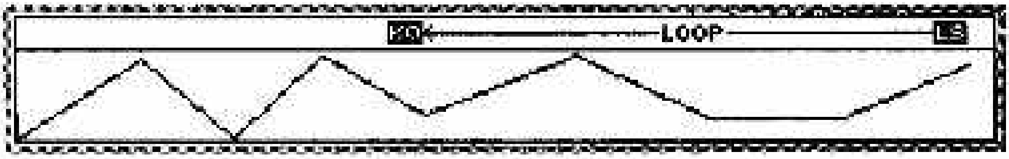
- *<Loop Start Point> is before <Key Off Point>:* The Wave envelope will pass through all key-on segments once. After reaching the Key Off [Level], it will fade back to the Loop Start segment using that segment's [Time] value and play again to the Key Off [Level], until the note-off command is received. See the figure below :

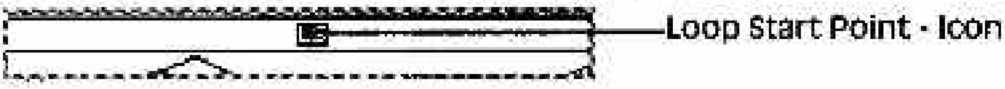


- *<Loop Start Point> is identical to <Key Off Point>*: In this case, you created a loop that only loops the Key Off [Level]. No loop will be audible; this is the same as turning Loop Mode off.



- *<Key Off Point> is before <Loop Start Point>*: This allows you to create a loop in the release portion of the Wave envelope. The envelope will pass through all its key-on segments, remain at the Key Off [Level] until the note-off command is received, play all the release segments up to the <Loop Start Point>, fade back to the <Key Off Point> in the time set as the <Loop Start> [Time] and repeat the loop continuously.





The <Loop Start Point> is indicated in the display by the icon atop the envelope graph.

<Loop Mode>

Range: off / on

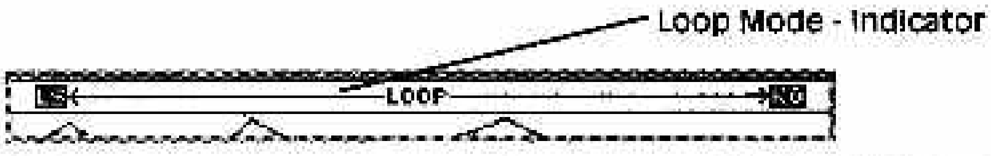
Loop Mode defines whether or not the Wave envelope's loop will be active.

You can program this parameter using the respective display fader by pressing the Wave envelope's [Edit] button.

- *on* will enable looping. Fasten your seat belts and watch your keys when your Wavetables turn upside down.

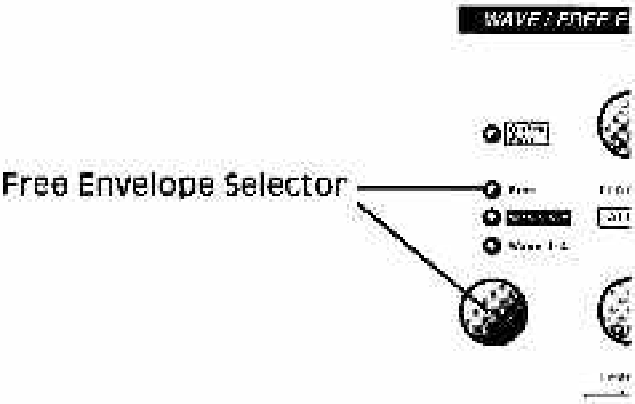
- *off* disables looping mode. The Wave envelope will pass through all key-on segments and remain happily at the <Key Off Point's> [Level] until the note-off is received, after which it will finally move through the release portion, and vanish into non-existance...almost. The Wave envelope will hold the [Level] of the last segment, and if that is a value other than *0*, that [Level] will be held until the envelope is triggered again by a new note.

The <Loop Mode> will be indicated in the display by an arrow pointing from the <Key Off Point> to the <Loop Start Point> atop the envelope graph.



Free Envelope *(bipolar)*

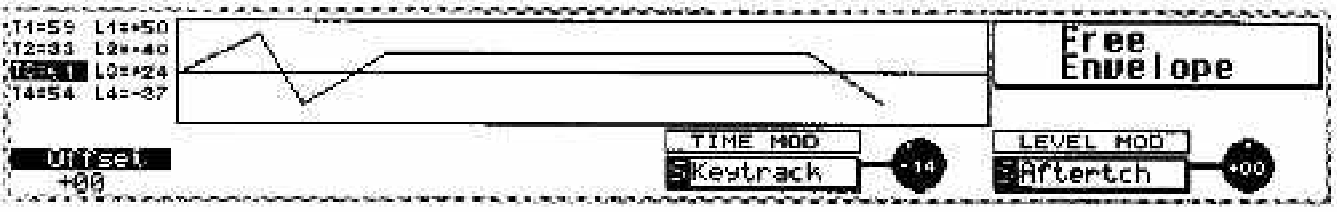
The Free envelope is somewhat similar to the Wave envelope. However, it sports only 4 segments and is loopless - no loopholes offered here. Then again, it is actually a *bipolar* envelope, which allows you both adding and subtracting its output from the modulation destination . This makes it especially noteworthy for pitch and panning modulations.



Free Envelope Selector

The Free envelope is exclusively available via the modifier table, and is not used at any preconfigured modulation input.

The Free envelope shares the same user-interface that controls the Wave envelope. To program the Free envelope, you must first press the [Envelope Select] button in the Wave/Free envelope module until the LED "Free" is lit. The eight dials will then give you access to the parameters [Time 1...4] and [Level 1...4], while the [Edit] button will call the Free envelope display page with the envelope graph and additional fader parameters.



```
T1=59  L1=+50
T2=33  L2=+40
T3= 1  L3=+24
T4=54  L4=-37

Offset
 +00
```

Free Envelope

TIME MOD: S Keytrack -14

LEVEL MOD: S Aftertch +00

[Time 1]

Range: 0...127

[Time 1] sets the time it takes for segment 1 of the Free envelope to travel to [Level 1].

- *0* jumps immediately to [Level 1].
- *127* sets the maximum time it takes for segment 1 to reach [Level 1].

[Level 1]

Range: -64...+63

[Level 1] sets the level that will be reached by [Time 1]. Please note that negative values are possible. Negative values will subtract from the destination parameter when the amount set at the destination is not inverted. In that case, the output of the Free envelope would be inverted, which would change all negative [Levels] to positive ones and vice versa.

The Free envelope always starts at a level of *0*, which is actually the non-adjustable [Level 0].

Each Time/Level pair makes up one segment of the multi-segment Wave envelope. A [Time] parameter will always determine the time it takes to reach the corresponding [Level].

- *0* is the level where normally no change at the destination parameter will occur. However, this is dependent on the setting of the <Offset> parameter.
- *-64* is the maximum negative value.
- *+63* is the maximum positive value for the [Level].

[Time 2...4 / Level 2...4]

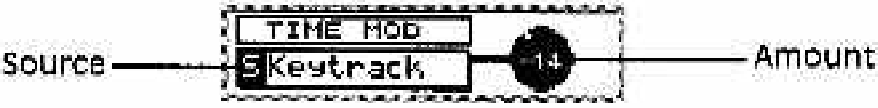
[Time 2...4] / [Level 2...4] define segments 2 through 4 respectively. They are identical in function to the first segment-pair. One pair follows another in numerical succession.

There can be no unused segments in the Free envelope.

Since the Free envelope has no loop mode, the following restrictions will always apply:

- [Level 3] is the sustain level, which will remain valid until the key is lifted.
- [Time 4] / [Level 4] will always be the release segment of the Free envelope.

<Time Modulation Input>



Time Modulation Input is a regular modulation input that scales all [Times] of the Free envelope equally. It consists of two parameters:

• **<Source>**

Range: modifier table

This defines the source modifier of the Time Modulation Input to scale all the [Times] of the Free envelope concurrently.

You can program this parameter using the respective display fader by pressing the Free envelope's [Edit] button.

• **<Amount>**

Range: -64…+63

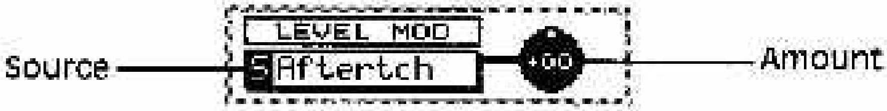
Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Free envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual values set at the [Time] parameters. Therefore, a negative value will shorten the [Time] values, whereas a positive value will lengthen them.

<Level Modulation Input>



Level Modulation Input is a regular modulation input that scales all [Levels] of the Free envelope equally. It consists of two parameters:

• **<Source>**

Range: modifier table

This defines the source modifier of the Level Modulation Input to scale all the [Levels] of the Free envelope concurrently.

You can program this parameter using the respective display fader by pressing the Free envelope's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

You can program this parameter using the respective display fader by pressing the Free envelope's [Edit] button.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

All modulation values will be added to the actual values set at the [Level] parameters. Therefore, a negative value will decrease all [Levels], whereas a positive value will increase them.

<Offset>

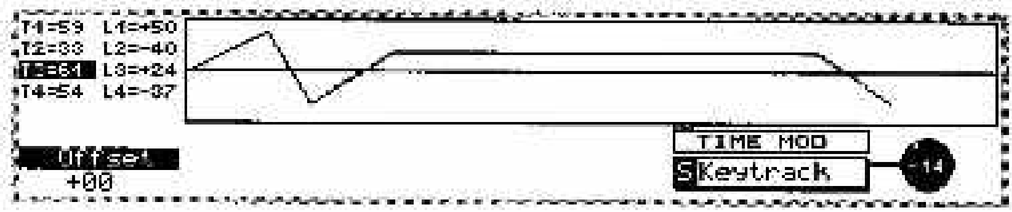
Range: -64...+63

This parameter allows you to shift the zero axis of the bipolar Free envelope. By shifting this axis, you shift the [Levels] of this envelope toward either positive or negative values. This is accomplished by adding an offset (hence the name) to each level.

You can program this parameter using the respective display fader by pressing the Free envelope's [Edit] button.

In the envelope graph of the display page you can see the zero line. Any [Level] that matches this zero line will not actually change the value of the destination parameter, but will be regarded as 0 (even though the [Level's] parameter value might not be 0). You can set the zero line with the <Offset> parameter to match any possible level.

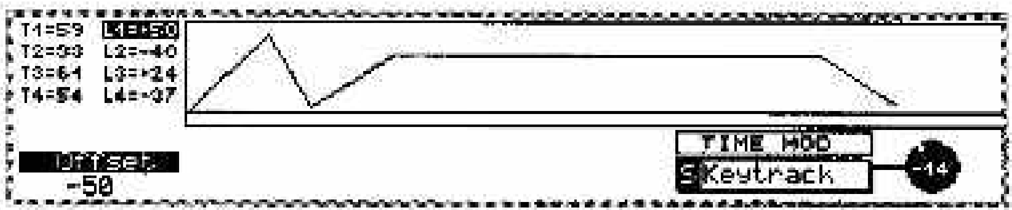
- *0* will add no offset value. The Free envelope will act as a bipolar envelope.



T1=59 L1=+50
T2=33 L2=-40
T3=31 L3=+24
T4=54 L4=-37

Offset
+00

- *-64* will move the zero line all the way to the bottom of the graph. The resultant envelope will be unipolar and output *only* positive values. This resembles the way a normal unipolar envelope would work.

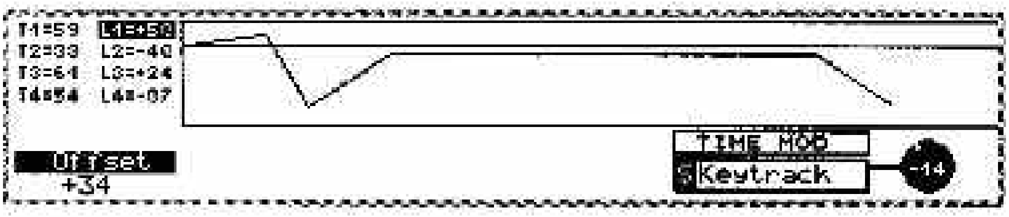


T1=59 L1=+50
T2=33 L2=-40
T3=64 L3=+24
T4=54 L4=-37

Offset
-50

TIME MOD
S Keytrack
-14

- *+63* moves the zero line all the way to the top of the graph. The resultant envelope will be unipolar and output only negative values.

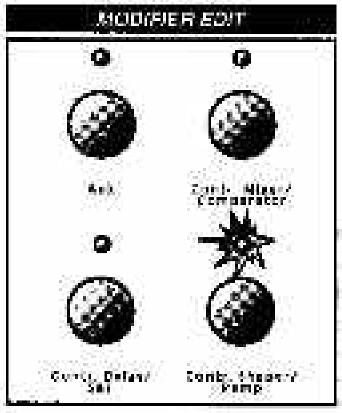


T1=59 L1=+50
T2=33 L2=-40
T3=64 L3=+24
T4=54 L4=-37

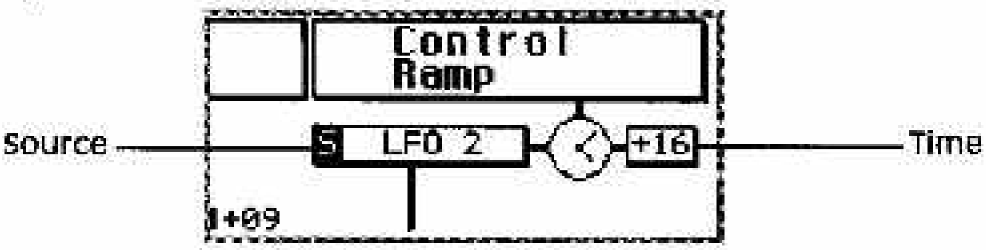
Offset
+34

TIME MOD
S Keytrack
-14

Control Ramp *(unipolar)*



The Control Ramp can be regarded as a very simple envelope generator. It outputs a single ramp whose start and end levels are fixed, though the duration and direction of the ramp are programmable.



You can program this modifier module by pressing the [Control Shaper/Ramp] button in the Modifier Edit panel section. All parameters can be programmed by the respective display faders.

Some possible applications:

- Use the Control Ramp to fade in an LFO.
- Use the Control Comparator as the <Source> to conditionally trigger the Control Ramp, and use the Ramp itself at a control input of a sidechain modulator to initiate the programmed modulation according to specific conditions.
- Use a slow LFO to trigger the Ramp continuously.

<Source>

Range: modifier table

The <Source> is the trigger source for the ramp. Unlike the envelopes, which are always triggered when a key is pressed, the Control Ramp has a selectable trigger source. The Control Ramp will be triggered whenever the value of the <Source> exceeds 0. If the Control Ramp was previously triggered, it will be retriggered the next time the source exceeds 0.

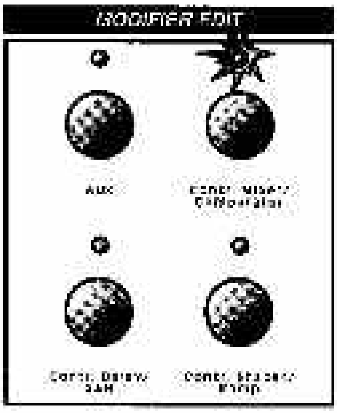
<Time>

Range: D64...A63 (Decay 64...Attack 63)

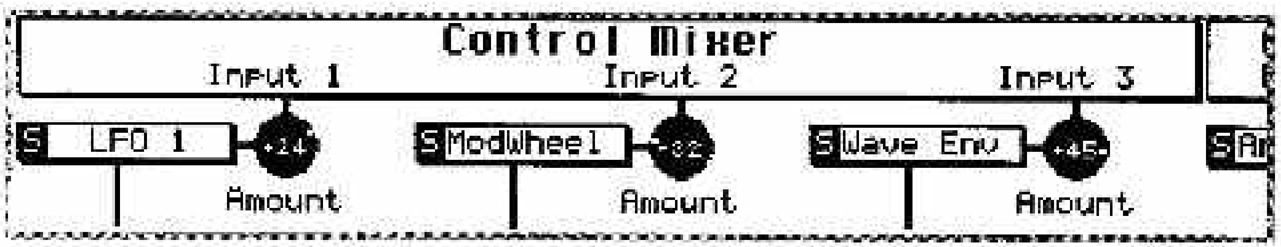
This parameter sets both the duration of the Ramp and its direction.

- *D64 Decay 64* defines a decaying ramp with the longest duration.
- *A63 Attack 63* programs a rising ramp with the longest duration.
- *0* does not deactivate the Control Ramp, but sets the shortest attack duration.

Control Mixer (bipolar)



The Control Mixer allows you to combine up to three different Control <Sources>.



Control Mixer

Input 1 — S LFO 1 — Amount +24

Input 2 — S ModWheel — Amount -32

Input 3 — S Wave Env — Amount +45

You can program this modifier module by pressing the [Control Mixer/Comparator] button in the Modifier Edit panel section. All parameters can be programmed by the respective display faders.

Some possible applications:

- Use it if two modulation inputs are not enough.
- Use it to boost the value coming from a single modifier by routing that modifier to all three Control Mixer inputs.

<Source 1>

Range: modifier table

Select the first modifier you want to mix.

<Amount 1>

Range: -64...+63

Set the level of <Source 1> using this parameter. Note that you can add or subtract <Source 1> from the summed output of the Control Mixer.

<Source 2>

Range: modifier table

Select the second modifier you want to mix.

<Amount 2>

Range: -64...+63

Set the level of <Source 2> using this parameter. Note that you can add or subtract <Source 2> from the summed output of the Control Mixer.

<Source 3>

Range: modifier table

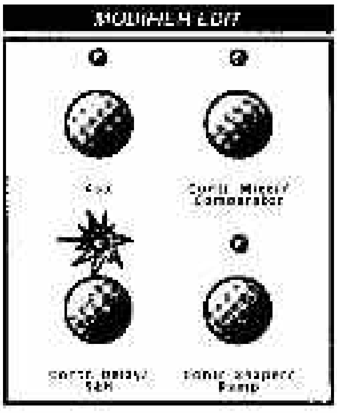
Select the third modifier you want to mix.

<Amount 3>

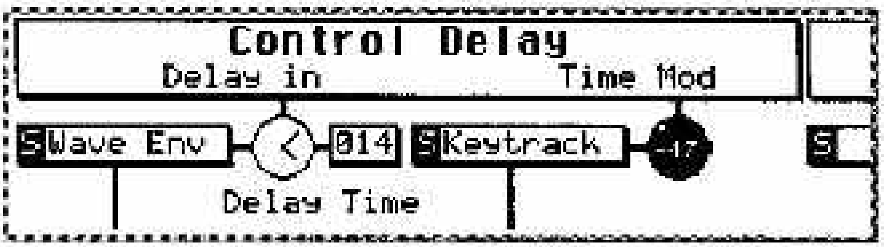
Range: -64...+63

Set the level of <Source 3> using this parameter. Note that you can add or subtract <Source 3> from the summed output of the Control Mixer.

Control Delay *(bipolar)*



The Control delay allows you to delay the onset of any modifier.



```
           Control  Delay
        Delay in              Time Mod
S Wave Env  (<) 014  S Keytrack  (-17)    S
              Delay Time
```

You can program this modifier module by pressing the [Control Delay/S & H] button in the Modifier Edit panel section. All parameters can be programmed by the respective display faders.

Some possible applications:

- Use the Control Delay to delay the onset of an envelope that is being applied to different destinations.
- Route the modifier you intend to delay to the Control Mixer. Route the output of the Control Delay to the second <Source> input of the Control Mixer. Route the Control Mixer to the input of the Control Delay; this creates a feedback loop. Adjust the <Amount> parameter of the Mixer input that is being fed by the Delay to create the desired number of echoes. Assign the resulting signal to a Modulation Input of the Amplifier.

<Source>

Range: modifier table

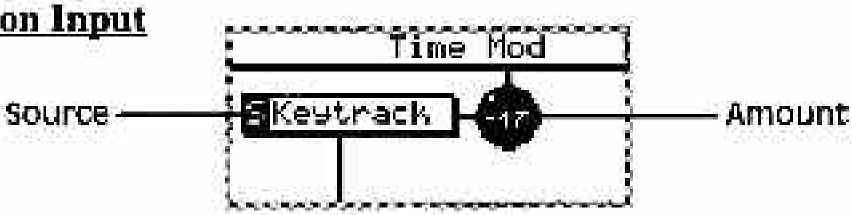
Select the modifier you want to delay.

<Delay Time>

Range: 0...127

This sets the time by which the <Source> modifier will be delayed.

Time Modulation Input



Time Modulation Input is a regular modulation input that allows you to modulate the [Delay Time] in real time. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Time Modulation Input to modulate the [Delay Time].

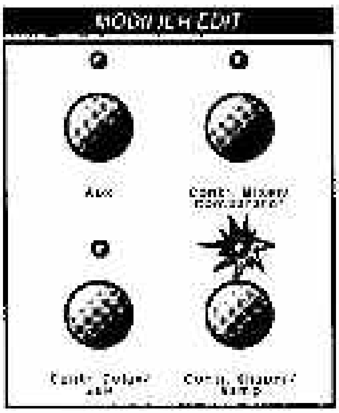
- **<Amount>**

Range: -64...+63

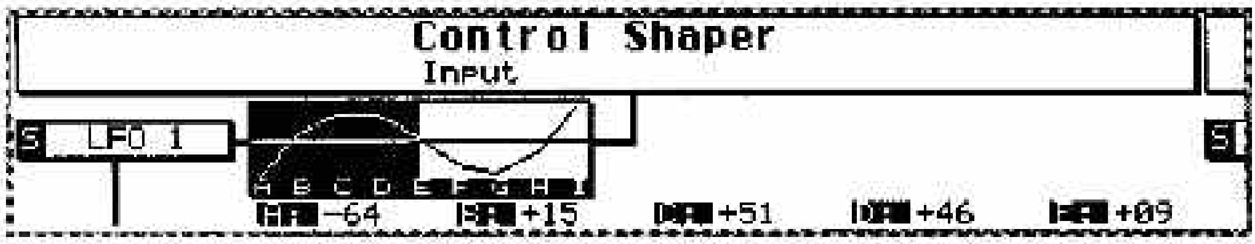
Amount sets the maximum possible amount of modulation for this Modulation Input.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

Control Shaper *(bipolar)*



The Control Shaper allows you to change the shape or curve of any modifier. This is accomplished using nine break-points, which can be used to program a completely different output function or curve for any incoming function or curve. The Control Shaper can modify bipolar inputs and output bipolar signals; it even can transform a bipolar modifier into an unipolar one and vice-versa.



You can program this modifier module by pressing the [Control Shaper/Ramp] button in the Modifier Edit panel section. All parameters can be programmed by the respective display faders.

Some possible applications:

- Route any MIDI controller through the shaper to change its response curve.
- Route the Control Ramp through the Shaper to transform it into a more complex envelope.
- Route an envelope through the Control Shaper to generate a second envelope that is closely tied to the input envelope, but of a different shape. You might also change a unipolar envelope into a bipolar one.

<Source>

Range: modifier table

Selects the modifier you want to reshape.

Points <A…E>

Range: -64…+63

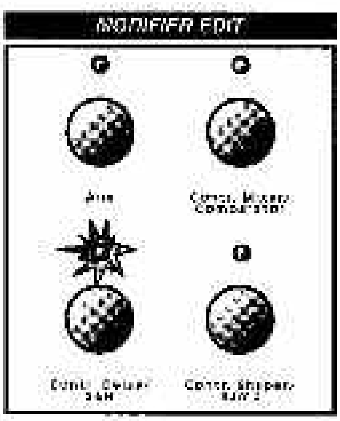
These five break-points control the negative half of a bipolar <Source> modifier. For unipolar modifiers, these break-points (except for break-point <E>, which remaps the input value 0) will not have any effect. Each negative input value can be mapped to either a positive or negative output value.

Points <E…I>

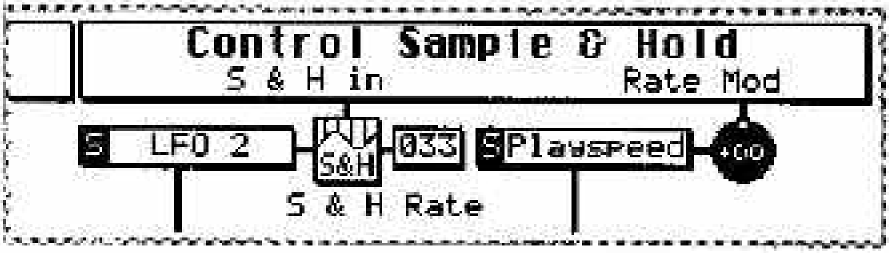
Range: -64…+63

These five break-points control the positive half of a bipolar <Source> modifier or the entire input range of an unipolar modifier. Each positive input value can be mapped to either a positive or negative output value

Control S & H (bipolar)



The Control Sample & Hold module lets you sample any modifier (except for audio modules - sorry) with an adjustable Rate that can be modulated in real time. It measures the value of the <Source> modifier at intervals set by the <Rate> parameter and holds that value until the next measurement takes place.



Control Sample & Hold

S & H in

Rate Mod

S LFO 2

S&H

033

S Playspeed

+00

S & H Rate

You can program this modifier module by pressing the [Control Delay/S & H] button in the Modifier Edit panel section. All parameters can be programmed by the respective display faders.

Some possible applications:

- Sample the output of an envelope to generate a staircase-like function that is closely related to the <Source> envelope.
- Sample an LFO to have both its continuous signal and a staircase signal available.

<Source>

Range: modifier table

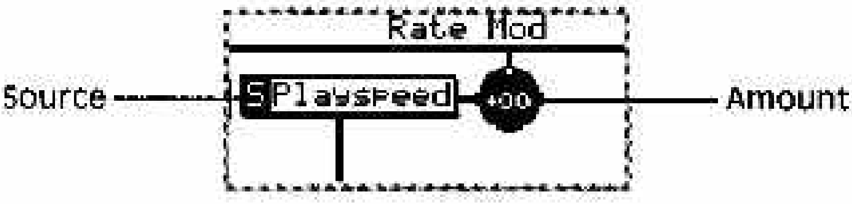
Select the modifier that will be sampled.

<S&H Rate>

Range: 0...127

This is the rate at which the <Source> signal will be sampled.

Rate Modulation Input



Rate Modulation Input is a regular modulation input that allows you to modulate the [S&H Rate] in real time. It consists of two parameters:

• <Source>

Range: modifier table

This defines the source modifier of the Rate Modulation Input to modulate the [S&H Rate].

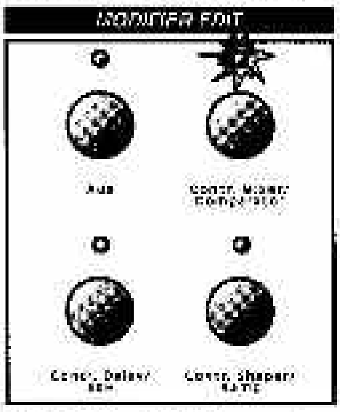
• <Amount>

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

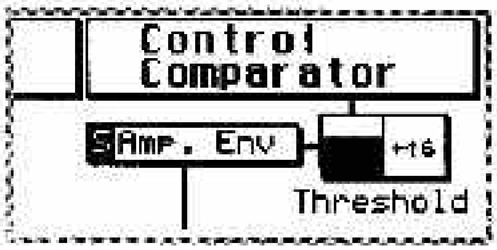
Control Comparator (unipolar)



The Control Comparator module measures the value of the <Source> modifier and compares it to the <Threshold> parameter. The Control Comparator will then set its two output-values based on the evaluation.

The Comparator has two outputs in the modifier table whose values compliment each other:

- **Comp pos** will output *127* when the <Threshold> has been equalled or exceeded by the <Source>. Otherwise it will output a value of *0*.
- **Comp neg** will output *127* when the <Source> value is smaller than the <Threshold>, otherwise it will output a value of *0*.



You can program this modifier module by pressing the [Control Mixer/Comparator] button in the Modifier Edit panel section. All parameters can be programmed by the respective display faders.

Some possible applications:

- Use the mod wheel or other MIDI controller as <Source>. Whenever the mod wheel exceeds a certain setting, an additional modulation will kick in.
- Compare the **more keys** or **less keys** modifier of the modifier table and set <Threshold> such that whenever you exceed a certain number of voices the **Comp pos** output will output full value. Use the Comp pos output at various

control-inputs of sidechain modulation inputs to change the timbre for the newly triggered voices.

- Compare the **more keys** or **less keys** modifier of the modifier table and set <Threshold> so that whenever you exceed a certain number of voices the **Comp pos** output will be at its maximum value. Use the Comp pos output at control inputs of various sidechain modulation inputs to change the timbre with each newly triggered voices.
- Assign **Keytrack** of the modifier table as an input and use the Comparator to set up a split sound by changing various Sound parameters when you play above the <Threshold> key.

<Source>

Range: modifier table

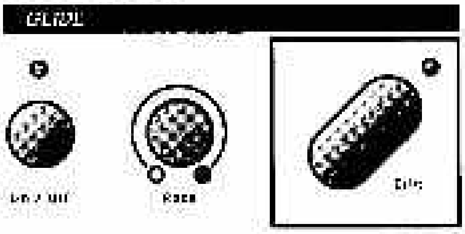
Select the modifier that shall be compared to the Control Comparators <Threshold> parameter.

<Threshold>

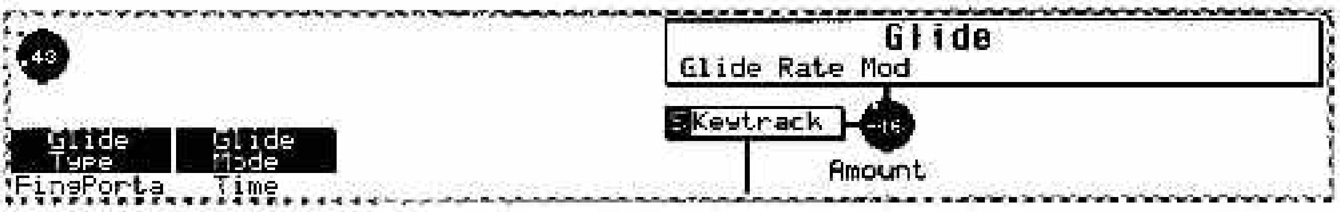
Range: -64...+63

This parameter sets the value to which the <Source> value will be compared. Please note that unipolar modifiers will be mapped accordingly, so that, as an example, a unipolar value of *30* will trigger the Comparator when <Threshold> is set to +*15*.

Glide (unipolar)



This is the good ol' Glide effect found on so many older analog synthesizers. In the Wave, Glide is available both in polyphonic and monophonic voice allocation modes, and as continuous portamento or stepped glissando - offering you a wide variety of possible effects



43

Glide Type: FingPorta

Glide Mode: Time

Glide

Glide Rate Mod

Keytrack

Amount

The Glide Algorithm

We worked hard at implementing polyphonic Glide in a useful way. The algorithm works roughly as follows:

- Whenever you are holding a key (or keys) and play an additional note, that note will *not* be played with Glide. However, the Wave will remember the note and keep track of how many and which keys you played.
- When you are playing, the Wave tracks the number of keys you are currently holding. Each time it sees the same number of keys played, but at different pitches, Glide will be applied.
- When applying Glide, the Wave tries to track where each voice should go. If you play two consecutive major chords, for example, chances are that the entire chord will glide. Playing a bass note that moves the opposite direction should still be tracked correctly.
- When you strike the same key or keys repeatedly, no glide will be used on those keys.

An example:

- *Play a 3-voice chord with Glide enabled.*
  When you play the chord initially, no Glide will be applied.
- *Let go of the chord and play another 3-voice chord comprised of different pitches.*
  Notice that the notes will Glide accordingly.
- *Hold that chord and play a bass note.*
  Notice that no Glide is used, since this is an additional note.
- *Now let go of the bass note and play another bass note.*
  The Wave will Glide from the first key you played as a bass note.
- *Now, play a different chord and bass note.*
  All pitches should Glide to the new notes.
- *After the Glide has been completed, restrike the very same keys.*
  No Glide should be introduced this time.

Monophonic Glide is available in all monophonic voice-allocation modes. Depending on the [Glide Type], the pitch will simply Glide from whatever key you played to the next pitch that succeeds it.

The Global Parameter <Glide Window>

It takes some time, naturally, for the Wave to recognize the current number of voices you are playing as the chords you are play playing. The Wave uses a time window to catch all the necessary information. The window will be triggered every time you play a new key.

The actual length of the window, however, depends very much on the playing style and the application. In order to allow for all different kinds of applications, we offer you the ability to set the length of the window. This is done globally for all Instruments and voices for which Glide has been enabled.

You find this parameter in Global Edit in the menu <Global 2> under the parameter name <Glide Window>. The longer you make the window, the more accurately your playing will be traced. At the same time, however, the note-on delay will increase. Therefore, you should find the balance between accurate tracking and fast response. As a rule, keep the length of the <Glide Window> as short as possible.

See also Performance, chapter 8.5, "Glide Window".

[On/Off]

Range: on / off

This nice little button activates and deactivates the Glide effect.

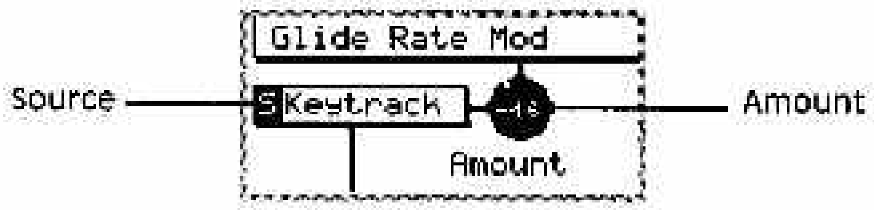
[Rate]

Range: 0...127

[Rate] sets the speed of the Glide effect.

- *0* disables all Glide. Since the [Rate] is instantaneous, you get the same effect as if Glide was set to *off*.
- *127* selects the longest possible Glide Rate - and yes, we mean *really* long.

<Rate Modulation Input>



Rate Modulation Input is a regular modulation input that allows you to modulate the [Rate] of the Glide effect in real time. It consists of two parameters:

- **<Source>**

Range: modifier table

This defines the source modifier of the Rate Modulation Input to modulate the Glide [Rate].

You can program this parameter using the respective display fader by pressing the Glide's [Edit] button.

- **<Amount>**

Range: -64...+63

Amount sets the maximum possible amount of modulation for this Modulation Input.

- *-64* inverts the source's output signal and applies the full modulation amount.
- *+63* applies the source as programmed at the full amount.

You can program this parameter using the respective display fader by pressing the Glide's [Edit] button.

<Glide Type>

Range: Porta / Glissando / MIDIPorta / MIDIGliss / FingPorta / FingGliss

You can program this parameter using the respective display fader by pressing the Glide's [Edit] button.

This parameter selects the basic type of Glide.

- *Porta* selects the portamento effect, which results in a continuous transition between successive pitches. Welcome to true synthesizer whining.
- *Glissando* selects a glissando Glide effect. Rather than continuously moving from one pitch to the next, Gliss uses semitone steps to Glide between the two pitches.
- *MIDIPorta* is the same as - you guessed it - Porta, but with one difference: The portamento effect will only be applied when a MIDI portamento command (MIDI Controller 65) is received. Use the MIDI portamento time controller (Controller 5) to change the speed of the portamento.
- *MIDIGliss* is the same as Glissando,except that the glissando effect will only be

applied if a MIDI portamento command (MIDI Controller 65) is received. Use the MIDI portamento-time controller (Controller 5) to change the speed of the glissando.

- *FingPorta* will apply portamento only when you play legato. All staccato played notes will sound without portamento.
  This parameter only works in monophonic voice allocation modes. When assigned in polyphonic allocation modes, standard portamento will be used.
- *FingGliss* will apply glissando only when you play legato. All staccato played notes will sound without glissando.
  This parameter only works in monophonic voice allocation modes. When assigned in polyphonic allocation modes, standard glissando will be used.

<Glide Mode>

Range: Time / Distance

Glide Mode lets you choose between two different ways of applying Glide: equal Time and equal Distance.

You can program this parameter using the respective display fader by pressing the Glide's [Edit] button.

- *Time* selects the equal time option. This means that a glide always takes the same time to reach its destination pitch regardless of the distance it must travel. In other words, if the interval the pitch must sweep is a minor third, the actual glide speed will be slower than that of a glide over three octaves. However, the time it takes to reach the destination pitch will be the same for both intervals.

  This is useful if you play chords that must glide and then hit the downbeat exactly. The Glide [Rate] parameter sets the time it takes to reach the destination pitch.
- *Distance* selects the equal distance option. It specifies that a glide takes place always at the same speed for the same distance, regardless of the time it may take to reach the destination pitch. Therefore, a glide over two octaves takes eight times the time of a glide over a minor third.

  This is good, for example, if you use Gliss and want the semitone movement to stay in rhythm. The Glide [Rate] parameter sets the actual speed of the glide.

Quick Edit

SOUND DESIGN

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This chapter describes the parameters and macros of the Wave's Quick Edit function. Quick Edit allows you to make very fast changes in the sound by altering several parameters of the sound engine at the same time in a single gesture.

The Basic Concept

There are two different Quick Edit types: FastAccess parameters and Macros.

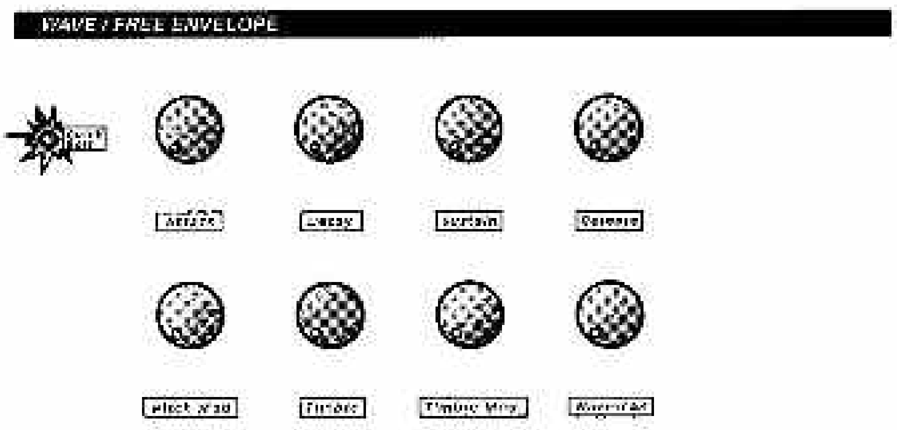
FastAccess parameters give you truly fast control over the most vital aspects of a sound. It allows you to control several modules of the Wave with a single turn of a dial to execute a complex sound edit with the utmost ease.

Macros call certain predefined parameter-sets that provide you with instant access to an assortment of envelope shapes and modulation effects.

Macros and FastAccess can make brand new areas of sound design available to you in seconds. Obviously, you can always edit single parameters as well as fine tune the "rough" strokes of the Quick Edit sound brush.

When you're in the studio with a producer breathing down your neck and demanding "more percussive bite" or "less touch-sensitivity" for a sound, you'll definitely appreciate the FastAccess parameters.

Fast Access Parameters



These parameters offer simultaneous control over a variety of Sound parameters using only a single knob.

To access the FastAccess parameters, you must select the Quick Edit operational mode. Then the eight [dials] of the Wave/Free envelope panel section will adjust the corresponding FastAccess parameters. Additionally, the three leftmost [display faders] will adjust the sensitivity FastAccess parameters.

There is no visual feedback in the Quick Edit display for those FastAccess parameters that are controlled via the [dials].

[Attack]

[Attack] adjusts the attack rates of the Amplifier and Filter envelopes and [Time 1] of the Wave and Free envelopes.

By decreasing the Attack parameter dramatically, the Wave assumes that you want to achieve a more percussive sound. Therefore it will decrease the decay parameters if the attack is close to or already instantaneous, and perhaps even lower the sustain levels to make the Sound more and more percussive.

Increasing the Attack, on the other hand, will prolong the decay times above a certain value and raise the Sustain levels to achieve a more sustaining envelope.

[Decay]

[Decay] alters the decay times of the Amplifier and Filter envelopes and [Time 2] of the Wave envelope (if its <Key Off Point> is set equal to or greater than 2) and Free envelope.

Lowering the [Decay] below a certain value will simultaneously decrease the attack times, and later the sustain levels, since the Wave assumes you are striving for a more percussive sound.

Increasing the [Decay] above a certain point will also increase the sustain levels in order to produce a more sustained envelope.

[Sustain]

[Sustain] changes the sustain levels of the Amplifier and Filter envelopes, the <Key Off Point> level of the Wave envelope and [Level 3] of the Free envelope.

Decreasing the Sustain below a certain value will simultaneously decrease the decay times, since the Wave assumes you are striving for a more percussive sound.

Increasing the Sustain will only alter the respective sustain levels.

[Release]

[Release] adjusts the release times of all envelopes; for the Wave envelope, all [Times] behind the <Key Off Point> will be decreased simultaneously.

Only the respective release times are altered by the this parameter.

[Pitch Mod]

[Pitch Mod] adjusts all Modulation Inputs of the two Oscillators.

Use it to control the overall pitch modulation or vibrato of a Sound.

[Timbre]

[Timbre] changes the [Start Wave] parameters of both Wave generators as well as the Filter [Cutoff] frequency and [Resonance] .

Use [Timbre] to quickly change the tone color of the Sound.

[Timbre Mod]

[Timbre Modulation] controls the [Amounts] of the Modulation Inputs of both Wave generators and the Filter.

Use it to adjust the change in timbre introduced by the modulation inputs, rather than by the envelopes.

[Wavescan]

[Wavescan] controls the [Amounts] of the Wave envelope fed into both Wave generators.

Use this FastAccess parameter to quickly program a change of timbre that's produced by scanning the Wavetable. Call up the appropriate Wave envelope macro to achieve the desired effect, or try various Wave envelope macros, and adjust their intensity using [Wavescan].

<Velocity>

<Velocity> lets you alter the velocity sensitivity of all modules. Use it to quickly adjust a program to your playing style or particular application.

<Velocity> affects the following parameters:

- Amplifier envelope velocity
- Filter envelope velocity
- Wave 1 envelope velocity
- Wave 2 envelope velocity

For these parameters <Velocity> will adjust the difference between the [Envelope Amount] and [Envelope Velocity] parameters, while the originally-programmed sum of both parameters will be left untouched.

<Velocity> will also adjust all modulation inputs to which velocity is routed, whether they are <Control> or <Source> inputs.

All amounts affected will be scaled on a percentage basis to preserve their original relationships.

<Aftertouch>

<Aftertouch> allows you to alter the aftertouch (MIDI channel pressure) sensitivity of all modules. Use it to quickly adjust a Sound to your playing style or particular application.

<Aftertouch> will adjust all those routable modulation inputs to which aftertouch is routed, whether they are <Control> or <Source> inputs.

All amounts affected will be scaled on a percentage basis to preserve their original relationships.

<Mod Wheel>

<Mod Wheel> allows you to alter the sensitivity of all modules to which the mod wheel is routed. Use it to quickly adjust a Sound to your playing style or particular application.

<Mod Wheel> will adjust all those routable modulation inputs to which the mod wheel is routed, whether they are <Control> or <Source> inputs.

All amounts affected will be scaled on a percentage basis to preserve their original relationship.

Envelope Macros take predefined envelope shapes stored in ROM and copy them to the respective envelopes of the Wave. This offers a convenient way of setting up basic envelopes reminiscent of a typical sound family. Use the appropriate FastAccess parameters or the respective individual parameters to fine tune the Macro envelopes to your liking.

Of course, only a single template can be used per envelope. Sorry, no mixing, merging or hidden hardware will ever alter that. If you need two envelopes for a single destination module, use the routable modulators.

Envelope templates will reset all parameters of an envelope including the modulation inputs.

<Volume Envelope Macros>

These Macros use specific templates for the Amplifier envelope. Of course, the destination-module of the Amplifier envelope must not necessarily be the Amplifier module; this depends on where the envelope is routed to and applied.

To copy one of the templates into the Amplifier envelope's parameters of the current main edit-active Sound:

- Select the template using the display fader <Amp. Env>.
- Press the [OK] button. Now the Wave knows that you intend to copy the selected template into the active Amplifier envelope.
- A dialog box appears, giving you the name of the template and asking for verification to copy the template.
- Press [OK] to verify, or abort by pressing [Cancel].

You can choose between the following Volume-envelope Macros:

- Click Organ
- Pipe Organ
- Strings
- Woodwind
- Orch. Brass
- Pop Brass
- Piano

- Pluck
- Long Perc
- Medium Perc
- Short Perc

<Filter Envelope Macros>

These Macros use specific templates for the Filter envelope. As with the Amplifier envelope. the destination module of the Filter envelope must not necessarily be the Filter module.

To copy one of the templates into the Filter envelope's parameters of the current main edit-active Sound:

- Select the template using the display fader <FilterEnv>.
- Pres the [OK] button. Now the Wave knows that you intend to copy the selected template into the active Filter envelope.
- A dialog box appears, giving you the name of the template and asking for verification to copy the template.
- Press [OK] to verify, or abort by pressing [Cancel].

You can choose from the following Filter envelope Macros, which correspond to the Amplifier templates, but are not identical to them:

- Click Organ
- Pipe Organ
- Strings
- Woodwind
- Orch. Brass
- Pop Brass
- Piano
- Pluck
- Long Perc
- Medium Perc
- Short Perc
- Delay Perc

<Wave Envelope Macros>

These Macros use specific templates for the Wave envelope. As with the Amplifier envelope, the destination module of the Wave envelope must not necessarily be a Wave module.

To copy one of the templates into the Wave envelope's parameters of the current main edit - active Sound:

- Select the template using the display fader <Wave Env>.
- Pres the [OK] button. Now the Wave knows that you intend to copy the selected template into the active Wave envelope.
- A dialog box appears, giving you the name of the template and asking for verification to copy the template.
- Press [OK] to verify, or abort by pressing [Cancel].

You can choose between the following Wave envelope Macros:

- Slow Attack
- Slow Decay
- ADSR
- Inverse ADSR
- Soit Valve
- Slap Back
- Wah Wah
- Single Echo
- Repeating Echo
- Long Loop

Modulation Macros

Modulation Macros take predefined modulation settings stored in ROM and copy them to the respective modulation inputs of the Wave. This offers a convenient way of setting up basic modulation effects.

There are two different Modulation Macro functions. Each one copies the corresponding ROM templates to their respective routable modulation inputs. The templates of the <Mod1 Macro> fader will be copied to the respective parameters of the corresponding sidechain-modulators, while the templates of the <Mod2 Macro> fader will alter the regular modulation-inputs.

Depending on the modulation effect, from one to all modulation inputs of the various Sound modules might be used; any used modulation-input will completely erase the previously set parameters at this input.

<Modulation 1 Macros>

Modulation 1 Macros put certain predefined effects at your disposal. They will alter a number of audio and modifier modules depending on the effect.

To copy one of the templates into the corresponding parameters of the respective modifiers for the currently main edit active Sound:

- Select the template using the display fader <Mod1Macro>.
- Press the [OK] button. Now the Wave knows that you intend to copy the selected template into the respective modifiers and sidechain modulation inputs.
- A dialog box appears, giving you the name of the template and asking for verification to copy the template.
- Press [OK] to verify, or abort by pressing [Cancel].

You can choose from the following Modulation 1 Macros:

• Mod easy Vib	LFO 2 -> Oscillator 1&2 only, use Mod wheel
• Aft easy Vib	LFO 2 -> Oscillator 1&2 only, use Aftertouch
• Mod acoust.Vib	LFO 2 -> Oscillators, Amplifier, Filter, Mod wheel
• Aft acoust.Vib	LFO 2 -> Oscillators, Amplifier, Filter, Aftertouch
• Stereo Chorus	LFO 2 -> Oscillator 2, Panning
• Vel Chorus	same as Stereo Chorus, but Velocity on <Control> inputs
• Vel Wave Vib	LFO 2 -> Wave 1 positive, Wave 2 neg, Filter (Velocity)

<Modulation 2 Macros>

Modulation 2 Macros put certain predefined modulation effects at your disposal. They will alter a number of audio- and modifier-modules depending on the chosen effect.

To copy one of the templates into the corresponding parameters of the respective modifiers for the current main edit-active Sound:

- Select the template using the display fader <Mod2Macro>.
- Press the [OK] button. Now the Wave knows that you intend to copy the selected template into the respective modifiers and regular modulation inputs.
- A dialog box appears, giving you the name of the template and asking for verification to copy the template.
- Press [OK] to verify, or abort by pressing [Cancel].

You can choose from the following Modulation 2 Macros:

- Mod easy Vib   LFO 1 -> Oscillator 1&2 only, use Mod wheel
- Aft easy Vib   LFO 1 -> Oscillator 1&2 only, use Aftertouch
- Delay easy Vib   LFO 1 -> Oscillator 1&2 only, AR Env on LFO1
- Mod acoust.Vib   LFO 1 -> Oscillators, Amplifier, Filter, Mod wheel
- Aft acoust.Vib   LFO 1 -> Oscillators, Amplifier, Filter, A-touch
- Del acoust.Vib   LFO 1 -> Oscillators, Amplifier, Filter, AR on LFO1
- Tremolo   LFO 1 -> Amplifier
- Leslie   LFO 1 -> Oscillator 1&2, Filter, Amplifier, Pan; use Mod Wheel for speed
- Auto Wah   LFO 1 -> Filter Cut and Resonance,
- Vel Auto Wah   as above, plus velocity control
- Auto Panning   LFO 1 -> Panning
- VelAuto Pan   as above, plus velocity control
- Echo   LFO 1 -> Amplifier

Wavetable Design

1.1 - 1.17 Introduction

2.1 - 2.25 Waves Menu

3.1 - 3.21 Wavetable Menu

4.1 - 4.15 Analyze Menu

5.1 - 5.3 >Listen To< Menu

6.1 Quitting

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Introduction

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This chapter provides a general introduction into the world of Waves and Wavetables - the building blocks of the Wave's sound-generation functions.

The Basic Concept

Synthesizers usually contain some basic waveforms, be they "analog" oscillator waveforms, spectrums or samples. With a little luck, additional waveforms may be loaded into the unit via a plug-in waveform card.

The Wave is *very* different in that respect. It lets you create completely new waveforms either from scratch (if you enjoy editing) or by applying some powerful macro edit functions to existing data . You can even create new waves by analyzing existing samples. In any event, you have *total* control over raw waveforms, down to a single harmonic.

The Wave was built right from the start with this open architecture in mind, offering a user interface that not only allows you to edit all of this data, but also invites you to create your own, custom timbres. Many of these functions can be accessed so quickly that you might even want to make use of them while the studio clock is ticking away.

All editing that's concerned with modifying or creating Wavetables or Waves is performed in the Wave Edit operation mode (what a surprise!). In Wave Edit, a waveform is represented simultaneously in the time domain (as a Wave) and the frequency domain (called a Spectrum), allowing you to instantly compare the harmonic content to the shape of waveform. Besides being very educational, it's fun to watch both graphs change when you move a fader.

Designing your own Wavetables may appear to be more complicated than it really is. The software will guide you and even solve a number of problems in the background to simplify the task for you. Nevertheless, it might take some time to grasp all the available features and to get a feeling for what can be done using what method. The possibilities are truly vast, and even we only had time to scratch the surface.

Waves and Wavetables

A Wavetable is your basic raw waveform building block used for designing Sounds. As you probably know by now, it consists of 64 individual Waves arranged in a specific order. This allows for timbral evolutions over time or for different keys to play different spectrums.

Whereas the *Waves* define the actual spectrums, the *Wavetable* defines their relationships. A Wavetable not only defines the order of individual Waves and hence the spectrums, it will automatically interpolate between successive Waves (if instructed to do so). This allows you to create dramatic timbral evolutions simply by defining a few spectrums, placing them in the desired positions in the Wavetable, and letting the Wavetable fill in the blanks.

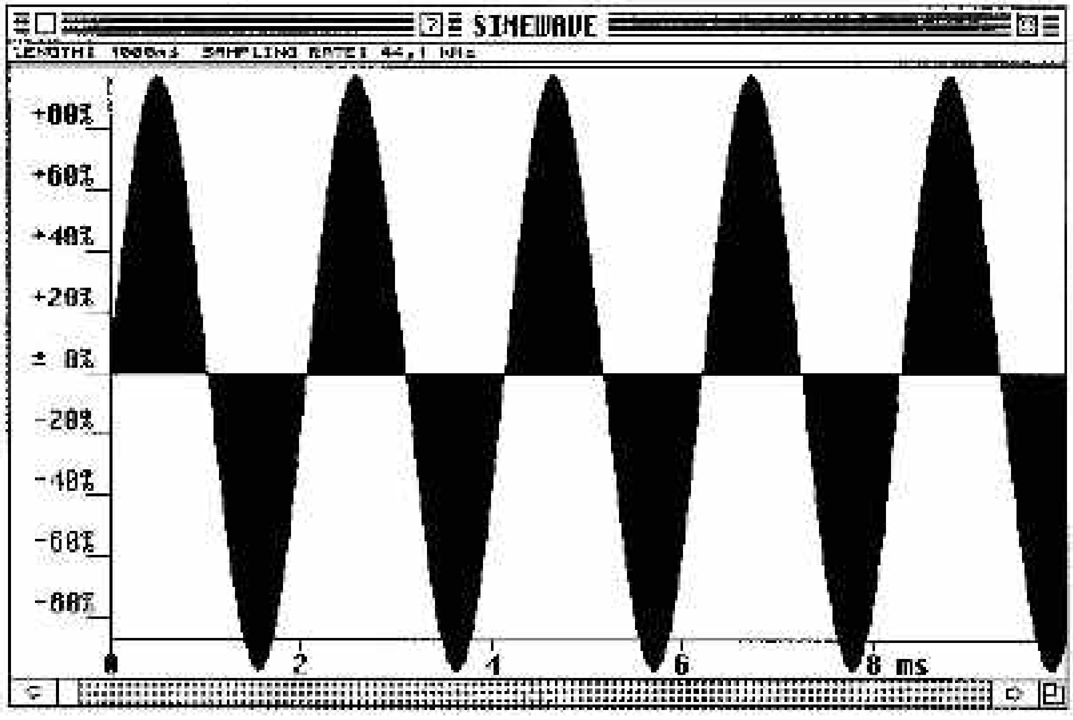
You can edit both Waves and Wavetables in Wave Edit. This allows you to precisely define single spectrums and their timbral evolution.

A single Wave can be used in as many Wavetables as you like. This way, you might, for example, create two Wavetables from analyzing a sample, and create a third that uses Waves from both of those Wavetables in order to create a hybrid or interpolated timbre. This is actually one of the strongest features of Wave Edit: Grab a few existing Waves and, in only a few minutes, arrange them into something totally new.

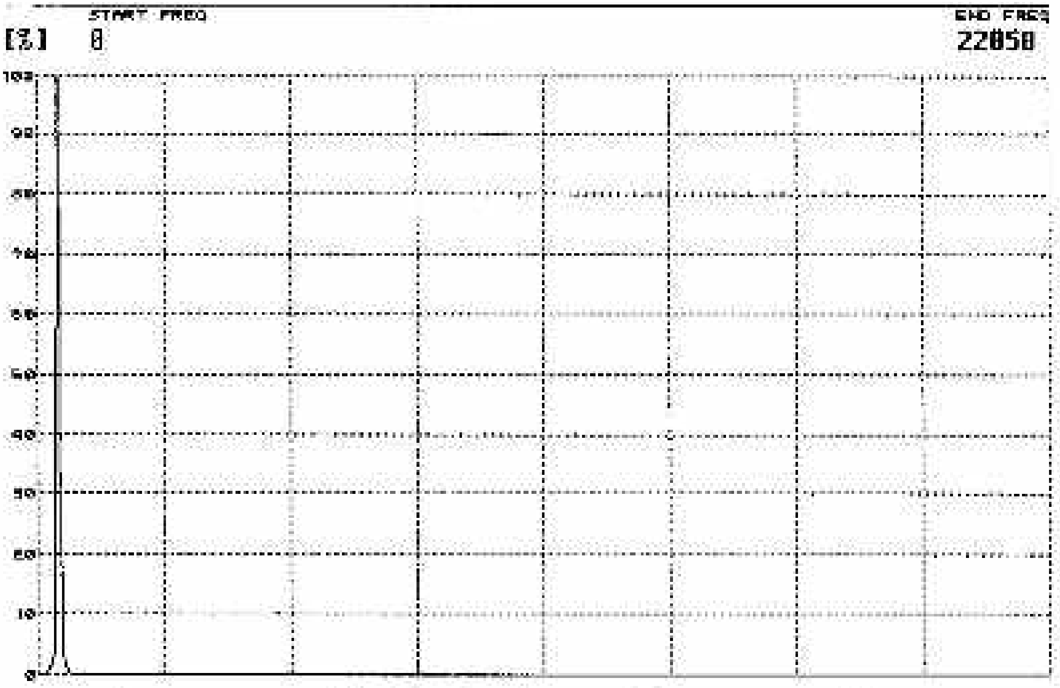
About Harmonic Spectrums

Since we speak about spectrums so much in this section, let's move a bit closer and define what exactly a spectrum is.

A spectrum is the representation of an acoustical signal (actually, of *any* signal that can be broken into sinusoidal waves, including light and radio transmissions) in the frequency domain. Most often, when you see a typical waveform, you look at its signal in the time domain. This proverbial sine wave diagram is one such example:



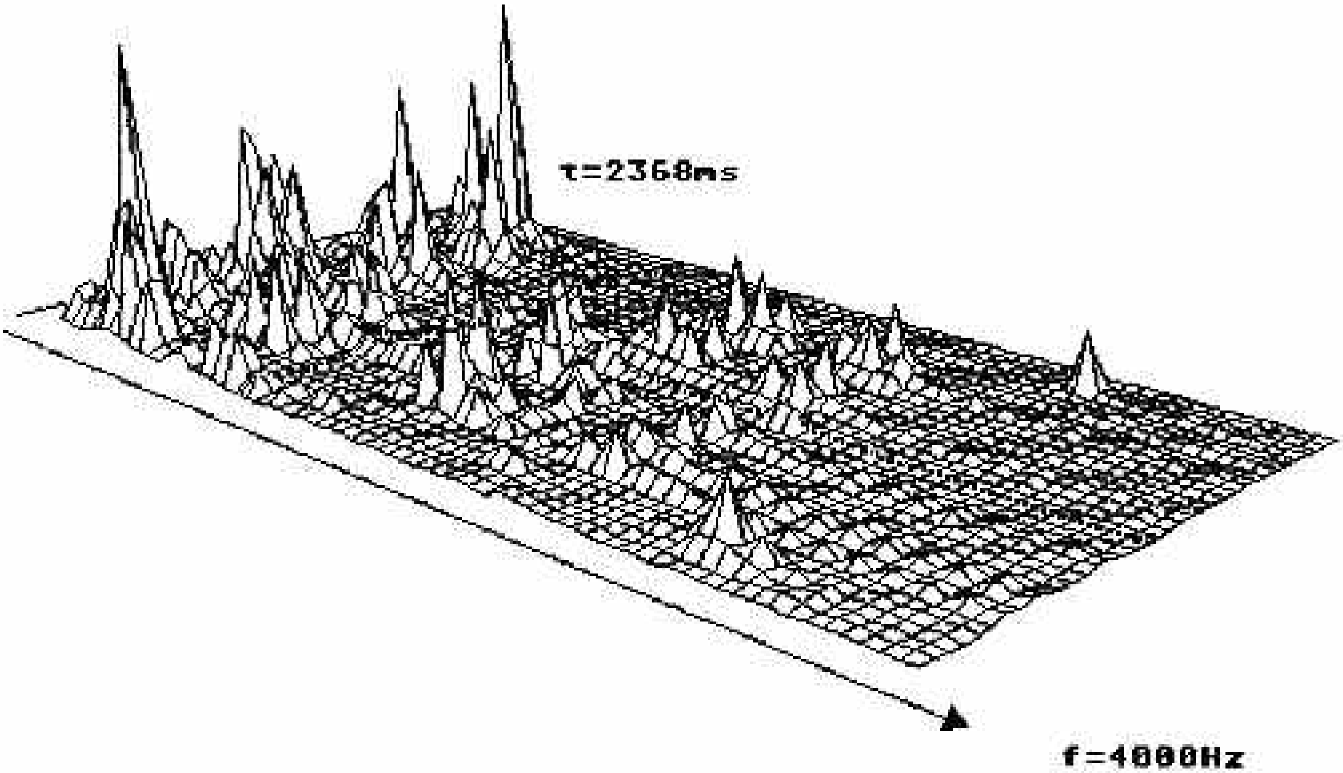
Beyond you can see how this sine wave looks when viewed in the frequency domain



Since a pure sine wave consists of a fundamental frequency with no overtones, it contains only a single frequency component.

While the time domain representation gives you a good indication of the actual shape of the waveform, it does not suggest at all how this waveform is composed. This is not a problem when looking at a sine wave; in real life, however, most acoustic signals are far more complex, containing a number of harmonics that, to complicate things even further, change over time.

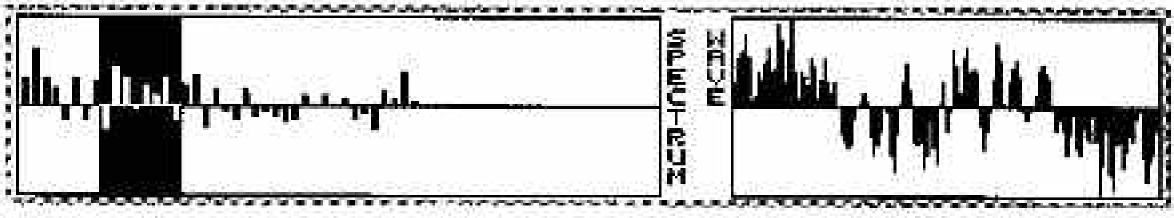
A graphic representation of the frequency domain can give you more detailed information about a signal. It allows you to see the individual sinusoidal components that make up the complex waveform, giving you information about both the frequency and amplitude of each component. Depending on the way this information is presented, the evolution over time of that specific sound can be depicted in what is called a time-variant spectrum. Usually these spectrums are analyzed by a Fast Fourier Transform or a Discrete Fourier Transform; the difference between the two being primarily computational speed.



The figure above shows a typical time-variant spectrum (one that looks markedly similar to a mountain range somewhere north of here. . .).

It consists of a number of time slices, each slice representing a static spectrum at a given point in time. Much like a digitally sampled analog signal, the time-variant spectrum consists of a number of static sampled spectrums. Each individual spectrum is a snapshot of the acoustic signal at a given time, consisting of the frequency and amplitude of the individual sinusoidal components.

This is the basic, general outlay of spectrums vs. waveforms. However, the Wave uses an even more specific form of spectrums, called *harmonic spectrums.*



These spectrums represent only harmonic signals, where the frequency of each harmonic is a whole-numbered multiple of the basic pitch of the (musical) sound. The first harmonic is called the *fundamental;* the other harmonics are known as *overtones.*

To make things musically useful and easy to control and edit, the Wave uses harmonic spectrums exclusively and automatically displays them as partials in the harmonic series. As such, the frequency of each sinusoidal component is automatically set, so you don't have to think about them. Rather, you simply change the amplitude of harmonic number *x*, much as you would adjust a graphic equalizer - only in this case, it's an equalizer that's perfectly matched to the sound's harmonic series.

So, what is *amplitude* in the context of Wave Edit? Essentially, it's what it has always been - the loudness of something. However, this amplitude is a *signed* value that can both be positive *and* negative. A negative amplitude value, however, will not attenuate the level of the harmonic, but rather add it 180 degrees out of phase. This allows us to properly analyze sampled audio and turn it into spectrums and Waves that look something like the original waveform would look in the time domain. It also offers us the ability to cancel out particular harmonics within a Wavetable over time and to make the best use of headroom when creating Waves.

By generating harmonic spectrums only, the Wave can do some tricks when playing back the spectrums, as well as when you're editing Waves or analyzing samples. On the other hand, you cannot create spectrums that contain detuned harmonics - at least not quite so easily.

You can achieve non-harmonic spectrums by creating separate Waves for each Oscillator in a Sound and detuning the second Oscillator. You could even go so far as to set up 16 separate portions of a Sound and create a Performance using eight instruments in which each Sound played two freely - tunable components of a complex non-harmonic timbre.

About the User Interface

Wave Edit could be almost regarded as a separate, specific software application that runs on the Wave. A majority of its functions are executed using the user interface hardware in the display section; most of the time you will use the faders to change values and the display buttons to select menus and functions.

Wave Edit is specifically designed with menus and display pages in mind to allow us to easily upgrade the feature set without making too many changes in the user interface section. In general, you will find that the user interface complies with the conventions used everywhere else in the Wave.

Menus

Wave Edit makes great use of menus to give you access to many functions in a concise and clear manner. As a quick reminder, menus can be operated in the following way:

- To select an entry from a menu, first press the corresponding <display> button.
- Repeatedly press the <display> button of the menu you chose to scroll through the menu entries, as indicated by the moving inverse video bar. You can only scroll downwards using this method, but when you have reached the last entry, the next button press will cycle you back to the top one.
- Use the [-/+] buttons to scroll through the menu options in either direction.
- To change the menu, simply push the corresponding <display> button of the menu you wish to select.
- When the desired menu-entry is highlighted, you can select it with the [OK] button.
- To close a menu without selecting anything, press the [Cancel] button.

Doubling the Faders with the Envelope Dials

On occasion it may be easier to use the increment dials rather than the faders to change the value of a display fader. Since the dials are not usually used in Wave Edit, we've provided a way of doubling the functions of the faders with the dials of the Wave/Free envelope section of the panel.

The advantage is that dials act in a relative update mode, adding to or subtracting from the relative value of the fader parameter, while the parameter will always jump to the value that corresponds to the current physical position of the fader if that is used. However, faders allow you to make large changes quickly. Now, in Wave Edit, you can choose the best method.

The following method works only while working in Wave Edit!

- Press the [Group Edit] button to instruct the dials to act as fader doubles.
- The top dials will double as faders 1...4, the bottom dials as faders 5...8, from left to right.
- When set to double as faders, the three envelope select LEDs will flash.

» If you have selected the <Listen To> item <Selected Sound>, the panel will function as in the regular operational modes, allowing you to edit the Sound you've selected. The function of the dials will still be determined by the [Group Edit] button: if it is activated, the dials will act as fader doubles, if it is not selected (its LED is off), you can use the dials to edit the Wave and Free envelopes.

» Group Edit is not available in Wave Edit mode.

About memory

You can store up to 64 of your own Wavetables in internal memory. To define these Wavetables, you can create a total of 1000 individual Waves. Whatever you run out of first - Waves or Wavetables - will determine the memory limit. But...

You will recall that a single Wave may be used in as many Wavetables as you like. Therefore, even if you run out of space for individual Waves, you still can come up with new Wavetables by rearranging the existing Waves. This alone can yield a variety of new and different sounding timbres.

Chances are you won't run out of Waves too quickly. If you create Wavetables that use 64 individual Waves throughout, though, you'll run out of memory relatively soon - after creating about 15 Wavetables. But in reality, you'll usually use only a couple of individual Waves and have the Wavetable create the rest via interpolation. This means that on the average you'll use about 15 Waves per Wavetable to create a full complement of 64 Waves. Additionally, you can use the same Wave in any number of Wavetables, so there are substantial options for creating Wavetables from the 1000 user Waves and ROM Waves.

And this is only the battery-backed internal memory we're talking about. Don't forget that you can load Waves from disk, giving you access to a virtually unlimited number of Wavetables.

Temporary locations for uploading Arrangements

You may remember that Arrangements will be saved with any Wavetables used by the particular Sounds in the Arrangement. To make the best of this feature, we suggest that you not store any Wavetables that you would like to have permanent access to in the last eight Wavetable locations (121 through 128).

Rather, use these locations when you create an Arrangement that uses its own Wavetables. This way, whenever you load in an Arrangement, the appropriate Wavetables will be loaded into these locations, without interfering with the ones you use most often.

The Lifecycle of Waves

When you store a Wavetable to internal memory, you will overwrite that memory location and the Wavetable that resides within it. All of the Waves used by the Wavetable that originally resided in that memory location will be regarded as unused - provided the Waves were used only by that particular Wavetable.

These Waves will not actually be deleted. Rather, they may be overwritten:

- the next time a new Wave is created and stored as a user Wave;

- when a new Wavetable is loaded into internal memory from disk or via MIDI;
- when Waves from another Wavetable have been edited and stored with that Wavetable in <Append> mode.

You may use any Wave currently residing in internal memory when creating Wavetables, even if that Wave is a "stray" Wave that's not assigned to any Wavetable. However, the next time you open Wave Edit, such a stray Wave may be gone. Therefore, if you know of an unused Wave that you wish to keep, you should immediately assign it to a Wavetable.

Please note that you need not - and never should - store individual Waves to internal memory. The Wave (the instrument) has software algorithms that will allocate a Wave to an empty Wave location. All this will be done automatically, so you never have to think about actual storage numbers or the like.

When storing Wavetables, however, be aware of the two different modes that may be used to store a particular Wavetable:

Replace Mode

All user Waves (not Wavetables!) that you have *edited* will replace the original Waves. All Waves you have newly-generated, as well as edited ROM Waves, will be put into unused memory spaces.

Should the edited Waves also be used by another Wavetable, this other Wavetable will reflect the edits made to the Waves and thus will sound different than before. However, these edited Waves do not use up additional memory space.

Append Mode

All Waves that you have edited - as well as those that are newly-generated - will be copied into new memory locations. Thus, another Wavetable using the same source Waves that you just edited will sound as it originally did, since the source Waves remain unaffected.

We strongly recommend that you use Append mode as the default, since this will be the safest way to insure that stored and retrieved Wavetables will sound as you intended. Switch to Replace mode only when:

- memory gets really tight (even then, *newly* created Wavetables will not be saved if memory is full).
- you've edited Waves of a Wavetable and are *positive* that these Waves are used in that particular Wavetable *only*.

Running Out of Internal Memory

Oops! There are times when that stupid little dialog box stands between you and your goal: You simply can't store anything - you're out of memory. Unfortunately, the internal memory of the Wave is limited. Up to 1000 user Waves can be stored, period. No amount of begging, pleading or threatening can change that. But, thanks to modern technology, there are intermediate alternatives.

Wavetables

You cannot run out of Wavetable memory. There are 64 slots available, and regardless of whether or not you use them, they are always available. You can *always* store a Wavetable to one of these slots, and the Wavetable previously residing in that location will *always* be overwritten. The idea is that (hopefully) the older Wavetable was way more boring than your enticingly fresh new one.

But what if all stored 64 user Wavetables are so good that you just don't know which one should be erased to make room for the 65th?

- Store the newly created Wavetable to floppy disk.
- Store all internal Wavetables to floppy disk (for backup).
- Find out what Sounds you need for the current production you're working on, and determine which user Wavetables these Sounds use.
- Any user Wavetable not used by the Sounds you currently need is idle and can be saved to floppy disk, then its memory location overwritten by the new Wavetable. Since you previously made a backup of the Wavetables, you can load a particular Wavetable into memory when you need it again.
- If you kept the last eight Wavetable locations as temporary buffers (as mentioned before), store the new Wavetable to one of these locations and then store the Arrangement that makes use of that new Wavetable to disk. Any time you load that Arrangement, the corresponding Wavetable will automatically be loaded into the temporary Arrangement location.

Waves

When you run out of Wave memory, you can store newly-edited Waves to disk as well. You will notice that Wave memory is used up only when you store the Wavetable you are currently working on. When you create new Waves or edit old ones, these will first be stored in edit buffers (which are *not* battery backed), so during a long and intensive session, you could actually create many more Waves than can be stored at a given time.

The following solutions are available:

- Store the edited Wavetable to disk. All accompanying Waves will be automatically stored to disk as well. This is the easiest way.
- Find one or more Wavetables in internal memory that you do not need anymore, and initialize them. That will free up the memory space that the Waves in these Wavetables occupied. Depending on the number of Waves contained in the Wavetable you want to store, you may have to initialize more than one Wavetable.
- Load the new Wavetable from disk to internal memory. If the dialog box tells you that there is not enough memory available, you must initialize another Wavetable to free up more Wave storage locations.
- If you primarily *edited* existing Waves rather than creating new ones, changing the memory mode from <Append> to <Replace> might help as well. However, if you used the original Waves you just edited in more than one Wavetable, all corresponding Wavetables will also be affected.
- If only one or two new Waves have been created but cannot be stored, you may want to delete other Waves from the Wavetable (Waves you hopefully can spare), store the Wavetable, and then insert the newly created Waves. The Wavetable should then again be stored. However, this will work only if the Waves you deleted are used exclusively in that Wavetable.

About Edit Buffers

When you edit Wavetables and Waves, you're actually working in edit buffers - as you might expect. See below for what happens to these edit buffers when storing Wavetables, selecting another Wavetable for editing or exiting Wave Edit.

Editing Waves

All Waves that you edit are put into an edit buffer, so don't be afraid to check out ideas that pop up in your mind. Just understand the following details:

- Waves can be stored to internal memory only by storing the Wavetable - you cannot store individual Waves yourself.
- However, if genius strikes, and you want to edit single Waves and keep them until you figure out exactly what to do with them, you may store individual Waves to disk for posterity.
- To store the edited Waves of a Wavetable, you must store the Wavetable itself. Depending on the selected storage mode, edited Waves will either replace the originals or be appended to the list of user Waves.

- When you edit Waves in a Wavetable, these Waves will remain in their edit buffers until you exit Wave Edit. Therefore, you still can store them (even if the Wavetable itself has already been flushed from its edit buffer), by storing the Wavetable before exiting Wave Edit. Of course, changes you made to the Wavetable itself will only be valid for as long as the Wavetable resides in an edit buffer.
- There is only one edit buffer per Wave. To check various versions of an edit, you must store the intermediate edits as <New Waves> and replace the source Wave with these new Waves in the Wavetable.

Creating New Waves

Whenever you create new Waves using either the <New Wave> button found in various parts of the <Wave> menu or by editing interpolated Waves, the new Waves will be stored when you save the Wavetable in which they are used. Therefore, when you create hundreds of <New Waves>, but use only a few in a Wavetable, all those you did not assign to a Wavetable will be cleared when exiting Wave Edit.

Still, you may save these newly-created but unused Waves to disk - but that must be done before you quit the current Wave Edit session.

Editing Wavetables

When you edit a Wavetable it will be placed into an edit buffer. However, as soon as you select a new Wavetable and call one of the topics under the <Wavetable> menu on the main page of Wave Edit, the edits of the Wavetable that you were previously working on will be lost forever.

The edits made to individual Waves in that Wavetable, though, will still be valid. Only changes made with regards to the positions of the Waves and the actual Waves used in the Wavetable will be lost when a Wavetable gets kicked out of the Wavetable edit buffer. Therefore, if you know which Waves were assigned to what positions within the Wavetable, you can manually recreate this Wavetable as long as you haven't yet quit the current Wave Edit session.

Creating new Wavetables

You only can *edit* an existing Wavetable - as opposed to actually creating a new one - so there is really nothing to tell you about this topic. Well, maybe one thing: You can *initialize* a Wavetable. There are 64 user Wavetable slots in the Wave, and all carry valid data - even if that data is simply the "Init Table" sound.

WAVETABLE DESIGN

Then again, you can use the source Wavetable you're editing as a starting point for creating something totally different. Though this "new" Wavetable would actually be a 65th Wavetable, it must still be saved to one of the 64 user locations (though not necessarily to the one used by the source Wavetable). If you do not wish to overwrite a user Wavetable, the new Wavetable may be stored to disk.

About the Undo function

Wavetable Edit allows you to manipulate data in rather intricate ways. Sometimes you will find yourself trying out a particular edit, only to discover that the *other* edit you considered was the right one for the job.

The save for those moments comes via the Undo function. Like a good computer program, the Wave lets you undo your last edit when in Wave Edit mode. This gives you the chance to retrieve your data after finding out something just does not work as intended.

How to Undo

To undo your *last edit*, simply press the **[Compare/Undo]** button in the manager section.

The item you are currently editing will revert to the state it was immediately before you executed that last edit.

You may also undo the undo - commonly called Redo. Simply press the [Compare/Undo] button once again to Redo your Undo. You then may again Undo the Redo to get back to your edited version. In essence, the [Compare/Undo] button acts as a toggle between the original and edited versions.

However, you may perform a Redo of your Undo only if you have not edited the Undo-version, since otherwise you will simply Undo this latest edit.

What to Undo

You may Undo any edit you performed in the following pages in Wave Edit:

Wavetable Menu

- All Wave menu pages/functions
- All functions of the Macro menu
- Inserting/Changing a Wave

IMPORTANT! You can only Undo an edit as long as the corresponding page is still selected. If you have changed the page or menu you cannot Undo the last edit performed, even if you have made no subsequent edits. In that respect, changing to a new page in Wave Edit is the same as performing an edit.

Undo verses Recall

Now, if you've read this manual carefully so far (and undoubtedly you have), you will notice that the Undo function seems to be very similar to the Recall function. However, there is one important difference:

- **Recall** will always copy the original version as stored in the corresponding location into the edit buffer, thus flushing all edits you have performed since executing the last Store command. This will most likely abort any edits you have done during this session, unless you have frequently stored the associated Wavetable manually.

  After having performed a Recall, there is no possible way to get back to the edited version except by manually creating it again - a task that, while being a beautiful exercise for an apprentice sound designer, will most likely be next to impossible - and rather costly in terms of hair color (more than one hair *will* turn grey).

- **Undo** will always return the Wave or Wavetable to the state it was in before you performed the most recent edit. Also, you may Redo the Undo, effectively comparing the two different versions - as long as you have not made any other edits or changed the page.

A practical example:

You select a Wavetable you wish to overwrite and analyze a sample. Thereafter you use the <Reduce> function of the <Macro> menu to delete the most redundant Waves of that newly analyzed Wavetable.

- Now, pressing **Undo** would revert the edited Wavetable back to the originally analyzed version, restoring all the Waves that were deleted by the Reduce function.

- Pressing **Recall**, on the other hand, would recall the Wavetable that was originally stored at that location and and delete the newly-analyzed Wavetable.The only way to get the new Wavetable back would be to analyze the sample again.

Some restrictions

Since we ask quite a lot from the processors and little chips of the Wave when in Wave Edit, some restrictions apply:

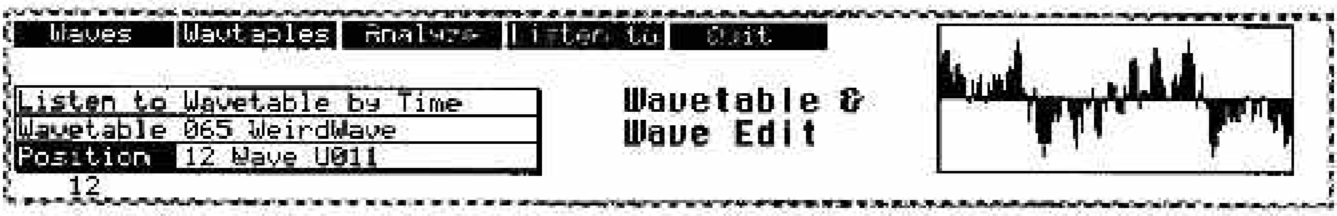
- Only one Sound can be played at a time.

- No sys-ex transfers are possible.

- Access to other modes is not possible once you entered Wave Edit mode, unless you first quit Wave Edit.

The Main Page

The main page gives you access to all the various functions of Wave Edit and displays some useful information as well. From here you can take different routes to accomplish your edits that will lead you into different areas of Wave Edit. Think of the main page of Wave Edit as the opening screen of a software application that gives you access to various windows.



Listen to Wavetable by Time
Wavetable 065 WeirdWave
Position 12 Wave U011
12

The main page allows you to:

- select the Wavetable to edit.

- select a single Wave within that Wavetable to edit.

- choose the main functions you want to perform by selecting an item from one of the menus.

It displays:

- The listening mode.
- The Wavetable you can currently edit.
- The position of the currently selected Wave in the Wavetable, plus the number of that position or the fact that it is an interpolated position.
- The waveform of the currently selected Wavetable position, whether it is an actual Wave or one created via interpolation.

Your choice of menus are:

- **<Waves>** : Allows you to perform an edit on the Wave currently selected on the main page, or to create new Waves that are not part yet of a Wavetable.
- **<Wavetable>** : Allows you to edit the currently selected Wavetable. This encompasses the editing of all individual Waves within that Wavetable as well, including the creation of new Waves.
- **<Analyze>** : Allows you to load and analyze a digital sample.
- **<Listen To>** : Allows you to define what, how and in which way you can audition your edits.
- **<Quit>** : Lets you exit Wave Edit.

This section of the manual follows closely these menus as they appear on the main page.

Selecting a Wavetable

You must select the Wavetable you wish to edit or "create" at the main page. If you intend to edit specific Waves in a Wavetable, you should select the Wavetable in which those Waves are used in order to have easy access to them. You can always assign *any* Wave to a Wavetable in the <Wavetable Edit> menu, but that requires knowing the right number of the right Wave - something even we tend to forget.

If you want to create a new Wavetable, you must start from an existing one. This, of course, could be a Wavetable that is of no use anymore or one that is initialized. You can initialize any Wavetable, see below for details. The Wavetable you use to create a new Wavetable must not necessarily be the one in which you ultimately store your edits. You can store an edited or newly-created Wavetable to any of the 64 user Wavetable locations.

To select the Wavetable to edit:

- Select the main page of Wave Edit.
- Select the Wavetable to edit using the [Wavetable] dial (you know, that big red plastic thing).

Only one Wavetable can be edited at a time in Wave Edit. You can, however, select as many Wavetables as you like consecutively. Please be aware of the status of the various edit buffers, though, so as to not inadvertently delete important data.

Creating a Wavetable from Scratch

There are various ways you can create a completely new Wavetable, so the route indicated here is only one possible way of traveling to Rome (or is that RAM?).

In any event, creating a Wavetable from scratch still means actually reprogramming one of the existing 64 user Wavetables - even if only temporarily, as when you store the new Wavetable *only* to disk, and not to internal memory.

- Find a user-Wavetable to spare and initialize it.
- Select the <Edit Wavetable> entry from the <Wavetable> menu on the main page.
- Even an initialized Wavetable will not be empty (for internal reasons), so don't be concerned about the two Waves in positions 1 and 61.
- Select the <Waves> menu from within the <Edit Wavetable> window.
- Select whichever function you prefer for creating Waves.
- Each time you create a single Wave that you find interesting, press the <New Wave> button on that page to store the current spectrum as a Wave.
- Go back to the <Edit Wavetable> window to compile and arrange the various new Waves, thus creating a new Wavetable.

Exiting Wave Edit Mode

As mentioned before, Wave Edit mode is a very special mode, akin to a specific application program that you run on the Wave (and it comes free with your unit!). The program initializes certain parameters and functions of the Wave and also allocates *a lot* of the internal working memory.

Therefore, you must actually quit Wave Edit, to allow the Wave to restore its memory and normal operating functions.

- Select the main display page of Wave Edit.
- Press the <Quit> button located on that page.
- A dialog box will warn you that you will loose all unsaved edits when quitting.
- Press the [OK] button to return to the regular operation modes of the Wave.
- If you want to save edits made in Wave Edit or simply don't feel like you've tweaked enough harmonics yet, press the [Cancel] button to remain in Wave Edit.

When you quit Wave Edit, **all unsaved data** that was generated or edited in Wave Edit will definitely be lost, so handle the [Cancel] button with care.

Waves Menu

WAVETABLE DESIGN

waldorf

This chapter describes the various functions that are used to generate or modify individual Waves in a Wavetable. You'll find all these functions in the <Wave> menu on the main page of the Wave Edit mode and in a menu of the same name in <Edit Wavetable>.

Wave Memory Status

Waves can reside in various portions of internal memory. The memory status is indicated to you by the letter that precedes the number of any particular Wave. It is important to know the memory status of a Wave to not only find the Wave you're looking for, but also to determine whether or not a particular Wave/Wavetable combination needs to be stored after editing.

The following indications of memory status are currently in use:

- **R**: All factory Waves of the internal ROM will be preceded by this letter. You cannot delete or overwrite these Waves; you can, however, edit them, after which they can be stored as a user Wave.
- **U**: All user-generated *and stored* Waves that reside in internal battery-backed memory will be preceded by this letter. In general, these Waves will be used by one or more user Wavetables; however, it might be possible that they are "stray" Waves without a home, their parent Wavetable having discarded them. (As you can see, sad stories exist even in musical electronics.) Anyway, such a Wave is liable to be deleted and replaced soon. Alternately, you can use it in a new Wavetable, thereby giving it a new home and a happy future, sparing it from becoming bad data lost in alien silicon.
- **X**: After analyzing a sample, all extracted spectrums will be stored as Waves preceded by the letter X, with a total of 64 such Waves comprising one extracted Wavetable. At any given time, only one extracted (and not-yet-stored) Wavetable can exist, and as such, a maximum of 64 X-Waves are available. All X-Waves are automatically assigned to the corresponding Wavetable that's created when you analyze a sample.

  Waves created by the Formant Synthesis function of the <Wavetable> menu will also show the "X" memory status.

  Attention! All X-Waves will be discarded when you exit Wave Edit or when another sample analysis is performed. Therefore, if you want to keep the current set of Waves, you must store them (by storing the corresponding parent Wavetable) before either quitting or analyzing another sample

WAVETABLE DESIGN

- **N**: All Waves you create using any function in the <Waves> menu, whether from the main page or from within <Edit Wavetable>, will be temporarily stored in an edit buffer. These waves are indicated by the letter N preceding them. No such Wave will be used by any Wavetable when it is created; you must manually assign the Waves in <Edit Wavetable>.

  Additionally, all user-edited interpolated positions within a Wavetable will be N Waves until that Wavetable is stored. N-Waves created this way, however, will automatically be placed at their respective positions in the Wavetable.

  Attention! All N-Waves will be discarded when you exit Wave Edit. Therefore, when you want to keep the respective Waves, you must store them before quitting by first assigning them to a parent Wavetable and storing that Wavetable.

New Wave

It used to be a musical style, and now it's a button. Will wonders never cease?

Each function page of the <Waves> menu contains this button. It allows you to store the *current* spectrum in an edit buffer as a temporary Wave. This Wave then can be used as would any other Wave to build Wavetables.

However, new Waves will be discarded when you quit Wave Edit *unless* they were stored with a Wavetable. At that point they will be converted to regular user Waves, which results in their being renumbered and their memory status changed from the volatile "N" to a more comfortable battery-backed "U".

- After having set a spectrum you like, press the <New Wave> button to temporarily store the spectrum.
- This Wave will be stored with a preceding **N**. The number corresponds to the number of new Waves that were created during this particular session of Wave Edit, with the first new Wave labeled **N000**, the next **N001** and so on.
- To use this new Wave, you must manually assign it to a Wavetable.
- Upon quitting, *all* N-Waves will be flushed.

Clip Modes

No, this has nothing to do with office supplies, but rather with the problem of digital systems having a finite limit as to how much gain they can tolerate before hard clipping occurs - a phenomenon owners of DAT recorders are likely all-too-familiar with.

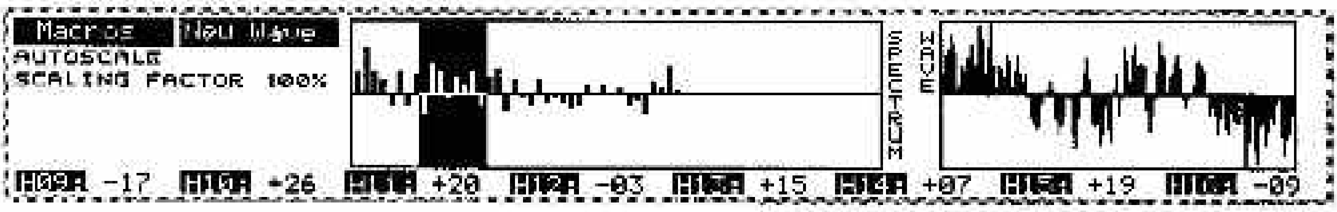
A Wave is very similar to a regular digital recording, since it is represented by a finite number of bits and a specific sampling rate. As in any digital system, you want to get the best signal-to-noise ratio for any given Wave, so most likely you'll want to keep the Waves at their highest gain (though this may not always be the case, such as when creating Wavetables with internal dynamics).

When you add 64 harmonics together to create a new spectrum, there is the potential for lots of gain, since the amplitude value of each harmonic will be added to the existing spectrum. When the sum of all harmonics exceeds the Wave's maximum amplitude tolerance, digital distortion will occur.

Contrary to the normal experience when recording in a digital medium, this distortion can be quite interesting when applied to a Wave, since it will produce new harmonics. Due to the format Waves are stored in, these distortions actually produce only harmonic distortions, yielding another harmonic spectrum that can be represented by a Wave. As such, we prefer the term *clipping* over distortion.

Rather than only giving you one way to work, we offer different options for handling clipping - and in which way clipping will affect the spectrum. By all means, try all of these clipping modes, since they yield new and interesting timbres, often with a minimum amount of editing.

• Autoscale



Macros | New Wave

AUTOSCALE

SCALING FACTOR 100%

H09A -17 H10A +26 H11A +20 H12A -03 H13A +15 H14A +07 H15A +19 H16A -09

Autoscale is the default clip mode used when editing Waves. It will automatically scale the amplitude of the Wave you edit to its maximum, without ever introducing clipping. This always results in a perfect full-code Wave with the best possible signal-to-noise ratio.

While autoscale usually uses 100% as the maximum reference, this is not necessarily true when using the Wave function <Harmonic Edit>. Here, the autoscale value is derived from the original maximum level of the stored Wave, which could be less than 100%. This is most often the case when editing analyzed Waves.

The actual maximum autoscale level is noted under the clip-mode reference in <Harmonic Edit>.

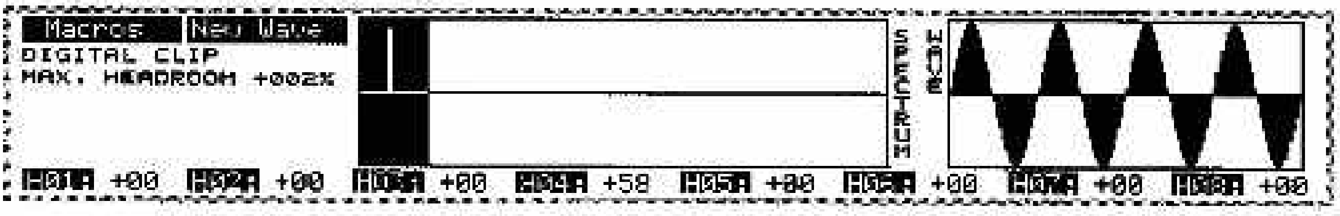
However, you always can amplify a below-scale Wave up to the maximum 100% level by using the <Normalize!> or <Scale> macros.

You should become familiar with the working of the autoscale mode, since some aspects will behave differently than you might expect. For example:

- When using only a single harmonic to generate a spectrum, you will hear no changes in loudness, regardless of the amplitude you assign to that harmonic. Since autoscale always creates a full-code Wave, you'll hear changes while in autoscale mode only when using more than one harmonic.
- When increasing the amplitude of a single harmonic, part of the spectrum might seem to decrease in volume, depending on the relative balances and phase characteristics of the harmonics. Remember that autoscale has to adjust the entire spectrum to compensate for the additional gain of the new harmonic. This is especially true when there are only two low harmonics, in which case one may seem to fade out while the other fades in. This happens because autoscale must balance the two harmonics while keeping the sum of both amplitudes constant. Especially when you introduce high harmonics, do not forget to use negative amplitudes (which change the harmonic's phase by 180 degrees) as well as positive amplitudes, since this allows you to distribute the peaks and dips of the waveform in a more uniform manner.
- When decreasing the amplitude of a harmonic, the remaining spectrum might seem to increase in volume - especially when decreasing low harmonics. This again can be explained as above, only in reverse.
- Sometimes when editing a Wave that apparently contains no signal, adding a low amplitude harmonic results in a sound that contains prominent high harmonics. This can happen when changing clip modes, or when certain functions have been executed in which the amplitude of every harmonic has been set to nearly zero. When the new harmonic is added, the Wave is recalculated, and the Autoscale function amplifies those near-zero amplitudes to full code, thus making their presence known in no uncertain terms.This rarely happens, but when it does, you'll be glad you know why it did...

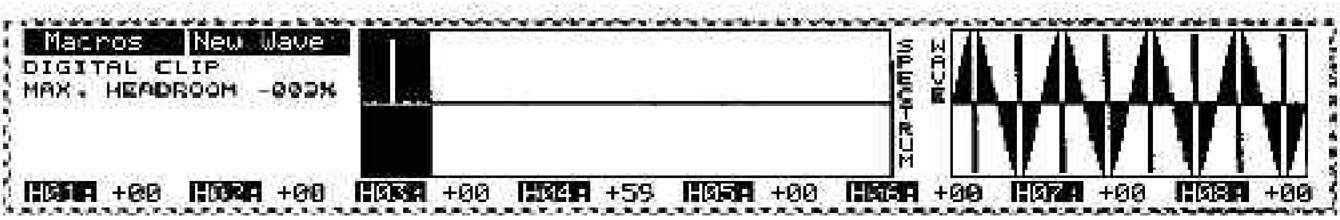
• Digital Clip

This mode introduces clipping in the same manner as digital equipment distorts when too much gain is applied - and yes, it is awful sounding, especially when the signal used to be your favorite grand piano sound. But with Waves, clipping usually results in excessively bright and "digital" sounding spectrums. Use two low harmonics and get the "instant Clavinet".



Macros New Wave
DIGITAL CLIP
MAX. HEADROOM +002%

H01A +00 H02A +00 H03A +00 H04A +58 H05A +00 H06A +00 H07A +00 H08A +00



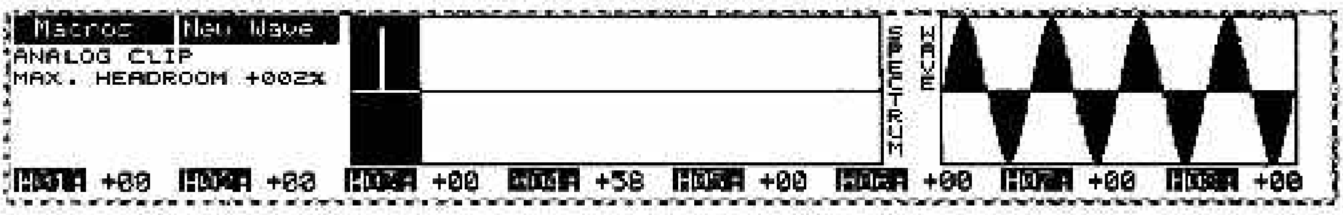
DIGITAL CLIP
MAX. HEADROOM -003%

H01A +00 H02A +00 H03A +00 H04A +59 H05A +00 H06A +00 H07A +00 H08A +00

In digital clip mode, the clipped portions of the signal will appear at the opposite limit; technically, no overflow correction takes place, so the digital numbers "fold over" (yes, yet some other form of aliasing). This results in additional high harmonics due to the steep slope of the "perfect" digital pulse introduced. As you can see in the above illustrations, only a single increment of that single amplitude will clip the waveform, showing the typical added pulse-waveform. The resulting sound will be *radically* different from the original.

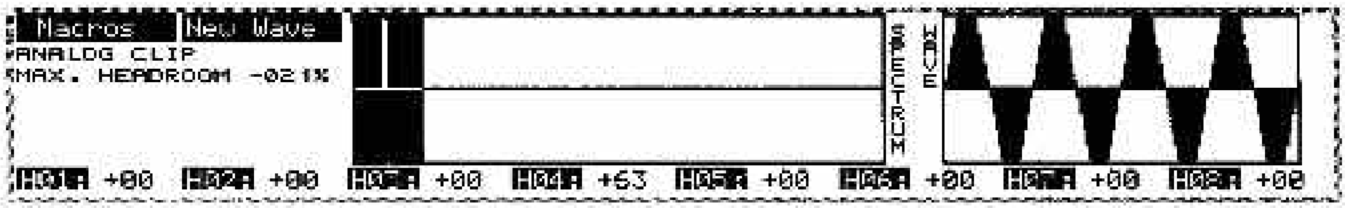
• Analog Clip

Clipping in the analog world is quite different from its digital counterpart, and this behavior is simulated when you apply the analog clip mode.



ANALOG CLIP
MAX. HEADROOM +002%

H01A +00 H02A +00 H03A +00 H04A +58 H05A +00 H06A +00 H07A +00 H08A +00



ANALOG CLIP
MAX. HEADROOM -021%

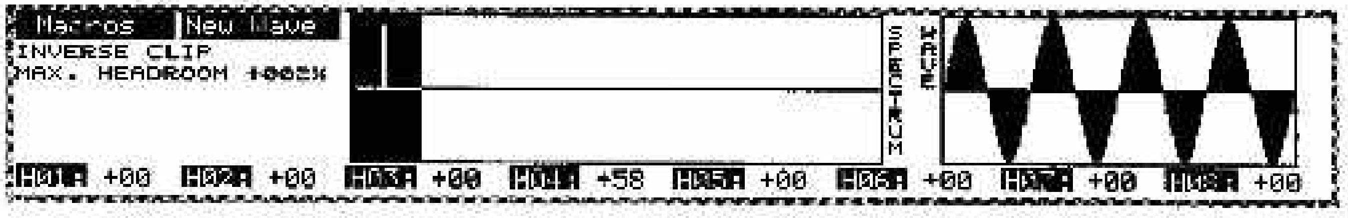
H01A +00 H02A +00 H03A +00 H04A +63 H05A +00 H06A +00 H07A +00 H08A +00

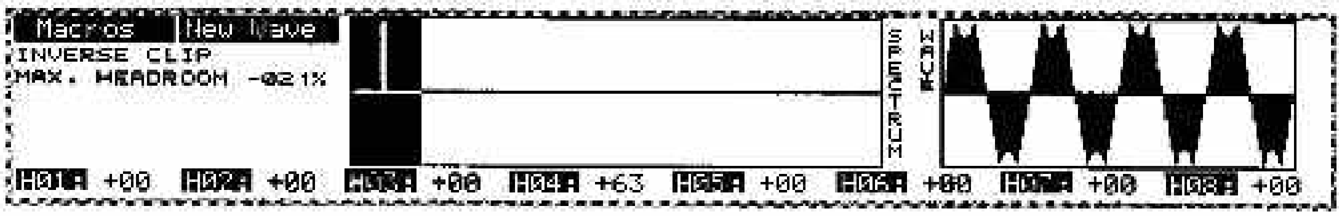
In analog clipping, the clipped signal does not fold over, but is rather chopped off above the upper limit of the waveform. The resulting changes will also introduce pulse-like components, since there is now a sharp slope at the upper edge of the waveform, though these changes are much smoother and more gradual than in Digital Clipmode. Eventually, when the entire signal will be clipped and thus chopped off, a very square-like waveform will result.

• Inverse Clip

Inverse clipping is for the advanced audio engineer who has every gizmo at hand and who recently discarded chemical substances in order to broaden his or her horizons (just the opposite of the old days when engineers took extra chemicals in order to get "groovy" sounds).

Well, inverse clip mode is actually a unique type of clipping available only in the Wave. It is in some ways a mixture of analog and digital clipping. The resultant sound will change gradually and smoothly when you change the amplitudes of the harmonics, but more and different harmonics will be produced than would be the case using analog clipping.


Macros New Wave
INVERSE CLIP
MAX. HEADROOM +002%
H01A +00 H02A +00 H03A +00 H04A +58 H05A +00 H06A +00 H07A +00 H08A +00


Macros New Wave
INVERSE CLIP
MAX. HEADROOM -021%
H01A +00 H02A +00 H03A +00 H04A +63 H05A +00 H06A +00 H07A +00 H08A +00

In inverse clipping the clipped signal will be mirrored at the upper or lower border of the waveform. It then will fold back into the waveform, forming rounded slopes and rounded spikes at the same time. The resultant effect is somewhat similar to waveshaping, yet here it will always yield harmonic spectrums.

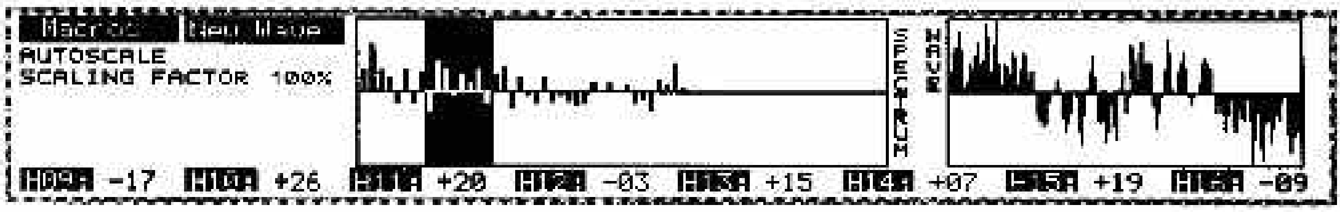
Harmonic Edit

Basic Concept

Harmonic Edit affords you precise control over the amplitude of each individual harmonic in a given spectrum. Depending on what you do, you may execute delicate, precise edits or create dramatic changes.

Harmonic Edit is designed to allow you to edit Waves with a great degree of precision. Fine tuning is really the main thrust of this Wave Edit mode. At the same time, though, you can create a timbre from scratch simply by adjusting the amplitudes of the harmonics. A host of macro-functions further enable you to enhance existing Waves or to create new ones that are based on existing spectrums.

You should definitely check out the various clip modes that are available on this page since they offer an enormous number of timbral possibilities simply by changing a few parameters. The *inverse* clip mode especially allows you to quickly, yet intuitively, achieve new and interesting results. *Autoscale* mode, on the other hand, should be your choice when you want to fine-tune harmonics, or when you input a harmonic spectrum that you derived from an outside analysis or from a textbook on acoustics.



On the display page you can view the harmonic spectrum (frequency domain) and the Wave (time domain) simultaneously, and you can see those graphs change as you edit the amplitudes of the spectrum components. You can hear any changes you do in real time, although occasional pops or clicks cannot be avoided due to the enormous processor load. You have access to the first 64 harmonics of the spectrum.

In the top left corner of the display you'll find the currently selected clip mode. For clip modes other than Autoscale, the remaining headroom is also indicated. If the headroom displayed is negative, clipping occurs, and you can see and hear the waveform changing much more radically than when there is no clipping.

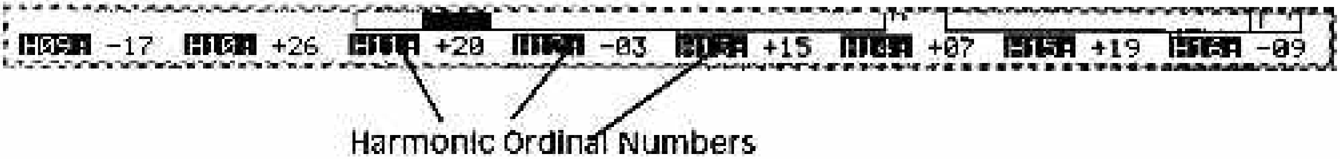
The faders allow you to adjust the amplitudes of the harmonics, while the leftmost display button gives you access to all macro functions and clip modes. The <New Wave> button allows you to generate new Waves, as described earlier.

Editing the Harmonics

Range: -64...0...+63

This is as easy as using a graphic equalizer, only here you are adjusting harmonics rather than frequency bands. Doing is believing, so go ahead and edit as you please. You have access to eight harmonics at a time.

- Select the group of harmonics you wish to edit by selecting them with the [page] buttons. The selected group will be displayed in inverse video.

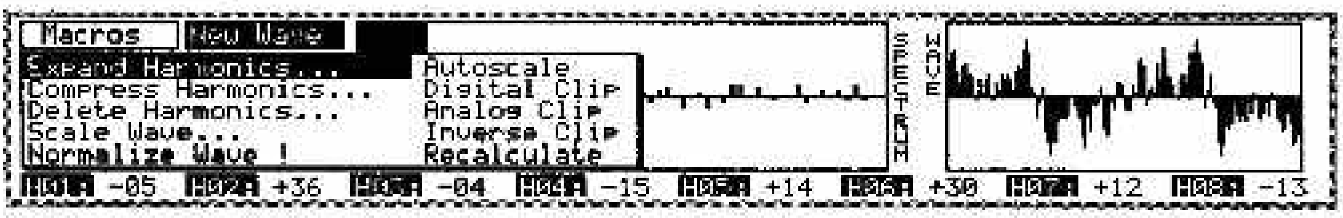


- The <faders> adjust the amplitudes of the respective harmonics. The fader label shows you both the harmonic's ordinal number and the corresponding amplitude.
- Since the amplitude of a harmonic can be positive or negative, you will achieve zero-amplitude (muting the harmonic) by setting the fader to its center position.

- Positive amplitudes ("in phase") are programmed by moving the fader further toward the display.

- Negative amplitudes ("out-of-phase") are programmed by moving the fader away from the display.

Macro Menu



You will find all other functions - except for the <New Wave> function - under this menu. All macros will display a dialog box when executed, asking you to acknowledge or abandon the desired function, and, where applicable, giving you the option of setting certain parameters for executing that specific macro.

- Press the [OK] button to execute the macro you've selected.

- Press the [Cancel] button to abandon the macro.

You will also find the four clip modes under this button. They will be in effect as soon as you select them with the [OK] button.

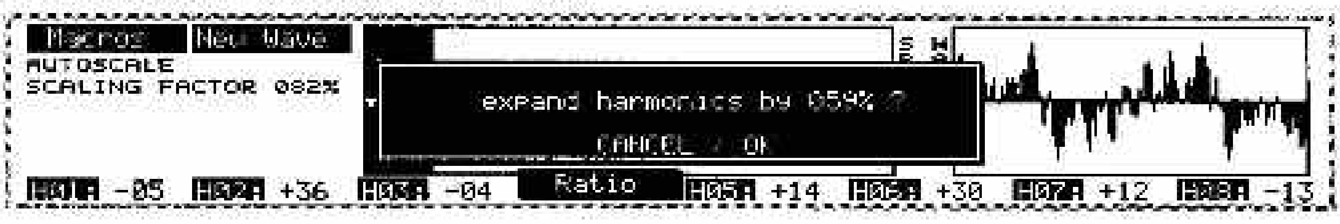
<Expand Harmonics>

This macro function allows you to expand the harmonics of the currently selected spectrum. As a result, the more prominent harmonics will become even more pronounced, while the soft harmonics will become even softer.

Use this macro to make the loud harmonics in a spectrum more pronounced. The resultant sound will usually have more frequency peaks and be less smooth harmonically.

Remember, this macro works in the frequency domain on the amplitudes of the various harmonics, not on the time domain waveform. The effect will therefore not be a change in loudness, but in timbre.

This function can be undone by pressing the [Compare/Undo] button so long as no additional edits have been performed.


AUTOSCALE
SCALING FACTOR 082%

expand harmonics by 059% ?

- **<Ratio>**

Range: 0...100%

Sets the expansion ratio.

- *0* will have no effect. The signal will not be changed.
- *100* will expand the spectrum as much as possible, making strong harmonics very pronounced, thus making the resultant spectrum rather hollow sounding.

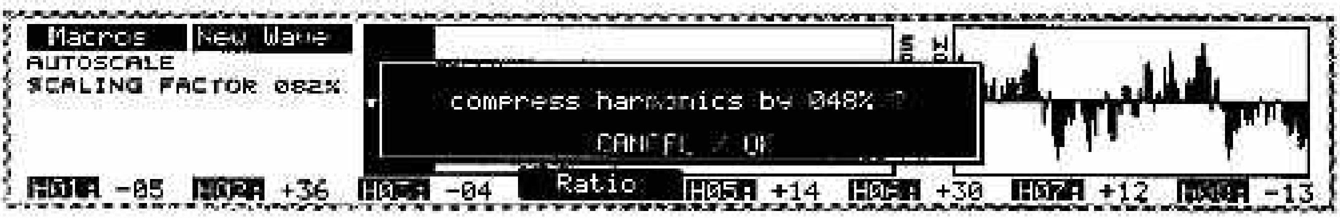
<Compress Harmonics>

This macro function is the twin brother of the previous one, only "out-of-phase," so to say. It will compress the harmonics of the given spectrum. As a result, the most prominent harmonics will be softened, whereas the softer harmonics will become louder.

This usually leads to a more uniform, thicker and smoother sound.

Once again, remember that this macro works in the frequency domain on the amplitudes of the various harmonics, not on the time domain waveform. The effect will therefore not be a change in loudness, but in timbre.

This function can be undone by pressing the [Compare/Undo] button so long as no additional edits have been performed.



Macros New Wave
AUTOSCALE
SCALING FACTOR 082%

compress harmonics by 048% ?
CANCEL / OK

H01A -05 H02A +36 H03A -04 Ratio H05A +14 H06A +30 H07A +12 H08A -13

- **<Ratio>**

Range: 0...100%

Sets the compression ratio.

- *0%* will have no effect. The signal will not be changed.
- *100%* will compress the spectrum as much as possible, making strong harmonics very soft, thus making the resultant spectrum smoother sounding.

<Delete Harmonics>

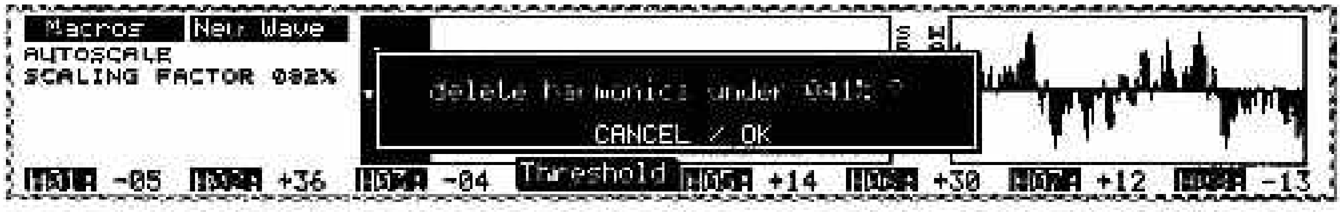
This macro will set to *0* all harmonics whose amplitudes are at or below the programmed Threshold level, effectively eliminating them from the spectrum.

Use this macro to clear a generated or analyzed spectrum of the low-level noise that may be adding some unwanted coloration. To do this, use percentages below *10%*.

You could also radically change the sound, making it very hollow and introducing pronounced peaks, by applying a rather large threshold value.

Use a threshold of *100%* to clear the Wave.

This function can be undone by pressing the [Compare/Undo] button so long as no additional edits have been performed.



Macros New Wave
AUTOSCALE
SCALING FACTOR 082%

delete harmonics under 041% ?
CANCEL / OK

H01A -05 H02A +36 H03A -04 Threshold H05A +14 H06A +30 H07A +12 H08A -13

• <Threshold>

Range: 0...100%

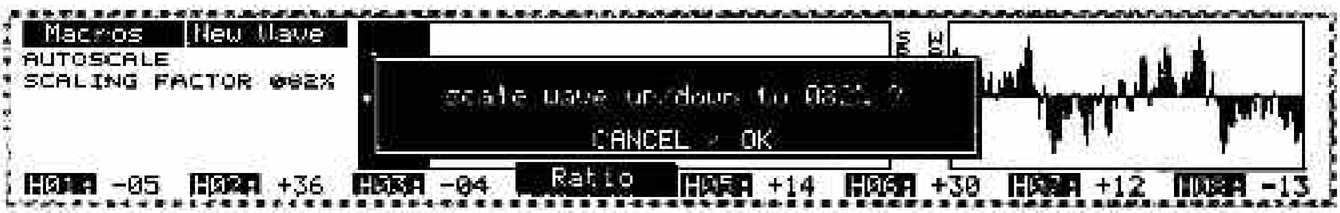
Those harmonics whose amplitude is equal to or smaller than the programmed [Threshold] will be deleted.

- *0* will have no effect. No harmonics will be deleted.
- *100* will effectively clear the entire spectrum, since this is the maximum amplitude of any harmonic.

<Scale Wave>

This macro allows you to adjust the loudness of the Wave. It works in the time domain as opposed to the frequency domain, as explained above.

☞ <Scale Wave> *will* have an effect when editing a Wave in the *Autoscale* clip mode. The <Ratio> of the applied scaling function will become the maximum amplitude of the Wave and thus the new Autoscale limit.


AUTOSCALE
SCALING FACTOR 082%

scale wave up/down to 082% ?
CANCEL / OK

- **<Ratio>**

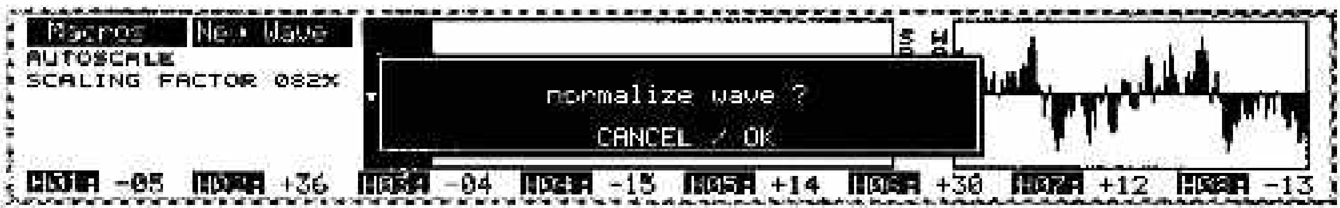
Range: 0...100%

Sets the loudness of the Wave.

- *0%* will effectively delete the entire Wave. Note that this behavior is exactly the opposite of the <Delete Harmonics> macro in the frequency domain.
- *100%* will scale the Wave to play back at full code, the maximum possible level. Sorry, no time domain distortion is available (which would inevitably lead to another harmonic spectrum anyway, and that's easier to control in the frequency domain).

<Normalize Wave !>

This function will automatically increase the gain of the Wave to the maximum possible level, yielding a Wave that plays back at full code. It also works in the time domain and has the same effect as using the <Scale Wave> macro with a <Ratio> of *100%*.


AUTOSCALE
SCALING FACTOR 082%

normalize wave ?
CANCEL / OK

There are no other parameters to adjust.

Clip Modes

In the second column of the macro menu you will find the four clip modes

- **<Autoscale>**
- **<Digital Clip>**
- **<Analog Clip>**
- **<Inverse Clip>**

Please refer to chapter 2.2, "Clip Modes", for a detailed explanation of these modes.

<Recalculate!>

When using clip modes other than *Autoscale*, you will effectively alter the harmonic content of the Wave as it is clipped. While you can actually hear that change, it will not yet be reflected in the amplitudes of the spectrum, giving you the option of reverting the clipped sound back to its original state, even after having changed the amplitude of more than one harmonic.

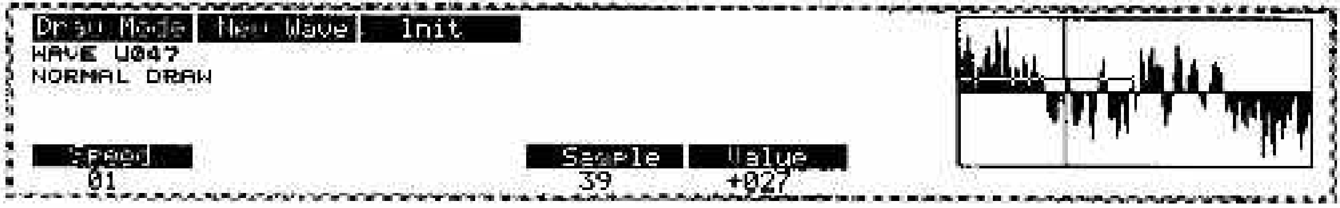
If, on the other hand, you want to make the current setting permanent, you should use the <Recalculate!> macro. It will update the amplitude spectrum to what you are actually hearing. You then might, for example, try additional clipping, perhaps with a different mode or other harmonics.

However, once you have invoked the <Recalculate!> macro, chances are very good that you will never be able to get back to the original spectrum (unless it was a single sine wave, which is always easy to reproduce), since a host of new harmonics will now possibly be displayed and be part of every edit you do from now on.There are no other parameters to adjust.

Graphic Edit

Basic Concept

Graphic Edit allows you to draw a waveform for use as a Wave.



WAVE U047
NORMAL DRAW

Speed 01

Sample 39

Value +027

Graphic Edit processes data entirely in the time domain, so all you see is the actual waveform of the Wave, not the corresponding spectrum. To see the spectrum, you must switch from Graphic Edit to Harmonic Edit.

There are four methods, called *Draw Modes*, for inputting data in Graphic Edit:

- Normal Draw
- Auto Draw
- Polynomial Point Mode
- Linear Point Mode

Each of these modes has its assets, and you should familiarize yourself with them to get the most mileage out of the options.

The basic layout of Graphic Edit is the same for all draw modes. Two faders (numbers four and five) are used to input the data, depending on the draw mode you choose under the <Draw Mode> menu. Depending on the draw mode, additional buttons or faders might become active.

The various clip modes can be selected at the <Draw Mode> menu. They will, however, be active *only* in the <Polynomial Point> draw mode, since you cannot draw a Sample value beyond the outer limits of the waveform.

Please note that you can listen to the new waveform **as you draw it**. This is especially useful when editing existing Waves, because you can immediately hear to the differences while drawing changes in the waveform.

Initializing a Wave

You may either edit an existing Wave to put some additional artistic touches into it, or you may create a totally new waveform. The latter is especially true in Autodraw and Breakpoint modes.

To start from scratch, you should first initialize the Wave. This is very easily done:

- Push the <Init> display button.

Presto. You're listening to a true null Wave.

<Draw Mode> Menu

This menu lets you choose the draw mode you desire. For details, please see the explanations below under their respective topics.

You can also choose the desired clip mode in this menu. However, be aware that the various clip modes are available only in the draw mode <Polynomial Point Mode> .

<Normal Draw>

This is about as straightforward as possible. Use it to modify an existing Wave or to create new Waves that should sound very buzzy (by drawing only a few spikes in the waveform).

- **<Sample>**

Select the sample in the waveform whose value you want to edit or set with the <Sample> fader.

- **<Value>**

Set the value for the sample using the <Value> fader. You can set samples both above or below the zero axis.

You can audition the changing timbre while you edit the sample's value.

➪ Clip modes are not available in <Normal Draw> mode.

<Auto Draw>

<Auto Draw> lets you "paint" a waveform simply by moving the <Value> fader while the sample position automatically advances at the programmed speed. Ever wanted to know if you can draw a perfect sine wave? Here you can try it - and you'll likely achieve a much more interesting sounding result.

- **<Speed>**

This fader sets the speed at which the sample position will be automatically incremented. You may change the fader, and thus the speed, as you draw.

- **<Start>**

Press this button to start the auto draw process. The first sample will be the first to be redrawn.

- **<Stop>**

Use this button to stop the auto draw process.

- **<Sample>**

You may use this fader during the auto draw process to change the sample position. Unless you have stopped the auto draw process, the Wave will redraw according to the value you set with the <Sample> fader. You could use this function, for instance, to create stepped waveforms.

- **<Value>**

This is the "brush" that you use to draw the waveform. Both positive and negative sample values can be created.

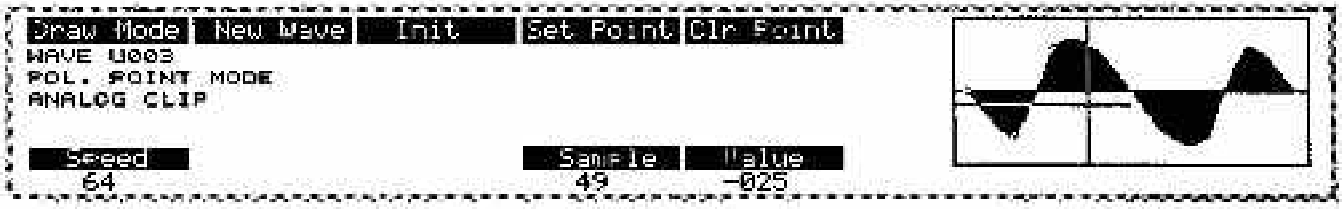
➪ As mentioned before, clip modes are not available in <Normal Draw> mode.

<Polynomial Point Mode>

This draw mode will automatically generate a waveform based on a number of breakpoints. The processor will automatically interpolate between these breakpoints, producing a new waveshape.

This type of interpolation is called *polynomial interpolation*. It will yield "rounded" shapes, that resemble a natural spectrum more closer than a linearly interpolated waveform. At any rate, you should try various breakpoints and, especially, various clip modes along the way.

The basic procedure would be to set particular breakpoints. The Wave will automatically interpolate between the last point set and the next one, giving you instantaneous feedback about what the Wave you created sounds like. Go ahead and set additional breakpoints to further change the waveform. You may also delete a breakpoint to see how that might affect the waveshape.



```
WAVE U003
POL. POINT MODE
ANALOG CLIP

Speed                       Sample   Value
 64                          49      -025
```

As you can see in the above figure, breakpoints are displayed with a small cross symbol. The resulting waveshape is displayed as usual.

- **<Sample>**

Use this fader to select the sample position where you wish to set a breakpoint.

- **<Value>**

Set the value for the breakpoint as defined by the <Sample> fader; the resulting waveshape will have this value at the selected position. The positions between this point, the previous one and the succeeding point will be calculated automatically by the processor using polynomial interpolation.

• <Set Point>

After you set both the sample position with the <Sample> fader and its corresponding <Value>, press this button to actually define the breakpoint and to create the interpolations as described above.

• <Clear Point>

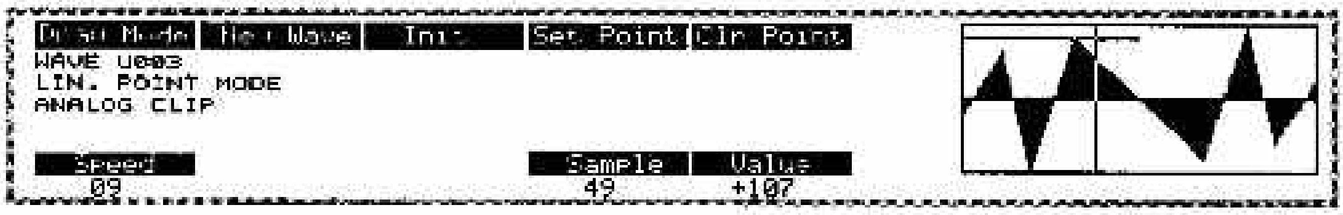
You may delete a breakpoint. To do so,

- Select the breakpoint to delete using the <Sample> fader; hit the sample at that point as closely as possible. Breakpoints are indicated by a cross symbol.
- Press the <Clear Point> button.

⇨ The setting of the <Value> fader is irrelevant when deleting a breakpoint.

<Linear Point Mode>

The handling of Linear Point Mode Is exatly the same as for <Polynomial Point Mode>.The only difference is that it uses linear interpolation instead of polynomial Interpolation.



WAVE U003
LIN. POINT MODE
ANALOG CLIP

Speed 09
Sample 49
Value +107

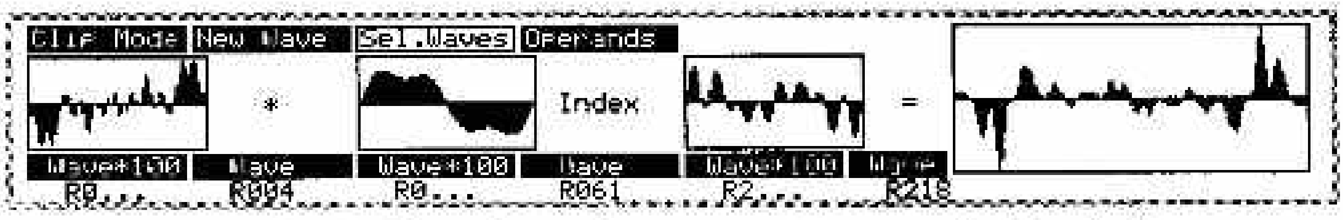
<Clip Modes>

Graphic Edit offers the same clip modes that you find in the other Wave Edit functions. You find the clip modes listed in the second column of the <Draw Mode> menu.

Be aware that clip modes are only used in <Breakpoint Mode>. The other draw modes do not make use of clip modes, since there is no possible way to introduce clipping when drawing a time domain waveform.

Basic Concept

The Wave Blender is pretty much exactly that - a device where you can mix Waves in some rather different ways. Just as you would mix your favorite drink (vegetable health stuff, obviously), you can select ingredients (namely existing Waves) and magically create a new Wave by mixing and blending these source Waves.

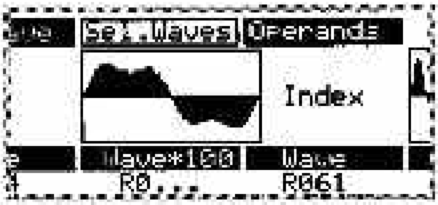


As you can see in the figure above, three source Waves can be blended into one new Wave. That Wave, by the way, is the one you selected before you called this function. You can also create new Waves using the <New Wave> button.

The three source Waves are combined using various mathematical operations. You can see the current operations between the displayed waveforms. The easiest way to combine the source Waves is by adding them. This way you achieve composite sounds from various sources. But we did not stop there, and neither should you. A host of new timbres are waiting for you, and they are easy enough to create - simply by moving a couple of faders 'til it sounds right.

The faders will either select the source Waves, or set their levels and operands - depending which of the two buttons <Sel. Waves> or <Operands> is active. You can also select one of the four clip modes; once again, we strongly recommend checking out the effects of the various clip modes in the Wave Blender, since different and interesting timbres will result according to the clip mode used.

<Sel. Waves>



Before you can actually blend anything, you must select the source Waves. You should begin with Waves that you like, but do not hesitate to change Waves while you are blending in a new one - interaction is the name of the game, so listen and decide.

To select Waves, you must first instruct the processor that you intend to do so by selecting the proper mode.

- **<Sel. Waves>**

Press this button when you intend to select the source Waves. Either this mode *or* the <Operands> mode can be active at a given time.

- **<Wave*100>**

Since there are so many Waves available for selection, we had to assign the Wave select function to two faders. The <Wave*100> fader is used to select the 100 banks, with the following selections possible:

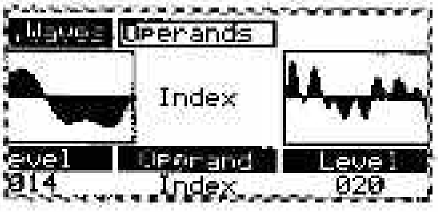
- ROM Waves: *R0... to R2...*
- User Waves: *U0... to U9...*
- Extracted Waves (from sample analysis): *X0...*
- New Waves (created by pressing the <New Wave> button): *N0... to N9...*

- **<Wave>**

The <Wave> fader is used to select the Wave within the bank you selected with using the <Wave*100> fader.

➪ Not every Wave will necessarily contain original data. Waves may be not initialized and contain "garbage" data, because the RAM that is used to store the Wave may not necessarily be filled with a series of nice and tidy zeros. (Actually, one old PPG Wavetable was accidentally created this way, and it became very famous.) So, if you like a particular sound, feel free to use it. As soon as you store the Wave with a Wavetable, it will become a true user Wavetable. Do not be afraid, you can't break anything - maybe except your tweeters when you listen at excessive volume levels to Waves that contain lots of high harmonics, as can easily be the case with "garbage" Waves.

<Operands>



This is where the fun starts. After selecting a Wave you can switch into this mode and start blending your own personal Wave. Easy on the ice, please.

• <Operands>

This button will switch into the Operands mode of the Wave Blender. Either this mode or the previously described <Sel.Waves> mode can be active.

• <Level>

These faders set the levels for the respective Waves that will be blended. Except when using Autoscale clip mode, higher levels will usually cause the destination Wave to clip even when only a single source Wave is used.

• <Operand>

Seems we ran out of names. Well, these faders actually set the operands that govern the mathematical relation between the three source Wave, thus defining the Wave that's being created in the Wave Blender. You have the following choices:

- + (addition)
- - (subtraction)
- * (multiplication)
- / (division)
- Index

See below for details of the respective operands.

Wave Mixing

That's the basic scoop, and the original intention of the Wave Blender. If we hadn't had so many ideas, the blender would probably have been named the Wave Mixer. But hey, blended Scotch is nearly drinkable, whereas mixed Scotch ... maybe we should just stick with veggies.

Mixing is achieved by the two following operands:

- + (addition)
- - (subtraction)

Wave mixing works very much the same as mixing two sounds: Source Waves will be mixed together in the destination Wave according to their programmed levels. When you use the subtraction operand, the phase of a Wave will be inverted and then added - the only way to perform a subtract function in the time-domain.

Wave Multiplication

Waves can also be multiplied. When doing so, each individual sample of the source wave will be multiplied by its corresponding sample in another wave.

Thus, if for example you use a perfect square wave as one source when multiplying two Waves, the result will always be identical to the other source Wave. This is because the value of each sample of the first half of the square wave is considered to be maximum (a value of 1); when multiplying sample by sample, each sample in the second source Wave is therefore multiplied by 1. (The second half of the wave is also at maximum value, but it is phase-inverted.) The only difference will be that the level of the resultant Wave will shift according to the level settings of the source Waves, unless <Autoscale> clip mode is selected.

When multiplying Waves, the level of any source Waves that will be multiplied together must not be 0, since multiplying anything with 0 will yield 0. Just like back in school...

Additionally, there will be no timbral changes regardless of the level settings of each Wave that is being multiplied, except for those that may be introduced by the selected clip mode.

Wave multiplication is achieved using the following operand:

- * (multiplication)

Wave Division

No, this is neither the new sales force sent out by Waldorf to get this unit into the marketplace, nor a secret military brigade. It's once again a basic mathematical rule used to try and obtain musically valid results.

When dividing one Wave (the spectrum, *NOT* the big chunk of metal and silicon!) by another, you will usually get waveforms that contain lots of spikes, presumably where you would find zero-crossings in the original spectrums. The process of dividing Waves is not particularly straightforward - but try it, as some interesting results can be achieved.

Since dividing by zero is mathematically not valid, a square-wave will be the resultant Wave when doing so.

Wave division is achieved using the following operand:

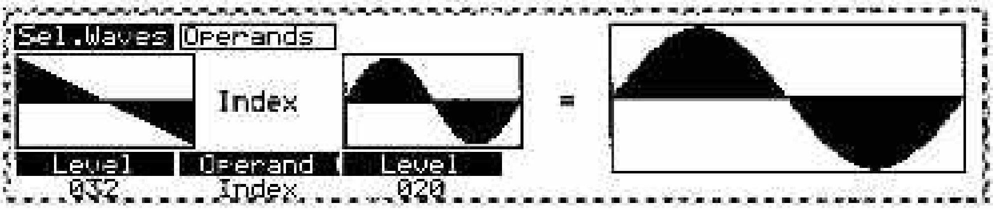
- / (division)

Wave Indexing

When using the <Index> operand, the right-most Wave in the display will be the source Wave that will be indexed by the Wave displayed at the left. To help understand what happens when <Index> is used, remember first that a Wave is composed of a number of samples, each of which has a discrete value and a fixed position.

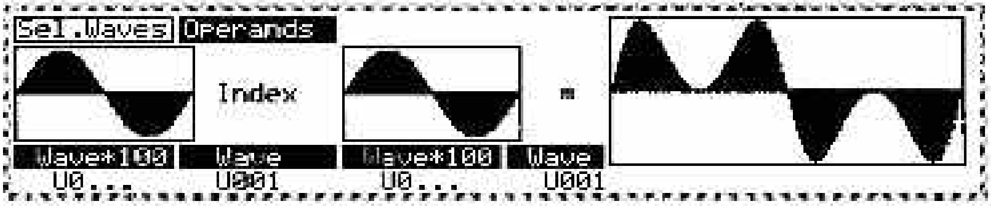
Usually, each sample position will be played in succession, thus producing the desired waveform. When this is the case, you could say that the Wave is indexed continuously from start to end. If you were to change the order in which the individual samples were played out, their values in the resultant Wave would still be the same, but the resulting Wave would likely sound very different.

This is exactly what happen when you use Wave Indexing to create a new Wave: The amplitude value of each sample in the Wave on the left side of the "equation" is used as a control signal to calculate the sample position that the Wave on the right side of the equation should play next. As such, if you were to use an upward ramping saw Wave as the control signal (the left Wave), the samples in the right Wave would play out in their normal order, because the amplitude of each successive sample in the left Wave is one increment higher than the previous sample. Thus, sample #0 has a value of 0, sample #4 has a value of 4, sample #12 has a value of 12, and so on.



Level 032
Operand Index
Level 020

However, if you were to use a sine wave as the indexing Wave, a very different Wave would result, because successive sample values in a sine wave are not related in a linear manner, but rather as a function of sine (so *that's* where the name comes from!).



Wave*100 U0...
Wave U001
Wave*100 U0...
Wave U001

As you can see, the resultant Wave depends on the source Wave as much as on the indexing Wave. Consequently, a "boring" waveform such as a square wave would not produce too many varying results, since it only bears two different sample values, namely full positive and full negative swing. When a square wave is used as the indexing Wave, the resultant waveform will always be a square wave or a pulse wave with different pulses within the same waveform.

Since sample values are used as the index of the source Wave, we found it interesting to offer you the ability to adjust the amplitude of the indexing Wave. This will provide you with a host of different waveshape results, since the Wave amplitude will directly affect the individual sample values. The smaller the level is, the narrower is the range the indexing Wave will access of the source Wave. A level of 0 will effectively produce a square wave, since only the sample position 0 in the source Wave will be used and appended until the resultant Wave is complete.

➪ Be aware that you can create a very complex Wave indexing by combining two Waves as the indexing Wave, using any of the operands offered in the Wave Blender. You may even use an already indexed Wave as the indexing Wave. Play around, have fun, and don't forget to be home before dark.

Wave Indexing is achieved with the following operand:

- Index

Clip Modes

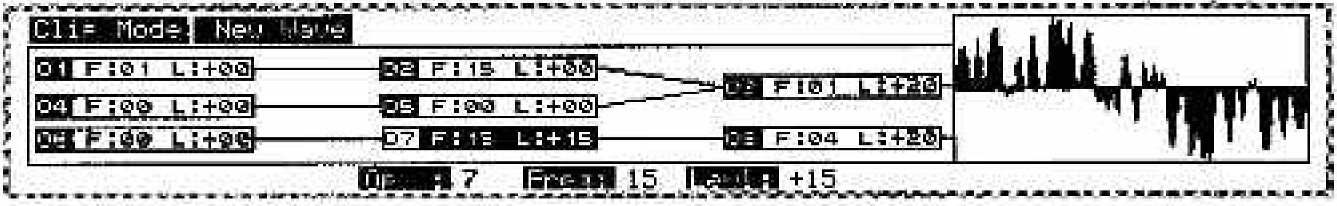
The Wave Blender offers all the regular clip modes. You can access them via the menu <Clip Mode>.

The set clip mode always affects the newly created Wave, not the source Waves of the Wave Blender.

FM Synthesis

Basic Concept

Frequency Modulation synthesis is quite well known by now. It produces interesting timbres by combining one or more *operators* . These operators usually consist of a sine wave whose frequency and amplitude can be programmed by the user. The output of the operator can then either be audible or used to modulate the frequency of another operator. Audible operators are called carriers, whereas those that modulate the carriers are, quite cleverly, called modulators.



O1 F:01 L:+00
O2 F:15 L:+00
O3 F:01 L:+20
O4 F:00 L:+00
O5 F:00 L:+00
O6 F:00 L:+00
O7 F:15 L:+15
O8 F:04 L:+20

Op. 7 Freq. 15 Level +15

The volume of a carrier governs the overall loudness of the FM timbre, while the output-level of a modulator defines the timbre itself, whereas the frequency to which the modulator is set controls timbre. The greater the output level of a modulator, the more sidebands will appear in the resultant sound.

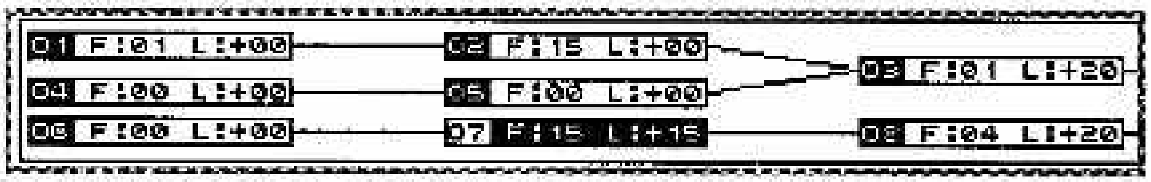
These sidebands could actually be regarded as the harmonics of the FM spectrum. The modulator's level, also called the "index," defines how many sidebands there are and their volumes. The frequency ratio between the modulator and the carrier governs the "spacings" or frequencies of the harmonics.

The Wave provides all of the basic components and parameters of FM synthesis, though all you can create with them is a static spectrum. You may, however create a number of static FM spectrums and arrange them in a dynamically moving timbre by placing them as desired into a Wavetable.

Also, be aware that you can only obtain harmonic spectrums when creating a Wave, so no inharmonic frequency ratios are available via this FM implementation.

The Algorithm

The connection of operators among themselves as well as the definition of carriers and modulators is commonly called the FM algorithm. The Wavc contains exactly one such algorithm comprised of eight operators.



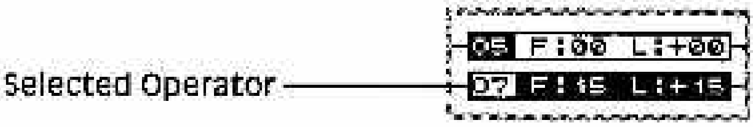
You can access two FM lines with one carrier each. Line one offers a pair of two cascaded modulators each that modulate the carrier in combination, while line two simply offers two cascaded modulators that drive the carrier.

FM enthusiasts may bemoan the absence of more algorithms, but please keep in mind that this algorithm is used only to create a momentary static snapshot. Typical FM programming with separate attack and sustain lines etc., would make no sense in this environment. However, keep in mind that you may create a Wavetable that evolves over time by programming the appropriate FM Waves.

Selecting an Operator

Range: 1...8

To edit either the frequency or level of an operator, you must select the operator first. A selected operator will be displayed in inverse video.



- Use the fader labeled <Op> to select the desired operator. Operators are numbered from left to right, top to bottom.
  operator 3 is Carrier 1, operator 8 is Carrier 2.

- You can also select an operator using the [Page] buttons; the [<] button will select the preceding operator and the [>] button will select the succeeding one.

Changing an Operator's Frequency

Range: 0...64

- You must first select the operator whose frequency you wish to alter as described above.

- To change the frequency, use the fader labeled <Freq.>.

The frequency is given as the harmonic number. A frequency setting of 1 corresponds to the fundamental, whereas a setting of 5 selects the fifth harmonic. Note that you may select a frequency of 0, which will only produce an output if that operator's frequency is itself modulated.

Due to the harmonic-spectrums-only synthesis method, there is no parameter given for detuning a frequency from its pure harmonic tuning.

Changing an Operator's Level

Range: -63...+63

- You must first select the operator whose level you wish to alter as described above.

- To change the amplitude, use the fader labeled <Levl>.

- A negative level will change the operator's phase by 180 degrees, which will be noticeable especially when using mixed positive and negative settings.

In order to hear any sound at all, at least one carrier (operator 3 or 8) must have a level greater than *0*.

Clip Modes

The FM synthesis function offers all the regular clip modes. You can access them via the menu <Clip Modes>.

The selected clip mode is relevant primarily for the carriers of the newly created Wave.

Exiting

No matter what page or function you selected to create or edit a Wave, there is only one way out. Well, actually, two ways.

Executing

If you are satisfied with the Wave you have created or with the edits you performed on an existing Wave, you should exit the particular page by "executing" the associated edit. Executing means that you confirm all the edits done to that Wave in the particular session and want to keep the results.

- Press the **[OK]** button to confirm your edits and exit the particular page and return to the main page or to the Wavetable Edit page.

Canceling

If you dislike what you have done, and would rather not keep any of the edits you have made during this particular edit session, you may abort all changes and return to the main or Wavetable Edit page without keeping the edits you have done.

- Press the **[Cancel]** button to abort all edits and return to the main page or to the Wavetable Edit page.

Wavetable Menu

waldorf

This chapter describes how to build Wavetables from individual Waves. It also contains instructions for generating entire Wavetables plus simultaneous generation of the Waves within the respective Wavetable.

Wavetable Edit

The Basic Concept

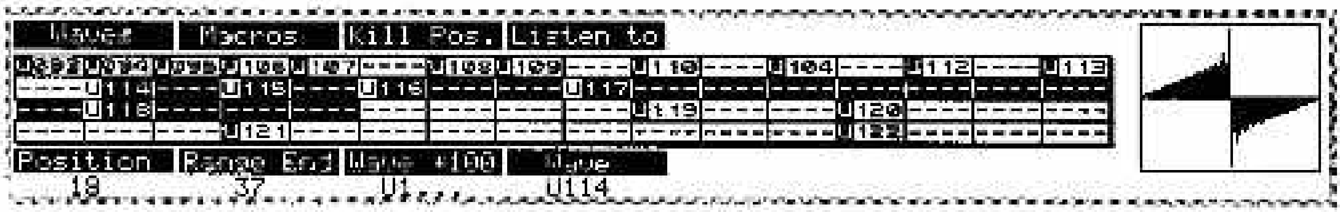
A Wavetable really is the heart of the sound generation of the Wave. It is responsible for the spectrums you will have at your disposal at any given time and for the spectrum's evolution over time. Whatever sound and timbre you want to create, the basic building block will always be the Wavetable.

There are 64 factory Wavetables that come with the unit as standard repertoire, and all of those can be used in a myriad of ways to design Sounds that are most remarkable. However, designing your own personal Wavetables will allow you to do very specific things, such as those that may only be applicable to a single song.

The Wave was conceived and designed with an open architecture, allowing you to continuously create new Wavetables, thus allowing you to sound fresh with every production - from your source waveforms on up.

A Wavetable could be regarded as a big control section for Waves. It defines which Waves will be used at a given time, and controls the order in which these Waves are played back. It is also capable of interpolating between two successive Waves, which allows you to create new Waves in the unoccupied positions between Waves.

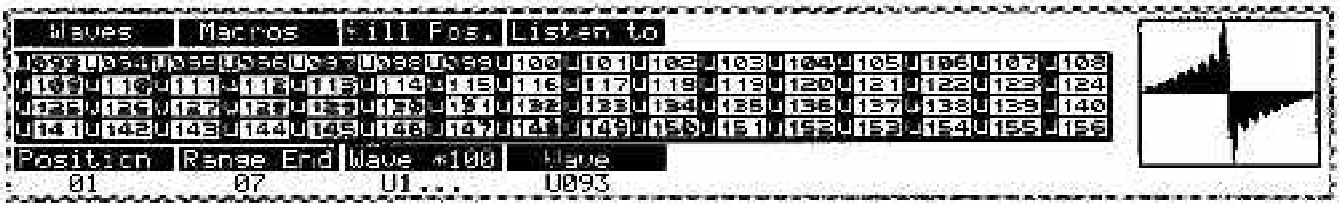
Lets look at the Wavetable structure and what it does:



```
 Waves     Macros    Kill Pos.  Listen to
U092|U094|U096|U106|U107|----|U108|U109|----|U110|----|U104|----|U112|----|U113
----|U114|----|U115|----|U116|----|----|U117|----|----|----|----|----|----|----
----|U118|----|----|----|----|----|----|----|U119|----|----|U120|----|----|----
----|----|----|U121|----|----|----|----|----|----|----|----|U122|----|----|----
Position  Range End  Wave +100  Wave
   19        37         U1      U114
```

Each Wavetable contains 64 locations for Waves. Each Wave represents a certain spectrum (for more info about Waves, please refer to chapter 2, "Waves Menu"). Each position, and consequently each spectrum, has its distinctive address. This address is the position of the Wave in the Wavetable, and is identical to the Sound parameter [Start Wave].

If there is a distinct Wave filling each position of the Wavetable, the [Start Wave] parameter of the Wave generators will simply select one of those Waves. If you were to scan through the Wavetable, those same Waves would also be used.

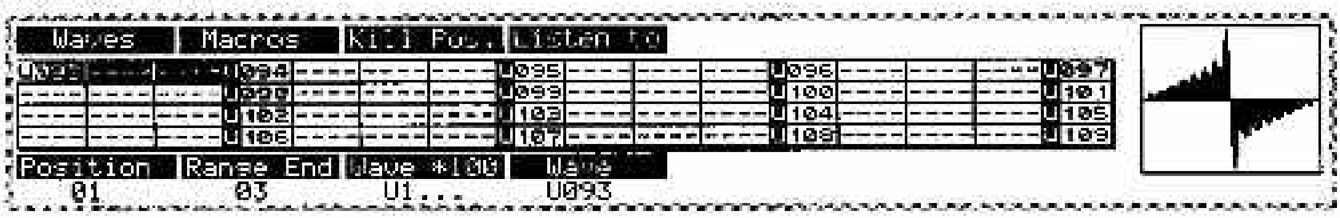


```
 Waves    Macros    Kill Pos. Listen to
U093 U094 U095 U096 U097 U098 U099 U100 U101 U102 U103 U104 U105 U106 U107 U108
U109 U110 U111 U112 U113 U114 U115 U116 U117 U118 U119 U120 U121 U122 U123 U124
U125 U126 U127 U128 U129 U130 U131 U132 U133 U134 U135 U136 U137 U138 U139 U140
U141 U142 U143 U144 U145 U146 U147 U148 U149 U150 U151 U152 U153 U154 U155 U156
Position  Range End  Wave *100   Wave
   01        07        U1...     U093
```

By creating a Wavetable, you can define each spectrum for a Wavescan yourself, which affords you control over even the minutest details in a sound.

While this is highly desirable, and sometimes badly needed, it nevertheless imposes a considerable workload on the user. To minimize your mental strain — as well as offering a very quick and convenient way to explore new timbres — Wavetables contain a special feature called *Wave-Interpolation*.

With Wave Interpolation, all you have to do is specify certain base spectrums and place them within the Wavetable, while leaving blank the positions between the defined spectrums.



```
 Waves    Macros    Kill Pos. Listen to
U093 ---- ---- U094 ---- ---- ---- U095 ---- ---- ---- U096 ---- ---- ---- U097
---- ---- ---- U098 ---- ---- ---- U099 ---- ---- ---- U100 ---- ---- ---- U101
---- ---- ---- U102 ---- ---- ---- U103 ---- ---- ---- U104 ---- ---- ---- U105
---- ---- ---- U106 ---- ---- ---- U107 ---- ---- ---- U108 ---- ---- ---- U109
Position  Range End  Wave *100   Wave
   01        03        U1...     U093
```

The empty positions will automatically be filled in with *Interpolation-Waves*. These Waves are "invisible" to you. Their spectrums will gradually change from the spectrum immediately preceding them to the spectrums that immediately follow them (the "base" spectrums). The smoothness and length of the interpolation is determined by the number of blank positions in between the respective base spectrums.

The harmonic content of these interpolated spectrums is based solely on the Waves used as base spectrums. The resultant Wavetable could be very smooth, with gradual shifts between similar spectrums or, it could be dramatically evolving. This all depends on how you set up the Waves you use as the base spectrums.

You will notice that an initialized Wavetable is never empty. Rather, it contains 2 Waves, one at position 1 and the other at position 61. This is the minimum configuration when creating a Wavetable, where only two Waves are used as base spectrums. When this is the case, the entire Wavetable will be interpolated.

You may wonder why the last base spectrum is placed in position 61 rather than position 64. This is because there is another "automatic" Wavetable function at work, that makes programming analog-style synthesizer sounds very simple: The last three Wavetable positions will usually be filled with basic geometric waveforms: a triangle, a square and a sawtooth Wave.

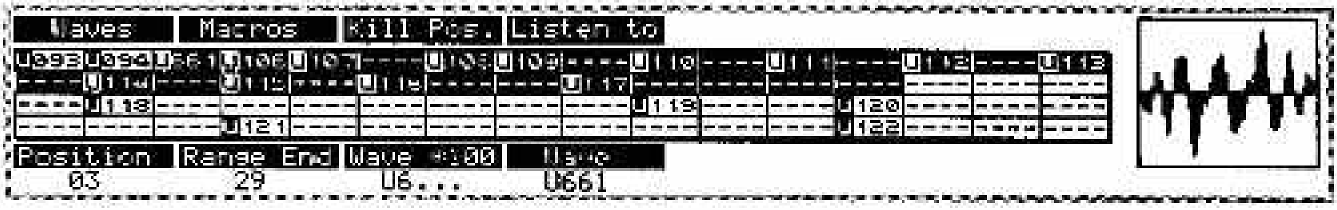
You have probably noticed that all factory tables use these last three waveforms consistently. Naturally, we offer you the same layout when designing your own Wavetable. However, you do not have to follow that model. Rather, you may overwrite these positions with your own Waves, at which point the automatically-generated basic waveforms will be overwritten in favor of your specified spectrums.

You can program a Wavetable to contain only the sawtooth Wave, or the square and the sawtooth Wave, by leaving the positions 64 or 64 and 63 empty respectively, and using position 63 or 62 for defining your final base spectrum. If, however, you place a Wave at position 64, the two preceding positions will become part of the interpolation (unless you manually specified specific Waves for these positions).

You might use a number of base spectrums with a different number of blank positions between each successive pair in order to generate timbral evolutions that have varying times and strength. However, keep in mind that the ultimate sound of a Wavetable is defined when programming the Wave generators' parameters.

In any event, Wave interpolation allows you to create stunning timbres in only seconds. And best of all, you will be able to audition the resulting Wavetable right away *as you design it*! So experiment, use Waves in any and all possible combinations, and just have fun.

The <Edit Wavetable> Page



U393	U394	U661	U106	U107	----	U108	U109	----	U110	----	U111	----	U112	----	U113
----	U114	----	U115	----	U116	----	----	U117	----	----	----	----	----	----	----
----	U118	----	----	----	----	----	----	----	U119	----	----	U120	----	----	----
----	----	----	U121	----	----	----	----	----	----	----	----	U122	----	----	----

Position	Range End	Wave #100	Wave
03	29	U6...	U661

This page is your focal point when creating Wavetables. All the necessary tools and options are either on this page or accessible from this page.

The large section in the middle displays the 64 positions of the Wavetable in four rows of 16 positions each. Within this display you will either see a valid Wave, as indicated by its memory location and number, or four dashes ("- - - -"). The four dashes represent the interpolated Waves that are located between the respective base spectrum Waves.

To the right of the position-block you will see the waveform of the Wave that is currently selected by the <Position> fader. Note that you may select Interpolated Waves, and that these will be displayed correctly as well.

Under the buttons you'll find the menus of the <Edit Wavetable>page:

- **<Waves>**

  This menus allows you to edit a single Wave in the currently-selected Wavetable.

- **<Macros>**

  This menu contains a variety of macro functions for editing or creating the Wavetable or a Range within it.

- **<Listen To>**

  This menu offers you a variety of ways to audition the currently-selected Wavetable.

The faders provide the following functions in the <Edit Wavetable> page:

- **<Position>**

  This fader selects the position within the Wavetable where you can insert, edit or audition a Wave.

- **<RangeStrt>**

  This fader selects the position that marks the beginning of an edit range.

- **<Range End>**

  This fader selects the last position in the edit range.

- **<Wave*100>**

  This fader selects the 100's numerator in the Waves banks for the position currently selected by the <Position> fader. The following selections are possible:

  - ROM Waves: *R0... to R2...*

  - User Waves: *U0... to U9...*

  - Extracted Waves (from sample analysis): *X0...*

  - New Waves (created by pressing the <New Wave> buttons in the Waves menus): *N0... to N9...*

- **<Wave>**

  This fader will select the Wave within the 100 bank you selected using the <Wave*100> fader. The respective Wave will be used as a base spectrum Wave at the position defined by the <Position> fader.

Building a New Wavetable

As described earlier in this section, you cannot actually build a new Wavetable, as there are a fixed number of Wavetables available at any given time, regardless of whether they are in use, whether they contain sensible data, or whether they are simply leftover from your last potluck dinner party.

To create a Wavetable from scratch, you must initialize one of the existing user Wavetables. The initialized Wavetable does not necessarily need to be the one where you plan to store the newly created Wavetable; it will serve only as a temporary buffer for your edits. Until you actually store that specific Wavetable to internal memory, it will remain intact. Thus, you may use any Wavetable to start with, and finally decide when storing it which internal Wavetable to replace. You may even store the respective Wavetable to disk only, thereby leaving all internal Wavetables intact.

- Select a user Wavetable to serve as a starting point. If you want to start from scratch, initialize the selected Wavetable using the [Recall/Init] function.
- Select <Edit Wavetable> from the <Wavetable> menu on the main page.
- Using the <Position> fader, select the position within the Wavetable where you want to insert a Wave. You may select a position that is already occupied; the new Wave will replace the Wave that currently resides at the selected position.
- Use the <Wave*100> and <Wave> faders to select any available Wave as the Wave to be inserted.
- As an alternate method you may:
  - Select the <Waves> menu from within the <Edit Wavetable> window
  - Select whichever function you prefer for creating Waves and
  - Create new Waves by using the <New Wave> button of the respective page.
  - Now go back to the <Edit Wavetable> window and insert the new Wave (with the <N> prefix) as described earlier.

You will be able to listen to the changes in the Wavetable as you do them. Select the <Listen To> mode that best suits your working mode; see chapter 5.1, "Listening Modes", below for more information.

Please note that at the very least you must define Wavetable positions 1 and 61 in order to create an interpolated Wavetable. If you define position 1 only, the Wavetable will automatically interpolate between the defined Wave and a triangle waveform, since the triangle Wave will be used as default Wave in position 62, and that position is automatically selected as the next base spectrum for Interpolation.

Editing a Wavetable

Editing a Wavetable is not much different than creating one. You must, however, make a clear distinction between editing the *harmonic content* of the Wavetable and its *Wave arrangement* .

If a specific Wavetable sounds approximately like what you are looking for and simply needs some touch-ups in its harmonic content, you'll most likely want to edit the individual Waves that are assigned to the Wavetable. By editing these Waves, you can change the harmonics of various base spectrums without altering the overall structure of the Wavetable - namely the positional of the Waves and the corresponding interpolations between them.

If you feel like altering the harmonic content of a Wavetable, you should decide whether you want to change only certain portions of the Wavetable only, for example, the attack, or if you want to "equalize" the entire Wavetable. In the first case, you need to alter the harmonic content of individual Waves within the Wavetable. In the latter case you must change all of the Waves equally. A specific Wavetable editing function is provided for the latter task.

To **change the harmonic content of individual Waves**,

- Select the Wavetable you wish to edit.
- Choose the <Edit Wavetable> entry of the <Wavetable> menu on the main page of Wave-Edit.
- Select the Wave or Waves you wish to edit using the <Position> fader.
- Select the edit operation you wish to perform by choosing the appropriate entry in the <Waves> menu. In most cases, this is likely to be <Harmonic Edit>.
- Edit the Wave as discussed in the previous chapter 2, Waves Menu.
- Return to <Edit Wavetable> by pressing [OK] in the corresponding Wave function; changes will be immediately audible. Select the desired audition mode in the <Listen To> menu.

If you want to **change the harmonic content of the entire Wavetable** rather than the harmonic content of the individual Waves,

- Choose the <Wavetable Harmonic Edit> menu entry.

This is a different way to edit Wavetables than the one discussed earlier in this chapter. You can choose <Wavetable Harmonic Edit> on the Wave Edit main page in the <Wavetable> menu. See chapter 3.14, "Wavetable Harmonic Edit", for additional details.

Finally, you may wish to edit the actual Wave arrangement of a given Wavetable, either by moving the positions of particular Waves within the Wavetable or by inserting or replacing Waves at specific positions. The latter operation will, of course, also alter the harmonic structure of the Wavetable, though not that of the Waves themselves.

To **replace Wave positions currently occupied by other Waves,**

- Use the <Position> fader to select the position in the Wavetable where you want to replace a Wave.
- Use the <Wave*100> and <Wave> faders to select the Wave that will replace the Wave currently residing in the selected position.

To **insert Waves in blank (interpolated) positions**,

- Use the <Position> fader to select the position within the Wavetable where you want to insert a new Wave. An unused position (which contains an interpolated Wave) will be displayed with the symbol <——>.
- Use the <Wave*100> and <Wave> faders to select the Wave that will be inserted at that position.

To **move Waves from one position to another**.

- First, make a mental note (or a written one, if your gray matter memory works at all like ours) of the Wave number you want to move.
- Select that Wave using the <Position> fader.
- Select the menu entry <Delete Position> in the <Macros> menu. The corresponding position will be cleared, though the Wave will not actually be deleted. It will simply be removed from that Wavetable and held in memory (an edit buffer in the case of a newly-created Wave; RAM in the case of an existing user Wave).
- Select the position where you wish to move the Wave using the <Position> fader.
- Use the <Wave*100> and <Wave> faders to select the Wave you have just deleted. It will be inserted at the selected position.

The <Waves> Menu

This menu allows you to edit the Wave that you have selected using the <Position> fader. It offers all the same options as the <Waves> menu on the main page:

- **<Harmonic Edit>**
- **<Graphic Edit>**
- **<Wave Blender>**
- **<FM Synthesis>**

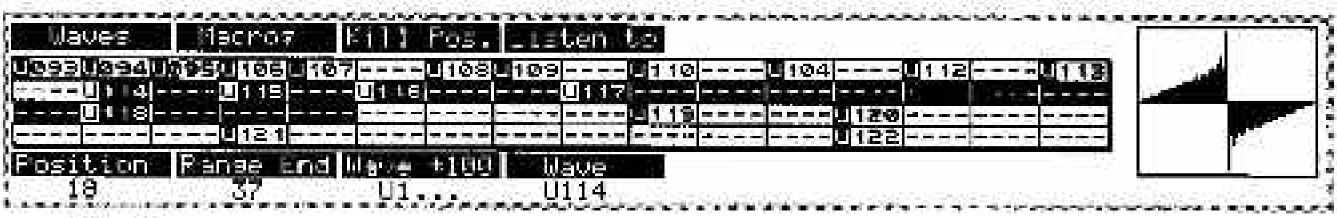
See chapter 2, "Waves Menu", above for details.

☞ Note that you can only select Waves that are assigned to the Wavetable you are currently editing. You may, however, select interpolated positions for editing; when you do, a new Wave will be automatically generated and inserted at the corresponding position. This allows you to fine-tune the interpolation between two base spectrums so as to fit your exact needs. If only life could be so easy...

☞ Please note as well that even you cannot select Waves that do not reside in the current Wavetable, you still can use the <New Wave> function within the various Wave editing pages to generate new Waves, which may then be inserted into the present Wavetable - or any subsequently selected Wavetable - as long as you have not quit the Wave Edit operation mode.

Wavetable Range

You can select a range within the Wavetable and edit it using macros. This allows you to manipulate a Wavetable both very precisely and very quickly.



U093	U094	U095	U106	U107	----	U108	U109	----	U110	----	U104	----	U112	----	U113
----	U114	----	U115	----	U116	----	----	U117	----	----	----	----		----	----
----	U118	----	----	----	----	----	----	----	U119	----	----	U120	----	----	----
----	----	----	U121	----	----	----	----	----	----	----	----	U122	----	----	----

Position	Range End	Wave +100	Wave
18	37	U1...	U114

<Position>

This fader is used to define both the position of the actual wave and the range start position.

<Range End>

This fader is used to select the position at which the range will end.The range will always be displayed in inverse video.

The <Macros> Menu

In this menu you'll find the various macros that you can use to help you create and edit a Wavetable. All macros will display a dialog-box when called up, in which you will be asked to acknowledge or abandon the desired function and, where applicable, be provided with the option of setting certain parameters for executing the specific macro.

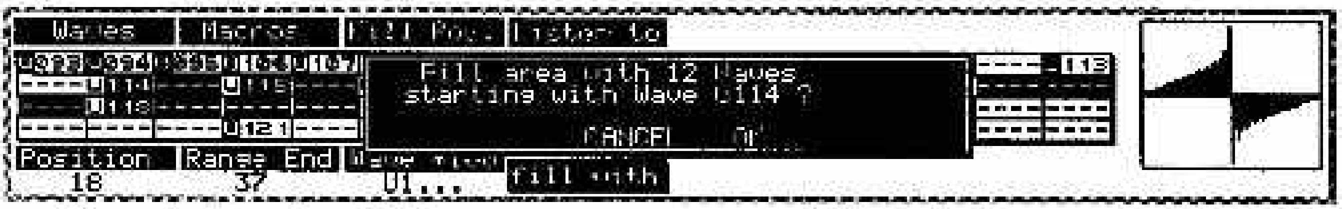
- Press the [OK] button to execute the macro you've selected.
- Press the [Cancel] button to abort the execution of the macro.

Almost all macros use the Wavetable *range* settings to define which part of the Wavetable will be altered. This way you may execute various macros or the same macro with different settings for different portions of the Wavetable. This feature comes in very handy when you want to change a portion of a Wavetable - the attack of an analyzed sample, for example - in one way and the sustain portion in another way.

See below for the various macros that are available.

<Fill Range>

This macro allows you to fill automatically the selected Wavetable range with a specified number of consecutive Waves. These Waves will be spread evenly across the selected range. If you specify less Waves than the range has positions, the function will automatically place the Waves in equally-spaced positions and interpolate between them. The first Wave will always be the one that is selected by the <Position> fader.



Fill area with 12 Waves
starting with Wave U114 ?

Position 18
Range End 37
Wave ... U1...
fill with

After selecting the <Fill Range> macro, you can set the following parameter in the dialog box shown above:

- **<Fill with>**

  This function allows you to specify how many Waves will fill the selected range. You cannot, however, specify more Waves than there are positions within the range.

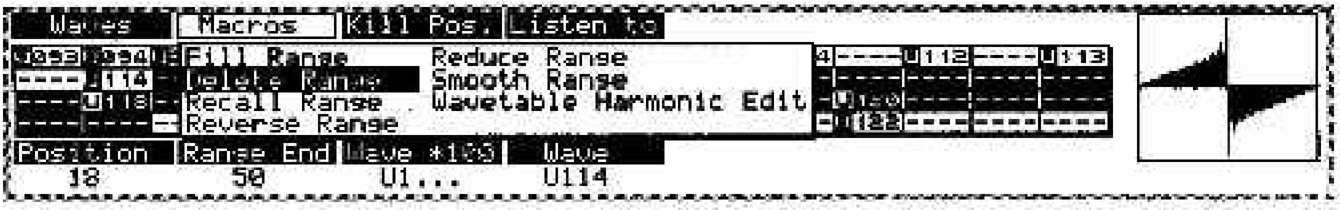
The primary application for the <Fill Range> macro is to generate a Wavetable that contains the Waves you have just generated.

- Create a number of new Waves using the <New Wave> function in the various Wave pages.
- Keep a mental (or written) note of how many new Waves you have created. You may also check for the number of new Waves that have been created by looking at the new Waves in the <Wave Blender> page. Look for the first and last new Wave you created. New Waves will always be in a successive order.
- Set the entire Wavetable to be the Wavetable range or to only a portion of it if, for example, if you want to create a split table.
- Set the <Wave*100> and <Wave> parameters to the first <New Wave> you created. New Waves will be found in the <N...> Wave memory locations.
- Select the <Fill Range> macro.
- Set the <Fill With> parameter to the number of <New Waves> you created.
- Press [OK] to fill the range, or [Cancel] to abandon the operation.

<Delete Range>

This macro will remove all Waves that are within the selected range in the Wavetable. All positions within the deleted range will become interpolated positions.

- Specify the range to be deleted.
- Select the <Delete Range> macro.
- Press [OK] to delete the range , or [Cancel] to abandon the operation.



Position	Range End	Wave *100	Wave
18	50	U1...	U114

The Waves that are removed will not be deleted. They will still be in memory and will be available for use in this or any other Wavetable. However, if a Wave is not used by *any* Wavetable, it is likely that it will sooner or later be overwritten by another Wave. (According to Murphy's law, that will happen immediately before you need the Wave.)

<Recall Range>

Also known as the life saver of Wavetable editing, this macro allows you to recall the arrangement of Waves in the selected range as they were stored in the original Wavetable. This macro allows you to recover the original Wavetable even after heavy editing or after deleting a range.

➪ Note that this macro is *not* an undo function, but a *recall* function. It restores the range as stored in the Wavetable that resides in the Wavetable number you are currently editing. For example, if you initialized the Wavetable and filled it with new Waves, and then deleted the new Waves using the <Delete Range> macro, the <Recall Range> macro will recall the Waves that were originally stored in the Wavetable, *not* the new Waves that you added to the initialized Wavetable.

- Select the <Recall Range> macro.
- Press [OK] to recall the range, or [Cancel] to abort the operation.

<Reverse Range>

So you love backward-running tape? Reversed snares? Reverse gears? Maybe we've got the next hip thing for you...

The <Reverse Range> macro allows you to reverse the order of Waves within the selected range. As such, the programmed timbre will play back in reverse.

- Select the <Reverse Range> macro.
- Press [OK] to reverse the range, or [Cancel] to abort the function.

➪ Note that you can achieve similar results by modulating the Wave generators with negative modulation amounts. However, <Reverse Range> generally offers better control over the exact positions that are reversed, even when you reverse only a short portion of a Wavetable.

<Reduce Range>

This macro is a clever algorithm that deletes Waves within the selected range based on how redundant they are.

Imagine a range that consists of two base spectrums with interpolated positions between them. The range contains no redundancy as there are only two Waves present, and both are needed to create the interpolated range. Now imagine that you placed a Wave in an interpolated position, and that the new Wave had exactly the same harmonic content as the interpolated position it replaced. In such a case, the new Wave would be completely redundant.

The <Reduce Range> macro checks all Waves within the selected range to find out how redundant each Wave is compared to the surrounding Waves. Depending on the number of Waves the range should be reduced to, the most redundant Waves will be deleted. In the above case, the newly inserted Wave that is identical to the interpolated position would be the first to go, since it is 100% redundant - the overall timbre of the Wavetable would not be affected if the Wave were removed.

Thus, <Reduce Range> will always delete the most redundant Waves. The idea is to conserve Wave memory by eliminating those Waves that can be reproduced simply by interpolating between two surrounding Waves. This is especially true when analyzing samples; frequently the number of individual Waves used to represent a sample's steady state can be greatly reduced without losing too much information.

After selecting the Macro, a dialog box allows you to set the following parameter:

- **<Reduce To>**

  This parameter will set the number of Waves that will remain in the range after the <Reduce Range> macro is executed. The more Waves you reduce, the more the new timbre will differ from the original, unreduced Wavetable. A range can actually be reduced to 0 Waves; however, the first position of a Wavetable must *always* be defined, and as such can never be deleted.

<Smooth Range>

<Smooth Range> is the inverse of <Reduce Range>. It works similarly to <Reduce Range>, in that it will delete Waves according to a specific algorithm. That algorithm is actually the same basic algorithm used for <Reduce Waves>.

If you remember, the reduce algorithm works by looking at each Wave and its surrounding Waves in order to construct a list of the most redundant Waves - in other words, those Waves that could be eliminated without substantially changing the overall timbre of the Wavetable. If you were to look at such a list from the other way around, it would tell you which Waves are the *least* redundant Waves, or better, the Waves that have the least to do with the surrounding Waves.

This is exactly what <Smooth Range> does: It deletes the least redundant Waves *first*.

So, what's the point in doing that? Well, since the Waves that will be removed are those that are the most unlike those Waves that surround them, the resulting Wavetable will have fewer pronounced base spectrums, and consequently become more uniform.

You will notice the effect especially when you are processing a Wavetable that consists of extracted Waves. If you <Reduce Waves>, you will reduce the amount of data contained in the Wavetable, while retaining the Wavetable's most prominent transitions. On the other hand, when applying the <Smooth Range> function, the prominent transitions will be the first to go. By applying both macros to specific ranges in the right balance, you can achieve excellent fidelity and uniformity while at the same time optimizing memory usage.

After selecting the <Smooth Range> macro, a dialog box allows you to adjust the following parameter:

- **<Smooth To>**

  This parameter sets the number of Waves that will remain in the range after executing the macro. It works similarly to the <Reduce Range> macro, except that it removes the most pronounced Wave first. A range can actually be smoothed down to 0 Waves (that's really putting the Shmooze on); however, the first position of a Wavetable must *always* be defined, and as such can never be deleted.

<Kill Position>

This function will remove the Wave that is currently selected by the <Position> fader. It is simply a shortcut for deleting a single position without having to redefine the currently active range.

The Listen to Menu

This menu allows you to select the way you audition your edits. The following options are available:

- Listen to Wave
- Listen to Wavetable by Time
- Listen to Wavetable by Keys
- Listen to selected Sound

You can freely choose among any of the available listening modes. Select the one that suits your needs best at any given time.

Please refer to chapter 5.1, "Listening Modes", for detailed explanations of the various modes.

Wavetable Harmonic Edit

The Basic Concept

Imagine - you have just created the one Wavetable that could shake the universe. Neither Captain Kirk nor Lt. Uhura could beam down anything better - except: It cries out for more fundamental. Yeah, you need more fundamental things in life, and you sure would want to start with this Wavetable. Simply put, the first Harmonic seems a bit weak.

Now, you could go into every single Wave that makes up this precious Wavetable and start fiddling with the harmonics. While that's a great idea, Spock eagerly awaits your report, and the communication channel only allows for a few button-pushes and fader-movements. What to do?

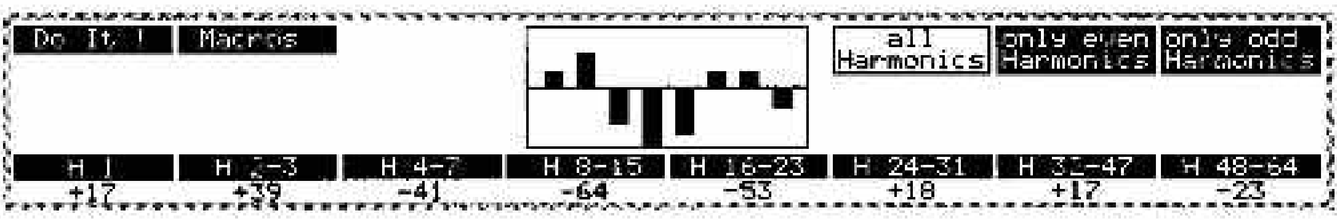
That's where <Wavetable Harmonic Edit> comes in. You are already familiar with <Harmonic Edit> from the <Waves> menu, which allows you to fine tune every single harmonic of a Wave. Well, <Wavetable Harmonic Edit> is very similar, only that it will affect *all* Waves in the selected Wavetable equally.

You could think of it as a very precise graphic equalizer with a total of eight bands. But rather than controlling *frequency bands*, this equalizer controls *harmonic bands*. While a certain frequency might be, say, the fundamental frequency of a sound when played at a certain pitch, it will be something completely different when that sound is played at a different pitch.

On the other hand, a harmonic will always remain the harmonic at a specific order, regardless of the pitch at which you play the spectrum. As such, the Wavetable harmonic equalizer works on the spectrum directly, giving you precise control over the harmonic content to a degree that a regular equalizer simply could not.

You will notice this especially when editing formant Wavetables, which have been created either using the Formant Synthesis method, or by analyzing a sample in formant mode. Using Wavetable Harmonic Edit, you can control the overall sound of the formant Wavetable exactly without ever losing the typical formant structure of that table. Thanks to this harmonic equalizer, you can "equalize" a formant Wavetable in the most intuitive way - after having created it.

The <Wavetable Harmonic Edit> Main Page



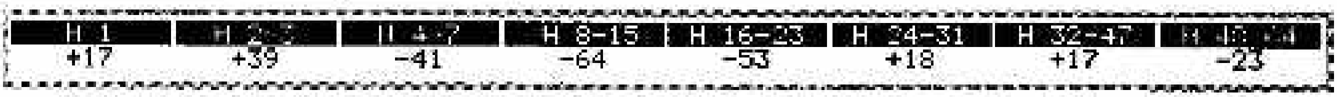
H 1	H 2-3	H 4-7	H 8-15	H 16-23	H 24-31	H 32-47	H 48-64
+17	+39	-41	-64	-53	+18	+17	-23

There is only one page available in Wavetable Harmonic Edit, so "main page" might be a bit of an exaggeration - but it fits the concept.

In the middle of the display, you see a graphic representation of the eight harmonic bands you can adjust. Since you might either amplify or attenuate harmonic bands, their zero-axis is in the center of the displayed box. Consequently, a bar pointing upwards indicates that the respective band is amplified, while a downward pointing band shows an attenuated harmonic band.

The faders allow you to adjust the eight harmonic bands, while the buttons offer various choices regarding the harmonic content as well as for initializing and executing the function.

The Harmonic Weight Faders



H 1	H 2-3	H 4-7	H 8-15	H 16-23	H 24-31	H 32-47	H 48-64
+17	+39	−41	−64	−53	+18	+17	−23

As you can see, the eight faders each control one harmonic band. Since there are 64 harmonics to process with the eight faders, we chose a somewhat arbitrary way to split these harmonics into bands, but we think that the choice made works pretty well.

Since you put a weight on some harmonics and not on others in this function, these faders are called harmonic weight faders, accordingly. You impose varying strengths, which are technically called weights, on the respective harmonics, hence the name. (And you thought you'd get a few free hours at your local music-gym.)

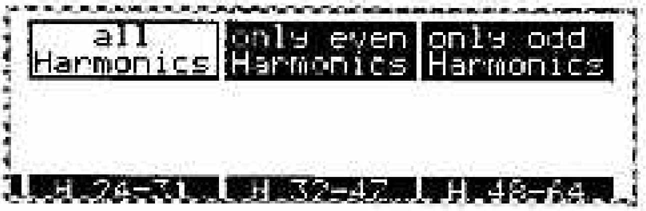
To amplify a harmonic band, you must move the respective fader upwards, to attenuate the band, move it downwards. The appropriate harmonics of all Waves assigned to the Wavetable will be scaled as set by the fader.

- **<H 1>** scales the fundamental - the first harmonic - only.
- **<H 2-3>** scales harmonics 2 and 3 simultaneously
- **<H 4-7>** scales harmonics 4-7
- **<H 8-15>** scales harmonics 8-15
- **<H16-23>** scales harmonics 16-23
- **<H 24-31>** scales harmonics 24-31
- **<H 32-47>** scales harmonics 32-47
- **<H 48-64>** scales - yes, right, harmonics 48-64

Ranges: —64+63

Choosing the Harmonic Content

Besides adjusting the relative levels of the eight harmonic bands, you can also choose which types of harmonics to edit, which affords you pretty good control over harmonic content.



- **<All Harmonics>**

  This button selects all harmonics within each band to be affected by the edits.

- **<Only even Harmonics>**

  This function lets you adjust only the even-numbered harmonics in each harmonic band. Consequently, whatever channges you try to set using fader <H 1>, which controls the fundamental, will not have any effect.

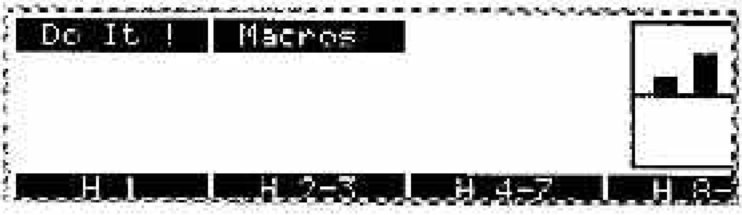
  Setting all harmonic bands to *-64* with this button engaged will yield a square wave-like sound, since most all even harmonics will be gone.

- **<Only odd Harmonics>**

  As you might have guessed, when this function is engaged, only the odd-numbered harmonics of each harmonic band will be affected by the edits.

  Setting all faders to *-64* with this function engaged will yield a sound one octave higher than the original sound.

<Do It!>



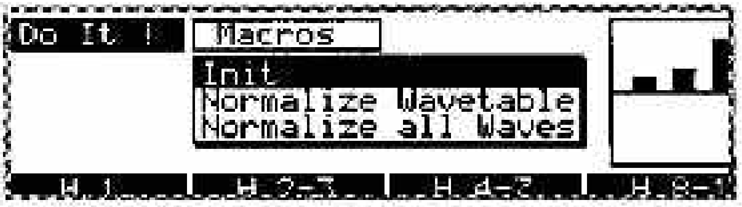
That's exactly what this button does: It does it. The Waves of the Wavetable will be recalculated according to the settings of the harmonic weight faders and the harmonic content buttons.

Unfortunately the number-crunching involved in the Wavetable Harmonic Edit is too much to allow this function to be performed in real time. Still, turnover is very quick and usually only takes a couple of seconds.

If you want to keep the edited version of this Wavetable, you **must** store it to internal memory or to disk. Otherwise, the edits will be gone when you quit Wave Edit.

The <Macros> Menu

In this menu you find three different items:



• <Init>

This function allows you to reset all the weights - all the harmonic band adjustments - to zero, if you want to get back to a neutral starting point.

• <Normalize Wavetable>

This function will increase the level of all Waves in a way that at least one Wave reaches the maximum amplitude. The relative levels of the Waves are unchanged, so the Wavetable will sound exactly as before, but with a higher output level.

• <Normalize all Waves>

This function will increase the level of each Wave individually to its maximum amplitude. The relative levels of the Waves will be changed, so the Wavetable will sound different than before.

Formant Synthesis

The Basic Concept

The Formant Synthesis algorithm allows you to create a Wavetable with a pronounced formant structure that is consistent across the entire keyboard. It allows you to synthesize vocal-like spectrums, or, in general, spectrums with strong fixed formants.

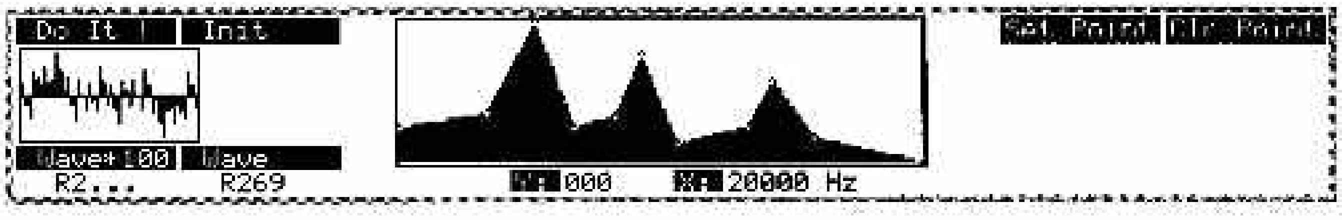
Different from the more common time-varying usage of Wavetables, formant Wavetables are specifically created to be used with keyboard tracking to assign each key a different Wave. Each of these Waves will be specifically created to contain the formant structure specified in the formant synthesis page.

This algorithm uses a Wave and imposes onto that Wave the formant structure you create. Any Wave can be used as a source Wave.

To be played back properly in the context of a Sound, watch for the following:

- Set the Waves generators [Keytrack] parameter to *+32* to achieve the intended effect. Other positive values will loosen the formant spectrum, with changing formant frequencies across the keyboard.
- Use the [Start Wave] parameter of the Wave generators to tune the resonant frequencies as desired.

The Formant Synthesis main Page



Once again, this is a function that only has one page - which had better be called the main page, right? In any event, the above figure shows you this main page.

To the right, you see the source Wave upon which the formant spectrum shall be imposed. Under it, you see the familiar faders used to select the Wave. Above it, you find the ominous <Do it!> button, which is used to execute this function, and the <init> button.

In the middle of the display, you see the graph representing the formant filter, under which you see the two faders that set up the filter by specifying an amplitude value Y and a frequency value X.

On the right top there are two buttons used to set or clear a breakpoint in the graph according to the values of the X and Y faders.

Selecting a Source Spectrum

The source spectrum is selected by choosing the source Wave.

- **<Wave*100>**

  Lets you select the 100 block of Waves for the source Wave.

- **<Wave>**

  Lets you select the Wave within the 100 block that will be used as the source Wave.

  The very last Waves at the end of the each Wave block are special Waves that are available only in the Formant Synthesis algorithm. They can be selected by moving the <Wave> fader all the way up. These Waves are:

  - **<Sawtooth Wave>**, a good old analog-style acquaintance suitable for almost any general formant superimposition. The natural decaying harmonics give a good, even frequency response across the entire keyboard-range.

  - **<Square Wave>**, another friend from the analog days. All you'll ever get will be other square Waves, but with pronounced formants. Good for creating old-style lead sounds, but ones that have more a character.

  - **<Full Spectrum>** gives you every harmonic at full amplitude. This is a good starting point if you prefer a generally thinner, brighter sound than you would get using the sawtooth Wave. This spectrum is also great for creating a time-varying filter Wavetable rather than a true formant one.

Depending on the desired results, it's essential to select the proper source Wave for the Formant Synthesis algorithm. For vocal-type sounds, try various pulse Waves; sawtooth sources can generate some nice clavinet/string-like results. The key lies - as it often does - in unbridled experimentation.

Setting up the Formant Filter

The formant filter is set up by selecting a certain frequency, assigning that frequency a certain relative loudness, and acknowledging that input.

To **insert a breakpoint** into the formant filter:

- Select the first formant frequency using the <X> fader. Frequencies across the entire audio range can be selected.

- Set the desired level for the frequency using the <Y> fader.
- Acknowledge your selection by pressing the <SetPoint!> button.
- Repeat the process until the formant filter looks as desired.

Any point you insert into the formant filter will serve as a breakpoint. The amplitudes of the frequencies between breakpoints will be interpolated linearly.

➪ To generate a very pronounced peak, you must also set breakpoints at low levels on either side of the peak frequency.

To **delete a breakpoint** from the formant filter:

- Select the respective formant frequency using the <X> fader. Programmed breakpoints can be identified by a small cross in the filter graph.
- The actual setting of the <Y> fader is irrelevant when deleting a breakpoint.
- Delete the selected breakpoint by pressing the <ClrPoint!> button.

<Do It!>

After you have set up the desired formant filter function (or one that simply looks good; try the Matterhorn, for instance), press this button to get going.

Unfortunately, the number-crunching involved in creating a formant Wavetable is too great to allow this function to be performed in real time. Still, turnover is very quick and usually only takes a couple of seconds.

If you want to keep this formant Wavetable, you **must** store it to internal memory or disk. Otherwise, the edits will be gone when you quit Wave Edit.

Creating Time-Varying Filters

An interesting alternative usage of Formant Synthesis is the creation of a time-varying filter response curve that moves across five octaves. Truly awesome, meaty sounds can be generated this way.

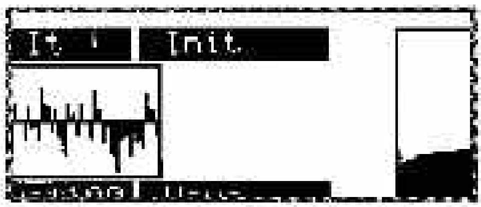
Set up the formant filter as usual and create the Wavetable as you would to get a formant Wavetable. However, when you apply that Wavetable within a Sound, do not use [Keytrack], rather use a ramped-up or -down Wave envelope to scan the Wavetable at full swing.

Instead of hearing a fixed formant, you will hear the changing sound of a more-or-less resonant filter traveling a range of five octaves.

➪ When designing the formant filter for such a Wavetable, set a number of not-too-closely spaced peaks to achieve an iteration within the filter-sweep that sounds as if a number of sweeps at different frequencies are taking place synchronously.

➪ The <Full Spectrum> Wave is a good starting point for creating such a time-varying filter Wavetable, as is any Wave that contains a healthy number of harmonics.

<Init>



This button allows you to reset the filter response curve to zero, so that you can return to a neutral setting.

Analyze Menu

waldorf

This chapter describes the process of loading a sample and analyzing it in order to generate a Wavetable whose Waves will be composed of the analyzed sample's spectral information.

The Basic Concept

How often did you wish to use a sampled sound not just as it is, as some sort of "dumb" playback sound, but rather to change aspects of that sound as you would on a synthesizer? Changing the playback speed, altering the harmonics, combining various timbres to form a new composite, or simply getting rid of the speed-up/slow-down effect when pitch-shifting the sample?

The Wave allows you to perform such tasks with a sampled sound. It can analyze a sample, extract one Wavetable full of spectrums from that sample and thus convert the sample from a typical time-domain signal into a Wavetable, whose spectrums and playback characteristics you can manipulate in some rather elaborate ways.

Once the sample has been converted into a Wavetable, you can edit it using all of the functions that are available in Wave Edit. Options like Harmonic Edit, Wave Blending, Wavetable interpolation and all other possible operations are available for manipulating the extracted spectrums. And, at no extra cost, pitch-shifting the extracted Wavetable will not introduce changes to its playback speed. Rather, you can control pitch and speed independently of each other.

While the process of analyzing a sample in order to extract meaningful spectrums is very complex, doing so is very easy for you. All you have to do is load a sample from disk or via MIDI. When that is done, the analysis will be started immediately, and everything is taken care of automatically.

Note that the analysis performed by the Wave is not just a simple FFT or the like. To allow for meaningful edits in the harmonic spectrum, the extracted spectrums must bear the correct assignment of harmonics and amplitudes. For example, only when the fundamental pitch of the sample is faithfully mapped to the first harmonic of a Wave does editing the spectrum in the frequency domain become useful.

You see, first the correct pitch of the sample has to be found, then some complex transformations from the time domain into the frequency domain have to be performed. Finally, the Waves have to be created and inserted into a Wavetable. Again, all of this is done automatically. You only have to look and see.

Although the necessary number crunching is one of the most complex functions that the Wave performs, it still only takes a few seconds to analyze a sample.

The Analysis Modes

There are two different and distinct analysis modes available for spectral extraction:

- Time Mode
- Formant Mode

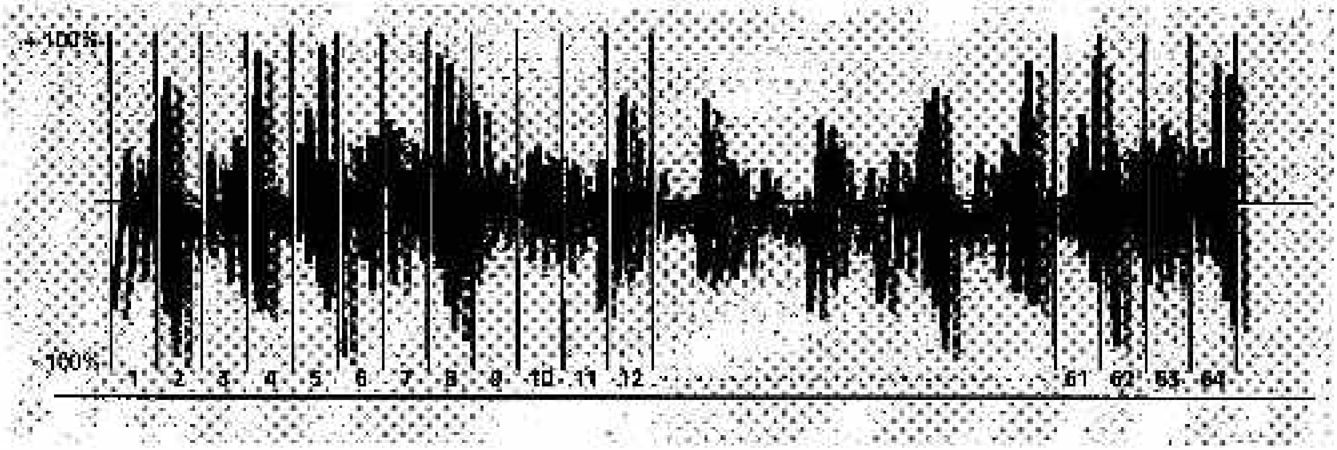
Each mode uses a particular analysis method to extract the spectrums for creating a Wavetable. Each method will produce a very different Wavetable.

Time Mode Analysis

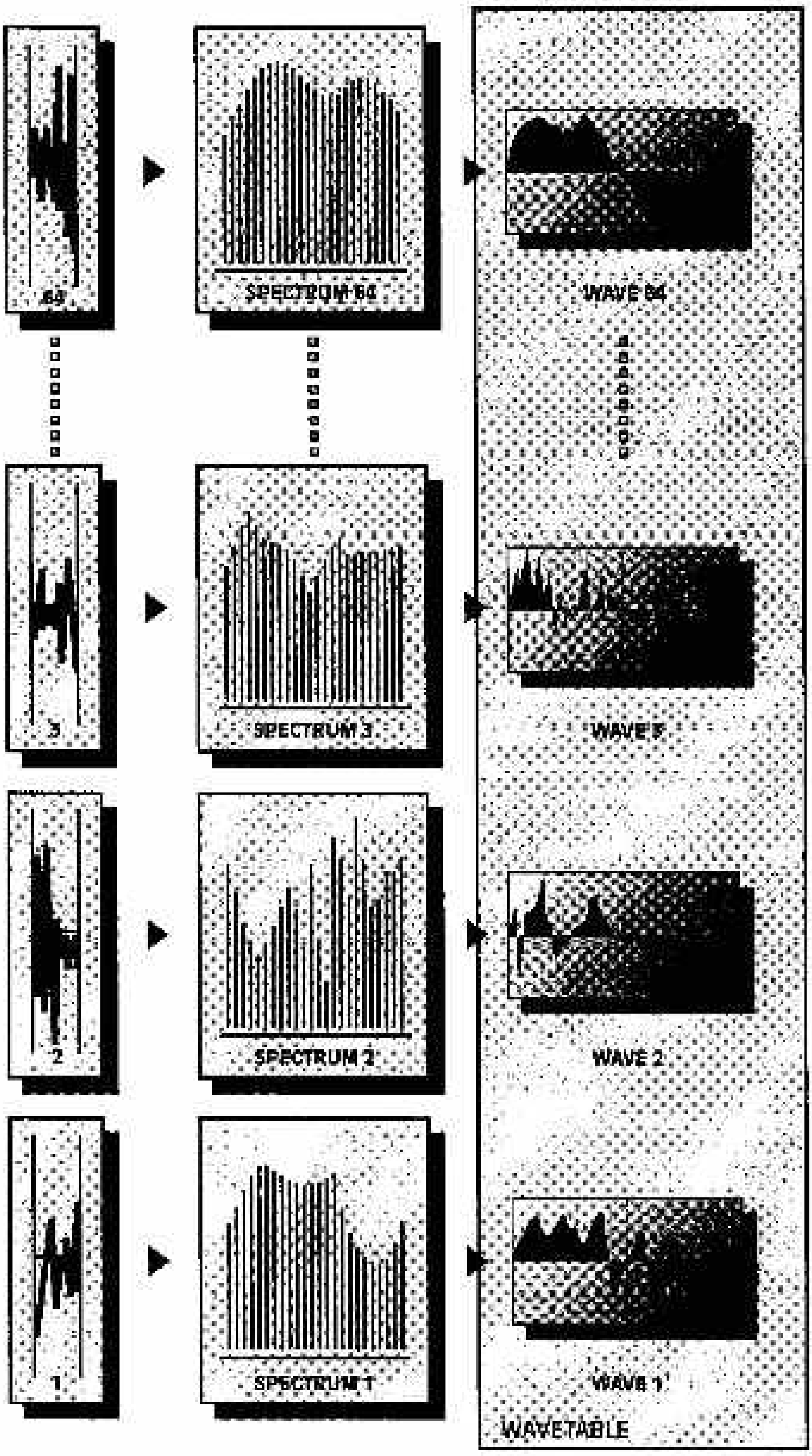
This analysis mode divides the sample into a number of slices (64, to be exact), where each slice represents one moment in time of that sample. All slices together span the entire length of the original sample. A spectrum will be extracted and a Wave created from each slice. All extracted Waves then form a Wavetable that comprises 64 discrete Waves, where each Wave represents one moment in time of the original sample. When played back with a standard linear envelope, the succession of Waves will create a sound that represents the harmonic spectrum of the analyzed sample over time.

Sounds a bit complicated? Well...

Imagine taking a sample and chopping it into 64 pieces, with each piece of equal length; you end up with 64 short snippets. Each of these snippets represents the sound that the original sample made at that specific moment in time.



The Wave starts by doing exactly that. Then it extracts the spectral information from each of the snippets. To do so, it must find out the amplitude of each harmonic of the sample during the time of each particular snippet. To actually find the harmonics, the Wave first has to determine the fundamental pitch of the sample, since that defines at which frequency bands the harmonics will be found.



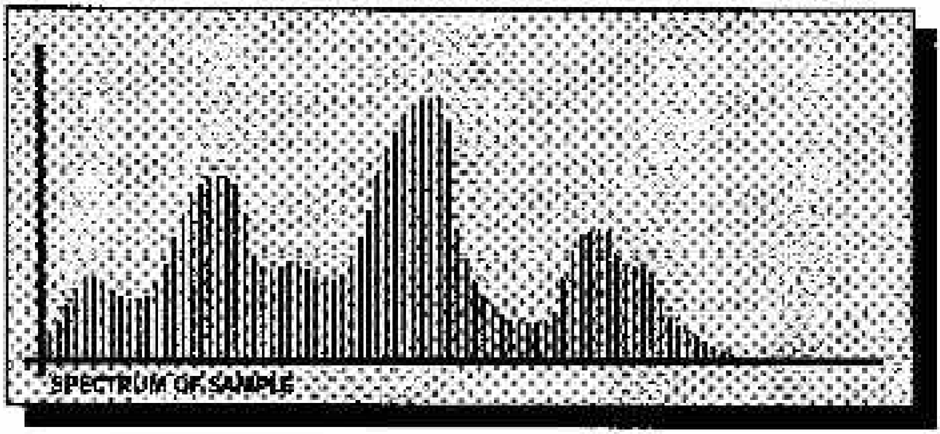
Now, after successful analysis and spectral extraction of the individual Waves, the order of the Waves must be in the same order as the original snippets. That is done by creating a Wavetable, where each Wave is placed in the order that the snippets were when the original sample was chopped up.

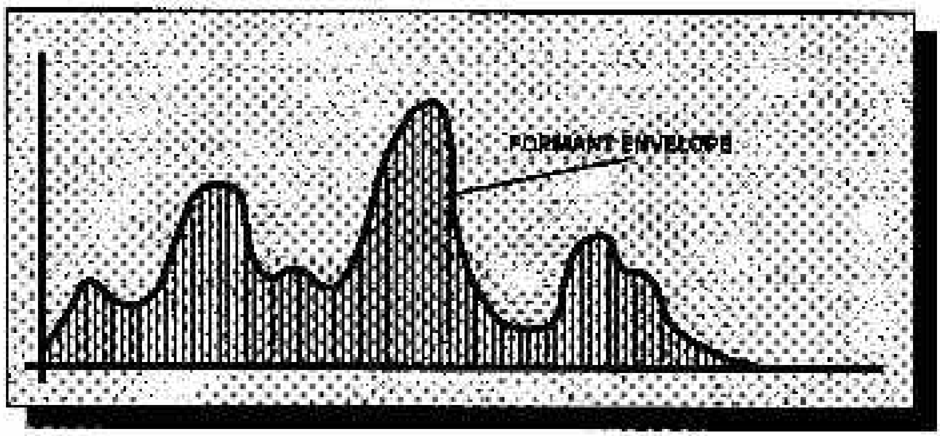
Thus, the entire Wavetable essentially represents the spectral evolution over time of the original sample. To mimic the source sample, the Wavetable must be scanned in a linear fashion, playing each Wave for approximately the same time, since the snippets of the original sample were of equal length.

Formant Mode Analysis

Formant mode analysis works quite differently than Time Mode. While the time analysis mode creates a Wavetable that corresponds to the timbral evolution of the analyzed sample, the formant mode creates a formant Wavetable based on the formant structure of the analyzed sample.

The original sample is analyzed, but this time it is not divided into snippets. Rather, the entire sample is used to find the formant structure of the sample.





Then, a Wavetable is created in which each Wave represents that formant spectrum at a specific pitch. Thus, if [Keytrack] is used to modulate the Wave generators, each key will play its corresponding Wave, representing the formants of the sample at that pitch. As a result, you will hear a fixed-formant structure across the entire keyboard, regardless of the note you play.

Formant mode analysis works similar to the <Formant Synthesis> function in the <Wavetables> menu. However, rather than using an arbitrary source Wave and an arbitrary formant filter function, both of these are replaced by analyzed data derived from the sample.

Time Mode vs. Formant Mode

So, what's the difference between the two analysis modes, and when should you choose which?

Time mode analysis is what you would likely expect from a spectral extraction function: It will deliver a Wavetable that contains the spectral evolution of a sample, or, to put it another way, it resembles the varying sound of the analyzed sample over time.

Formant mode analysis, on the other hand, is unique and not quite as straightforward as the other mode. It will extract the essence of a sample, so to say, while keeping the formant structure constant.

Thus, formant mode analysis yields a Wavetable that does not reflect the varying timbre over time inherent in the original sample. When played back as originally intended (without scanning the Wavetable over time, but rather by using keytracking), you will hear one Wave per key only, without any timbral evolution. That Wave resembles the original sample in about the same way a single-cycle looped sample resembles an original sound: You can hear its heritage, where it comes from, but it does sound quite different.

However, in marked contrast to a single-cycle loop of a sample, the formant Wavetable extracted from the sample bears the fixed formant structure of the original sample. Fixed formants, as their name implies, are independent of pitch. They rather pronounce certain frequency bands, thus forming specific resonances, that remain at the same frequency regardless of the pitch played.

When playing a formant Wavetable, you will notice that the resonances remain at the same position, regardless of pitch - something very untrue for samples, in which the formant structure is transposed along with pitch.

An analysis done in time mode, on the other hand, will show the same effect of shifting formants when transposing the Wavetable as a sample would. However, it will not show the typical speed change of a sample when transposed. The playback speed of the Wavetable created from the analyzed sample will remain constant, dependent only on the way the Wavetable scanning is programmed.

As such, when applying a linear envelope (like one segment of the Wave envelope), you can control the playback speed using the envelope's time parameter. This speed, however, will remain constant regardless of the key you play. You could, for example, take a spoken word or phrase and play chords, and all voices will be completely synchronized.

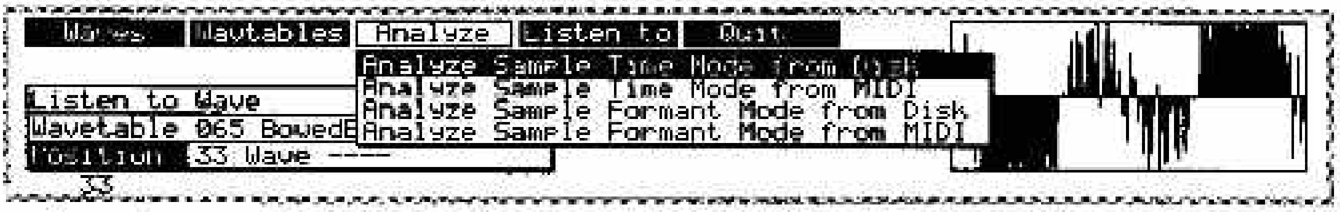
So when you have a sample that varies over time - and that timbral evolution is important - you should use time mode analysis. This might be true, for instance, for spoken words or sounds with a typical attack that evolves into a steady state. On the other hand, if you want to keep the formants of a sample, use formant mode analysis. Try sung vocals, for instance, or other sounds with strong fixed frequency formants.

Loading the Sample

For the Wave to analyze a sound it must be available as a sample. And no, the Wave has no sampling capabilities of its own. Therefore, you must provide some means to sample a sound yourself, such as a standard sampler (available from some of our competitors). You may also use a computerized sampling device or sample editor, provided it can store a sample in a format that is readable by the Wave's built-in disk drive.

Loading from Disk

This is the easiest way to transfer a sample into the Wave, and it may well be the fastest, too.


Waves
Wavtables
Analyze
Listen to
Quit
Analyze Sample Time Mode from Disk
Analyze Sample Time Mode from MIDI
Analyze Sample Formant Mode from Disk
Analyze Sample Formant Mode from MIDI

Listen to Wave
Wavetable 065 BowedE
Position 33 Wave ----
33

To analyze a sample that's stored on disk, insert the disk into the Wave's floppy drive. Then:

- Select the <Analyze> menu on the main page of Wave Edit.
- Choose one of the <Analyze...from disk> modes, according to the analysis mode you wish to perform.
- Press the [OK] button to acknowledge your selection, or [Cancel] if you have changed your mind and would rather not analyze anything.
- A file selector box appears on the display. It functions the same way as any Wave file selector box. (For details, see Performance, 10, "Disk Functions").
- Select the sample you wish to analyze. You may change disks if the desired sample does not reside on the current disk; however, do not forget to press the <DiskChnge> button after having done so.
- Press [OK] to acknowledge your selection, or [Cancel] to abort.
- The sample will be loaded and analyzed automatically.

Accepted File Formats

Currently, the following file formats will be recognized by the Wave:

Apple Macintosh

- Sound Designer I format (Digidesign)

Any Mac disk to be read by the Wave *must* be formatted as a PC disk. Use any of the available programs that offer the respective formatting functions. The Wave can read both double density (DD) and high density (HD) disks that are formatted as PC diskettes.

Atari ST/TT/Falcon

- Avalon format (Steinberg)

Floppy disks can be formatted under any TOS to be readable as a PC-compatible disk by the Wave. Alternatively, you may format a double density (DD) disk on the Wave itself and use that to store your files on the Atari.

PC-compatible Computers

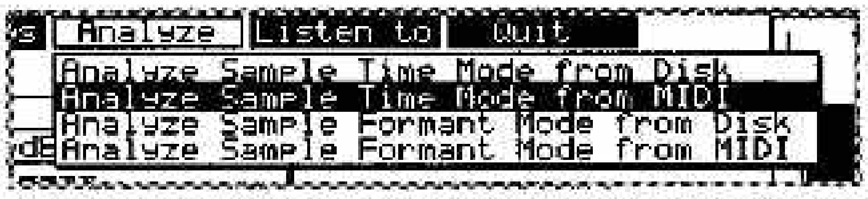
We still have to work on this one. Future updates will include a PC-compatible sample format.

Loading via MIDI Sample Dump Standard

Maybe you're one of those people who have a host of dedicated samplers, but no sample-editing software that's compatible with any of the Wave's supported computers or formats. You will still be able to get a sample into the Wave using the MIDI sample dump standard.

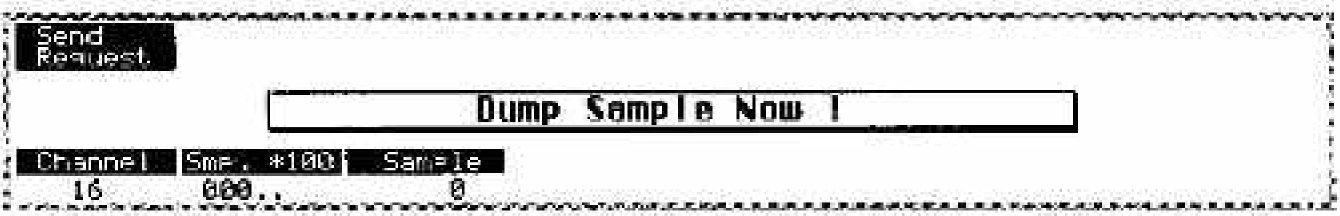
If your particular sampler does not support this standard, you are somewhat out of luck. A last resort might be to transfer the sample to a dedicated (or generic) computer-based sample editor that can either store a sample in one of the accepted disk-formats, or that itself supports the MIDI sample dump standard.

In any event, make sure that you have connected the MIDI cables correctly to your sampler. Connect the sampler's MIDI Out to the Wave's MIDI In, and either of the Wave's MIDI Outs to the sampler's MIDI In. This way the sample transfer will take place as a closed-loop data transfer, which offers a better chance of maintaining data integrity than an open-loop transfer, where you only connect the sampler's MIDI Out to the Wave'S MIDI in.


Analyze
Listen to
Quit
Analyze Sample Time Mode from Disk
Analyze Sample Time Mode from MIDI
Analyze Sample Formant Mode from Disk
Analyze Sample Formant Mode from MIDI

To load a sample via MIDI sample dump select the analysis mode you want to perform with the addendum <... from MIDI> in the <Analyze> menu.

The following page will appear:



Dump Sample Now !

Channel	Smp. *100	Sample
16	000..	0

You may either initiate a dump at the sampler itself, or, if your sampler does not support dump initiation commands, send a dump request from the Wave.

Initiating a request from the Wave

You *must* make a closed loop MIDI connection (connecting both MIDI-ports between the Wave and the sampler) to initiate a sample dump request from the Wave.

- Make sure the sys-ex transfer channel of your sampler is set to a valid MIDI channel, not to a unit ID number or the like, which may be outside the usual range of MIDI channels (as is true, for example, with Roland samplers, which can be set to an unit ID above 16).
- Set the parameter <Channel> in the sample dump display of the Wave to match the sys-ex transfer channel of your sampler.
- Use the faders <Smp.*100> and <Sample> to set the sample number you wish to request from your sampler. Some samplers might interpret this number to actually dump the sample with the next higher number, due to possible differences in the way samples are numbered (do you start at 0 or at 1?). It is best to test this first with a short sample.
- Press the button <Send Request> to request the appropriate sample from your sampler.
- The sample should now be received by the Wave. A dialog box will inform you that sample reception is in progress.
- Immediately after a successful data transfer, the received sample will be analyzed.

Actively dumping a sample from the sampler

You *may* connect only the MIDI Out of the sampler to the MIDI In of the Wave (open loop connection) for this kind of transfer, but we still prefer a closed-loop connection for data integrity (and transfer speed).

- Select the sample to be dumped at your sampler.
- Initiate the sample dump at your sampler.
- The sample should now be received by the Wave. A dialog box will inform you that sample reception is in progress.
- Immediately after a successful data transfer, the received sample will be analyzed.

Analyzing

Analysis is done automatically after a sample has been loaded or received via MIDI. There is nothing else that you have to do.

You will also automatically be presented with a Wavetable that's ready to play. The <Listen To> mode will automatically be set to either <Listen to Wavetable by Time> or <Wavetable by Key> according to the analysis mode used.

So, as you see, simply load the sample, lean back, relax and let the machine do the work for you. Life can be so easy. But sorry, no time for a cup of coffee - unless you use the sample dump standard to transfer a sample into the Wave - as the analysis process only takes a few seconds.

Hints and Remarks

Which Samples work?

Those samples work best that most closely match the harmonic synthesis of the Wave. Usually that would be synthetic samples, such as a sample that contains a single note from another synthesizer or the like. Why?

Well, the synthesis engine of the Wave, as pointed out before, produces purely *harmonic spectrums*. These spectrums build a timbre by adding up sinusoidal components that are perfect whole number multiples of the first harmonic, also known as the fundamental. These spectrums do not contain any detuned harmonics or overtones that are not perfectly in tune with the fundamental.

Usually a typical synthesizer waveform (at least from the analog days, anyway) comes closest to producing a perfect harmonic spectrum, and thus the highest fidelity for analysis.

However, this does not at all mean that you should never try anything else - quite the contrary. You must simply remember that a typical acoustic sound will not commit to the perfect world of harmonic synthesis. Thus, an analyzed acoustic timbre will usually sound different from the original sample.

Also, acoustic samples contain noisy elements, such as vocal sibilance, that you might not initially perceive.These elements cannot be faithfully reproduced by the Wave's analysis/synthesis method. However, often a healthy amount of high harmonics will be detected when analyzing samples that contain these "noisy" elements, which could result in analyzed samples that ultimately sound much noisier than you might have expected. This is usually most apparent when analyzing plucked timbres, such as an acoustic guitar.

For obvious reasons, an instrument, such as a snare drum, that contains a prominent amount of noise, will not be reproduced very well. Actually, that is, very *accurately*. You should know that the analysis algorithm will *always* analyze a sample, but it may sound very close to or dramatically different from the original source-material - or anywhere in-between. Nevertheless, even the extracted spectrum of a snare drum might sound interesting, though it will not resemble a drum very much.

Generally, the less detuned and less noisy a sound is, the better it will be analyzed. Also, only single, clearly defined pitches should be used - while a harp glissando might make for a great Wavetable (if you ever tried that), it will definitely sound nothing like the original sample, thanks to the completely unstable fundamental pitch. For the same reason, analysis of chords will yield results that sound fairly different from the source material.

As a general rule, the more harmonic a sound is, the better the chances of it being analyzed accurately. Once again, it should be made clear that a lot of material does work and will yield very interesting timbres. We've had good results using speech signals as source material, for instance.

You should also take the length of a sample into consideration. The longer a sample, the broader the snippets will be when doing a time mode analysis, and the more complicated the parameters of a formant mode analysis are to derive. Therefore, do not use samples that are too long. On the other hand, a sample that's too short will not contain enough information to generate a useful Wavetable, although a few of the Waves in the Wavetable that's generated from a short sample might be useful.

A good length for a sample that's going to be analyzed in the time domain is between two and four seconds; a sample to be formant-analyzed might even be only one second long. Depending on the sample rate, you could analyze a sample of about up to 10 seconds in length if enough free memory is available.

What to expect

Whatever you analyze, it *will* sound different from the original sample - If only because of the different modes of representation and the different synthesis engines. After all, the Wave does not simply play back a recording.

In any event, most likely you will find the analyzed Wavetable to be a good *starting point* to get the most out of the analysis. There are a lot of editing and macro functions available, and you should never be afraid of trying them out to get the results you intended.

After the analysis, the Waves of the Wavetable will closely represent the dynamic behavior of the analyzed sample. We found that to be very important in creating faithful timbral evolutions. If you would prefer either different ranges, or for each Wave to be normalized to output at full code, there are various gain-normalization functions available.

You may also notice some high-frequency shifting when scanning the Wavetable. This has to do with various aspects involved in the analysis process, such as the differences in the individual snippets and also the presence of detuned harmonics that must be mapped to the perfect harmonics of the spectrum to be extracted.

To reduce this "glitter-hiss", you can effectively use the <Reduce> or <Smooth> macro. Which one to use depends very much on the source material - experimentation often is the key to success here. You may also check the harmonics of each Wave, individually editing them in <Harmonic Edit> of the <Waves> menu. The <Wavetable Harmonic Edit> might also be a good try, but be aware that it will alter all Waves equally - something that might not be the best cure for a problem at a given moment.

Speech samples work pretty well if they do not contain too much drift in the fundamental pitch, since that will cause problems when mapping the analyzed harmonics to the spectrums to be extracted.

All in all, you may get good results rather fast, yet a *perfect* extracted Wavetable might take more time to achieve - as is usually true in life. Do not forget the option of editing the parameters of the Sound that the extracted Wavetable is to be used in as well; this often gets you a similar result much faster (using the high- and low-pass filters, for instance).

And finally, don't forget that the Wave is all about synthesizing new timbres. If you need the perfect string section, hire one and record it to tape, or use a sampler with perpetual memory. But if you want to get a very playable, but *different* sounding string-section, analyze a few string samples, build a few Wavetables, edit them, design a few Sounds and you'll end up with a really fresh, new sound.

Reducing Data

As you get the hang of analyzing, you will notice that memory is not without its limits. Some data reduction comes in pretty handy at this point.

That is the reason we included the <Reduce To> macro-function. It allows you to specify the maximum number of Waves you want to *keep* in the Wavetable. It then will delete the least important, most redundant Waves until the number of Waves you specified has been reached.

For best results, you should use the <Reduce To> macro at specific ranges. Most often, the steady state of a sustaining timbre (where you would place a loop when sampling) or the decaying part after the initial attack-Waves in a percussive timbre lend themselves to data-reduction.

However, be careful not to delete too many Waves, since then the resultant Wavetable might easily become too static sounding.

See chapter 3.11, "Reduce Range", for more detail on the <Reduce To> macro.

Smoothing an extracted Wavetable

After analyzing a longer sample that contains noticeable timbral changes, you might find the resulting Wavetable to be rather jagged, and not quite as smooth as would be enjoyable.

Use the <Smooth> macro in <Wavetable Edit> on these occasions. For best results, use the macro on specific ranges. This macro will delete those Waves in a Wavetable that are both close together and dissimilar. By removing these spectrums from the Wavetable, interpolated positions are created automatically in their place, allowing for smoother changes among the remaining Waves.

This function is also very useful for creating smooth timbral evolutions from rhythmically pronounced material, such as spoken words. The fluctuations will remain present, but they will be softened so that the rhythm will be reduced or eliminated altogether, leaving you with a textural sound of a distinct, yet musical quality.

See chapter 3.12, "Smooth Range", for more details on this function.

Creating Spectral Interpolations

By analyzing different timbres and storing them as Wavetables, you also get the option of creating Wavetables where one timbre might evolve into a different one without any noticeable crossfades or changes. This process is called spectral interpolation, or "morphing," as it relates to the visual process of smoothly turning one object into another (Asta la vista, Baby!).

You can create such a spectral interpolation by combining two (or more) extracted Wavetables into a new one that contains elements of both. The trick is to leave enough undefined positions between the two sections to allow the Wavetable to create interpolated Waves that smoothly turn one spectrum into the other.

- First, you must analyze the respective samples you want to morph. Store each Wavetable you create this way in internal memory.
- Now, check the Wavetable whose Waves should be used to start with. Depending on the nature of the sound, you should use the first couple of Waves, but not more than the first third of the Wavetable. With some spectrums, you only need the first few Waves that define the attack of a sound; sometimes even a single spectrum is enough.
- Make notes about the respective Waves and their positions.
- Do the same for the Wavetable that contains the spectrums you intend to morph into. Here, you should decide if it might be better to morph into the attack or the sustain/decay portion of the Wavetable.
- Once again, make notes about the Waves and their corresponding positions. This time, the number of blank positions in-between the Waves is of importance, not so much their precise locations.
- Copy the first Wavetable by storing it to an unused location.
- Delete all positions except those of the initial Waves that you want to use as the starting ground for the spectral interpolation.
- Insert the selected Waves of the destination timbre into the end of the Wavetable using the <Wave*100> and <Wave> faders; use your notes as a reference.
- Make sure that at least one third of positions in the middle of the Wavetable are empty for use as the interpolation range by the Wavetable.

Of course, you can always use more than two source spectrums to create spectral interpolations. However, keep in mind that you must allow for enough empty positions within the Wavetable so that the spectral interpolation will be smooth.

Harmonic Equalization

This is another one of the many possible ways to edit an analyzed Wavetable. By employing harmonic equalization, you can adjust and fine-tune an extracted Wavetable to your liking.

To alter the overall timbre of an extracted table, use the <Wavetable Harmonic Edit> macro. It yields a uniform change that affects the Wavetable as a whole, whether it's a time mode or formant mode analysis.

However, to make very specific edits to separate portions of the extracted Wavetable, <Harmonic Edit> from the Waves menu should be your first choice. Especially when some attack transients are not as clear or crisp as you would like them to be, touch-ups of the first Waves can make a difference.

On the other hand, after having done some data reduction using the <Reduce To> macro, it can be very helpful to edit the final Waves of an extracted Wavetable to attain more body and maybe even high end, especially for decaying sounds where you might apply a filter- and amplitude-envelope via Sound parameters.

Formant Shifting

This function comes free with formant Wavetables.

After having applied the correct [Keytrack] amount (a value of *+32* yields a different Wave with every semitone), use the [Start Wave] parameter to shift the frequency of the formant bands. Of course, positions at the extreme ends will have the effect of transposing the formant bands when playing higher or lower notes on the keyboard, but even then many useful Sounds can be obtained.

Detuned Harmonics

Even though this is not directly possible within the confines of the Wave's synthesis techniques, you can use some tricks to get around it and at least get a similar effect.

The basic starting ground should always be an extracted Wavetable that sounds as close to your liking as possible.

- Create two copies of the Wavetable by storing it to two other Wavetable locations.
- Decide which harmonic band you would like to detune.
- Select one of the copied Wavetables and choose the <Wavetable Harmonic Edit> function from the <Wavetable> menu on the main page of Wave Edit.
- Delete the frequency band you want to detune by setting the appropriate fader to *-64*.
- Store the edited Wavetable to internal memory. Use the <Append> mode.
- Select the other copy of the original Wavetable, and delete all harmonic bands *except* the one you want to detune in <Wavetable Harmonic Edit>.
- Store that Wavetable to internal memory.
- Create a Sound using the first edited Wavetable and store it.

- Copy that Sound by storing it to another location, and select the second edited Wavetable for it.
- Assign both Sounds in a Performance to play simultaneously.
- Use the Instrument's <Detune> function to detune the Sound with the Wavetable that contains the harmonic band you wish to detune.

➪ Obviously, you could create even more such Wavetables - up to eight, each one with its own Wavetable that contains only its specific harmonic band. Then you have enormous possibilities for creating thick, lush and detuned timbres. Use envelopes to modulate the frequency of various harmonic bands for detuned harmonics that drift over time. Also, various amplitude, filter and panning modulations can create some dramatic effects.

➪ If you have to be voice- and Instrument cautious, and if the timbral evolutions within the Wavetable are more subtle, you may also create a split Wavetable. Assign the spectrums without the detuned harmonic band to the first 32 positions, the sole detuned harmonic band to the last 32 Wavetable positions. In order to do this, you first have to create the two Wavetables as described above, and then copy both into a new Wavetable, taking the shortened space into account (the <fill > function might be of help for this).

➪ Finally, you may use both of these techniques to create up to 16 different frequency bands that can be controlled individually. Either split the bands into even/odd harmonics, or use <Harmonic Edit> from the <Waves> menu to achieve 16 rather than only eight harmonic bands.

<Listen To> Menu

This chapter describes the function and usage of the <Listen To> menu, which you will find on both the main page and the <Edit Wavetable> page in Wave Edit.

The Basic Concept

Whenever you edit or create a Wave or Wavetable, you can listen to the edits while you work on them in real time. This simplifies all Wavetable or Wave edits enormously, since you can hear what you're doing while you're doing it.

However, depending on what you edit, you might want to listen to your edits in different ways. Especially when designing Wavetables there are times when you might only want to listen to a single Wave, followed by a wavescan over time. The <Listen To> menu allows you to choose your preferred listening situation at any time.

When you choose one of the three specific Wave Edit listening modes, you will always hear only one oscillator. All envelopes are set to an organ-style response, and the filter is wide open. There is no additional processing or modulation taking place; the sound you hear is as close as possible to the pure sound of the Wave or Wavetable, unmodified and unprocessed.

Listening Modes

Currently you can choose between four different listening modes. All modes are mutually exclusive. Automatic selections might override your current selection; see below for more information about automatic selection of the listening mode.

Listen to <Wave>

In this mode, you listen to one and only one Wave. This is especially useful when editing Wavetables to compare various Waves in the Wavetable to each other. Also, you may check an interpolated position and decide if you want to edit it.

The Wave you listen to when <Edit Wavetable> is active is the Wave whose position is currently selected by the <Position> fader.

On the main page, the currently selected Wave in the selected Wavetable will be the one you will listen to.

Listen to <Wavetable by Time>

This mode allows you to listen to the selected Wavetable as it sounds when scanned over time. The scanning speed is rather slow, allowing you to hear the timbral evolution precisely. In a "real" sound, this type of wavescan would typically be produced by the Wave envelope.

This listening mode will always scan the entire Wavetable, from position 1 to position 64, at the same, constant speed. When position 64 has been reached, that Wave will be played until the key is released.

Listen to <Wavetable by Keys>

This mode allows you to check how a Wavetable will work when the Wave position is determined by key number. This mode is especially useful when checking formant Wavetables.

Each key will play a different Wave, with Waves succeeding in a linear fashion. The lowest C on the non-octave-transposed keyboard will play the Wave at position 1.

Listen to <Selected Sound>

Undoubtedly you'll want to edit a Wavetable while listening to it in its natural habitat, namely the Sound in which it will be used. The <Selected Sound> mode offers you exactly that option. And there is more to come: You may even edit the Sound you selected for auditioning as well, giving you a chance to design a specific Sound right down to a single harmonic.

You can select the Sound you want to listen to as usual from the [keypad]. As a default, the Sound that was used by the main edit-active Instrument will be used when you first choose this option.

You may change the selected Sound at any time. The edits you make during your Wave Edit session will remain active even after quitting the Wave Edit operation mode. However, if you did not save the edited Wavetables before quitting, the edited Sounds will be different after you exit Wave Edit, since the Wavetable you were listening to will no longer be available.

As usual, you may store the currently selected and edited Sound to any location in the internal memory using the [Store] button.

Automatic Selection

Certain menus and functions of Wave Edit will automatically set the listening mode in order to let you hear the edit in the most straight-forward way. You can still manually change the listening mode when editing Wavetables to suit your current needs.

Edit Waves

Whenever you edit a Wave, whether from the main page or from the <Edit Wavetable> menu, the listening mode is automatically set to <Listen to Wave>. This is a provision to keep your mind sane and your body free from physical harm, which you might introduce to yourself if you were to edit a Wave while the Wavetable was being scanned, thus leaving you notoriously in doubt about what you do and what you hear.

To avoid such unhealthy confusion, there is no other listening option available when editing Waves. To check how the Wave performs within the context of a Wavetable, you must select <Edit Wavetable> or the main page and choose the appropriate listening mode, and, obviously, the Wave in question must be assigned to that Wavetable.

Analysis Time Mode

Whenever you analyze a sample to extract its spectrums over time by employing one of the <Analyze Time Mode> functions, the <Wavetable by Time> listening mode will be set automatically. As such, you can directly audition the newly-generated Wavetable that contains the extracted spectrums as a timbral evolution over time.

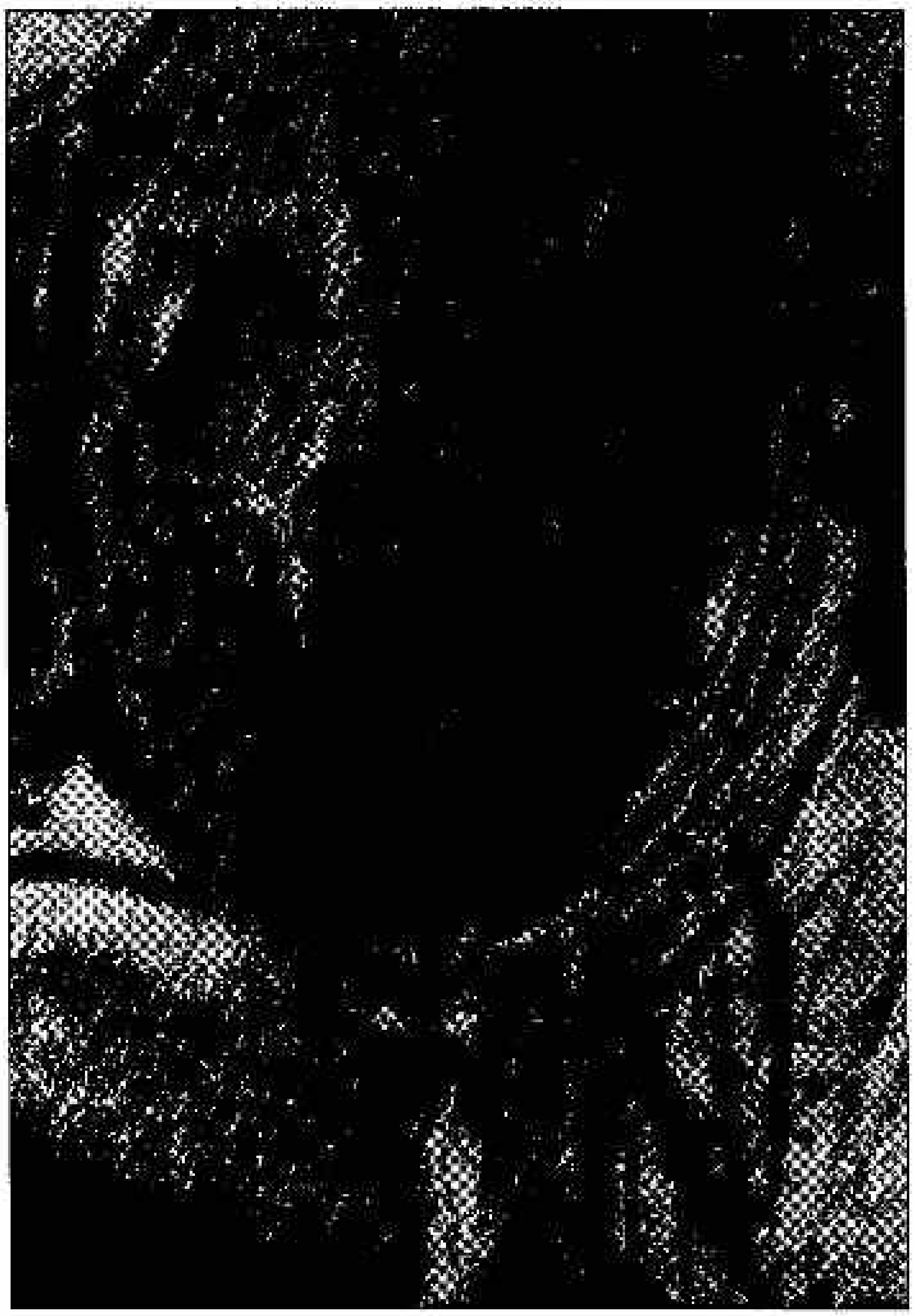
You may change that mode using the <Listen To> menu any time you like.

Analysis Formant Mode

When analyzing a sample using one of the two <Analyze Formant Mode> functions, the <Listen To> mode will be automatically set to <Wavetable by Keys>. This allows you to audition the newly created Wavetable in the way a formant Wavetable would usually be applied.

You may change that mode using the <Listen To> menu any time you like.

Quitting



WAVETABLE DESIGN

waldorf

This chapter tells you how to stop working in Wave Edit. You will find it helpful in maintaining a natural social life.

Why Quit?

As mentioned before, Wave Edit mode is a very special mode. A lot of memory might have been used during your session, and many temporary edits could have taken place. To make the Wave (the hardware thing) workable under normal conditions again, memory has to be reorganized and parameters must be re-initialized.

If you could simply switch back to another operation mode, chances are you would lose a lot of valuable data by hitting the wrong button at the wrong time. There is no way to keep all the edits of Wave Edit for an extended time - especially when you intend to play the Wave in the standard way. It must be flushed when exiting Wave Edit to get back to the normal working environment.

Therefore you must actually quit Wave Edit, to give the Wave a chance to restore its memory and functions, to give you a chance of making up your mind and to check once more if all of the Wavetables you wanted to save are, indeed, saved.

The Exit

Exiting Wave Edit must be done the following way:

- Select the main display page of Wave Edit
- Press the <Quit> button located on that page
- A dialog box will warn you that you will loose all unsaved edits when quitting
- Press the [OK] button to return to the regular operation modes of the Wave
- If you want to save edits made in Wave Edit, or simply don't feel like you've tweaked enough harmonics, press the [Cancel] button to remain in Wave Edit

When you quit Wave Edit **all unsaved data** generated or edited in Wave Edit will absolutely be lost, so handle this one button with care.