

Dave Bellingham
Peter Gorges

Introduction to Additive Synthesis Advanced Sound Design Tips and Tricks

for all models
KAWAI
K5000

Library Hill



WIZO
the sound generation

**Introduction to Additive Synthesis,
Advanced Sound Design, Tips and Tricks**

Dave Bellingham

Peter Gorges

KAWAI
K5000

**Introduction to Additive
Synthesis,
Advanced Sound Design,
Tips and Tricks**



Imprint

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Welcome ...

... to everybody. This WIZOO Guide to the Kawai K5000 series synthesizers was written primarily for those of you who are not new to synthesis in general but lost when it comes to additive synthesis, and also for anyone who would like to take *full* advantage of this extraordinarily powerful and flexible sound engine.

The guide features loads of practical examples, uses and explanations *in a >real world< context* which will make the Advanced Additive synthesis engine both easier to understand and to use.

It is strongly recommended that you are in front of your K5000 with it turned on and hooked up to your PA as many of the explanations are best understood if you can see and hear what's going on.

You *won't* find info on how to use the arpeggiator or sequencer/APG sections in the specific models. This guide is dedicated to using the synth engine, and when we say using, we mean USING.

We're sure that you'll enjoy reading the book. We have put a lot of effort into it in order to make it a relaxed, conversational and humorous thing to read, and best of all, we have literally stuffed it with hardcore insights, tips and tricks you *will* not find anywhere else, no matter where you look ... after all, the last thing you wanted was *another* manual when you picked up your copy, right?

Have fun!

Dave Bellingham & Peter Gorges

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Table of Contents

1 Introduction

This section will introduce you to the ›fundamentals‹ that you *need to know* on your way to becoming a programming wizard with your K5000. Some of the things you will learn here are pretty theoretical and you may wonder why we're actually getting you to read them ...

The answer's pretty simple really ... if you don't understand this stuff *now*, you'll be completely lost when we start doing some advanced programming with the K5000 as many of the terms used later are explained in this section.

There's a second reason too ... we have a sadistic streak!

 Please load the ALL file included with the disk into your K5000 *now*. It contains all the example patches used in this book.

What is Sound?

You might think this is a pretty dumb question, but many people don't know what sound is ... ready to test *your* theories?

Simply put, sound is created by the movement of air.

All sounds that occur in nature (or elsewhere) are actually combinations of *sine* waves or, if you like, fundamental *tones* plus their related *harmonics*.

For any of you ›purists,‹ the closest ›natural‹—i.e. not synthetically generated—sound to a pure *sine* wave is a tuning fork ... although this also contains some overtones.

If you think of these fundamental *tones* as being like DNA—the building blocks of life ... you can consider them the ›building blocks‹ of sound.

These ›building blocks‹—fundamental *tones* plus their *harmonics*—change over time to create unique sounds ... let's say a dog barking.

›What's so unique about a dog's bark?‹ you're thinking to yourself ... well let's compare the ›woof‹ of a Great Dane to

Chapter 1 Introduction

the ›woof‹ (yap) of a Chihuahua. I'm pretty sure that most would agree that these barks sound different—the larger dog having a louder and deeper ›woof.‹

›So what have dog barks got to do with my K5000?‹ ... well lots, as it happens!

The Great Dane's bark is deeper and louder because of the physical characteristics of the animal. Compared to the Chihuahua, the Dane has much longer vocal cords, a bigger mouth, deeper chest cavity, bigger lungs and a dozen other physical attributes which can alter the depth and volume of its bark. And this is without going into things like being excited about going for ›walkies‹ or chasing a cat.

Fundamentally, however, the ›woof‹ we hear from either dog is made up from various combinations of *tones* or *frequencies* plus their *harmonics* ... it's those building blocks again.

- 1 To illustrate *frequencies*, play the middle ›C‹ on your K5000 keyboard.
- 2 Now play the C an octave above.

The pitch of the 2nd note is higher ... in fact it is playing at twice the speed or *frequency* of the first C.

Playing another C an octave above will be playing back at four times the speed or *frequency* of the middle C we started with.

Do you see a pattern forming here?

Going back to our barking dogs, the ›fundamental‹ or base *tone* of the Great Dane's bark is actually a slower *frequency* (and lower *pitch*) than that of the Chihuahua.

So, faster *frequencies* are heard as higher *itches* and lower (or slower speed) *frequencies* are heard as lower *itches*.

See ... this stuff isn't so hard ...

What is Synthesis?

In simple terms, synthesis (musically speaking) is the method of combining various elements together to create a sound ... to illustrate this, let's have a look at the word ›chicken.‹

If we were to break this down into its composite parts you would end up with something roughly like this ... CH-I-CK-EN

...

Working with small sections like the above means that you have full control over the individual bits because (as yet) no-one has come up with a method of synthesis which would allow you to create something as complex as speech in one hit.

Among the methods of synthesis which have been used over the years are analog, PCM (Pulse Code Modulation) and of course, additive as well as many others.

- ▶ A simple and often used analogy when comparing these methods of synthesis is related to art.
- ▶ Analog synthesis and PCM synthesis both use a subtractive method, much like a sculptor would start off with a large bit of rock and chip away (subtract) until the final shape was revealed.
- ▶ Additive synthesis is a lot like painting where you blend different colours together to create new hues and then you place them on a canvas using whatever's handy.
- ▶ Another term which is related to the PCM method of synthesis (and is also found in the K5000) is Sampling. The K5000 contains a number of samples which are useful for quick patch creation. Using the art analogy, sampling is most closely related to photography where a ›snapshot‹ of a sound at a particular moment in time is recorded and placed into memory.

Analog synthesis at its simplest incorporates three main sections, namely the VCO, VCF and VCA—abbreviations for Voltage Controlled Oscillator, Filter and Amplifier, respectively.

The VCO generates the sound (a simple but harmonically rich waveform such as a *sine* wave, *pulse* (sometimes called *square*) wave or *sawtooth* wave).

The VCF filters and contours the *colour* of the wave which has been sent to it from the VCO.

The VCA is the third component in the chain and controls the volume of the generated and filtered waveform over time.

PCM synthesis works in essentially the same way but substitutes the Voltage control for Digital control of the various sections ... the DCO, DCF and DCA.

The other difference is that instead of using a simple waveform as the starting point of a sound, samples (recordings of real instruments ... pianos, guitars, strings, drums etc.) are used instead.

This method of synthesis sounds *much* more realistic than analog synthesis when emulating acoustic instruments but is limited by the fact that sounds generated in this way sound ›static‹ and have very little movement, if any.

... this is where additive synthesis comes in.

So, what's this ›Additive‹ thing all about?

Additive synthesis is a method employed by the K5000 synthesizers which allows you to combine *tones* and their related *harmonics* together to create new sounds ... more on that in a moment ...

And what about the ›Advanced‹ Additive bit?

The ›Advanced‹ in Advanced Additive means that the K5000 synthesizers, in addition to conventional additive engines, also offer a separate envelope for *each* harmonic.

Colour—Harmonics

Remember our dogs from a page or two ago and the discussion about *tones* and *frequencies*? ... It's time for a new term—›*harmonics*.‹

So, what's this ›Additive‹ thing all about?

- ◆ The fundamental (or ›base‹) *tone* is referred to as the first *harmonic*.
- ◆ A *tone* played at twice the speed (*frequency*) of the first harmonic is called the second *harmonic*.
- ◆ A *tone* played at four times the speed of the first harmonic is called the fourth *harmonic*.
- ◆ A *tone* played at 64 times the speed of the first harmonic is the 64th *harmonic*.

Once again we have another pattern forming here ... (bet you weren't expecting a maths lesson).

Each of these *harmonics* have a different tonal quality in relation to the *fundamental (base) tone* and as you build up a patch by adding harmonics, the colour of your sound starts to take shape.

In general, *harmonics* that have a mathematical relationship to each other, such as Octaves, Odd numbered or Even Numbered etc. sound ›musical.‹

A collection of *tones* with various related *harmonics* that change over time are what we perceive as a *sound*, musical or otherwise.

Contour—Harmonic Envelopes

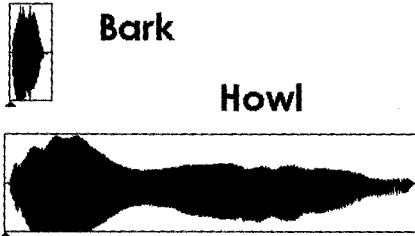
Back to our dogs ... the Great Dane and Chihuahua like to howl as well.

I'm pretty sure all of you will agree that a howl sounds different to a bark (or a yap).

The ›howl‹ is longer than the bark, and usually starts off gradually with a high pitch that slides down to a lower pitch, and then fades out to silence.

The ›bark‹ is short, starts quickly and doesn't vary much in pitch over time.

Check out the diagrams below to see the difference between these two.



The waveform diagrams above only show *volume* differences over time, as well as a comparative length difference. They do *not* show pitch differences.

The images above represent what is known technically as an *amplitude envelope*.

In non-technical terms and using the images as a reference, the ›Howl‹ gradually works up from the left to its loudest volume (*amplitude*) then slowly moves down the longer sustained portion on the right, before eventually fading out to silence. The ›Bark‹ very quickly reaches its loudest amplitude, doesn't sustain much at all and drops to silence almost immediately.

If we were to break down the sounds above into regions over time:

- ◆ The ›Bark‹ would have a quick *attack* time, a short *sustain* time and a short *release* time.
- ◆ The ›Howl‹ would have a longer *attack* time, a short *sustain* time, a short *decay* time, another *attack* time, a long *sustain* time and finally a long *release* time.
- ◆ The terms above ... *attack*, *decay*, *sustain* and *release* are found in the K5000's *envelope* generators.

The *amplitude envelope* allows you to sculpt volume levels of a sound over time.

In the case of the *amplitude envelope* (fancy name for volume control), you can change the various sections of the

So, what's this ›Additive‹ thing all about?

sound to make them louder (or softer) and to take more (or less) time to change.

We're in the home stretch with this section ... PHEW!

So far we've covered that all *sounds* are made up of combinations of *tones* with various *harmonics* of different *frequencies* that change over time.

In a traditional synth (*subtractive*) you cannot control which *tones* and *harmonics* are contained in a *sound* as the waveform which is generated by the VCO is fixed. Any *envelope* changes made with this method of synthesis will affect the *whole sound*.

The K5000 allows you to have complete *envelope* control over *each harmonic* (up to 64 per source!!!) within the *sound*

...

In the Additive section of the K5000, the *amplitude envelope* is called the *harmonic envelope* and it is exactly the same thing, just a different name and there are 64 of 'em per source—wow!

With this level of control, it would be possible to change the Great Dane's ›bark‹ into the Chihuahua's ›yap‹ and vice-versa (oh no ... it's the dogs again!) by altering the appropriate *harmonics* and their respective *harmonic envelope* levels within the *sound*.

Control—Velocity, Controllers

Having a collection of *tones* and their *harmonics* which have each been individually modified by the *harmonic envelope* is all well and good *but ... sounds* that occur in the real world are *not static!*

A number of factors can affect this such as wind, other noise, whether the sound happens indoors or outdoors, how loud the sound is and many thousands of other variables.

To simulate this ›real world‹ aspect of sound, the K5000 has a number of control functions which allow the *harmonic envelope* (and the *tones* and *harmonics* which it is shaping) to respond to input that *you* give it.

Keeping in line with the ›real world‹ theme ... and to illustrate this a little more clearly ... let's take a look at (listen to?) the sound of a Grand Piano.

When the piano's keyboard is struck softly, the amount of energy applied to the hammers which strike the strings is minimal and so the tonal quality of the sound is ›mellow, soft and rounded.‹

When struck hard, the tonal quality of the piano sound is ›bright, loud and sharp.‹

Using the K5000, you have the power to modify the *harmonic envelope* to respond to *velocity* (how hard you hit the keyboard) so that—as *one possible example*—the harder you hit the keyboard the more loudly the *even* harmonics are heard and if you play softly, the *odd* harmonics are more prominent.

Used in this way, the *sound* ›moves‹ and changes in response to your playing style.

Other possibilities and methods of using the control functions to modulate the *harmonic envelope* are through/via the pitch and modulation wheels, keyboard pressure (*aftertouch*) or using keyboard scaling so that the further up (or down) the keyboard you play, the more (or less) the *harmonic envelope* affects the sound.

Complex Changes—The Formant Filter

The Formant Filter is a real ›powerhouse‹ feature of the K5000 and can do some amazing things to your sounds. Technically the filter is not that remarkable *but* the amount of control you have over it, and therefore over your sound, is phenomenal.

In plain language, the Formant Filter is a 128-band equalizer, (see the *Glossary of Terms* on page 135) but there's a lot more to it—think of a 128-band-equalizer that you can run your thumbnail up and down like a haircomb, each tooth representing a frequency and you get closer to the concept of what the Formant Filter can do.

So, what's this ›Additive‹ thing all about?

One of the many things that the Formant Filter can do is the emulation of physical characteristics of ›reak‹ instruments, such as the length and body of a flute or radical sweeps across the frequency spectrum resulting in pseudo-melodies.

Here is a simple example of what the Formant Filter can do:

- 1 Load up ›StageMk1‹.
- 2 Press the EDIT button.
- 3 Press the 05 button in the Sound Select section of your K5000.
- 4 Press the L1 button.

 StageMk1—A003

In the resulting Window (the DFL Editor) you will see ›GEQ, Band, Level & Bias‹ listed on the right.

- 5 Press the R4 button.
- 6 Use the dial to change the Bias from 0 up to 63.

At (or near) 63, the sound should change to a very sweet ›bell-like‹ electric piano ...

This is only an introduction to, and a *very* simple example of, what the Formant Filter can do ... but we promise that it will get a lot more ›in-depth‹ in the next few chapters.

So ... there you have it!

From here on in, we'll concentrate less on the theoretical and more on the practical aspects of programming the K5000.

From time to time, there will be some technical/theoretical bits, and maybe the dogs will make a cameo appearance or two, just to help out ...

Once you've got the hang of it, you'll find the Advanced Additive synth engine both easy to use and unbelievably powerful ... and you will be creating new and unique sounds well into the next millenium.

OK—onto the next chapter ... is your propeller-hat on?

Chapter 1 Introduction

2 K5000 Programming Tutorial


This chapter is all about ›how to‹ program a patch using the K5000 in simple terms. In the next few chapters we'll take a more ›in-depth‹ look at the actual synthesis functions covering both their practical application—what they do to your sound—and also the technicalities if you're a propellerhead.

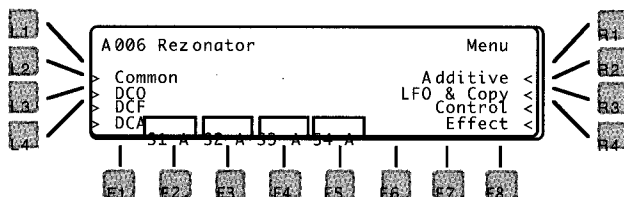
First step

There's no point in swimming the English Channel if you can't tread water, so if you haven't read the manual and don't know how to choose banks/patches, write patches and select parameters in the various edit windows, then go and read it *now*. When you're done, come back and we'll let you play.

'Ere, this all sounds a bit common ...

Select the ›@Vocoder‹ patch and press the EDIT button.

 @Vocoder —
A040



The K5000 Main
Menu

Chapter 2 K5000 Programming Tutorial

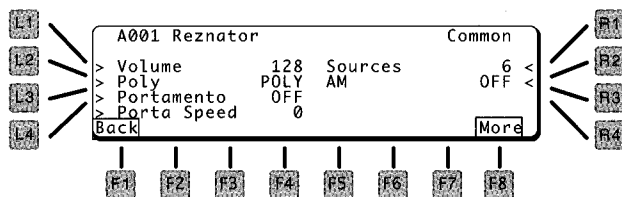
Note that this patch uses *two* sources which can be seen just above the F2 and F3 buttons.

Press the F3 button once so that the display changes from S2 P to S2--. You have just muted the second *source* in this patch so that we are now left with a single source which can be heard. To unmute this *source*, simply press the F3 button once—but leave it alone for now.

- ▶ The six *sources* can be muted/unmuted in this way.
P = a PCM source
A = an Additive source

Press the L1 (COMMON) button and press the F8 button on the >name< page which will take you to the display shown below.

Adjusting the Volume using the dial will result in the patch being louder or softer. Try it.



Pressing L2 to select Poly allows you to use the dial and change the patch to play polyphonically or monophonically. Give it a try as well.

The next two functions are linked, so that Porta Speed will have *no* effect unless Portamento is ON.

Turn the Portamento ON, and change the Porta Speed to 115.

Now, select and change the Poly value between the 3 choices and play a couple of notes at least 2 octaves apart on the keyboard.

You'll hear how the note glides up or down and how the Poly value affects the way this sounds and responds ... this stuff is great for those phat & fonkee Chicago house bass sounds.

Also on this page is the Sources parameter, which allows you to define the number of sources available to the patch if you want to add other sources to the existing two. You can

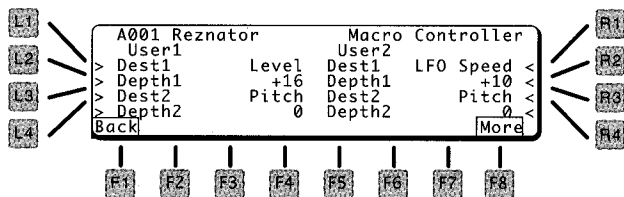
The DCO—what's it all about?

also reduce the number of sources available to the patch to conserve polyphony.

The last parameter available is the AM (Amplitude Modulation) which we don't regard a very powerful tool—it's more like a concession to K4 and K1 owners.

- ▶ We think AM was important on the old K-synths as they had no other creative options to really change waveforms. On the K5000 there are so many better ways to shape your sound, so why bother about AM?

Pressing the MORE button will take you to the next page



This page and the pages that follow (keep pressing F8) is where you set up your patch Macro and footswitch controllers which are discussed at length in *Adding Realtime Control* from page 101 onwards. The Macro controllers are available on the K5000S or by using the MCB-1/10 with the K5000R/W.

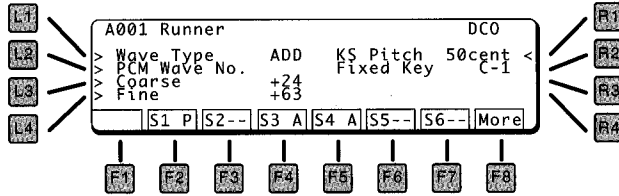
Using these four controllers, you can simultaneously adjust *two* discrete parameters with each knob.

The DCO—what's it all about?

Reselect the Vocodor Patch—don't save any changes when prompted.

The pic below shows the DCO page which you can get to by pressing EDIT/L2.

The DCO page



Press the F2 button once, so that the ADD source is muted, then press the F3 button twice—once to select the PCM source, and once to unmute it.

If you play a key or two, you should hear a kinda metallic raspy sort of sound.

Press the L2 button to select the PCM Wave No., and change it to 398. You can repeatedly play a note on the keyboard as you're doing this and hear the raw PCM waveforms that are in the K5000.

Now use the Coarse Tuning and change the value to -12.

You should be hearing a sawtooth sound—kinda like an old analog synth.

Congratulations—you've now mastered the selection and tuning of raw PCM waveforms in the K5000.

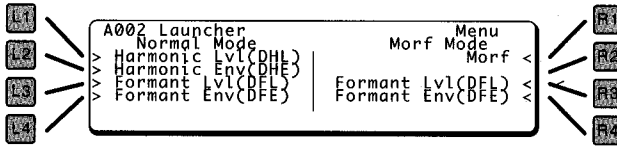
Setting relative levels between sources

As we're still playing around with our new sawtooth sound, unmute source 1 by pressing F2 and have a play with the keyboard.

The ADD source is pretty loud in comparison with the sawtooth sound, huh?

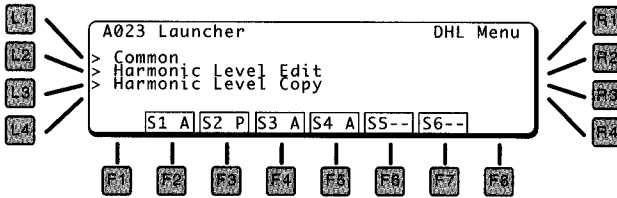
To change this, return to the main menu by pressing the EXIT button, and press the R1 button—make *sure* that source 1 is selected before doing this.

And we thought DHL was a courier company ...



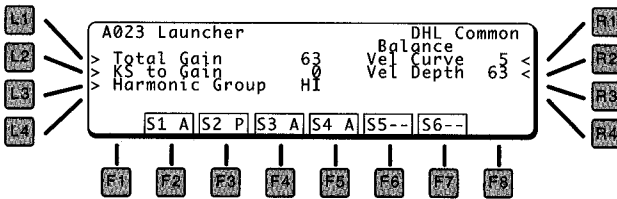
The Additive Synthesis Menu

Press L1 which will take you to this screen.



The Digital Harmonic Level Menu

... and then L1 again which will show you the screen below.

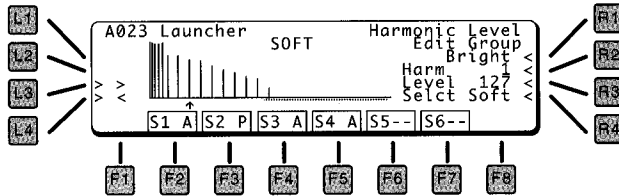


Select and change the total gain from 63 down to a level that you're happy with (we like 45 as the balance between them)

And we thought DHL was a courier company ...

If you haven't changed anything, press EXIT/L2.

The Harmonic Level Edit window



- 1 Press R4 and use the dial to change the value from SOFT to LOUD.
- 2 Press the R1 button and use the dial to scroll through the values available in this Edit Group parameter, and while you're doing this watch the display below the vertical lines in the onscreen >ramp< where you will notice the >dots< changing.

These >dots< indicate the individual harmonics in the various groups—select >Oct< and you'll see that the 1st, 2nd, 4th, 8th, 16th, 32nd and 64th harmonics are selected. Select 5th and you'll see that the 3rd, 6th, 12th, 24th and 48th harmonics are selected.

These harmonics are tuned to the selected interval above the *fundamental tone* that we talked about in the introduction chapter. Remember the mathematical relationships between harmonics stuff?—Octaves, 5ths, even, odd etc.—this is it in practice!

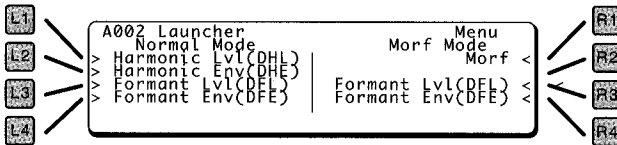
- 3 Select 5th and play a note on your keyboard and hold it down (use your sustain pedal if you have one).
- 4 While the note is sustaining, press R3, and dial like crazy to the left to change the level of the 5th group. You'll see it graphically changing on the display.
- 5 Now dial to the right and as the onscreen >bars< get up towards the top of the ramp, if you keep on dialing they continue and you should slowly hear the 5th harmonics become audible.
- 6 Select the Oct group and do the same thing.

Apart from giving your dialing finger a great workout, you have just covered almost all there is to know about the selection of harmonics and altering their volumes in relation to each other—well done!

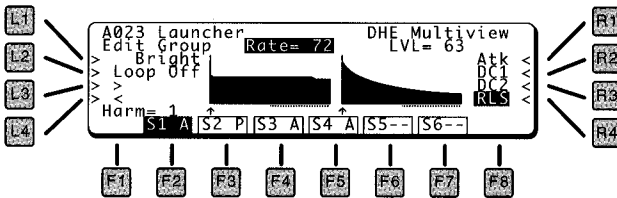
Creating harmonic contours—groupstyle

The grouping used in the DHL section has been carried over to the DHE (Digital Harmonic Envelope) to assist you in *quickly* putting a patch together.

Provided you haven't changed anything, press EXIT twice and you'll see the following screen.



Press L2, and on the next screen press L1—Harmonic Envelope Multiview, which looks something like this.



The Harmonic Envelope Multiview—allows you to see all harmonic envelopes

Notice the Edit Group parameter on the left hand side?

This works just like the one in the DHL, so you can scroll through and check them out using the dial.

- 1 Select Oct.
- 2 Press the R1 button and the Rate value is highlighted. Turn the dial to the left and you'll see that all of the Octave harmonics in the block change.

On the right-hand side, you will see Atk, DC1, DC2 and RLS. These are the various sections of the envelope that can be adjusted in the DHE Multiview and can be selected individually by pressing the R1—R4 buttons.

For now, however, we'll simply concentrate on the Atk (Attack) portion of the sound's Octave harmonics.

Chapter 2 K5000 Programming Tutorial

- 1 Change the rate to a value of 84 and press the R1 button. Notice that the LVL is now highlighted.
 - 2 Change this to a value of 20 and play a key or two on the keyboard and hold it down. You should hear the Octave harmonics slowly fade in after a short period.
- The R1 button in this page accesses *three* discrete parameters. It will toggle between Rate and LVL if Atk is selected. If the Atk parameter is *not* selected, then you need to toggle the R1 button to either Rate or LVL (whichever you want to adjust) *before* you select DC1, DC2 or RLS.

We recommend using groups as often as possible. The alternative of building harmonic by harmonic, envelope by envelope is certainly possible, but is extremely painful, slow and it is *very easy* to forget exactly what it was you originally set out to create.

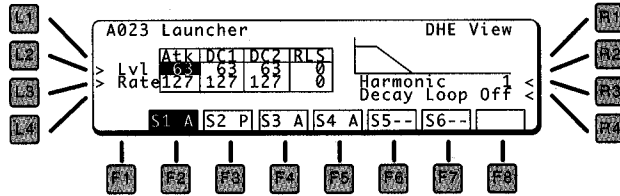
Using the DHE Multiview in this way allows you to quickly set up an ADD source with a group of harmonics that fade in or out etc. in the same way.

This is a great way to quickly put together a patch, but if you want to sculpt the sound further—the control freak in you takes over—it is possible in the next area we'll take a look at.

Harmonic Contours for surgeons

As we're still in the DHE Multiview window, press EXIT and then L2.

This is the DHE view window where you can individually adjust the envelope shape for each harmonic.



Press R3 and use the dial to scroll through the individual harmonics.

Note that for harmonics 1 and 2, the Atk LVL and Rate are 20 and 84, respectively. Harmonic 3 has Atk LVL and Rate of 63 and 127, harmonic 4 has 20 and 84 and so on.

Fun with Formant Filters

The changes that we made in the DHE Multiview Window are reflected here and are related to the harmonic series we covered earlier for Octave harmonics. (1st, 2nd, 4th, 8th, 16th, 32nd and 64th ... remember?)

- 1 Select harmonic 1 and press the L2 button. Now use the dial and see what happens to the attack portion in the graphic in the top right of the screen.
- 2 Use the L2 and L3 buttons to step through the options in the chart and change the values so that they read as follows:

LVL	15	63	48	0
Rate	84	71	102	127

- 3 Now press the R4 button and change the value from OFF to LP1 and play a key on the keyboard.

You should hear the 1st harmonic start cycling after a short period creating a sort of pulsing sound which underpins the sustained stuff.

This cycling/pulsing thing is actually the 1st harmonic's envelope looping over the first down ramp you can see in the graphic. This is possible for every harmonic in your sound if you wish for those >Aliens from Zarg< patches.

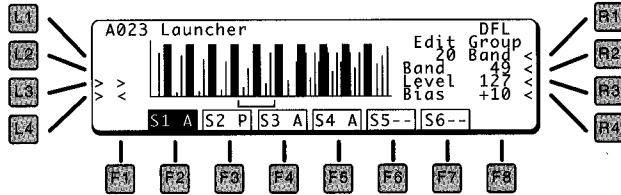
So there you have it!

Fun with Formant Filters

Now let's get into the real *fun* stuff ... press EXIT twice to get back to the Additive Menu and select the DFL (Digital Formant Level) by pressing L3 and then L1.

Chapter 2 K5000 Programming Tutorial

The Formant Filter
Level Edit page



- 1 Press the R1 button and change the value to GEQ, but first have a quick scroll through the options.
- 2 Press the R2 button and change the value to 91.
- 3 R3 ... and the winning value is 99.
- 4 Finally press R4, play and hold a note on the keyboard and go berserk with the Bias control.

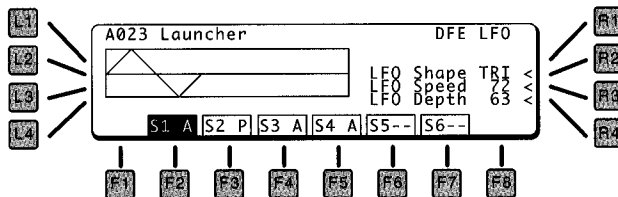
Note that while you're doing this, the PCM source is unaffected. The Formant Filter *only* works on ADD sources.

- 1 Change the value to 20 Band
- 2 Band to 38
- 3 Level to 127 and mess around with the Bias.
- 4 Play around with the values ... particularly the negative values, and if you hold down a chord and *slowly* dial through the values from around -4 to -30 you will hear a sort of melody start to happen.

Wouldn't it be *great* if you could automate that melody thing! As it happens—you can.

- 1 Set the BIAS to -28 and press EXIT twice.
- 2 In the ADD menu, select Formant Env—L4, and then R2.

The DFE LFO Edit page



In the DFE LFO page, change the LFO Shape to TRI, the LFO Speed to 17 and the LFO Depth to 34.

Now play a note and hold it down ... pretty wild, huh?

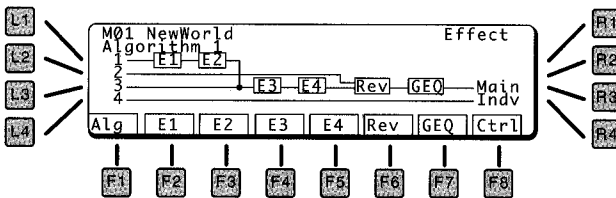
What is actually happening here is that the 20 Band Formant Filter that we set up a little earlier is now having its Bias position (center frequency) swept up and down the harmonic group (WAVESET) by the LFO (Low Frequency Oscillator). As this Bias changes, the Formant Filter which can be customized to enhance particular frequencies, is moved as a whole.

The Formant Filter can be modulated in other ways or just left static, it's up to you, so experiment—you can't break anything.

Remember how this patch started out? (a vocal pad)—we think by now, you're starting to get an idea of how flexible the ADD engine is, and we haven't even got to the effects section yet.

Love and Fxion

Press EXIT three times to get back to the main menu and press R4.



The Effects Routing Page

Press F2 to select the effect.

- 1 Press L1 and change it to Phaser 2.
- 2 Press L2 and set your DRY/WET balance to 33/67
- 3 Speed to 33
- 4 Depth 75

Chapter 2 K5000 Programming Tutorial

5 Predelay to 100

6 Feedback to 67

Press F3 to select the second effect and change

the Type to TAP Delay 2
Delay level to 100
Delay Time 1 to 150mS
Tap Level to 80
DLY Time 2 to 250
Feedback to 76

This patch is also set up to be routed via the other FX busses as well, but we won't bother with them too much at this stage.

From here, you can adjust the F6 and F7 parameters to change the Reverb type and amount for the entire patch (this will affect *all* sources) and the 7-band GEQ which also affects the entire patch.

Play the keyboard—we'd only suggest a single note or two and listen to the big, constantly moving and dizzying mess that the patch has become.

We did the overkill on the FX for two reasons. Firstly to show you how much power the FX processor has and how easy it is to *overdo* it. The second reason is to display the true nature of the K5000. This patch is only a *two* source patch and yet it fills most of the harmonic spectrum making it difficult to put in your drums, bass, pianos etc.

There are some things we *didn't* cover in this chapter, which we'll get to later on ... for now, it's coffee break time!

See you in the kitchen. If not, see you next chapter!

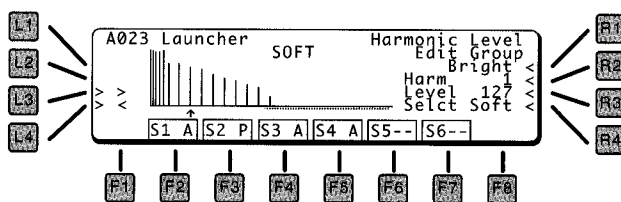
If you like, you can run through the tutorial again, but this time don't use our settings—choose your own. Remember, you can't break anything, so experiment!

3 ADD Synthesis Blocks

This chapter is a relatively hardcore one where we'll take a good look at the synthesis functions of the K5000 without repeating the manual, except where we felt it needed a little clarification. Some things here are conceptual and are designed to make you think about new ways of using your K5000. We'll assume that you know how to get around after reading the tutorial and your manual, so there's no ›press this, dial this‹ stuff here.

How to make use of the DHL Groups

This section looks at the various harmonic groupings and explains what type of things they do to your sounds. You'll find them in the DHL page—Harmonic Level Edit Groups.



The DHL Edit Window

Try them out using the ›Wizoolni‹ patch.

Wizoolni —A001

- 1 Select an Edit Group
- 2 Change the LEVEL with the VALUE dial.

BRIGHT

This group of harmonics is the upper 32 in your waveset and is the ›top end‹ of your sound. Increasing the LEVEL with this setting will make the upper harmonics louder in a proportional scale, with the 64th harmonic gradually changing

BRIGHT—A014

more quickly to become the loudest and the 33rd harmonic being the softest. If you continue to increase the level, this scaling becomes less pronounced until all upper harmonics are of equal value.

You can reduce aliasing by setting the 64th harmonic to a value of Zero. A smoother way of accomplishing this is by using a positive value for KS to Gain in the DHL Common Page.

 DARK—A015


► You can use BRIGHT to soften or brighten the sound. Be especially careful with the latter—always check by playing on the upper half of the keyboard. With all high harmonics fully turned up, aliasing is very likely to occur.

DARK

The lower 32 harmonics of the waveset and is the ›bottom end‹ of your sound. Adjusting this will make the lower harmonics louder in a proportional scale, with the 1st harmonic being the loudest and the 32nd harmonic being the softest, as with the BRIGHT group. If you continue to increase the level, this scaling becomes less pronounced until all lower harmonics are of equal value.

ODD

These are the ODD numbered (1, 3, 5, 7 etc.) harmonics in the waveset.


 ODD—A016

You can adjust the EVEN/ODD balance for all ADD sources by using the EVEN/ODD knob on the front panel.

Increasing the level of the ODD harmonics makes the sound more ›hollow‹. This is ideal for creating a ›woody‹ sound and you should use lots of odd harmonics when creating clarinets and oboe-ish sounds. All harmonics are changed by the same amount and this is true for all of the following groups as well.

EVEN

The EVEN numbered harmonics in the waveset (2, 4, 6, 8 etc.). Adjusting the EVEN harmonic level will make the sound more nasal or brassy. Ideal for strings and brass.

 EVEN—A017

How to make use of the DHL Groups


OCT

This group adjusts the OCTAVE harmonics above the fundamental (2, 4, 8, 16, 32, 64). This is great for adding overtones to your sound and adds an organ like quality. Also useful for bell sounds.

 OCTAVES—A018

5TH

Like the octave group, the 5th harmonics are those above the fundamental tone and are again great for organ and bell tones.

 5THS—A019

- ▶ By starting from Zero, then consecutively selecting OCT and 5TH and setting all harmonics of these groups to FULL level, you have the makings of great Organ sounds—at the very least, you won't have to ever search for ›footages‹ (pipe lengths) ever again!

ALL

Adjusts ALL harmonics simultaneously by the same value.

- ▶ You can easily add more bottom end to a spectrum by lowering the overall level with ALL, then select EACH and increase the 1st, 2nd and 3rd harmonic levels to higher values. This obviously works in reverse for thinning out a spectrum as well.

EACH

Allows you to control the individual level of each harmonic in the waveset. This is extremely powerful, but we recommend that you initially set up a basic spectrum using the other groups, by copying DHL sources from other patches or by using a SoundDiver template. Following this, use EACH for fine tuning the spectrum.

Be careful when changing harmonic levels, especially in the lower area (up to 7th harmonic) as a slight change can alter the tonal character of the spectrum completely.

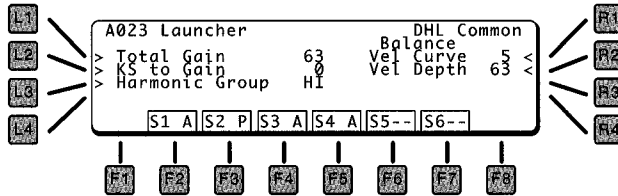
Use 'em

Using the groups and adjusting them as groups is the most efficient way to generate new sounds from scratch. Once you're getting close to an approximation of what you want to end up with, you can adjust harmonic levels individually if you wish.

Controlling the entire DHL made easy

The DHL Common section allows you to adjust the entire volume level of the waveset, retaining all proportionate relationships between harmonics.

The DHL Common Window



Additionally, in this section, you can control how the DHL responds to the keyboard scaling, or in other words, you can set up the DHL to get gradually louder as you play towards the treble end of the keyboard and softer towards the bass end of the keyboard, as one example.

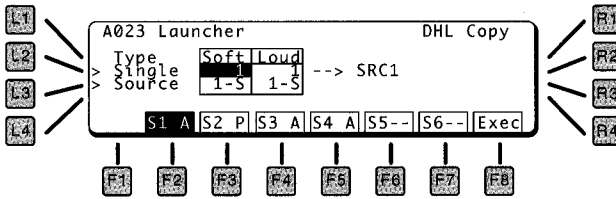
 VELCURVE—A020

There are a number of velocity curves available which are graphically displayed in the K5000 manual and SoundDiver. These affect not only the DHL, but also the DHE and DFL areas as well.

The Velo Depth parameter in the DHL common page gradually sets the velocity controlled blend from Soft to Loud.

Velocity curves are a great ›trick‹ for changing the way a patch responds, and therefore, the way it sounds, very quickly and easily.

Controlling time using Harmonic Envelopes



The DHE Multiview window—allows for ›group‹ editing of harmonic envelopes.

The Digital Harmonic Envelopes (DHE) are edited in much the same fashion as the DHL and feature the same ›groups‹ which allow you to adjust mutiple harmonics simultaneously.

Be careful with the DHE LEVELS as their direct relationship to the DHL LEVELS can alter the tonal characteristics of your source. Use the DHL levels for building spectrums as they are more precise.

- It makes sense to have a group of harmonics, such as 5ths or octaves responding in the same way as these grouped harmonics share the same tonal character. If these harmonics have the same envelope shape, then their impact as a group will be much more pronounced than if an individual harmonic fades in or out at a particular point in time.

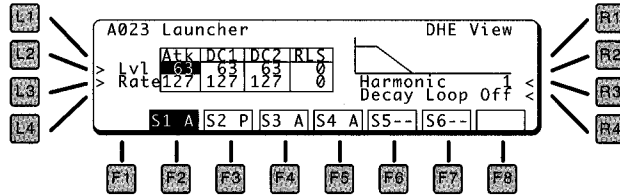
Be aware of the fact that the envelope LEVELS directly correspond to the Harmonic Levels—each envelope level adjusts the corresponding harmonic level. For example you could set all harmonics to full level and then create a blend between sawtooth and square by setting these ›waveforms‹ in the DHE levels.

Adjustments to individual harmonic envelopes will make subtle differences to the sound and this precision and finesse is the beauty of the Advanced Additive synth engine.

 DHE WAVE—A021

Chapter 3 ADD Synthesis Blocks

The DHE View allows you to adjust harmonic envelopes individually.



No other synthesis model gives you such precise control over sound in time. The drawback, however, is that harmonic envelopes require a *lot* more effort to program, so we recommend taking the following approach:

- ▶ If you want to create a fast and simple >color< envelope over time, use the DCF and its envelope.
If you need detailed control over groups of harmonics, use the DHE instead of or in combination with the DCF.
Work in small increments and constantly check as you're doing this.

The DHE, like the DHL, also features the ability to copy an entire DHE from one source/patch to another which is obviously a great shortcut (Additive: DHL Copy).

Featured in SoundDiver (which will be covered in more depth later on) is the ability to use envelope templates, much like using the DHE copy function. This allows the general envelope shape of a piano sound—short attack, long sustain, medium release—to be quickly applied to a vocal sound or another sound you may create. Likewise you could use a string envelope—long attack, long sustain, short release—on an electric piano sound allowing you to >bow< your synthesized Rhodes.

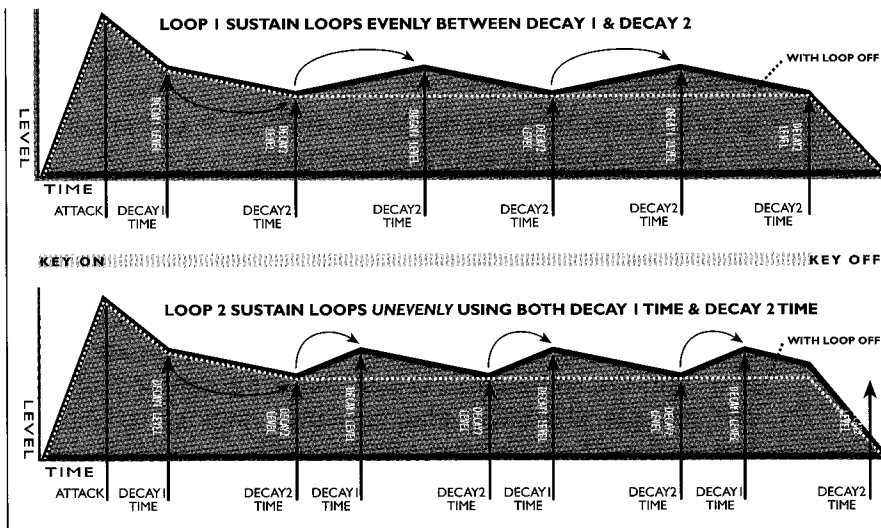
As you can see, the DHL/DHE combination both work in a very similar fashion with common methods to both. As a pairing they allow complete control over the overall level and levels over time of *each* of the 64 harmonics available in a source.

DHE Loops—Perpetual motion

One of the problems with any method of synthesis is that sound is not constant and if it is, it becomes real annoying real fast—despite the modulation in pitch, our personal tolerance for car alarms is about 10 seconds—how's yours?


A major complaint that people have about samplers is that they sound ›static‹ and your ear/brain combo will eventually start perceiving loops in the sample. At this point you recognize the sound as being synthetic or just plain boring and many of us tend to ›shut off‹ or go do something more interesting. Having said this, we're gonna talk about loops in the K5000.

Where this differs from a sampler is that sample loops cycle over a portion/portions of the *entire* sound. The K5000 DHE loops cycle over a portion of one or more harmonics contained in the sound, with the length and shape of the loop being different for each harmonic if you wish.



Chapter 3 ADD Synthesis Blocks

DHE Loops can be used over different portions of each harmonic envelope.

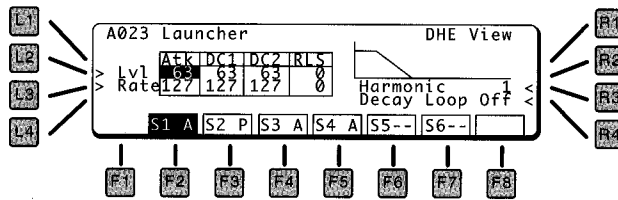
 DHE LOOP—A022

The DHE looping parameters can be found in the DHE view.

Remember that there are 64 harmonics, each capable of having its own envelope, so having two or three or 30 harmonics all with their own loops will create a sound that seems to be endlessly moving.

This will eventually cycle and the ear will eventually pick this up, but it will take a lot longer than recognising the same thing in a sampled loop. Many will *never* hear it.

This totally discounts other modulation possibilities from the LFO or Formant Filter sections which we'll get to shortly.



There are basically three settings—OFF, LP1 and LP2.

- ◆ OFF— If this needs explanation you really shouldn't be anywhere near a piece of sophisticated electronic equipment like a K5000.
- ◆ LP1— Loops between the levels of DECAY 1 and DECAY 2. It uses the envelope time specified by DECAY 2
- ◆ LP2— Loops between the levels of DECAY 1 and DECAY 2. It uses the envelope time specified by DECAY 1 *and* DECAY 2, first using one, then the other.

Judicious use of the DHE looping parameters can really add a lot of life to any sustained pads that you may create. Going nuts with the looping can create some ›out there‹ sounds or can emulate chorusing and ensemble settings, which can free up the effects processor for something more useful, particularly when using the K5000 multitimbrally.

Formant Filter—the blade of the sound butcher

In the words of the K5000 manual; *>The K5000's Formant Filter is a 128-band graphic equalizer, which can be used to create additional additive effects.<*

This is not the whole truth—in fact, it's not even close. The Formant Filter (FF) is a set of 128 bands in intervals of one semitone.

When set neutral, which means the BIAS value is set to Zero and there's no influence of any envelope or control, the 64th band exactly matches the first harmonic of the note C3 (60). Accordingly the 76th band matches the second harmonic, the 88th band the 4th a. s. o.

► Check out ›@Clustaz,‹ a patch which demonstrates this.

 @Clustaz—A005

The Formant Filter works in a fashion similar to a graphic EQ which has 128 bands. But the special capabilities of the FF come into play when you move the filter laterally (sideways) by changing the BIAS value by hand, wheel or envelope.

This is what distinguishes the FF from an EQ and makes it the most sophisticated synthesizer filter available (in our humble opinion). You can literally draw a lowpass with three peaks, a flanger or the Manhattan Skyline.

Peter has programmed a whole bunch of templates which you will find in SoundDiver for the Formant Filter which do some crazy things to the original sound, without touching any other parameters—but more on this later.

Like the DHL and DHE there is a copy parameter which allows the copying of one Formant Filter from any patch to another patch.

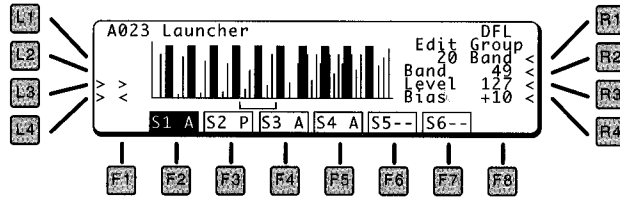
Formant Filter Nuts and Bolts

The Formant Filter shares some programming traits of the DHL and DHE in the form of groups of *frequencies*, not harmonics, as in the other sections.

Chapter 3 ADD Synthesis Blocks

The frequency distance between two harmonics in a DHL spectrum depends on their position. The distance between two FF bands is always one semitone.

We won't go through FF bands individually as they are covered by the manual and the concept of selecting a specific frequency or group of frequencies for global adjustment is exactly the same in practise as with harmonics in the DHL and DHE.



The GEQ band setting has a special feature which allows it to gradually change the band levels. You can use this to create smooth holes or peaks in the filter shape.

- ◆ The BAND control is just like a rubber band and the Formant Filter is like a comb. To lasso more >teeth< on the comb, you simply stretch the band—to select less, you stretch it less. The BAND control effectively defines the range of frequencies spanned (number of >teeth<) which can then be adjusted using the LEVEL control.
- ◆ The LEVEL control adjusts the amount of formant filtering—how much the Formant Filter affects the sound—within the range defined by the BAND control.
- ◆ The BIAS control adjusts the entire Formant Filter by shifting the center frequency up and down the entire range of frequencies.

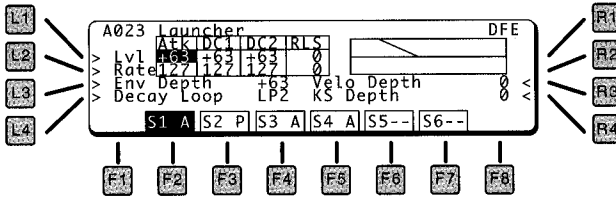
Keeping the Formant Filter under control

As there is one Formant Filter available to each ADD source in your patch, you may want to keep these bad boys in check. This is where the DFE—Digital Formant Envelope—comes to the rescue. Think of it as your very own zookeeper who keeps your animal filters in their cages and stops them from being unleashed onto an unsuspecting pair of ears or worse yet, your \$ 5000 speakers.

The standard complement of envelope controls is here allowing you to shape the movement of the bias parameter

Formant Filter—the blade of the sound butcher

over time. There is also an envelope depth function which determines how much the envelope actually affects the bias.



The DFE Envelope Edit allows precise control over the FF.

Additionally there are controls for looping, which are just like the loops available for the individual harmonics in the DHE section we covered above.

With these, you can control the FF to cycle over a particular section of the envelope that say ... pumped a range of frequencies for a second and then almost completely shut down for those door's open, door's closed, door's open/closed and there's a really loud party on the other side sounds.

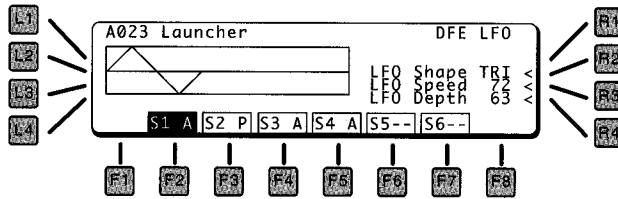
Actually the LFO mode is nothing more than a simplified, looped envelope preset.

Velocity Depth allows you to control how much the filter envelope will affect the bias based on how hard you play the keyboard. This parameter is affected by the Envelope Depth parameter—i. e. if the envelope depth is set to Zero—no effect—then it won't matter how hard or soft you play. Similarly, the KS Depth parameter will have no effect if the Envelope Depth parameter is set to Zero.

The KS Depth parameter allows you to control how much the filter envelope will affect the sound based on the pitch of note played. This is directly related to the DHL Vel Curve and KS to Gain parameters.

Last, but not least, and a personal fave is the ability to set the FF envelope to LFO mode.

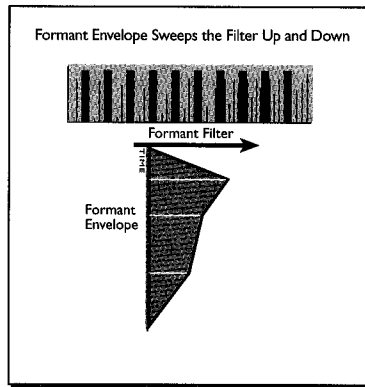
Chapter 3 ADD Synthesis Blocks



 MelMaker—A010

Using this allows the entire FF to be modulated in amazing ways—a great patch to check out is ›MelMaker‹ which shows this in all it's glory, and if you followed the tutorial, you would have seen this in action already.

The MelMaker patch is a classic example of the FF being swept up and down by the Formant Envelope.



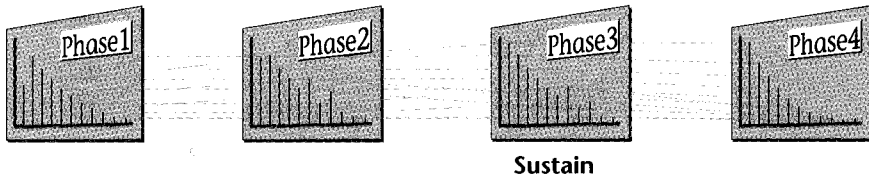
Morf's Up—the quick and easy approach

You've probably seen Terminator 2 with big Arnie and that liquid terminator—remember the guy who was a floor, then a knife, then frozen etc.? If you've seen it, you'll remember how he seemed to just melt into whatever he chose to.

This was quite a blast at the time and used a technique called ›video morphing‹ which is pretty lame in these days of living, breathing dinosaurs, but it's still a cool flick and we still dig the SFX.

Using the Copy functions

Kawai had a great idea—with focus on the impatient and the newbies—to include exactly the same idea into the K5000—only using sound, not video images, to ›morph‹ into each other.



Using Morf mode, there are six potential sources in *each* patch in your K5000—not including Loud and Soft variations. Given the fact that you can combine everything with everything there's literally millions of combinations already available in the patch memory of your machine.

Read the manual regarding Morf mode and have a good play with this. We think the manual explains the functions reasonably well, but doesn't explain why you would want to, and the number of possibilities afforded by morfing sounds.

For you serious programmers, invest your time in other areas of the synth. Morf mode is fun but the results are generally unspectacular.

If you want to create ›Pro‹ patches, then Morf Mode is *not* for you, but if you just want to have a bit of fun, or are looking for a really quick solution, then give it a whirl.

Using the Copy functions

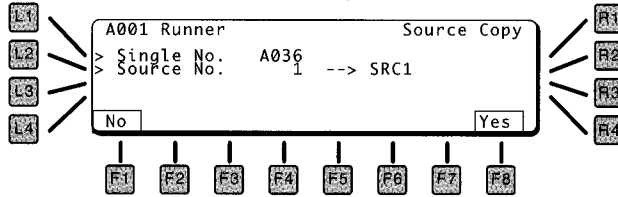
You may think that a copy function isn't that exciting, and you'd probably be right. Having just read the ›potential of Morf mode‹ stuff, however, the copy functions may now be a lot more interesting because, like morf mode, you can copy any source from any patch to any other patch. This opens up millions of instant possibilities, however—as it always is in life—only a handful of them may yield exciting results—it's a matter of taste.

In the tutorial chapter, you learned how to mute/unmute sources so that you could listen to them in isolation. When

Chapter 3 ADD Synthesis Blocks

isolated, you can hear the portion of the entire sound that you like from your favourite six patches and combine them into one superpatch.

The Source Copy Window



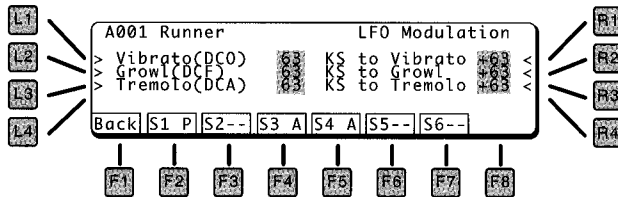
Utilising the copy functions in all areas of the K5000 is a great idea. If a professional programmer or yourself has programmed an envelope template or waveset, a Formant Filter setting, a modulation routing or an effects combination that is just *great*, then there is no reason not to make use of it as a basis for your own experiments.

If you consider that every waveset, envelope etc. that you or someone else has set up is a template which can be used in another patch, then you already have thousands of templates for all sorts of jobs in the factory patches.

As pointed out earlier, if you have a >template< which is not perfect, but pretty close to what you want, then copy it and carry out some small adjustments.

The LFO—your third hand

The LFO Modulation page



The LFO in the K5000 can be used to modulate pretty much everything in a number of different ways, so the description

The LFO—your third hand

in the manual which says that it can be used to ›give vibrato and tremolo effects‹ doesn't really do it justice.

The ability to set a delay time on the LFO is great if you're standing on stage playing a screaming solo and using the pitch bend wheel, but you need modulation to ›kick in‹ at a particular time in the sound.

Other great features are the ability to set the LFO up to respond to how hard or soft you're playing or to where on the keyboard you're playing—bass or treble end.

- ▶ For more info on the LFO refer to *LFOs—simple, but there's a catch ...* on page 57.

 LFO FADE—A023

Chapter 3 ADD Synthesis Blocks

4 Programming with PCM Sources

As you've no doubt discovered, the K5000 features a whole bunch of PCM samples which add ›spice‹ to ADD sources and can be used as the basis of a patch in their own right.

The downside to using PCM sources is that many of the wonderful features, such as control over individual harmonics and Formant Filtering which are available to additive sources are simply not available to the PCM synth engine.

The K5000, on this level, is much like many other subtractive synthesizers on the market. The bonus of the effects processor and additive sources, however, end any comparison.

Subtractive Synthesis

As briefly touched on in the introduction chapter, subtractive synthesis is a lot like sculpture. Harmonically rich waveforms such as SAWTOOTH and SQUARE waves are gradually cut away to reveal the ›Venus de Milo‹—your sound.

In the K5000's case, these ›harmonically rich waveforms‹ are actually 123 PCM samples. (recordings of acoustic instruments and other sounds stored in computer memory)

Any of these samples can be used alone or combined with one or more of the *six* sources available in a K5000 patch. Each PCM source can then be individually ›sculpted‹ to form part of, or an entire, sound.

A rose by any other name ...

Analog synthesizers feature analog components throughout, and these days many of the ›analog‹ synths you see in music technology magazines are partially under digital control or are completely digital but sound and, in some cases look like, analog synthesizers of the 60's and 70's.

The fundamental theory and methods of subtractive synthesis are still the same some 35 years down the road, so even though some of the names have changed—like VCO has become DCO—... a rose is still a rose.

Let's take a look at the individual sections of a subtractive synthesizer following the signal flow and the choices available in the K5000.

- ▶ We won't spend too much space and time on this issue. Analog or subtractive sound programming is pretty simple and obvious. You'll find it on billions (well a lot anyway) of conventional synthesizers and there's heaps of books (take a look at the WIZOO Library Hill). As the subtractive portion of the K5000 is not the exception from the rule, we decided to keep this chapter short and give more focus to the hardcore ADD stuff.

What is the DCO?

The Digitally Controlled Oscillator is the ›voice box‹ of any synthesizer and actually generates the sound. In analog synthesizers its pitch was voltage controlled (VCO) and its waveforms were generated by analog circuits.

The subtractive synthesizer on the K5000 uses the PCM synthesis method—you will find some ›analog‹ waveforms in the PCM Wave-ROM as well—and the subtractive portion of it is available to ADD sources too.

What is the DCF?

The Digitally Controlled Filter is used for colouring and contouring the sound generated by the DCO. The filters literally ›filter‹ out frequency ranges so that you are left with the portion of the sound that you want to hear. The interesting thing about these filters is that a control source—like an envelope, velocity or an LFO—can make the filter cutoff frequency move, thus creating changes of the sound color over time.

Traditional analog synthesizer filters come in two flavours—LOW PASS and HIGH PASS—which as you might expect, allow the LOW and/or HIGH frequency ranges to ›pass.‹

- ▶ You can even bypass the whole DCF by setting its mode to—Bypass (bet that was a surprise!)—but we won't recommend doing so even with ADD sources. It's always good to have the DCF ›smooth out‹ the very high frequency range a bit.

DCF filtering can be quite brutal to your sound as it can clear large chunks in one hit—no comparison to the fine, detailed changes available with additive harmonic levels.


You can make the DCF effect even more pronounced by using resonance. Be careful when turning up the resonance value because it adds to the overall source level, high resonance values (above 4) are very likely to cause distortion

You can balance the reso effect by lowering the DCF level value. Our rule of thumb: for every two steps you increase the resonance decrease the DCF level by one.

Both the subtractive *and* additive synthesizer engines of the K5000 can use the DCF section, the ADD section can get by without it, but the PCM section really *needs* it.

DCF Tips

- ◆ On instrument sounds—whether natural or electronic—always let the DCF cutoff be controlled by velocity and key tracking. Velocity gives you a better overall feel and key

 DCF LOPA—A024/
DCF HIPA—A025

As always in life there are two sides to the coin: Techno ADDicts use the filter distortion for basslines and distorted drum sounds. This is the reason why the Kawai engineers didn't implement an auto-balance for resonance and DCF level.

 DCF RESO—A026

tracking provides a balanced sound character throughout the entire keyboard range.

- ◆ You will need to experiment with the Velo to Cut and the Velo to Env parameter to find the right balance. Always give a bit to the Velo to Cut parameter (+10 at least) and add the envelope to it. As a good guide: The lower the sustain level (Dcy2 L) of the DCF envelope, the higher the direct envelope depth, otherwise the velocity would not affect sustained notes.
- ◆ Make heavy use of the DCF only on PCM sources. Its your only sound shaping tool—apart from effects, that is. When creating ADD sources, your preference should be the use of harmonic envelopes and the Formant Filter. In fact the Formant Filter can easily and completely simulate the DCF, plus a whole lot more.

FF—A027/FILTER—
A028

How about the DCA?

DCA stands for Digitally Controlled Amplifier and is the part of the synthesizer that controls the volume of the sound or *sections* of the sound over time.

In the K5000, both subtractive and additive sources can use the DCA.

The subtractive engine relies entirely on the DCA for its overall envelope shape whereas the additive engine is *far* more accurately shaped by the DHL and DHE.

We suggest the use of the DHL and DHE to set the volume *differences* between harmonics and the use of the DCA to shape the overall volume envelope for the *entire* source.

In most cases this is the best solution in addition to being the easiest and fastest way.

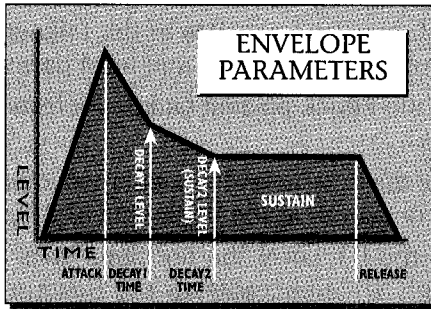
- ▶ The DCA envelope offers a few functions not available to the DHE. You can—among others—control Attack, Decay and Release times by key tracking, controllers and velocity. We recommend you make use of these features in addition to the ADD envelope parameters as

this gives you even more realtime control and expression to the overall sound.

Envelopes—a simple guide

Each of the sections in a subtractive synthesizer features envelopes which control different aspects of the sound over time.

To offer detailed control over the shape of the envelope, it is broken down into segments, each consisting of a **TIME** and a **LEVEL** parameter. Most envelopes are more or less broken down into these four segments:



- ◆ **ATTACK**—This is the beginning of a sound. The attack parameter can shape the start of a sound to respond in different ways so that—as examples—string sounds slowly fade in and piano sounds are heard as soon as you strike a key. Adjusting the attack to a longer time could be used to make the piano slowly fade in.
- ◆ **DECAY**—After the attack portion of a sound has been completed, most naturally occurring sounds dip slightly in level which is what the decay parameter deals with.
- ◆ **SUSTAIN**—This is the body of the sound and is usually the longest part. In the case of a piano sound, after the initial keystroke and the brighter and louder decay portion, the

Chapter 4 Programming with PCM Sources

resounding string tone takes over—this is the sustain of a piano.

- ◆ **RELEASE**—This is the portion of the sound that fades away to silence. This fade can be quick or slow.
- ◆ Collectively the envelope is often called the **ADSR**—each letter signifying the first letter of each sound section—Attack, Decay, Sustain, Release.
- ◆ In the most popular analog ADSR envelopes, the four parameters were even more restricted to Attack Time, Decay Time, Sustain Level and Release Time. No Attack Level, no Decay Level. As this envelope concept is easy to program yet not very flexible, many digital synthesizers—including the K5000 series—offer some extensions. In the K5000 each envelope consists of the following segments, each offering a separate time and level parameter:

A This is the attack portion as known from the ADSR envelope.

D1 This is the first decay. You will most often use this for little clicks or plucks at the beginning of the sound.

D2 From the D1 Level the envelope goes on to the D2 Level, which is comparable to the Sustain Level of the ADSR-Envelope

- ◆ Look at the table below—it allows you to compare the different K5000 envelopes with each other and with the ›analog‹ ADSR.

	Attack		Decay		Sustain		Release	
	Level	Time	Level	Time	Level	Time	Level	Time
conventional ADSR	0	yes	–	yes	yes	–	0	yes
Pitch Env	yes	yes	0	yes	0	–	–	–
DCF Env	0	yes	yes	yes	yes	yes	0	yes
DCA Env	0	yes	yes	yes	yes	yes	0	yes
DHE	yes	yes	yes	yes	yes	yes	yes	yes

LFOs—simple, but there’s a catch ...

	Attack		Decay		Sustain		Release	
	Level	Time	Level	Time	Level	Time	Level	Time
DFE	yes	yes	yes	yes	yes	yes	yes	yes
Parameter Name in K5000	AL	AT	D1L	D1T	D2L	D2T	RL	RT

When designing envelopes for a synth the developers always have to find a compromise between flexibility and ease-of-use. Well—at least one thing is for sure: Note volumes have to start and end at Zero level, so this is fixed. But sound colour and separate harmonics can start and end wherever you want. Be aware that the K5000 envelopes offer you unrivalled flexibility in controlling sound over time and velocity. The best thing: You *may* use it, but you don’t have to.

As each part of a subtractive synthesizer—DCO, DCF, DCA—does a different job, many synthesizers have a separate envelope for each of these sections to achieve more control over the sound. This is how they affect the K5000 sources:

- ◆ The envelope in the DCO controls *pitch* changes over time.
- ◆ The envelope in the DCF controls *tonal* changes over time.
- ◆ The envelope in the DCA controls *volume* changes over time.
- ◆ The envelope in the DHE section controls volume changes for *each harmonic* over time (ADD sources only)
- ◆ The envelope in the DFE section controls the FF BIAS value over time—again: ADD sources only.

LFOs—simple, but there’s a catch ...

The LFO section of the K5000 is pretty easy to understand, yet offers some features you won’t find in any other synth’s LFO.

The most flexible envelopes are located in the ADD section—Harmonic Envelopes and Formant Filter Envelope, the least flexible envelope is the Pitch Envelope.

Chapter 4 Programming with PCM Sources

Do we have to mention that the Waveform parameter controls the shape of the modulation, that sine creates vibrato or square plays a ›trilk‹ when applied to DCO pitch?

You know this already?

OK, let's take you a step further and have a look at a really fun feature: The Delay and Fade In.

Let's say you want the LFO to create kind of a rotating effect—like a Leslie speaker cabinet, for example. Simply put, you *can* achieve this by applying the LFO to Pitch (just a bit), DCF Cutoff (a bit more) and DCA Volume (quite a bit).

Lets say you're the demanding type of person. You want the rotation to smoothly blend in when the note is held, and you want it to accelerate over time.

The rotor in a Leslie cabinet is a horn that rotates—for those of you not familiar. This means that sometimes the outlet of the horn points towards you, sometimes away from you, and most of the time it's in-between. The horn position affects the pitch (something like the sound of an ambulance-coming towards you-and-going past-effect), the sound color and the volume.

We admit this sounds difficult to replicate, but look at the following to see how easy this is to achieve with the K5000's LFO:

Select the ›SmthWssn‹ patch.

Waveform	Tri	smooth rotation shape
Speed	95	end speed of the fast rotation
Delay Onset	0	delays the LFO, not needed here
Fade In Time	46	Time from almost no rotation to full speed and rotor
Fade In to Speed	63	amount of change to the Rotor speed over the Fade In Time
Vibrato	6	a little pitch change
Growl	17	some more color change
Tremolo	23	plus volume change

Try this with two sources slightly detuned and LFOS out of phase (use Delay Onset to offset them against each other)—and there you go with a nice Leslie simulation.

Programming can always be that easy with a little imagination and a creative approach instead of boiling your brain-cells with technical BS.

We can only encourage you to think creatively: K5000 synthesis requires an open mind.

A Subtractive Session

OK—let's put some of that subtractive synthesis power to work. We strongly advise that you follow the steps. This way, everything should be pretty clear as you work your way through.

This is a totally subtractive patch with the added bonus of effects. Dave was messing around with a sort of J. M. Jarre ›Magnetic Fields‹ track and came up with this patch as a result in a couple of minutes.

 Magnetic—A006

The patch is extremely responsive to touch with the filters opening and closing in response to velocity. The harder you hit, the faster the filter envelopes attack. It is also useful as a fat bottom-end pad and can be used as a ›house‹ lead sound.

Now let's mess around with it a bit.

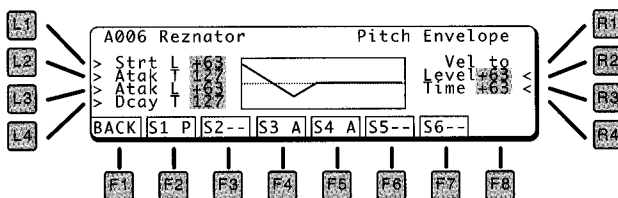
DCO Functions

The tutorial section covers the selection and tuning of PCM waveforms, so we won't double-up here. Take another look at this chapter later if you like.

- 1 Press EDIT / L2 and then F8 (MORE).
- 2 Make sure that S1 is selected and is showing S1 P.
- 3 In the Pitch Envelope window change the STRT L to +63 and Atak T to 67.

Chapter 4 Programming with PCM Sources

The DCO Pitch Envelope adjusts the pitch of a PCM source over time.



Play the keyboard and listen to what's happened.

Congratulations—you have just adjusted the Pitch Envelope. Let's take it a step further.

- 1 Change Atak L to -28.
- 2 Ensure that Dcay T is set to 64.

Play the keyboard again. That's attack and decay mastered!

If you like, you can play with these settings a little further on your own to get a better >feel< for what's going on.

Also in this edit window is the Vel to Level and Time parameters. Change the Time value to +57 and you'll get a really clear picture of what this does as you play a note on the keyboard at different velocities. Do the same with the level parameter.

PITCHENV—A029

Remember that *each* source can have different tunings and pitch envelopes. You can also set up each source to respond to velocity in different ways.

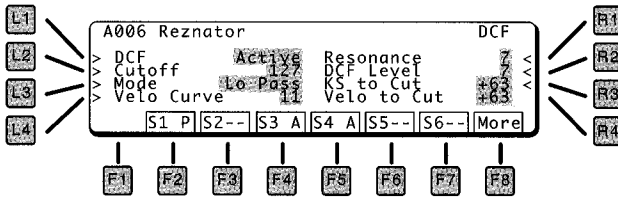
DCF Functions

Get out of EDIT mode by pressing EXIT a couple of times and press F8 when prompted to save or quit.

Magnetic—A006

Ensure that >Magnetic< is loaded.

- 1 Press EDIT / L3
- 2 In the DCF window, mute source 2 by pressing F3.
- 3 Press L1 and turn the dial to Bypass
- 4 Play a couple of notes on the keyboard and then turn the dial back to Active and play a few more notes.



The DCF Window

There's quite a bit of difference between the bypassed and filtered signals ... but not enough!

- 1 Press L2 and use the dial to adjust the Cutoff from 0 to 127—while you're doing this, repeatedly play a note on the keyboard.
- 2 Reset it to 31 when you're done.

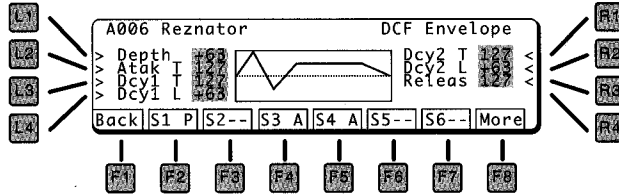
This function >cuts off< the frequency range at a particular point allowing you to shape a more muffled or brighter sound.

- 1 Now press L3 and use the dial to change the filter from Low to Hi pass and play a few notes.
- 2 Reset it to Lowpass when you're done.
- 3 Select the Velo Curve and change the value, trying a few out by playing the keyboard across the *entire* range. This parameter adjusts how the filter responds to *where* you play on the keyboard—i. e. are you playing bass or treble notes.

Time to introduce the nasty little monster of the K5000—filter resonance. This control, when coupled with the Cutoff function does savage things to your sound, your hearing, your speakers and causes the dog to run away—pausing on it's way out to bite you for being such a bastard!

We cannot emphasize this enough—use caution with this parameter—it's *great* if you're into this sort of thing but the K5000 filter is *very* capable of damaging your hearing and your speakers—*no joking!*

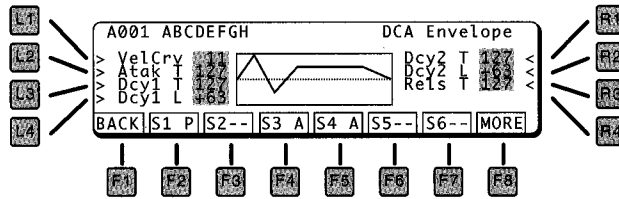
The DCF Envelope View



The DCF Envelope is marginally more sophisticated than the DCO envelope, but the concepts of the ADSR are the same. The only difference here is that you are controlling the *colour* of the sound over time—or more correctly, the filter—not pitch as you were with the DCO envelope.

DCA Parameters

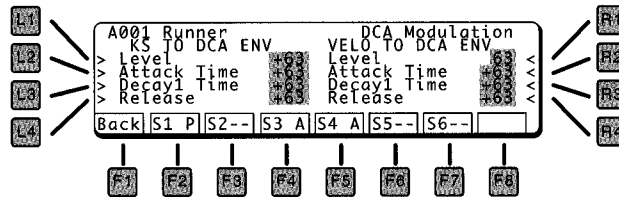
The DCA controls the volume of your entire source over time.



This is the master VOLUME envelope for the entire sound. You can, as with the DCO and DCF, control individual sources with their own ADSR.

The combined output of the original signal generated by the DCO and filtered by the DCF is sent to the DCA. If part of your sound is too loud or soft or takes too long to >get going,< then the first port of call should be the DCA.

The DCA can be modulated by velocity and keyboard scaling.



Leslie

Does this sound need a Leslie? If so, try the option explained above.

Other cool subtractive options

The K5000 has a number of great effects and modulation features which are discussed in the Effects and Modulation chapter—surprise, surprise.

These can be used with any source be they additive or subtractive.

The other great bonus is, of course, additive synthesis.

So if you've got an ›analog‹ headspace—you have this to add ›spice‹ to your subtractive sounds.

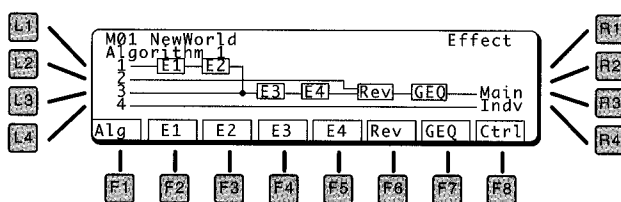
5 Effects and Modulation

The K5000 features an extremely powerful effects processor which sounds great and is a vital component of the Advanced Additive synth engine.

The manual offers a reasonable description of the parameters available for each of the algorithms, so we won't replicate this information, nor will we cover different settings for ›Coliseum‹ or ›Whitehouse‹ reverb or ›Spawn of Satan‹ distortion patches—there are many other books dedicated to this sort of thing—take a look into WIZOO's Library Hill program. Rather, we'll concentrate on some of the routing practicalities, shortcomings and creative control options available.

In addition, there are a number of flexible source routings for modulation of ADD and PCM sources, filtering and effects. We'll cast an eye over these as well.

Effects Processor rules of thumb



The Effects Page

When used on a single patch, each *source* can be routed to a different FX bus.

Chapter 5 Effects and Modulation

Utilize the difference in effect routings for creating completely new patches. Combine a phasing string pad with a ensemble choir patch or try the originally clean guitar signal with a wall of over-drive.

The effects processor can seriously blow out the harmonic levels of your patch resulting in aliasing or other unwanted artifacts.

The Effect Path parameter routes the currently selected source to any of the four inputs (buses) in the effects section.

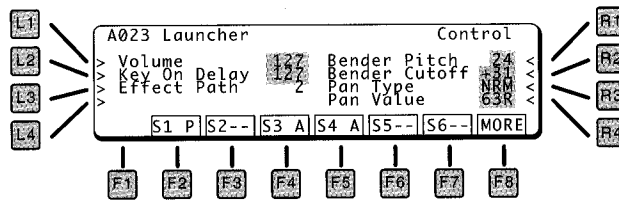
When used multitimbrally, each *sound*—an entire patch—can be routed to a different FX bus. This may, and in all likelihood will, radically affect the sound of the patches used. This is a double-edged sword as sometimes it sounds great and sometimes ... well it doesn't!

- ▶ Like all the best things in life, effects are best used in moderation although it's fun to indulge occasionally. Add effects after setting up the rest of your patch. The best way to do this is by using an initialized neutral patch with all FX disabled. This will assist you in creating a patch which sounds strong without FX—if and when you decide to add them—look out!

The other advantage is that when used multitimbrally, patches with minimal effects sound pretty much as they should in the overall mix.

Add effects *after* you have set up your DHL, DHE, DFL etc and DCO, DCF, DCA in your additive and subtractive sources.

When programming your patches, use the Effect Path parameter in the Control pages to choose the effects bus INPUT for each source.



Effect Routing—potential pitfalls

The flexibility of the onboard FX processor allows you to route the four effects units into others in series or parallel. While there are no absolute rules about what effects you should or shouldn't route into other effects, there are some factors which you should be mindful of:

- ◆ Some effects, like phasing or distortion, can add a *lot* of gain and emphasis to particular harmonics resulting in your original sound being unrecognizable.
- ◆ This extra gain can blast your eardrums and the speaker membranes into the rear wall of your studio.
- ◆ Again with the gain. If the level coming *out* of one of your ›effects units‹ is too hot going *into* the next processor, you can easily introduce distortion or aliasing even if you're using ›nice‹ effects like reverbs and delays.
- ◆ Routing chorus into delay is *not* the same as routing delay into chorus. The results are *completely* different.
- ◆ Logically *plan* your effects routings, pausing for a moment to consider what each effect will do to the sound although if you're only going to swap the chorus and delay around, you shouldn't spend too much time concerning yourself with this. Remember that once a sound has passed through one processor, the output from that processor is *summed*—is a combination of the sound *and* the effect—and is then passed onto the next processor in the chain. This summed effect will, in general, be, louder and will enhance certain frequencies in the original source.
- ◆ The global REVERB which follows the four ›effects units‹ can be used to enhance the overall ambience of the sound. It can also destroy any of the subtle delay and chorus effects you may have set up in the DHE or the four preceding effects. Add it *after* you have set up the other FX and only if your patch ›needs‹ it. The 7-Band graphic EQ which is the last ›effect‹ in the sound signal flowpath also has the ability to destroy any subtlety you may have programmed into your patch. It's useful, however, for ›less than perfect‹ listening environments and for circumventing some technical issues with the K5000's output stage—see the Tips and Tricks chapter.

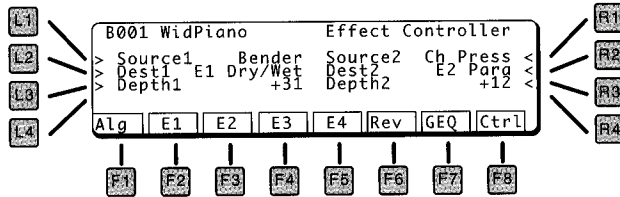
Realtime Effects Control

The effects processor, like other sections of the K5000 synth engine, can be manipulated in realtime using a variety of controllers such as the mod wheel, aftertouch and many others.

CONTROL—A030

You can access these via the effects control page.

The Effects Control Page



While it's possible to do, we don't recommend putting all of your eggs in one basket. Assigning your various destinations to different controllers is a better bet.

As other parts of your sound can also be controlled using the same modulation sources, such as your mod wheel, aftertouch etc., it is possible to assign *both* effects and synthesis parameters to a single control source.

As an example, you could assign the effect depth, the balance between two sources and the speed of the Formant Filter LFO to *one* controller such as the mod wheel. One roll of your thumb and your patch would go nuts!

GospelOrg—A031

Take a listen to the ›GospelOrg‹ patch and use the mod wheel to change the Rotary effect speed. This is a great example of how to use the effects control parameters—sensibly.

When and where to use FX

Sometimes it's smarter and easier to use the FX processor than to do a whole lot of programming to achieve the same or similar results. It's also smarter at times to use one type of effect over another to achieve a particular ›sound‹ which is appropriate to the type of music/playing style of your tracks.

First off, we'll take a look at where the K5000 FX processor has a bit of a weakness. The global reverb which runs across

the entire mix is not a particularly great reverb and doesn't offer enough control to really tailor the sound given its location in the signal path. You may get better results with external processing—more precise control, more headroom and ›shimmer‹—if you have a superior external effects unit.

Another shortcoming is in the absence of compression and gating types of algorithms although similar effects can be obtained by clever use of the filters (including bandpass effect) and envelopes.

- ◆ Delay FX—The K5000 delay algorithms are quite good and there's a good range of them for different jobs. Let's take a look at where you may be able to use specific algorithms more effectively than others.
- ◆ TAP DELAYS have two discrete delay times which can be set. The advantage of using this delay type is that really irregular beating patterns can be created by changing these times. If you control these in realtime, you can create those ›trippy‹ effects used on the dancefloor to simulate pushing ahead/pulling behind the beat with a sequenced or arpeggiated riff.
- ◆ SINGLE DELAY offers really precise control over the timing of your delays and is ideal for effecting sequenced or arpeggiated material that requires perfect synchronicity between the original and effected signal
- ◆ DUAL DELAY pans incoming signals hard left and right, regardless of incoming signal and uses two discrete delays so you can get effects which bounce from speaker to speaker.
- ◆ STEREO DELAY retains the pan position of the incoming signal and sounds full and rich—the Rolls Royce delay.
- ◆ CROSS DELAY bounces each repeat of the delayed signal from speaker to speaker. The effect is quite different to the Dual Delay.

Chapter 5 Effects and Modulation

- ◆ AUTO PAN constantly moves the signal from one side to the other of the stereo field. Useful on sustained pads and on some more staccato sounds like electric pianos for creating ›movement‹ in the sound.
- ◆ Chorus FX—Chorus effects are slightly detuned signals which are summed with the original signal and are useful for ›thickening‹ and ›warming up‹ the sound. They are great on strings and pads, electric pianos—in fact anything that sustains. Used in conjunction with a simple DCF setting, you can save hours of programming time by taking the ›edge‹ off of hard digital sounds like raw DX-ish electric piano sounds.

Use of the chorus can save programming time on single or dual source patches. You can even save sources and voices by simulating the effect of two detuned sources by using one source and the chorus.

Engage—A004

- 1 Load ›Engage‹ and open the Effects Edit page—EDIT/R4.
- 2 In here, select E1 and change the Dry/Wet balance to 100/0.
- 3 After playing it for a short time, change the effect to Chorus 1 with the following settings:
Dry/Wet= 0/100
Speed= 3
Depth= 100
Predelay= 0ms
Wave= TRI

This adds a subtle but noticeable difference to the ›fullness‹ and motion of the sound. Experiment with the following effects using this patch if you wish. Remember to set the Dry/Wet balance to 0/100 and Depth parameter to 100 if applicable to the effect.

- ◆ FLANGING is a different type of chorus effect which slowly or quickly moves the detuned signal out of phase with the original signal resulting in a sound which has a ›cyclic,‹ ›whooshing‹ quality to it, formerly called ›jet effect.‹ The

main difference between Chorus and Flanger is that the Flanger feeds the effect signal back to the Flanger Input (Feedback). The higher the Feedback amount, the more cutting the Flanger sound appears. Hard to describe but it sounds great on electric pianos, clavinetts and on synthetic string pad sounds. The more percussive the sound you use the Flanger on, the less delay time you should use unless you want to create doubling echos. Don't use it on any ›real‹ string emulations as it will instantly make them sound synthetic.


- ◆ ENSEMBLE effects are great for ›real‹ string and pad sounds or sounds with a slow attack and long sustain. The ensemble effect is actually three out of phase chorus effects which create a really rich sound. The reason why ensemble works so well on string sounds is because the phase correlation between the choruses changes but the detuning doesn't, unlike flanging type effects. Avoid using ensemble on sounds with a quick attack such as electric pianos. Ensemble is Peter's favourite effect on additive sounds as it gives even single metallic sources a ›richness‹ that he regards one of the strongest points of the K5000.
- ◆ CELESTE, which is also a three phase chorus is great on electric pianos because the phase correlation remains constant but detune rate and time can be changed.
- ◆ Phase FX—Phasing effects don't add a detuned signal to the original source, but generate a signal which is out of phase (out of time) with the original. The effect can be both more subtle and much more pronounced than chorus FX and creates motion in a range of different sound types. Useful on electric pianos, strings, basses ... you name it.
- ◆ ROTARY effects are essential on any Hammond B3/C3 sounds. Don't bother trying to program this into your sounds, just use the effect. While it ain't the ›real thing‹ (Leslie speaker cabinets) it's pretty good.

Chapter 5 Effects and Modulation

- ◆ Filter FX—The most obvious type of filter effect is Wah Wah which adds ... well a ›wah‹ kind of sound, so that your instrument seems to ›talk‹—check out any Jimi Hendrix album and you'll know what a Wah Wah sounds like.

When using the Wah Wah effect, be cautious, particularly with the resonance setting as it can be *very* hot on the output, resulting in distortion, aliasing and your eyes, ears and nose exploding in a torrent of blood. By the way wah effects are great on guitars, claws etc.

- ◆ BANDPASS—Is useful for quickly modifying certain types of patches on which a simple DCF is already applied and for those nasal ›Video Killed the Radio Star‹ covers. Can be particularly useful on bass sounds for adding ›punch.‹
- ◆ EXCITER/ENHANCER—These are great for ›lifting‹ a particular sound out of the mix, either in multitimbral mode or in single mode when you want to add that extra bit of ›sizzle‹ to a particular source in your patch. Be aware that these effects both enhance the high frequency content of the original signal, so they can introduce aliasing and can alter the tonal quality (colour) of your ADD wavesets.
- ◆ DISTORTION/OVERDRIVE—Again, caution is advised as these effects can add a lot of gain to your signal. Great for guitars, claws, Nine Inch Nails covers etc. Use of the Low Filter gain can add a lot of ›balls‹ to your sound (sorry if that offended the more politically correct among you). Adjusting the Hi Filter gain adds ›crunch‹ to your sounds. If you listen to Engage with the default Overdrive effect, you'll have an instant Adrian Belew simulation.

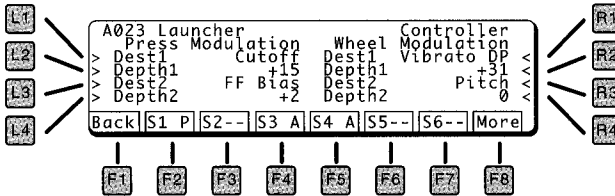
 Engage—A004

Feeding Bandpass or Exciter *into* the Distortion FX with the Hi and Lo Filters adjusted can create a range of speaker simulations—experiment!

Modulation Sources

Load up ›Angelvox‹ and take a look at not only the effects control page but also the general control section.

📄 Angelvox—A002



You will find that the third effect which doesn't feature in the patch—Phaser—kicks in when you use the mod wheel. The mod wheel also changes the harmonic balance towards the ODD harmonics. Keyboard pressure is used to introduce Auto-panning to the sound.

When Dave originally created the patch, he set up the FF to simulate phasing when tweaked. For the purpose of this book, he has modified the patch so that both the FF and FX processor ›phase‹ the sound. If you mess with the FF BIAS and mod wheel combined, you'll hear a ›super-phaser‹ but be *careful*. This introduces a lot of previously unheard harmonic content into the sound and could seriously damage your ears and speakers so turn your amp down.

In the Control Page with Press and Wheel Modulation, you will notice that the PCM source has *no* wheel modulation. Only the ADD sources in this patch will be affected by the modulation wheel.

This type of control over each source allows you to do stuff like the following:

- ◆ Set up your ADD sources and PCM sources to be modulated by LEVEL using the wheel modulation.
- ◆ As the mod wheel rolls away from you, either the PCM or ADD sources become louder or softer in relation to or combined with each other.

Chapter 5 Effects and Modulation

- ◆ This effectively allows you to have two completely different sounds available (or blends of them) at the flick of your wrist.
- ◆ Change the Decay time of one or more sources so that a source which was previously unheard (because it had a Zero decay time set) will appear ›out of nowhere.‹ This can radically change the way that you play the sound and is a really interesting effect to try. The best controller to assign this to is keyboard pressure.
- ◆ Simple things like vibrato can be added easily using the LFO to modulate pitch. Traditionally this type of control is assigned to the mod wheel.
- ◆ Level modulation using the LFO creates tremolo effects, great for EPs. Again, this is traditionally assigned to the mod wheel.
- ◆ Use Keyboard Scaling to modulate panning. As you play from the low to the high end of the keyboard, the sound changes position across the stereo field from left to right.
- ◆ Have the Formant Filter BIAS setting respond to velocity, keyboard pressure, mod wheel—well, *have* it assigned, because this is one of the really strong points of the K5000.
- ◆ Use key pressure or velocity to shut down/open envelope sustain or to change envelope attack. Soft playing = slow attack. Hard playing = fast attack.
- ◆ Again key pressure can be used to switch between ODD, EVEN, OCTAVE and 5TH harmonics in any (ADDITIVE) source or multiple sources.
- ◆ Use of Zones allows you to assign different sources/sounds to a range of the keyboard allowing splits and layers in a single patch. You could even replicate sources with different zones so that one type of modulation could be used on one zone and a different type on the other

while retaining the same sound for both zones. (A poor man's polyphonic aftertouch.)

And these are only a handful of simple examples. Use your imagination here—you know what you want your sound to do and how you want it to respond to your playing—this is the place to ›make it so.‹

Think of the control section as being like our dogs from the introduction chapter (they're back) who are trained to respond to hand signals. One flick of the thumb (on the mod wheel) will make them roll over (change from one source into another) while a squeeze on the tips of their ears (pressure modulation) will make them go to sleep (shut down the envelope).

- Use of modulation parameters have more impact on the overall sound when the same type of modulation is used on all sources—i. e. vibrato on all sources, not just the electric piano in a layered e. piano/string patch.

Conversely, and the electric piano/string layer is an ideal example, it would be preferable to have the vibrato *only* occur on one of these as the same modulation speed and type on both piano and strings would sound terrible and incredibly unnatural to the ear.

Use your modulation sources if they will benefit your patch by creating movement or change in the sound and where they will benefit you as a player.

Most of us only have two hands, so unless there have been some close—and we mean ›close‹—relationships in your family history, there will be times where the use of a foot-pedal or aftertouch for sound manipulation will come in ... well ... ›handy.‹ (sorry about that!)

Some things, like vibrato and tremolo, however, are best assigned to the mod wheel.

Where possible on appropriate sounds use pressure modulation as this allows you to keep both hands on the keyboard.

Chapter 5 Effects and Modulation

6 When to Use What

As you've no doubt discovered, there's a lot to your K5000 and to additive synthesis in general. With the hundreds of choices and dozens of parameters available, it's pretty easy to get a little lost—although at this stage, you should be doing OK.

This chapter covers a number of hints, tips and suggestions to assist you in making informed choices when programming which will not only accelerate sound creation but also save voices and resources in other areas of the synth engine.

ADD or PCM?

This is the first choice you need to make when creating a sound and is the most important one on a number of levels. In the table below, we have outlined the relative strengths and weaknesses of using ADD vs. PCM sources.

ADD	PCM
Can use a lot of memory for wavesets	Uses very little memory
Individual control of harmonics	No individual control over harmonics
Can use FF and DCF	Can only use DCF
Some sounds difficult to create	Fills these gaps
Slower and harder to program	Quick and easy to program
Spectrums can have lots of motion	Motions are fixed in sample
Can sound sterile, thin and synthetic	Sounds more natural, adds breath and noise partials

Chapter 6 When to Use What

ADD	PCM
Needs two or more sources plus tweaking for fat, chorusing sounds	Chorusing is already provided by single samples (e. g. pads)
Weak in emulating some instruments	Better at emulation
Blends beautifully with PCM	Blends beautifully with ADD

As you can see, each method of synthesis has both good and bad points. You can also see that for both ADD and PCM we have, in the last entry, mentioned that each method blends beautifully with the other.

Additive synthesis has a strength in the esoteric and bizarre sounds that are familiar, yet unfamiliar or have never heard anything like its area.

PCM-based (subtractive) synthesis uses samples—recordings of real acoustic instruments, noises or even electronic instruments—so they are instantly recognizable as such, dependent on how much doctoring you have or haven't done.

Let's take a look at some of the pros and cons in more detail.

Memory considerations

The K5000 uses a dynamic memory allocation scheme to store patches, sequences, arpeggios etc.—there is a finite amount of memory in the machine available for storage *but* there is not a fixed number of memory locations. The total number of wave sets—which is the company term for the additive parameter set of an ADD source—is limited to some 130 kits (without ME-1).

In plain language, this means that the number of sounds stored in the onboard memory is 128 maximum, but the maximum number of wave sets may limit this to some 60 or 70 if you make heavy use of ADD sources. The number of PCM

Saving memory by managing sources

sources is unlimited—you can have 128 patches with six PCM sources each.

Even ADD sources that are muted need a full wavekit, so be sure to decrease the value of the SOURCES parameter in DCO COMMON when not using the corresponding sources.

After this you will have to write the patch for the wave set memory to be released. Even if you just copy an ADD source to another source location and don't change a single parameter, the copy eats up a whole ADD set.

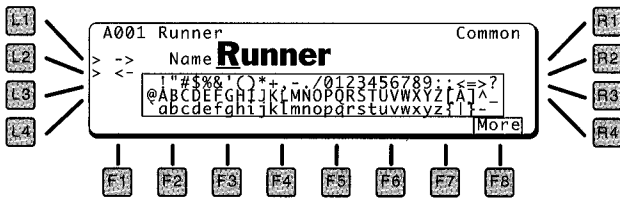
The example indicates, reasonably accurately, the true nature and size of ADD wavesets compared with PCM sources.

- ▶ You can double the maximum number of wave sets by installing the optional ME-1 memory expansion. We recommend you do so if you're a true ADDict.

Use ADD only when ADD is needed. Always check if this partial of the sound can be done using PCM. If so, use this mode. It's easier and it saves wave kit memory.

Saving memory by managing sources

In the second COMMON page—EDIT/L1/F8—there is a parameter called Sources.



The Common parameters

This can have a value from 2 to 6. Simply changing this value to the actual number of sources you actually require for your patch will save ADD memory if you are disabling ADD sources, of course.

Always reduce the number of sources to the number you actually require.

If you reduce this value on any existing patches remember to write the patch again.

Muting/Unmuting of sources does *not* achieve the same results as reducing the number of sources available to the patch.

Saving polyphony by saving sources

Imagine that every source used in a patch requires one voice *per note*. This means that if you use up six sources, this leaves you with only 5 comma something notes of total polyphony with regard to the K5000's 32 note maximum.

This might be OK with single patches, but with multis in mind, saving sources makes a lot of sense. Here are a few source saving tips:

K5000W owners—the 32 note polyphony limitation also affects you as the 64 note polyphony your machine has is divided into two discrete engines with half the polyphony available to the GM synth and the other half available to the ADD synth, which is identical to that of the K5000S and R.

- ◆ Instead of using lots of ADD sources in order to create a thick texture, try to use only one PCM source with a thick sampled pad and add some colour on top with only one ADD source.
- ◆ Another alternative is using the ensemble effect. You can create huge, wide textures with only one ADD source running through the EFX section. Set E1 to ensemble and E2 to delay to ›double the width.<
- ◆ Of course you can combine these methods. E.g. create a metallic pad by using one PCM source with a pad sample (PCM Wave No. 396 to 398 work fine), then adding one ADD source and running this through the ensemble effect.

ADD and PCM weak and strong points

As no synthesis method in the world is able to generate every kind of sound with at least ›good< quality, the ADD engine of the K5000 is no exception to this rule. We have discussed the strong points of additive synth engines more than once. To really make the best use of your K5000 you should also know where the weak points are, and how you can work around them by using PCM samples especially made for this purpose.

Additive sources—individually—are not good at creating

...

- ◆ Noisy sounds like voices or flutes

Working with sections of your sound

- ◆ chorusing textures
- ◆ natural partials (like hammer noise of a piano, bow noise of a cello, breath, sound effects)

This is where the ADD engine's PCM ROM comes in. To really make use of the PCM samples in the K5000, you should have a rough idea of what's in there and what's not. Take ten minutes *now* and listen carefully to the samples—here's how you can:

- 1 Select the ›Wizoolni‹ patch.
- 2 Press EDIT and L2, and you're in the DCO section of Source 1.
- 3 Set the cursor to PCM Wave No, on turn of the dial the Source is changed to PCM mode (you smarties out there may have noticed this is a hidden hint to a shortcut).
- 4 Start from Wave No. 342 and really play with each sample. Try every sample on different pitches. You will find that only by tuning a sample to different pitches you can create three or more completely different sound partials.

You may notice a lot of noises and textures that just can't be done using additive sources. You will also notice some sounds that could easily be achieved using additive sources—but you would need several sources and/or a lot of time. These samples are made for simplifying the process of sound creation and for saving wave set memory. Make use of this additional help from the Kawai sound designers.

Wizoolni—A001

The numbering of the ADD PCMs is due to the fact that all K5000 models share the same mask ROM for PCM samples. Only the W version uses numbers 1 to 341 for its GM samples.

Working with sections of your sound

Cast your mind back to (or physically take a look at) the introduction chapter where we discussed the barking dogs and broke down the bark and howl into their composite sections—we also broke down the word ›chicken‹ into small, manageable bits.

Using the same concept, but in an altogether more ›musical‹ sense, let's take a look at the sound of a Hammond B3

organ. If we were to break it down into components—and we'll keep this simple—there would be:

- ◆ The key ›click‹—sounds like tapping two plastic pens together softly
- ◆ The glide up to the note and sustained portion—DHL and DHE
- ◆ The vibrato and modulation—LFO and/or FF
- ◆ The ›Leslie‹ speaker cabinet—FX Processor

In earlier sections we discussed how to use the 5th and OCT harmonics to set up ›footages‹ for your organ patch, so we'll dispense with this. We also took a look at the use of the DHE to shape your harmonics over time, the use of the LFO and the effects processor which basically covers items 2 through to 4 from the breakdown above.

This leaves us with item 1—the key ›click.‹ This can certainly be emulated using the ADD engine, but it is surprisingly complex to set up as an ADD source for what, we're sure you'd agree, seems to be a pretty simple sound.

Working with small ›sections‹ of an overall sound allows more accurate emulation of other instruments and allows far more control.

At this point, the best choice for both memory conservation and simplicity's sake, is to choose a PCM source (367—Org Key Click) to add to the attack portion of your sound. A method you might like to try is to ›sound out‹ the overall sound using your voice—much like you would do if you were learning a new word in another language.

In doing this, you could break the overall sound down into its bits: CH—I—CK—EN which each can be synthesized individually to form the final ›chicken‹ sound. Once you have a mental picture of what each of these samples sounds like, you may have quite a few ideas of how and where they could be applied to make your patches more realistic or even better than they already are.

ADD for masochists

Additive synthesis is ›theoretically‹ capable of reproducing *any* sound, given enough processing power and control over parameters. The K5000 is extraordinarily well specified but it doesn't really have what it takes to pull off a convincing grand piano sound—if this is what you were after, you're barking up the wrong tree. (Maybe the next generation of Kawai additive synths.)

For those of you technically ›involved‹ these are the reasons why the K5000 additive synth engine can *not* virtually emulate any sound although it offers 64 harmonics and separate envelopes for each of them:

- ◆ The harmonics follow the harmonic scale, you cannot tune each harmonic individually making it become a true ›overtone‹ or ›partial.‹
- ◆ Over and above containing loudness envelopes, the harmonics in natural sounds also have pitch envelopes creating beating, detuning, noise and inharmonic content. The K5000 engine only has an amplitude envelope for each harmonic.
- ◆ The amplitude harmonic resolution (the number of times and levels) is too low to emulate every fast and detailed change found in analyses of natural instruments.

These reasons combined explain why you would hardly be *able* to recreate a grand piano on a K5000. A reason why you would possibly not *want* to do it is because you know some higher force made us (mankind) invent digital pianos for that purpose.

Where additive excels is in creating sounds that have never been heard before.

Some sounds, which seem relatively simple like the ›key click‹ we just looked at are extremely difficult to create using additive synthesis.

You can—with some effort—combine two or more sources, tune them to intervals, thus achieving new harmonic scales!

The PCM samples were specifically selected and created for the K5000 as ›spice‹ elements for your ADD sources and also as memory conservation aids. Many of the samples are ›plucks,‹ attacks etc. which are, by their very nature, ›components‹ designed from the outset to be combined with another source.

Unless you're making music that Frank Zappa and the Residents would find weird, many of these samples are unusable, musically, on their own.

Filter Choices

Only ADD sources have a choice of filtering options between or combining the Formant Filter and the DCF. PCM sources can only use the DCF.

Your decision on whether to use either the FF and/or the DCF with your ADD source comes down to a pretty simple equation and a question you should ask yourself when creating your patch.—>Do I really need to have control over each of the bands in the harmonic spectrum?<

If the answer is no, and all you really need to do to your waveshape is apply a simple low or high pass filter to the overall source/sound, then use the DCF.

If you require a little more control, you may be able to use the DHE in combination with the DCF, rather than using the FF. The advantage of utilizing the extra control of the DHE on a handful of harmonics will make the DCF's affect more or less pronounced.

If you want a filter that literally cuts into the spectrum and creates movements in the frequency spectrum that neither the DCF nor the DHE can create—you're right on the money with the FF. This is the filter of choice for *all* sounds that *only* the K5000 is able to create. The proof of the pudding is in the factory patches.

There are some K5000 patches you might be able to simulate on a conventional synth—*but* if a patch makes heavy use of the FF, no other synth has a chance of being a (pardon the pun) ›patch‹ on the K5000.

If you really need complete control, you megalomaniac, then use the DHE, FF and DCF combined.

Fattening up your ADD and PCM sounds

Digital technology is often accused of being sterile, cold and lifeless—the K5000 does all of these very well but can also sound extremely warm. If you or another pair of critical ears thinks that your sound is a little too ›digital‹ here's a couple of ideas which will help bring it back from the dead without destroying the original colour of the patch.

The use of DHE looping as an effect to simulate chorusing and ensemble effects is great for ›fattening up‹ a digital sound. This effect can also be used very subtly to create the aural illusion of motion and change which will make it more interesting to your ear.

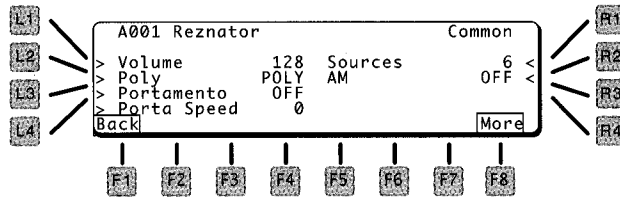
Increasing the level in the DHL of the first seven harmonics will make your sound much chunkier but be aware that this can radically affect the overall colour of the sound.

The GEQ in the EFX section is an easy way of balancing the overall quality of the patch. Unless you use one K5000 per patch all hooked up to separate stereo channels on your 360 channel Solid State Logic console—this is a good means of balancing sound characters between patches as well.

Often, in the context of a mix, these hard and spiky ›lifeless‹ patches lift the entire song because of their very difference and sterility.

Poly or Mono

Poly/Mono mode is selected in the Common page.



This one's pretty simple. Do you need to play chords with your patch or not?

If not, the choice is MONO 1 or MONO 2. The difference between the two comes down to this: If you press and hold a key, and while holding this key press a second key

MONO 1 will retrigger the envelope for the second note played, MONO 2 won't.

If for some reason you want to create one of those motown bass synth slides, MONO 2 is your choice. If you want to play percussive patterns and your fingers are too lazy to leave the keyboard before the next one hits it, MONO 1 is better.

We recommend the use of MONO 1 on lead sounds. To give you an idea of where it differs from MONO 2, just imagine a sax player taking breath before each note played.

Colour

This last one is a bit esoteric and not specifically related to the K5000 functions but more to it's place in the overall arrangement. Some questions you might like to consider are:

In the context of your mix, soundtrack or whatever is the K5000 the only synth that you're using?

If so, we recommend that you make heavy use of PCM sources in your patches as they are more neutral to the rest of the arrangement. >Less is more< is a good explanation of what we're saying: One to three ADD sounds in a whole mix >ac-

cents< and >flavours,< gives the mix that >special touch< and ADD character—use six or more of them, and its just an annoying mess of harmonics.

Will there be vocal parts and/or acoustic/synthetic or sampled instruments?

In this case, use the K5000's ability to add color even in track-crowded mixes. Add a melody line here, a chord there. Use ADD sounds with as few PCM sources as possible, but be careful: The K5000 is not a polite relative in the whole family of tracks—he likes to kick his companions out of the speaker membrane.

Is the K5000 a solo instrument or is it to be used as a colour in the overall arrangement?

In either case, ADD patches do a good job as long as they are distinct in tonal character from any other ADD sounds you may be using in the track.

Chapter 6 When to Use What

7 Analyzing Patches ...

Peter programmed the majority of the K5000 factory sounds. In this chapter, he'll demonstrate how he came up with some of the sounds and will show you how you can apply these techniques to create your own sounds.


Here you will learn how to analyze K5000 sounds, gain a basic insight into how they are structured and use this knowledge to implement your own ideas.

We highly recommend that you experiment with the patches as you read through this section. Switch the sources on and off alternately and take a close look at the sections as we describe them.

The graphical representation of patches in SoundDiver is excellent—and if you decide to use it, you'll avoid the hassle of scrolling through the pages on the LCD.

Sphaera

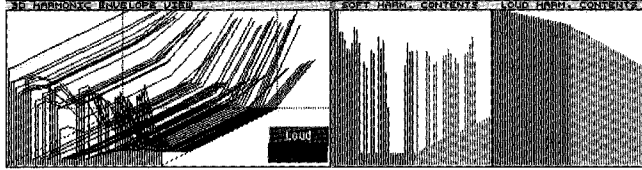
The basic waveshape of ›Sphaera‹ was derived from a Yamaha DX-7 bass. Way back when, Peter analyzed it via another additive synthesizer—the Waldorf Wave—and then manually converted and uploaded this data to the K5000. Definitely do not try this at home folks, it's just too onerous and time-consuming. Fortunately, today you have a much easier alternative: SoundDiver.

 Sphaera—A032

S1 and S2 are virtually identical. They generate a linear additive wave. The essential factor here is the interaction of the soft/loud crossfade and the harmonic envelopes. The dynamics of your attack have a substantially greater influence on the sound than they would in a conventional synthesizer.

You can use SoundDiver to analyze samples for the K5000. Please refer to the *Tips and Tricks* section.

S1/S2 The SoundDiver display of the harmonic envelopes (at the left) and the soft/loud spectra (at the right) graphically illustrate the complexity of the patch.



The sources are detuned and programmed with different LFO pitch modulations to achieve a more panoramic, pulsating sound.

The spectrum of the additive waveshapes has a great deal of overtone content, so the bottom end sounds a bit thin. Instead of boosting the lower harmonics, you'll come up with better results if you beef up the bottom end via a PCM waveshape as demonstrated here.


S3 plays back a looped pad sample. It was subjected to additional DCF filtering to soften it up a bit. Switch S3 on and off to hear exactly how this effect modifies the sound.

S4 is also a PCM source. It generates a metallic spectrum that slowly fades in and out of the sound via DCA envelope. Think of this effect as an exciter; it livens up the sound of sustained notes.

Modification tips:

- 1 Copy other spectra in Source 1 and 2 (LFO and Copy ⇒ Source Copy).
- 2 Experiment with the Formant Filter in LFO Mode to generate phasing effects. You will find the requisite templates in SoundDiver.
- 3 When you set slower attack rates in the DCA envelopes for S1 and S2 and deactivate S3/4, you can turn Sphaera into a digital string sound. The effect is even more pronounced when you change the effect section E2 setting from ›Celeste‹ to ›Ensemble.‹

DynoSaur

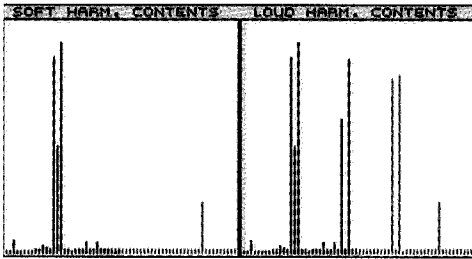
 DynoSaur—A033

In contrast to Sphaera, ›DynoSaur‹ is based on an existing sound—that of the electromagnetic Rhodes piano. We also

relied on wave analysis to create DynoSaur. First we played a loud note on the original, sampled it, analyzed the results and manually entered this data in the K5000. Check out Source 1 to hear what we came up with.

We repeated this little song-and-dance with a soft note, the results of which you can hear on Source 2. You may notice that the volume of S1 does not increase significantly until you get ›heavy handed‹ with your attack. This effect is achieved through different settings for the velocity envelopes and different depth values for the harmonic spectrum (e. g. S2 Additive DHL Common Velo Curve), filters (DCF Velo) and volume (DCA Velo). We also set slightly different settings in the harmonic level section's soft/loud spectra.

S3 is also an additive spectrum, although creating it was a matter of trial-and-error. In other words, it is not based on a sample.



When you are dealing with additive synthesizers you should always keep in mind that you might not be able to analyze everything, but you can improvise virtually anything. As a case in point, the majority of the percussive effect in this source is achieved via fast harmonic envelopes (Additive \Rightarrow DHE).

The Rhodes sound is, as a byproduct of it's fame, predestined for analysis: The original signal is a clean, simple waveshape without complex oscillations, vibrato or abrupt changes in harmonics. As simple as the structure of the sound is, you still can't rely exclusively on analysis to come up with the most desirable results.

S3 Just a few harmonics suffice for a metallic spectrum, provided they are fairly high frequency harmonics.

You'll find it easiest to structure the soft/loud contents if you first create the soft spectrum, copy it to the loud side and boost the upper harmonics there as depicted in the illustration on the previous page.

In the K5000, you can select a metallic waveshape for PCM sources to generate metallic contents—as is the case with S3 in this example. However, you can shape substantially more detailed sounds via an additive spectrum.

In this example, the metallic sound imitates the sound of the hammer striking the metal reed. The pitch of this sound only varies nominally over the entire range of the keyboard, so S3 has a KS pitch value of 50 cent (DCO Common). In other words, the source transposes a whole note played on your keyboard by a half-step.

When you turn the modulation wheel up, the pitch of S3 rises to achieve a brighter sound. At the same time, a chorus is added to the mix. This chorus is controlled via the CTRL page in the effect section.

For the obligatory culinary comparison: Experimenting with sound parameters is a bit like cooking. You have to measure the amount of velocity, envelope, filters and spectrum carefully—a little too much of one spice and you'll spoil the sound stew.

► Modification tips:

- 1 When you experiment with S3, you will find you can vary the sound of the electromagnetic piano radically. The following parameter groups are especially influential:
 - ◆ DCO Common: Coarse, KS Pitch
 - ◆ Additive Harmonic Level Edit: 7 and higher
 - ◆ Additive Harmonic Envelope: DC1/DC2 Rate
- 2 Lower the level of even harmonics in the S1 and S2 harmonic spectra:
 - ◆ Use the EVEN/ODD parameter or knob, or
 - ◆ Decrease the EVEN group in Additive—DHL Level Edit.
- 3 S1 / S2: You can soften the sound up to create a jazz-style tone by
 - a. lowering the DCF cutoff
 - b. boosting the first harmonic and dampening the upper harmonics (Additive ⇒ DHL Level Edit)

c. adding the Formant Filter to the mix; it cuts the upper harmonics:
Additive: FF Level Edit—Decrease the bias, slightly round off the right edge of the filter.


Gorgizmo

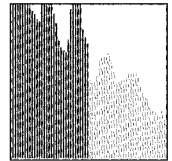
The secret to this sound is the Formant Filter. No synthesizer other than the K5000 can deliver anything even remotely similar.

One of Peter's standard operating procedures with additive sounds is to create two virtually identical sources and vary them slightly through different phase cancellations that create chorus/flanging-type effects and stereo panoramas. This sound was created along these lines. Usually, this type of treatment sounds better than if you try to achieve the same effect via the EFX section.

The spectrum of the two ADD sources shows a couple of prominent bumps. Generally, these bumps lend an additive sound characteristics that could be described as nasal, honking or metallic.

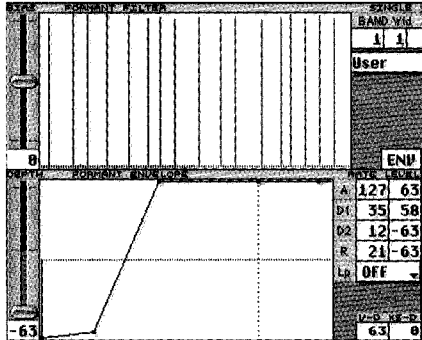
However, the wild effects in this sound are actually created by the Formant Filter. You're probably aware that the Formant Filter is not an audio signal filter, it actually influences the levels of the harmonics directly. Picture some one frantically turning the level of the harmonics up and down simultaneously, and you have a fairly accurate idea of what this filter is all about. Take a closer look at the Formant Filter in the following illustration.

 Gorgizmo—A035



S1 In an additive spectrum, bumps generate a nasal sound in the mid-range, metallic in the upper frequency range.

S1/2 The formant comb (top) is drawn horizontally through the spectrum by the FF envelope (bottom).



The Formant Filter features a setting much like a coarse comb. When it remains static, harmonics that match in the FF and the spectrum are audible, provided a given harmonic is turned up in both components.

Now the FF envelope draws the comb to the left and right and diverse harmonics are mixed in and out of the signal. It probably goes without saying, but just for the record: Set the values for the left / right shifting via the bias parameter.

The relatively wide gaps between the teeth of the comb are responsible for that distinctive pumping sound (kind of like an organ). If these were narrower, then more of the original spectrum would come through and this effect would be less pronounced.

All other aspects of the Gorgizmo sound are pretty basic. You shouldn't have any problems analyzing these on your own.

► Modification tip: Gorgizmo is a great medium for experimenting with how spectra and the Formant Filter interact. You'll come with at least a dozen other interesting sounds based on Gorgizmo. We recommend that you:

- 1 Mute Sources 2–4.
- 2 Replace the S1 spectrum with others. The easiest method is to use the templates in SoundDiver. If you are working directly at the

K5000, copy the spectra of other sources to S1 (Additive ⇒ DHL ⇒ Harmonic Level Copy).

- 3 Recall the original and try different Formant Filter settings, either via SoundDiver templates or copying (Additive ⇒ DFL ⇒ Formant Filter Level Copy).

Creaturz

Although the value of ›Creaturz‹ in musical terms is negligible, it is one of the wackiest (and coolest) sounds in the K5000 library. You won't find a better example of how the Formant Filter can be used to create sound effects.

To find out what makes Creaturz tick, follow this procedure:

- 1 Mute all sources except S2. S4 only lays down a PCM pad under the sound.
- 2 Go to the Additive section and take a close look at the Formant Filter parameters (level and envelope).

Do you see what we're getting at? Let's break the sound down to its constituent parts:

- ◆ The spectrum has no bearing on the effect. You can replace it with any other spectrum of your choosing to see for yourself.
- ◆ The source LFO generates vibrato which makes the individual creatures sound even creepier.
- ◆ You can see that just a single band is tweaked in the Formant Filter level (DFL). Everything outside this band is inaudible.
- ◆ Now take a look at the Formant Filter envelope (DFE). It is set to LFO mode. The LFO shifts the Formant Filter band randomly at intervals of approximately a third of a second.

Here's the deal: Every time the Formant Filter band matches the pitch of the key you are currently pressing, you can hear

 Creaturz—A036

the call of the really wild resound until the LFO moves the FF onwards.

The sources S1, S2 and S3 are spread in the stereo panorama, their LFO frequencies and FF bands are slightly different and the whole mess is subjected to an EFX delay, so it sounds as if a demented choir of aliens are sounding off.

- ▶ **Modification tip:** You can do the Frankenstein number and create creatures of your own by very slightly varying the LFO speeds and the Formant Filter bands. But remember brute force will get you nowhere. These are sensitive beasts, a little too much twiddling and they're gone forever.

@IsCream

 @IsCream—A037

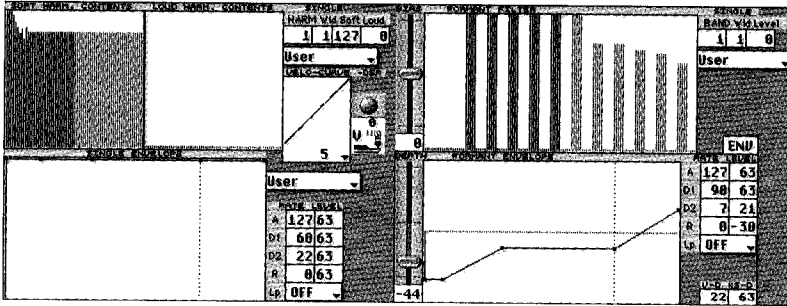
Before you read any further, give this sound try. Put on one of your favorite tunes and jam along with it. When you feel the urge to start soloing, make excessive use of the modulation wheel. Afterwards, the origin of the name inside the name (I Scream) should be abundantly clear.

Two features are responsible for the sound's edgy, screaming tone: EFX distortion and the Formant Filter.

The distortion isn't much of a mystery. It is programmed in the first effects processor (E1). By tweaking the Dry/Wet knob, you can turn ›@IsCream‹ into a lead sound Kurt Cobain would have been proud of. But before you start wailing away in heavy mode, set it to 100:0 so you can clearly hear what the Formant Filter is up to.

Distortion used in conjunction with synthesizer sounds achieves the best results when the sound features an added fifth. This is why in this case the ADD sources S1 and S2 are programmed with an interval of seven semitones between them—otherwise, the two sources are identical.

The SoundDiver display nicely illustrates how the spectrum and Formant Filter interact:



All harmonics in the spectrum (top left) have virtually equal amounts; in the Formant Filter, the fat bars generate radical sound sequences.

The spectrum is turned almost all the way up—only the lower harmonics are boosted somewhat to give the sound more oomph. The Formant Filter can really dig in here.

With the fat bars, the Formant Filter mutes a group of four or five harmonics while allowing the neighboring group to pass virtually unfiltered. The result: an extremely metallic spectrum—much like that of an overdriven electric guitar.

The Formant Filter is slowly shifted by the FF envelope (at the bottom right of the illustration) to lend the sound innate dynamics even when you are not spinning away on the modulation wheel.

- **Modification tip:** As with all radical additive sounds, you can simply replace spectra or enter different Formant Filter settings to arrive at completely different sounds. Experiment at will!

Cyber@FX

For this sound, we'll give you just the one clue and let you figure out the rest for yourself: Five sources are distributed over the keyboard. You can easily emulate this type of split within a single patch via the ZONE LO/HI parameters in the Control menus.

📄 Cyber@FX—A039

By now you should be able to analyze the individual effects on your own. After reading this and earlier chapters and experimenting with examples, you have dealt with plenty of Formant Filter applications so you shouldn't have any problems divining the structure of S1. The remainder of the sources are simple PCM sources and consequently are limited to the source parameters of the DCO, DCF and DCA.

Wizoolni

📁 Wizoolni—A001

If you want to create an ADD patch from scratch, you need a neutral starting point—a patch in which complex elements such as the harmonic spectra and envelopes as well as the Formant Filter feature neutral settings.

Of course you could work from an existing patch, provided you want to spend anywhere from fifteen minutes to who knows how long neutralizing those parameters that are less accessible.

SoundDiver features INIT presets for diverse sound components.

In contrast to a conventional neutral patch, this patch contains diverse basic settings that are practical for use with virtually all sounds:

- ◆ The patch responds subtly to dynamic attack and the modulation wheel; a minimal room and the graphic EQ slightly enhances the sound quality.
- ◆ The first source is activated and set to ADD. The second source is preset to PCM, and in the PCM, to a neutral sawtooth wave (413).
- ◆ The filter is already activated, but does not yet cut the sound. However, when you rotate the cutoff knob, you will hear the filter kick in.
- ◆ The envelopes feature neutral settings.
- ◆ Rather than a useless sine waveshape, the harmonic spectrum in the Additive section is set to a sawtooth—the ideal starting point for the majority of spectra. The har-

monic envelopes feature neutral settings and subsequently have no influence on the sound.

- ◆ The Formant Filter is virtually neutral, only the upper bands were slightly dampened to prevent aliasing at exceptionally high notes.
- ◆ The controller and effects feature practical, sensible presets but are currently inactive.
- ▶ When you are dealing with a synthesizer as complex as the K5000, you'll find a good INIT setting an invaluable aid. You should take the time to closely examine this patch before you use it. And of course you are free to adjust the basic settings to suit your taste.

8 Adding Realtime Control

All of the K5000 synths have extensive MIDI control available from a range of sources including the front panel, external controllers like Kawai's MCB box, sustain and controller pedals or other MIDI controllers/sequencers that you might own.

The K5000S features direct access to many of these controller functions on the front panel, and as these functions are also available via an external controller, like those mentioned above in the other K5000 units, we'll concentrate on this particular keyboard.

Why would you want to have realtime control over sounds?

Just because you're playing a synth, there's no reason why you shouldn't have—at the very least—the same expressive potential as an acoustic player—who can add expression by bending strings, adding vibrato or changing bowing, strumming.

Another point is that an electronic musical instrument goes beyond the limits of acoustic instruments. Apart from aspects like notes or dynamics, a synthesizer like the K5000 offers access to every single detail of the sound.

Realtime doesn't only mean things you can control while playing. It also refers to the dozens of sound parameters you can control from your sequencer such as moving the Formant Filter back and forth every four bars.

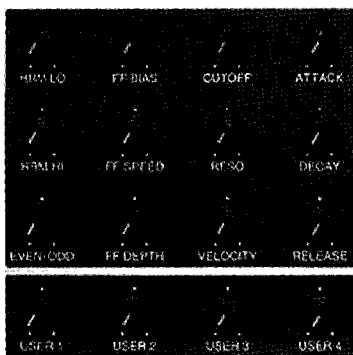
Another very real advantage is that the ADD engine of the K5000 series shows its true power when a little bit (or a lot) of realtime manipulation of sound takes place.

Easy sound programming with Macro Controls

You can save the changes made using the knobs. Just alter the sound to your liking and write it into memory. This is particularly useful for subtly adapting the sound to your taste.

The controls shown in the picture below are from the front panel of the K5000S. The K5000W and R allow you to access these parameters below the display.

Most of these controls work ›relative-ly.‹ The knobs have no fixed value range but change the value of the parameter starting from its initial setting.



Let's take a look at the knobs from the top left.

- ◆ HRM LO—Controls the low harmonics in an ADD source. The Kawai sound team decided to set the divider at the 7th harmonic, so basically what it does is boost/cut the volume of the ›bottom-end‹ or bass frequencies of the harmonics in your ADD source, making your sound either a little ›beefier‹ or ›less beefy.‹ (Left = ›light‹ Right = ›chunky!‹)

Easy sound programming with Macro Controls

- ◆ HRM HI—Controls the high harmonics—above the 7th harmonic—in an ADD source. This boosts/cuts the volume of the ›top-end‹ or treble frequencies of the harmonics in your ADD source, making your sound either a little ›brighter‹ or more muted. (Left = ›dull & lifeless‹ Right = ›shiny‹ ... kinda sounds like a shampoo ad, doesn't it?)
- ◆ EVEN/ODD—This control changes the balance between Even and Odd harmonics, making either louder or softer in relation to the other. If you had the knob turned fully left you would have EVEN Harmonics *only* ... right would be ODD harmonics *only*. A good sound to check out is ›Sphaera‹ (A001). When you listen to this, you will hear that the ODD harmonics sound more ›hollow‹ and more like a square wave whereas the EVEN harmonics sound more ›nasal‹ and like a sawtooth wave.
- ◆ FF BIAS—This control adjusts the center frequency of the Formant Filter in an ADD source. We already pointed out that you can imagine the FF as a 128 band equalizer. Well, that's only one side of the coin. In addition to adjusting the volume of each EQ band, you can shift the whole FF up and down in pitch by moving the bias frequency.
In patches making extensive use of the Formant Filter, this knob does evil things, so nail down any loose items. The FF is one of the strongest features of the K5000. Try it out with ›MelMaker‹. Note that this knob will only affect ADD sources whose Formant Filter setting is *not* neutral.
- ◆ FF SPEED—*If* your Formant Filter is set up to be modulated by the LFO or envelope, then this controller will adjust the speed at which this filtering takes place. Again, take a listen to ›MelMaker‹ and play with the control ... you'll see *exactly* what it does. (Note that this controller *only* affects ADD sources.)
- ◆ FF DEPTH—*If* your Formant Filter is set up to be modulated by the LFO or envelope, this controller will adjust how much the LFO and envelope affect the Formant Filter ... or

The effect of most of these controls depends on the patch and which kind of sources it uses. If a particular control knob does not affect the sound, it is probably something like an ADD parameter used with a PCM patch.

Be careful when using these controls, as they literally ›cut‹ into the harmonic spectrum. Sometimes you won't be able to return to the original patch after turning one of these controls. In this case just re-select the patch.

 MelMaker—A010

Chapter 8 Adding Realtime Control

more to the point *how much* effect the Formant Filter will have on your sound ... again use ›MelMaker‹ to check this out.

- ▶ The controls mentioned above *only* affect ADD sources. If the patch you selected only uses PCM sources, you will not hear any effect.
- ◆ All of these controls can be sent and received via MIDI, so you can record and ›play‹ them literally using your sequencer.

Bronx—A007

- ◆ CUTOFF—The cutoff is part of the ›standard‹ filter section (DCF) and will affect both ADD and PCM sources. What it does is adjust the point at which the upper frequencies of the sound ›cut off‹ (*if* the filter is set up to be a LOWPASS filter) Play ›Bronx‹ to try this out.
- ◆ RESO—Again, part of the standard filter section and affecting both ADD and PCM sources, the Resonance control adds ›resonance‹ to your sound. Try this control out with ›Bronx‹ but be *careful*—it's touchy!
- ◆ Used in conjunction with the CUTOFF function, you can change the amount and sonic quality of the resonance—try it out!

StageMK1—A003

- ◆ VELOCITY—This control is *ideal* for live players and does, as the name suggests, affect the velocity range of the sound. Take a listen to ›StageMK1‹ and repeatedly play a chord while slowly adjusting the velocity knob. This particular patch is set up to switch between ›bright‹ and ›mellow‹ versions of the sound dependent on how it is played—how hard/soft you hit the keys. As you can hear, the velocity control adjusts the responsiveness of the sound so that no matter how hard/soft you play the keyboard, it won't switch between layers.

Many other things can be adjusted by velocity as we covered earlier.

Let's look around the back ...

- ◆ **ATTACK**—This adjusts the attack time of both the DCF and DCA envelopes of all sources. A good sound to try this out on is ›Harmonic‹ and as you'll hear, it changes a ›spiky‹ digital sound into a useful pad.

 Harmonic—A008

- ◆ **DECAY**—same as before, but adjusting the decay time. Load up ›Protonic‹ and play a note in the top half of the keyboard. Slowly rotate the DECAY knob left and right while continually striking the note.

 Protonic—A009

The changes you are hearing in this patch are because the decay parameter has been set up to introduce the sawtooth wave (›brassy‹-sounding thing) a little way into the sound.

- ◆ **RELEASE**—same story *except* that it adjusts the amount of time over which a sound is sustained or decays *after* you have released the keyboard.

None of the envelope knobs affect the harmonic envelopes nor the FF envelope. However you can control the speed of the FF envelope with the FF SPEED knob.

It affects both the DCA and DCF Envelopes.

Let's look around the back ...

MIDI is the most powerful of your control input sources—but we won't go there just yet.

The keyboard versions have a sustain pedal jack—we'll dispense with the explanation for this one ... it is either ON or OFF.

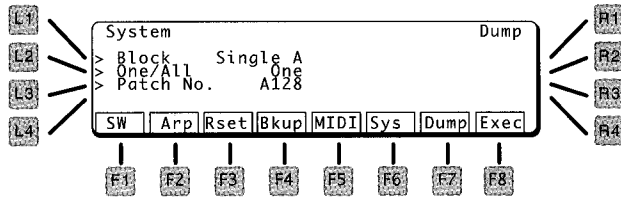
There is also an Expression Pedal input for adding CONTINUOUS control over the volume (or other parameter) as you play.

The K5000S also has two extra jacks which allow you to assign a number of functions to them including arpeggiator start/stop, octave up/down etc. Great for avoiding those ›ARGHHHHH!—I've only got *two* hands!‹ fights with the band (who just don't understand you ...)

So, what can I do via MIDI with my K5000?

There are certain functions only available via MIDI which are related to system exclusive control and editing of the K5000. These can be accessed using SoundDiver which is discussed in the Tips and Tricks chapter.

Functions such as single or bank patch dumps can be initiated from the SYSTEM/DUMP page.



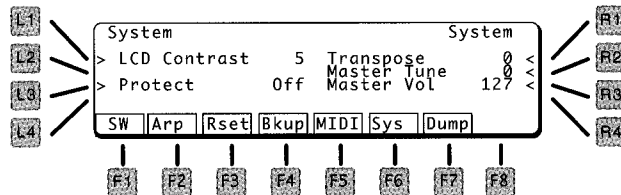
Multitimbral use is accessed via the SYSTEM/MIDI page—select PRG (Program Change) Receive and change it to SEC (section) using the dial.

This will allow you to send/receive program changes for different MIDI channels if you have a MULTI/COMBI patch which has been set up with different channels assigned in each section.

- ▶ If you are using your K5000 multitimbrally with an external sequencer, you should turn OFF the ›Local‹ function in the SYSTEM/MIDI page. If Local is set to ON in this circumstance, you are effectively halving your polyphony.

Global (i. e.—for the whole machine) Transposition, Tuning, Master Volume and Memory Protect functions are available by pressing SYSTEM once and selecting the appropriate L1—L4 or R1—R4 button.

Global parameters are set in the System page.



So, what can I do via MIDI with my K5000?

If you would like MIDI control of the Macro Functions covered earlier in this chapter using your computer sequencing program, take a look at the supplied disk.

Dave has built an Environment for Logic/Logic Audio which allows for this type of control and also patch selection (including bank select).

The file ›K5000.lso‹ can be found in the root directory of the floppy disk. (This is appropriate for Mac and PC versions of Logic/Logic Audio.)

More infos on MIDI can be found in *FAQ & Help* on page 109.

Chapter 8 Adding Realtime Control

9 FAQ & Help

In this chapter, we'll try to help you out of situations we have come across or know others come across frequently. We even invented a few possible questions and situations based on our experiences and experiments.

Please make use of our online support options discussed in *WIZOO Online Support* on page 117 if you can't find what you're looking for here.

At any rate, we recommend that you read this chapter from beginning to end—it *will* save you from a lot of potential headaches.

MIDI Questions

How do I transfer patches between the K5000 and a sequencer/data filer?

Functions such as single or bank patch dumps can be initiated from the SYSTEM/DUMP page. Ensure that both MIDI IN and MIDI OUT cables are plugged in and that the Memory Protect function (SYSTEM/L3) is OFF if you wish to receive patches. You will also need to make sure that Exclusive is turned ON in the second MIDI page (SYSTEM/MIDI/R3).

How do I set up my K5000S/R to work multitimbrally with my sequencer?

- 1 Select the Multi Patch you wish to use and press EDIT.
- 2 Press L2 (Section).
- 3 Select the section using F2—F5 keys.
- 4 Press R2 key.
- 5 Use Value Dial to change to the appropriate number/channel.
- 6 Repeat steps 3 to 5 for each section.

If you are using your K5000 multitimbrally with an external sequencer, you should turn OFF the ›Local‹ function in the SYSTEM/MIDI page. If Local is set to ON in this circumstance, you are effectively halving your polyphony.

7 Press Write to save the multi patch.

Multitimbral use is accessed via the SYSTEM/MIDI page—select PRG Receive and change it to SEC using the dial. This will allow you to send program changes for different MIDI channels if you have a MULTI/COMBI patch which has been set up with different channels assigned in each section.

Also ensure that Program Change reception is ON in the SYSTEM/MIDI/MORE page.

I'm using my K5000 as a slave MIDI device and every time I change something on my controller the K5000 ›weirds out.‹

Enabling/Disabling the transmission or reception of program changes, aftertouch and system exclusive functions can be accessed via the SYSTEM/MIDI/MORE page.

How do I record and play back all of my knob movements using my sequencer?

If you would like MIDI control of the Macro Functions using your computer sequencing program ... take a look at the supplied disk—Dave has built an Environment for Logic/Logic Audio which allows for this type of control and also patch selection (including bank select).

Feedback/recording can be done using either the front panel of your K5000 or using your mouse in Logic/Logic Audio. Logic's environment will update to reflect these changes in real time as the song plays back.

The file ›K5000.lso‹ can be found in the root directory of the floppy disk. (This file is appropriate for Mac and PC versions of Logic/Logic Audio.)

My K5000 does not respond to MIDI

In most cases, this happens when you first connect the K5000 to the rest of your MIDI system, and in almost every case this is human error. The solutions below are *really* simple, not because we regard people as fools but rather that the ›obvious‹ fix is often overlooked—even by the very experienced.

- 1 Check if the cable really carries MIDI events. Check connections. Try the same cable with another synth if you have one.
- 2 Exchange MIDI-In and MIDI-Out cables.
- 3 Make sure the UNIT CH (System ⇒ MIDI) and the transmit channel of the external device match.
- 4 If it's only Multis or Combis or the W's sequencer that do not respond, check the respective MIDI-channel settings for Sections and Tracks, and check the MUTE status of each of them.

My K5000 does not produce any sound

- 1 Check if you have connected the wrong audio out (INDIV instead of MAIN).
- 2 Try the audio cables with another synth if you have one. If this does not sound either, the reason is to be found in the audio equipment hooked up to the K5000—might be a defective cable, a mixer or amp not powered on, volume turned down ... you know the drill.
- 3 Check the LOCAL setting (SYSTEM--MIDI)—set it to On. (Local is automatically set to ON when powering up the K5000, so you may just try this.)
- 4 Switch to another patch and back again.
- 5 If it is a special patch that does not sound, check Source muting, check if you assigned a controller to LEVEL (EDIT ⇒ CONTROL ⇒ MORE), check foot pedal input, check EFX routing.
- 6 Turn the CUTOFF and the FF BIAS knobs all the way up.
- 7 Make sure the main volume slider is up.

Local ON should not be used when the K5000 is hooked up to a MIDI sequencing system in an IN/OUT loop because this produces a MIDI feedback halving polyphony and changing the sound.

I've just tried to save a patch and got an ›Error 37 PROTECT ERROR‹ message

This error is because your K5000 memory is protected.

- ◆ Press the SYSTEM button, press the L3 button (Protect) and use the dial to change this to OFF.

My K5000 seems to have ›lost its mind‹ ... nothing works properly

This type of behavior is possibly due to the operating system becoming scrambled by a power surge or a System Exclusive message which may have been inadvertently generated by another device.

Resetting your system in this way will re-initialize ALL of your edited patches back to the default system patches.

- ◆ To fix it, press the SYSTEM button and then the F3 button, followed by the F8 (Execute) button.

How do I synchronize my K5000 arpeggiator with an external sequencer/drum machine?

- 1 Press SYSTEM/F2 to enter the Arpeggiator page.
- 2 Press F3 to toggle synchronization to ON/OFF depending on whether you want to use your K5000 as the master or slave MIDI device.

Ensure that the other MIDI device/s are set to receive or send MIDI clock information dependent on whether it is the master or slave device.

If you have seen the ›Highlander‹ movies, remember ›There can be only one‹—*master clock* device, that is.

General Questions

How do I restore the system?

Kawai is very good with providing updates of the OS for the K5000. You should definitely take advantage of these, as they always improve your value-for-money, make the handling of the K5000 easier and often add great new features.

You can always check for the newest K5000 system version on the WIZOO site or get new versions from your dealer or distributor.

In any of these cases you need to create a system disk that is accepted by the K5000.

How can I create a system disk?

Its as easy as can be: Take a fresh disk, format it in the K5000 or in any DOS-compatible drive and copy the system file onto it.

- ▶ It is vital that you use a freshly formatted floppy—initialization is not enough, because the K5000 is a bit intolerant to changes in the physical location of the system file on disk.

NEVER overwrite an older system disk with the new system. In case the new system is corrupted for any reason you may be left with a ›brain-dead‹ K5000.

How can I update the system?

- 1 First make a backup of all data in the K5000 because *everything* will be overwritten during the installation of the new system.
- 2 Insert the system disk into the disk drive.
- 3 While powering up the K5000, press the following buttons on your model:

K5000S: [F2], K5000R: [F8], K5000W: [Oct Shift Down]

When the K5000 recognizes the system on disk, it will display a ›System found‹ message and start loading.

If the display reads ›Err08h,‹ the system file is not located on the first blocks of the floppy disk. In this case take a freshly formatted floppy, copy the system onto it and try again.

How do I restore the factory patches?

If for some reason you'd like to restore the factory patches, there are three ways of doing so.

- 1 If you bought this book together with the K5000, you could take some ›prophylactical‹ steps now and save the factory patches to a fresh disk or to a SoundDiver library. If you haven't already done so, *now* is the time to do it.
- 2 If you have Internet access you can download the factory settings from WIZOO.

If you have no Internet access and no backup there is only one way: You have to restore the system from the system disk as described above. This restores all factory settings including singles and multis or combis (dependent on your flavour of the K5000).

How do I tune SINGLE patches?

Press EDIT/L2 and on the next page (DC0) press L3 or L4 and use the dial to adjust your patch to whatever pitch. Note that this will need to be done for each SOURCE in the patch, by pressing the F1—F6 buttons and then L3/L4 & Dial method. When done with your edits, press WRITE.

Mac users: as the Mac usually writes the desktop file to the location the K5000 expects to find the system, you need to overwrite a system disk with the new system file to ensure the file is replaced.

The total of all de-tune values of the sources should be Zero to ensure the whole patch is in tune with the Master Tune.

Additive Questions

In the higher ranges of the keyboard the sound is distorted

This is digital aliasing, very common among additive synthesizers because the very high harmonics exceed the frequency range of the sound engine and are mirrored into the lower frequency spectrum. You find extensive explanations of this phenomena in *Avoiding Aliasing* on page 121.

When hitting the keys very hard the sound is distorted

Try to lower the overall level of the spectrum, the Formant Filter and the DCF. Explanations on this in *Avoiding Distortion* on page 121.

The spectrum I hear appears to be different from what I see

In most cases this is due to different SOFT and LOUD settings. You are editing the soft spectrum but due to velocity settings you are hearing the LOUD one. Set Vel Depth in the DHL Common page to Zero.

I want to edit the LOUD spectrum and *not* hear the SOFT spectrum

Set the Velocity Curve in the DHL Common to 1 and set Velo Depth to 127. Regardless of how hard you hit the keys, you will only hear the LOUD spectrum.

How do I know which FF bands match which harmonics?

In default setting—bias value 0, NO envelope—FF band 64 exactly matches the 1st harmonic on the middle C. Well—not a real help when designing sounds. We recommend that you set the Edit Group in the DFL to Each and temporarily set different harmonics to full level. This way you can easily hear the >outline< of a FF band when cutting through the spectrum.

How does the FF Envelope interact with the Velo setting?

In DFE, the velocity setting works subtractively. This means that if the envelope depth is Zero, the FF will not react to ve-

locity. If it is higher than Zero, the Velo Depth setting ›subtracts‹ envelope depth on low velocities.

How can I make the FF bias follow the keyboard?

Only by using the envelope, because the KS Depth parameter does not affect the bias directly but the FF envelope depth—don't ask us why, we *told* the development guys several times to change that.

To make the Bias follow the keyboard ...

- 1 Set all DFE levels to +63
- 2 Set all Rates to 127
- 3 Set DFE Env Depth to +63
- 4 Set KS Depth to your liking.

If you want the Formant filter to run *against* the keyboard, set DFE Env Depth to a negative value.

SoundDiver Help

I've hooked up SoundDiver and the K5000 but nothing changes when I alter stuff using my mouse in the program

Ensure that you have *both* a MIDI IN and MIDI OUT connection established between the computer and your K5000. To work properly, the K5000 uses a ›handshaking‹ protocol for System Exclusive communication which is why both MIDI I/O need to be connected.

Another possible problem is to be found on the K5000 in the SYSTEM/MIDI/MORE page (SYSTEM/F5/F8) The Exclusive option (R3) must be turned ON for the K5000 to work with SoundDiver.

Everything's hooked up properly but I can't hear any changes that I'm making ... so what's the point?

In the MIDI menu in SoundDiver, ensure that both AutoSurf and Autoplay are *enabled*. AutoPlay sends a test note each time you change a parameter, AutoSurf automatically sends patches you select in the Memory Manager or the Library to the K5000.

I have made changes on my K5000 but SoundDiver does not recognize them.

When working with SoundDiver we strongly recommend that you make changes to patches *only* in SoundDiver as it always tries to maintain synchronicity between the K5000's internal memory and it's own memory manager. This way of working has *many* advantages, but be aware that you're likely to run into problems such as patches being overwritten or lost when editing directly on the K5000's front panel.

I was naughty and have made changes directly on the K5000, now I want to get them into SoundDiver

- 1** To be safe, first switch on the memory protect of the K5000 (SYSTEM ⇒ SYS—Protect on).
- 2** Launch SoundDiver.
- 3** In the Memory Manager window, click into the ›ADD Singles Bank A‹ bar, after this, click on the icon showing a question mark and a keyboard or choose ›Request‹ from the MIDI menu.

From time to time the screen freezes in SoundDiver

The K5000 features a volatile RAM area for temporary changes. These changes have to be written in to the flash memory of the K5000 from time to time. This procedure is called backup and is carried out automatically, freezing everything but doing no harm. You can set a longer ›Backup Delay‹ in the Memory-Manager window (Special Parameters) or switch backup off completely by setting the Backup Delay to Zero. For more specific help on using SoundDiver, refer to the online help within the program and/or check out the Internet resources listed in the help file.

10 K5000 Tips'n Tricks

We think the title for this is pretty self explanatory. Apart from covering the K5000 indepth this chapter has a bit of a look at SoundDiver—not to explain how to use it, it already has online help—here, we're more interested in covering the use of templates. From reading the preceding chapters, you will have noticed that we're both pretty insistent about this and with good reason—additive synthesis has one major drawback—there are *so many* parameters to set up just to get *started*.

So *please* take heed and use the *groups* and copy functions in the various parts of the synth to speed up your sound creation. In professional circles, there are a handful of people who get the work and continue to get the work—the *fast*.

WIZOO Online Support

Book Updates

For every book WIZOO offers a web page with all the latest updates, new system versions and links to sites and pages offering patches and information. Point your browser to

<http://www.wizoo.com/docs/english/bookservice/K5000.htm>

and there you go!

Website

In case of problems you cannot solve with this book, WIZOO offers comprehensive online support on any aspect of electronic music production, synthesizers and MIDI.

Extensive use of these information and material resources saves you time, helps you get into contact with other users and contributes to expanding your horizons.

- ◆ Check our FAQ Area in Wizdom Valley for frequently asked questions on a variety of matters.
- ◆ Make use of our link database in order to find internet links to K5000 or synthesis related pages and sites:
<http://www.wizoo.com/docs/english/links.htm>
- ◆ Check our Newbie section in Wizdom Valley for introductions on synthesis, MIDI and more.
- ◆ Search our Web Site for your issue—just click the Search button in the navigation frame and type in a term.

E-mail

In case you do *not* find an answer to a problem in this book or our website, you're welcome to send us an e-mail:

e-mail address: `userinput@wizoo.com`

subject: `K5000 <shortdescription of your problem>`

e. g.: `K5000 arpeggiator doesn't work`

This service is free to all K5000 programming guide owners, but please

- ◆ only one question per e-mail
- ◆ keep it short and precise
- ◆ be patient, our crew has to answer literally hundreds of questions per day
- ◆ note that we cannot guarantee to give a sufficient answer and we may have to refer you to the manufacturer's hotline.

If you keep these simple rules in mind, it's very probable that we can help you. Best of all—its free, so be happy, dance, sing and tell your friends.

Optimal EQ settings

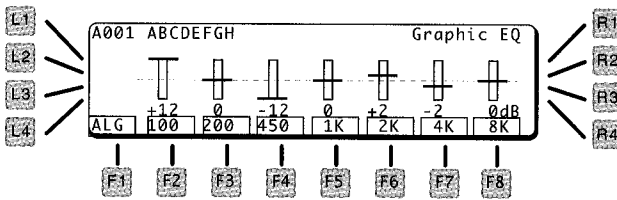
The K5000 has a certain ›mid-stressed‹ sound quality. Peter always uses an EQ setting on the mixing console which improves the overall sound quality of the K5000 by—he swears—30 % at least and makes it sound more ›expensive‹ and HiFi.

📄 BEST EQ—A048

You may like to try this as well. Generally the EQ setting balances the sensitive frequency range around 3 to 4 kHz which is usually a pain in the ear when using additive synthesizers, it increases the ›nice‹ high and low frequencies as well. We recommend using this setting rather than the internal graphic EQ in the EFX section, because the internal one is not very effective.

This setting is suitable for a 4-band parametric EQ, originally set up on a digital console:

Freq/Hz	100	670	2800	12500
Q	Low Shelf	2,5	5	Hi Shelf
dB	+5	-2	-5	+6



If for some reason you are limited to the internal EQ in the EFX section, this setting at least leans towards a HiFi characteristic:

100	200	450	1K	2K	4K	8K
+5	0	-2	0	-3	-4	+6

Try these settings with additive, very brilliant patches like ›@iScream‹ or ›DstPulse.‹

Copy Functions

Utilising the copy functions in all areas of the K5000 is a great idea. If a professional programmer or yourself has programmed an envelope template or waveset, a Formant Filter setting, a modulation routing or an effects combination that is just *great*, then there is no reason not to make use of it as a basis for your own experiments.

Additive Tips and Tricks

This is just ›a‹ collection of useful pro-tips. Additive programming is a matter of feel, intuition and routine, and you'll very likely develop lots of personal favourite ›tricks‹ when getting into the K5000. These are our personal favourites.

Always be careful when changing harmonic levels

There's an audible difference between an equalizer and a harmonic spectrum, so don't use the harmonic levels like EQ bands. Be careful when changing harmonic levels, especially in the lower area (up to 7th and 8th harmonics) as a slight change can alter the tonal character of the spectrum completely.

The same is true for all Formant Filter bands—honestly speaking, it's true for *every* parameter in the additive domain.

Simulating ›natural‹ sounds with additive synthesis

No other synthesis technique—FM included—needs as much experience and routine in method as additive synthesis does. Be patient—it will take months until you get a ›feel‹ for which harmonics are best used for particular sounds.


- 1 Actually the best way to get into spectrums is studying the spectrums provided with the factory presets and SoundDiver. Really look

INTO them in the ADDITIVE EDIT or in SoundDiver. Change harmonics and listen to what this change does to the sound.

- 2 Another good way of learning additive spectrums is analyzing cyclic waves of natural sounds. We provided a few of them with the floppy disk—analyze them in SoundDiver and have a close look at the spectrum. Try creating cyclic waves of your own—download samples from the WWW (look at our link base for URLs) and extract cyclic waves using a shareware sample editor like CoolEdit (Windows) or D-SoundPro (Mac).

Avoiding Aliasing

Without going into a really deep explanation: Aliasing is an unpleasant harmonic distortion you may experience with some additive sounds when playing in the higher range of the keyboard.

 ALIAS—A049

There are several ways of reducing it and there's no sure-fire solution for every case. We recommend that you try these methods in the order they appear and see if they fix your problem:

- 1 Try lowering the cutoff frequency of the DCF. You can use the Cutoff knob for all sources, but you have more control if you use the Cutoff parameter in the DCF page.
- 2 Try a lower or negative ›KS to Cut‹ value in the DCF page
- 3 Set the 64th harmonic to a value of Zero in the additive DHL page
- 4 Use a negative value for KS to Gain in the additive DHL Common Page.
- 5 Try to increase the Formant Filter bias.
- 6 Set the highest Formant Filter band to Zero and lower the BIAS value so that the sound is *not* changed but the aliasing disappears.

Avoiding Distortion

The internal additive engine of the K5000 has a level limit you can exceed by using spectrums with lots of loud harmonics, by setting certain levels too high and many other parameters which can ›max out‹ your machine. This usually leads to unwanted digital distortion. In some cases you can use this as a sound effect, but in most cases it's just an-

 DISTORT—A050

Chapter 10 K5000 Tips'n Tricks

noying. If you run into digital distortion, try these steps in order of appearance until you get to a step that removes the distortion:

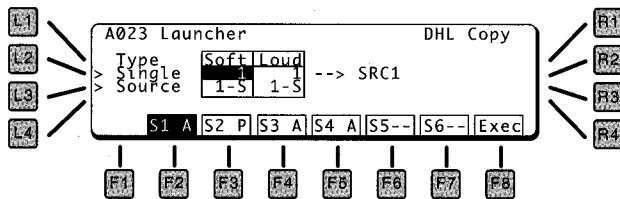
- 1 Mute the sources except one. If the distortion is gone, it may be caused by the fact that the total of the combined source levels are too high.
- 2 Isolate the source producing the distortion by unmuting until it ›kicks in.‹
- 3 Decrease the total Volume value in the COMMON page for the problem source/s.
- 4 If this doesn't work, set it back to the original value. Proceed the same way for all other steps.
- 5 Decrease the SOURCE VOLUME in the CONTROL PAGE.
- 6 Decrease the DCF LEVEL or the RESONANCE in the SOURCE DCF page.

Next steps only for ADDITIVE Sources:

- 7 Decrease the TOTAL GAIN value in the ADDITIVE DHL LEVEL COMMON page.
- 8 Decrease all harmonic levels in the DHL page using the ALL group, both for SOFT and LOUD settings.
- 9 Decrease the overall Formant Filter band levels in the DFL Level Edit page using the ALL group.

If all of these steps don't help, unplug the K5000 from your fuzz box and plug it directly into your mixer.

Using Harmonic Level Copy



The implementation of the Harmonic Level Copy drives everybody nuts. Be sure: every time we visit system pro-

Additive Tips and Tricks

grammer Mr. Kondo in Japan, it costs him a beer—we drink it to your health. At any rate—you have to make do with the current implementation of this, so let’s help you to at least understand what it does:

In the table below:

Type	Soft	Loud	
Single	1	1	⇒ SRC1
Source	1-S	1-S	

What it means is:

Type	Soft	Loud	
Single	The single patch FROM which the copy will be taken	The single patch FROM which the copy will be taken	The destination source
Source	The Source and S/L partial FROM which the spectrum is taken and copied to the SOFT partial	The Source and S/L partial FROM which the spectrum is taken and copied to the LOUD partial	

Example: Say you’re working on Patch A035. You have set the SOFT partial and now you want to copy it to the LOUD portion of the same source, SRC3.

Against everything you might intuitively want to do, you have to set it like this:

Type	Soft	Loud	
Single	35	35	⇒ SRC1
Source	3-S	3-S	

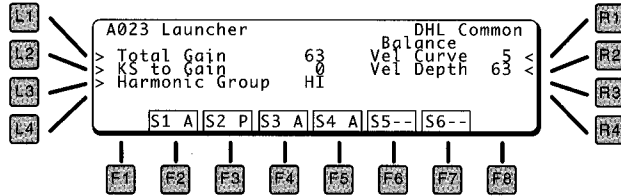
The Copy Function always copies from patch memory, not from the edit buffer. If for example you want to copy a freshly changed S1 to S2, first write the patch and then use Copy.

Caution! You always have to set the parameters correctly for *both* partials—SOFT and LOUD, even if you want to change only one of them. Otherwise your freshly created spectrum might disappear into harmonic heaven.

Using Soft and Loud

The use of Soft and Loud settings in the DHL are an easy way to achieve patches with harmonic content that responds to velocity. Here's our guide to using this feature the smart way:

The DHL Common Page



Wizoolni—A001

- 1 First make sure the VELO DEPTH value in the DHL Common page is zeroed. This ensures that you only hear the SOFT setting. Also use neutral settings for the DCF and the FF so that they don't get in the way of the DHL. The ›Wizoolni‹ patch shows you neutral settings.
- 2 Set or copy your ›average spectrum‹—the one that you want to hear at mid-high velocity—to the SOFT DHL setting.
- 3 Now copy that spectrum to the LOUD setting using Harmonic Level Copy.
- 4 After copying the average spectrum to LOUD, set the SOFT spectrum to the softest sound you want it to reach at low velocity. You may use the BRIGHT edit group for this.
- 5 Afterwards set VELO CURVE and ENV DEPTH values in the DHL Common page. A good starting point is Velo Curve = 2 and Env Depth = 100.
- 6 Now add harmonics to the LOUD spectrum, checking by playing with different velocities.

Set all the other source parameters like FF, DCF and DCA. After this, check the SOFT and LOUD effects and balance them against DCF and FF with the Env Depth settings in the DHL COMMON.

Control of the harmonic content—shaping sound

In sculpting the harmonic content control—by velocity or time—in an additive source, you have several possibilities.

We'd like to give you a guideline on which to use in what case:

- ◆ Slight velo control over the harmonic content is easily achieved by using Soft/Loud. However this determines only the static DHL spectrum when a key is hit, it does not affect the spectral changes over time. Use the DHE for this.
- ◆ More efficient, raw velo control of the harmonic content is achieved by using the DCF in Lowpass mode. You cannot control individual harmonics, but this method is best for simulating the dull ⇒ bright velo changes of natural instruments.
- ◆ Drastic timbral changes over time, by velocity or LFO are the territory of the Formant Filter.
- ◆ Resonant filter characteristics can be achieved by two methods: DCF or FF. DCF is easy, fast and leaves the FF free for more distinct and precise changes to the sound. FF can simulate the DCF and allows you to literally draw the filter curve but involves much more effort.

Here's how the ADD pros use these features for great ADD patches:

- ◆ First the DHL and the soft/loud-balance is programmed, slight changes in time are created in the DHE.
- ◆ Then the Formant Filter is programmed—characteristic, bias and envelope are set to virtually saw through the harmonic spectrum
- ◆ The last stage is the DCF—it is used to tame the rough, biting sound created by the FF.

Simulate Flanging by Formant Filter

By setting all Formant Filter bands to a level of 100, then setting each 5th or 6th band to 127 and applying LFO modulation of the BIAS you can create ›custom‹ flangers.

 FF FLANG—A043

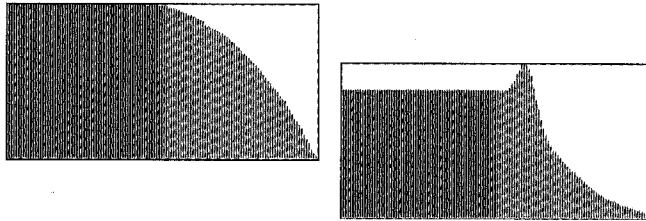
Create Resonance in the Formant Filter

- ▶ The FF is the only filter you can shape to your liking. You can create ten bumps or three pyramids or the silhouette of your favourite Bay-watch body lying on the beach ...

FF RES—A044

You can easily add resonance to a Formant Filter setting by creating a bump around the >cutoff frequency.< You can use the GEQ group setting for the draft bump and then refine it band by band.

FF Resonance is added to a normal lowpass filter (left) by drawing a sharp bump (right).



BELL LIK—A045

Create bell-like spectrums

This is *very* easy: Although the >shimmering,< resounding quality of bell-like sounds may make you assume that there are hundreds of harmonics involved, only three or four are enough in most cases.

- 1 To create the basic bell sound, start from a harmonic above 6, set it to full level.
- 2 Take another one with an inharmonic relation to your first one—e. g. 11, another one—let's say at 17 and maybe 20. Set them all to full level—there you go—easy huh?
- 3 To make the bell sound more >harmonic< and musically useful, introduce harmonics 1 and 2.
- 4 To give it more bite in the upper frequency range, multiply the >odd< harmonic numbers by 2 and add these harmonics as well.

Create biting leads

First rule: You cannot have enough harmonics.

Second rule: Create a >hi-pass< on the first three harmonics. E. g. Harmonic 1 level = 50, 2 = 80, 3 = 95 ...

Third rule: Use DCF to create a fat shape and achieve easy control over the harmonics using wheel and velocity.

SoundDiver

As mentioned above, we're not going to teach you how to use SoundDiver, but we strongly recommend that you do actually *use* it.

We humans are very visually orientated critters, and while the display on the K5000 is nice, it's no match for a computer monitor in size or in the amount of what it can show you at one time. After the initial shock of seeing a K5000 patch in its entirety in SoundDiver (and the string of expletives that usually ensue) you get a really good ›feel‹ for where everything is in the signal path and, after a while, start to visually relate the 3D waveform view with a particular sonic character—you start to ›see‹ what a waveform is going to sound like.

SoundDiver obviously has the ability to send the MIDI data in realtime to your K5000 so that any changes you make are heard as you actually do them, which further links your understanding of how the various components work.

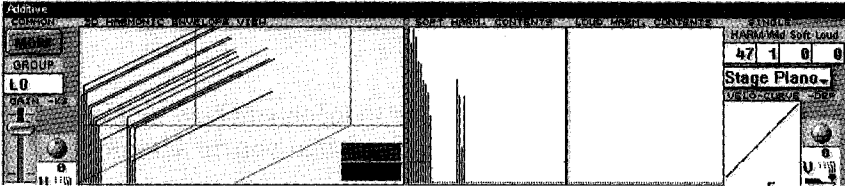
Sorry if this sounds like a commercial for SoundDiver, but much of what you have already learned in this book will make even more sense if you use it.

Another great bonus with SoundDiver (SD) are the templates—most of which were created by Peter—that cover a range of K5000 functions. Let's take a look at some.

Wavesets

In the single edit mode of SD, there are a number of predefined wavesets or waveform shapes for the DHL which cover everything from basses to organs, electric pianos, bells and even SAWTOOTH and SQUARE waves. Given these ›instant‹

starting points for sounds—no programming required—SD allows you to build patches in minutes.

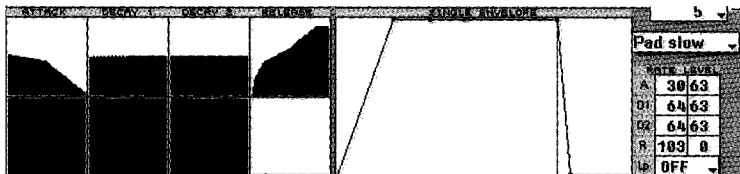


DHL >Waveform< templates are selected by clicking the flip menu where >Stage Piano< is displayed.

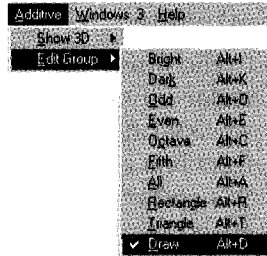
This can certainly be achieved using the front panel of the K5000, but having most, if not all, of the hard work done for you and >ready to go< is great on two levels. One is speed, and the second—at least while you're learning about your K5000 and additive synthesis—is as a tutor. If you open the appropriate page on your K5000's front panel (DHL Edit) you will see the changes made in SD happen on the LCD.

Also in this section are a number of DHL Envelope templates, covering plucks, pianos, slow pads and more so that you can apply individual envelope shapes quickly to individual harmonics in your waveset, or to entire groups.

DHE templates are selected by clicking the flip menu where >Pad slow< is displayed.



The greatest function of all, in Dave's opinion, is the >Draw< edit mode. In this mode of editing—an alternative to group editing—you can literally use the mouse to draw new wavesets in the DHL. Needless to say, this is unbelievably fast for coming up with the >raw< version of your sound, and from here, using the envelope templates make sound editing a joyous experience.



Draw mode and others can be selected in the Edit Group menu.

Listen to >StTramp< which is a completely initialized patch with a loud and soft waveset drawn in—the default filter bypass was turned off, no effects, no EQ etc.—this *rough* patch took literally five seconds to create and has the makings of a great SuperTramp electric piano sound.

 StTramp—A041

Sample Importing

One of SoundDiver’s neatest tricks is the ability to import WAV or AIFF samples and convert them into wavesets.

On the Disk included you will find several sample files to analyze and use for K5000 sounds (see *Disk Content* on page 137).

The main bonus with this feature is the sheer number of starting points for sonic experimentation. You have—out there in the big, wide world—a limitless supply of sounds to pilfer. In the K5000, you have control over these sounds—a nice combination.

Here’s a checklist of qualities to look for in raw sample material you wish to analyze that will ensure good results:

- ◆ No beating, detuning, chorusing, pitch changes. The analysis function tries to find the fundamental and then builds the harmonic spectrum. Every change in pitch or phase that creates frequencies outside the pure harmonic spectrum will result in aliasing, noise or distortion.
- ◆ The less changes over time, the better the analysis result. The harmonic envelopes of the K5000 cannot cope with

This function will *not* allow you to import a drum loop with a vocal and pull out the harmonics that constitute the singer’s voice, nor will it sound *exactly* like the original sample. It is an interpretation or a conversion, if you will, from one form to another—not a facsimile.

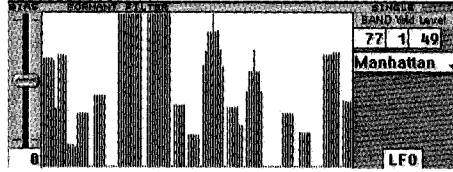
the complex harmonic changes of something like a musical phrase.

- ◆ Cyclic waveforms yield the best results if it comes to ›color‹ of a sound. If you want to have the sound of your voice forming a digital choir in the K5000, sing a note, extract one cycle, analyze it and then build the sound from this spectrum by using source detuning and the ensemble effect. Don't analyze a chorused sample!
- ◆ When analyzing, preferably use the part of the sound that contains the highest amount of harmonics. You can recreate percussive changes very easy using DHE or DCF. If you, for example, want to build a clavinet sound from a clavinet sample, use a cyclic extract taken from the sustained portion of the sound—100 ms or so after attack. You can recreate the hit or snap by adding a PCM attack sample.
- ◆ Normalize the sample before analyzing it. This yields a higher resolution allowing the analysis algorithm to better represent the differences in level between the individual harmonics.
- ◆ Be aware, however, that normalising algorithms usually ›dither‹ the sound resulting in an amount of quantize noise—in a ›best case‹ scenario leaving the sample as it was but with increased dynamic range. Some raw sample material may actually produce better results from analysis if left alone—i. e. *not* normalized.

Filtering

 MANHATTA—A046

Peter, being the seasoned traveller that he is, has also created a few Formant Filter presets called ›Manhattan,‹ ›Mt. Fuji‹ and ›Cologne‹ which resemble the shape of the city skylines and Japan's most famous tourist attraction, amongst a number of others.

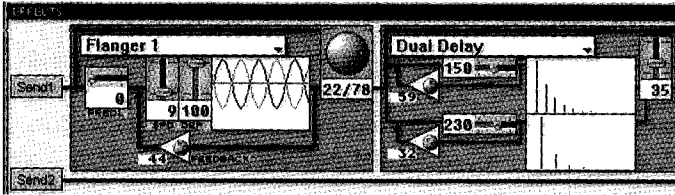


These presets are not only nice to look at, they are also extremely useful and in some cases extremely bizarre settings for your FF.

Tip: Click on the ENV parameter in the FF envelope section and it will change to the FF LFO, allowing you to adjust these parameters.

FX and Control

While not overly blessed with templates, selecting modulation sources and destinations is a snap in SD. Effects routings are equally as easy to set up and more importantly, allow you to see the signal flow much more clearly than on the LCD.

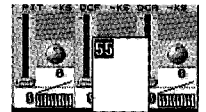


General SoundDiver Info

Emagic have a 'treasure hunt' mentality. This is probably due to the fact that the guys in the programming team are big kids who have a lot of fun creating their software and love surprising people with hidden functions.

SoundDiver has a number of these such as the click on ENV in the FF section mentioned above. Additionally with every parameter, even graphic sliders and knobs which have no obvious numeric value, you can double-click on them and type in the number directly.

In the DCO Sources area under TYPE, you can change from ADD to PCM. When PCM is selected as the source, a flip menu will appear below it showing you a list of all of the PCM wave-



The hidden truth behind every double-click

form names available—much nicer than scrolling through the list of numbers on the K5000's LCD.

Clicking on the ›Syn saw 1 Cyc‹ flip menu will show you a list of all of the K5000 waveforms you can use for subtractive synthesis.



Also in the DCA section, you can select velocity curves as graphics which is again much nicer than a list of numbers.

One downside is that even running in 1024×768 resolution, there just isn't enough monitor real estate to see the entire patch. To get around this, for each source, there is a button to the left. This will show up as a large green bar if you are looking at the parameters of a particular source. Clicking once on this will reduce it to a small grey button. Use this feature as it's a great aid to keep everything easy to see and understand.

Learn and use the keyboard commands. They are *much* faster than using the mouse and will speed up your use of SD tenfold.

Another tool in the screen real estate battle is a function called ›Screensets.‹ This function allows you to save ›snapshots‹ of your window positioning, zoom settings within windows and more—all of which can be retrieved with a single keypress. There are 90 of these customizable windows at your disposal.

Shortcut Keys

The K5000 front panel contains a number of shortcut keys which take you to various pages in the operating system in EDIT mode. To access these shortcuts you must first press the EDIT button followed by the appropriate shortcut key as follows:

Key	Function
00	Selects SOURCE 1
01	Selects SOURCE 2

Shortcut Keys

Key	Function
02	Selects SOURCE 3
0	Selects SOURCE 4
1	Selects SOURCE 5
2	Selects SOURCE 6
03	Opens COMMON page
3	Opens EFFECTS routing page
04	Opens DHL MENU (Only if an ADD source is selected)
4	Opens DHE MENU (Only if an ADD source is selected)
05	Opens DFL MENU (Only if an ADD source is selected)
5	Opens DFE MENU (Only if an ADD source is selected)
06	Opens DCO MENU
6	Opens DCO ENVELOPE page
07	Opens DCF MENU
7	Opens DCF ENVELOPE page
08	Opens DCA MENU
8	Opens DCA ENVELOPE page
09	Opens LFO page
9	Opens CONTROL parameters page

When you're in edit mode, this saves a lot of time by bypassing the multiple presses of the EXIT or BACK button to return to the menu you wanted to access. Simply use the shortcuts shown above and you'll find that things go much faster.

Once you're in EDIT mode, you don't need to hit the EDIT button again until you're ready to exit your editing session, rather use the shortcut keys directly.

Appendix

Glossary of Terms

Additive Synthesis The process of combining fundamental tones and related harmonics to create sound.

Aliasing A form of harmonic distortion resulting in the creation of false (alias) low frequency tones.

Amplitude Another word for volume.

Amplitude Envelope A control for manipulating the volume of a whole sound or part of a sound over time.

Bias Alters the center frequency, a weighting an audio signal to one end or the other i. e. lower or higher frequencies. Pertinent to the Formant Filter in the K5000.

DCO Digitally Controlled Oscillator: generates sound.

DCF Digitally Controlled Filter: contours the colour of the sound generated by the DCO.

DCA Digitally Controlled Amplifier: controls the volume of the signal passed from the DCO and DCF over time.

Distortion A generally unpleasant sound caused by feeding an audio signal from an output source into an input source at high gain, effectively overloading the input.

Envelope A tool used for shaping sound over time.

Equalizer (EQ) Adds or reduces the amount of gain to a particular frequency or range of frequencies in an audio signal.

Filter Is used to shape a waveform or complete sound altering the colour of the signal.

Filter Envelope Used to control the filter over time.

Formant Filter A combination of the Equalizer and Filter as described above with control of up to 128 frequency bands.

Appendix

Groups A collection of mathematically related harmonics.

Harmonic An overtone related to the fundamental frequency mathematically. E. g. the 2nd harmonic is at twice the frequency of the fundamental, 4th harmonic at four times the frequency of the fundamental a. s. o.

Harmonic Envelope Used to control the volume of each harmonic over time.

Key Pressure Also called aftertouch is a control for sound manipulation and modulation which responds to pressure on the keyboard *after* the initial note is struck.

Key Scaling A control for sound manipulation and modulation which responds to position on the keyboard i. e. what note number is being played.

LFO Low Frequency Oscillator: is used as a modulator for a range of K5000 functions.

Loop A cyclic repetition of a sound or section of a sound.

MIDI Abbreviation for Musical Instrument Digital Interface: is used for control of the K5000, synchronization, sound storage and communication with other MIDI devices.

Modulation Control of another function using a modulator/controller. E. g. use of the modulation wheel to add vibrato to a sound or key pressure to change (modulate) pitch.

Mono(phonic) Only plays one note at a time.

Poly(phonic) Can play many notes at one time.

PCM Pulse Code Modulation: a method of digitally encoding and storing sampled audio material into computer memory.

RAM Random Access Memory: used for storage and editing of material on the K5000.

ROM Read Only Memory: contains non-volatile sample material on the K5000. See PCM.

Sample A digital recording of an audio signal. See PCM.

Subtractive Synthesis The process of creating sound by combining harmonically rich waveforms and cutting away (subtracting) portions to achieve a result.

Synchronization The act of running the K5000 arpeggiator/sequencer to match tempo, start, stop and continue commands from an external MIDI device and vice versa.

Velocity Alters the way a sound responds to playing based on how hard the keyboard is struck.

Velocity Curve Alters the way a sound responds to playing based on where on the keyboard a note is struck.

Wave Set A combination or a set of harmonics and their respective harmonic envelopes.

Disk Content

File List

K5000.LSO	Logic Environment for K5000
K5000ENV.TXT	Readme text for Logic Environment
WIZOO.LIB	Example patches in SoundDiver format
WIZOO.KAA	Example patches as K5000 ALL-file to be directly loaded into the K5000 using the built-in floppy drive
AIFF	Folder containing samples for SoundDiver analysis—AIFF format for Mac and PC
WAV	Folder containing samples for SoundDiver analysis—WAV format for PC

Appendix

Patch List

No.	Name	additional info
A001	Wizoolni	Init Patch
A002	Angelvox	
A003	StageMKI	
A004	Engage	
A005	@Clustaz	
A006	Magnetic	
A007	Bronx	
A008	Harmonic	
A009	Protonic	
A010	MelMaker	
A011	SmthWssn	
A012	SAWTOOTH	Sawtooth wave
A013	SQUARE	Square wave
A014	BRIGHT	DHL group setting
A015	DARK	dto.
A016	ODD	dto.
A017	EVEN	dto.
A018	5THS	dto.
A019	OCTAVES	dto.
A020	VELCURVE	Try different Velo Curves in DHL Common
A021	DHE WAVE	A spectrum created by DHE instead of DHL
A022	DHE LOOP	
A023	LFO FADE	
A024	DCF LOPA	Lowpass DCF
A025	DCF HIPA	Hipass DCF
A026	DCF RESO	Reso effect
A027	FF	Lowpass created by Formant Filter

Disk Content

No.	Name	additional info
A028	FILTER	Like A027, created by DCF
A029	PITCHENV	Brass effect created by Pitch Envelope
A030	CONTROL	Complex FX and Source Control by ModWheel
A031	GosplOrg	
A032	Sphaera	
A033	DynoSaur	
A034	TB5005	
A035	Gorgizmo	
A036	Creaturz	
A037	@lsCream	
A038	Myst2006	
A039	Cyber@FX	
A040	@Vocodor	
A041	StTRAMP	
A042	ORGAN FO	Organ Spectrum made in one minute using Octave and Fifths
A043	FF FLANG	
A044	FF RES	
A045	BELL LIK	
A046	MANHATTA	
A047	SPLIT/ZO	Split created using source zones
A048	BEST EQ	recommended overall EQ setting
A049	ALIAS	Typical example of aliasing on upper key range
A050	DISTORT	Typical example of distortion

List of Samples

These samples are provided for experimenting with the analysis functions in SoundDiver's ADD editor. In each ADD source there is an ›Import‹ button where you can load an AIFF or WAV file. Both formats are provided with the disk. You can check the samples with any sample playback software on your PC.

ACOUBASS	Acoustic Bass
BANDONEO	Bandoneon
DX7PIANO	DX7 Rhodes
HARPSICH	Harpsichord
NYLONGIT	Nylon Guitar
RHODES	Natural Rhodes
SLAPBASS	Slap Bass
STRATOCS	Stratocaster

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