Peter Gorges/Len Sasso

2ND Edition

Wizoo Guide Nord Modular

Introduction
Modular Sound Design
Virtual Assembly Instructions

nord MODULAR

wizoo guide

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CD-ROM

For Modular and MicroModular, MacOS and Windows

Wizoo Guide

Nord Modular 3

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Introduction

Modular Sound Design

Virtual Assembly Instructions

Imprint

Publisher Peter Gorges

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Second, completely revised edition

Bremen, Bundesrepublik Deutschland
Printed in Germany
ISBN 3-934903-05-3

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Proofreading Peter Gorges
Layout and typesetting Uwe Senkler, Hamburg
Cover design design-box, Ravensburg
Printed by Druckhaus E A Quensen GmbH, Lamspringe

Welcome!

I have to admit that I've been a fan of the Clavia Nord Lead since this synthesizer debuted. That punchy sound, simple sound programming, cool, sleek design and the unique pitch toothpick made a true believer of me.

For several years now I've been an avid admirer of modular synthesizers, although from afar. Initially, I just couldn't afford them and now in the 90's they're just too volatile and cumbersome for my taste.

In October of 1997, I was given the opportunity to check out a pre-release prototype of the Modular in Stockholm. Love at first sight might be a bit over the top, but as a description of the relationship between this synthesizer nut and that little red box, it comes pretty close to the truth.

Now that I've spent months conjuring up sounds, beta-testing and exploring every aspect of the system, I've discovered that the Modular is one of the very few synthesizers I'll actually play in my free time.

At Wizoo we have a strict policy: We don't publish books about synthesizers that we can't recommend wholeheartedly. However, when a synthesizer is truly something special—when it has that ›certain something‹ that allows us to show you some of the truly exciting things it can do—our fun factor is substantially higher than when we are limited to demonstrating how to coax a couple of acceptable sounds out of mediocre synth.

In the case of the Modular we had a ball! It is one of the best synthesizers available. I sincerely hope that—after reading this book—you will agree with me.

Peter Gorges

Welcome to the Second Edition!

When Peter asked me if I wanted to update the Wizoo guide to the Nord Modular, I gave it approximately three nanoseconds of serious thought then shouted ›Yes‹ as loud as I could. And I can honestly say that the months I've spent with the Modular bringing this guide up to date have been the first time in many years that I haven't regretted selling my old, hardware modular system.

A lot has happened since the Nord Modular was introduced in 1997. For one thing there have been two major upgrades introducing new modules and new editor features. For another, it is now ›cross platform‹—there are versions for the Macintosh as well as the Pc.

The Modular is a wonderful instrument that only gets better as time goes on. You can expect many years of pleasure as well as numerous musical surprises from it. Have fun—buy some ear plugs for the cat.

Len Sasso

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Differences Between the Macintosh and PC Editors

There are few differences between the two versions other than the visual appearance of the editors. When there is a significant difference, we will point it out in the text. One difference which we will not repeatedly point out is that there is no ›right mouse‹ button on the Macintosh. Tasks which call for this button on the PC can be accomplished on the Macintosh by holding ctrl while clicking the mouse button. (Tip: if you have a multi-button mouse, configure one of the buttons for this combo.) Another difference is that ctrl key on the PC corresponds to the ⌘ key on the Macintosh except when making multiple selections in which case use the shift.

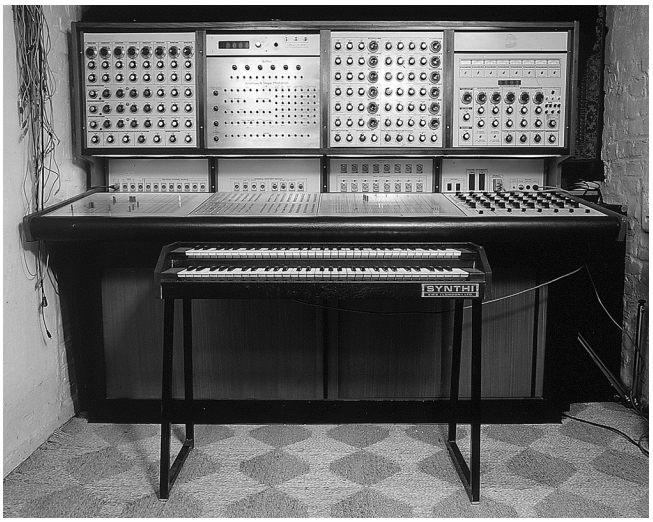
1 A Few Basics Worth Knowing

We're not going to delve into an in-depth history of modular synthesizers, but there are a few basics you should be aware of and a couple of helpful as well as interesting facts on the Modular that are well worth knowing.

Synth History 101

Robert Moog unveiled the first synthesizer prototype in August of 1964. (This was before Peter's time, but I can tell you the immediate response was—well, things have advanced a bit since then.)

With the advantage of hindsight, we can certainly say Robert Moog set a standard that prevails to this day and is reflected in synthesizers such as the Modular: Modular design and voltage control (Vc) of parameters.



An early predecessor (in spirit) to the Modular

Back in the good old days, sound was generated exclusively by a modular system—the oscillator (VCO) generated the initial wave, the filter (VCF) shaped the sound of the wave and the amplifier (VCA) controlled its gain and volume.

Of course there had to be some method of controlling all these sonic events. The most significant element was the keyboard, which supplied the trigger, a kind of trigger-and-hold voltage called a gate and a control voltage. These very basic features were the tools used to determine the pitch and to switch a note off and on.

Envelopes and LFOs opened up a wider range of options, the former for generating time-based events and the latter for periodic modulation. Footpedals and wheels also added voltage for direct, real-time sound shaping.

All of the early synthesizers were designed along these lines. They were also modular, i. e. they consisted of hardware modules with input and output jacks for routing audio, voltage control and gate signals by external cables.

Modular synthesizers were noted for their extreme characteristics: extremely versatile, extremely large, extremely expensive and extremely volatile.

The market for these behemoths was understandably limited and soon the demand for smaller, easy-to-transport-and-handle devices was met with the first wave of compact synthesizers. The Minimoog was by far the most popular of these and remains so to this day.

Modular on the inside, small on the outside: Robert Moog's bestseller.

These synthesizers were remarkably different from their modular predecessors. With a single uniform front panel, a fixed number of modules and a great deal of fixed wiring for internal signal routing, the new compact versions were a breed apart. What they lacked in range, they more than made up for in terms of handling ease. However, to say that they were user-friendly would be an overstatement. Although they were easier to program, it still took an experienced musician (in the present ›technology guru‹ sense of the word) to play these early models. The modern standard of simplicity—press a button and presto, instant new sound—was still a long way off.

Another big problem with the modular synths was that you couldn't save sounds; as soon as you unplugged cables, you lost the sounds you had dialed in. Then along came the first synthesizers featuring nonvolatile memories and suddenly the modular concept no longer seemed such a hot property.

The fate of the modular synthesizers was sealed. Technological evolution produced smaller, faster, smarter, cheaper and more stable synths and—much like their biological counterparts, the dinosaurs—the modular synthesizers were driven to (near) extinction.

Development continued unabated during the 80's. New sound synthesis techniques such as FM and sampling, additive synthesis, re-synthesis and finally physical modeling relegated analog synthesizers to the level of pawn shop oddities.

Paradoxically, during the late 80's a group of people interested in creating a radically different high-tech musical genre—fittingly labeled techno—gave the analog synths a new lease on life. The consensus among techno innovators was that as an alternative to digital synths, these relatively easy-to-program, powerful electronic sounds were suitably heavy for what they had in mind.

The retro-wave extended through to modular systems. Doepfer and Technosaurus for instance began offering totally analog synths—albeit in very small quantities. These new ›dinosaurs‹ were no less unwieldy, expensive and lacking in storage capacity than the dinosaurs they were modeled after.

The rest of the music world remained ambivalent about modular synthesizers until mid-1997, when Clavia announced that the Modular was ›in the works.‹ It is the first hybrid device to combine the versatility and sound of an analog modular system with the miniature dimensions, storage capability and MIDI functionality of a digital synthesizer.

Modular Models

The Modular comes in three ›flavors:‹ Keyboard, Rack and MicroModular. The Keyboard and Rack versions are identical except of course for the keyboard and both can be expanded from the standard four DSP slots to eight which basically doubles the polyphony. Both can be multi-timbral on up to four MIDI channels. Both have eighteen user-programmable front panel knobs.

The MicroModular is fully compatible with its bigger brothers but has only one DSP slot, three user-programmable knobs and is not multi-timbral. Depending on the size of the patch, it will play up to four voices and it fully supports the editor and all modules.

It also processes external audio like the Keyboard and Rack.

► When we refer to Slot A in the text, MicroModular owners should use their only slot.

► Examples which use the other slots (B, C and D) are not applicable to the MicroModular

Unlimited Versatility?

Currently, the Modular is certainly the most versatile synthesizer featuring analog sound synthesis. In essence, you can use it to ›build‹ a custom synth designed specifically for whatever purposes you have in mind. However, the Modular is limited to a degree; you can only achieve sounds by analog synthesis, FM and modulation. In other words, it can only do *almost* anything. You can patch in samples by the audio input only and alas, no digital waveshapes.

But with a healthy dose of imagination and a modicum of sound design skills, you can come up with some pretty impressive stuff—for instance an additive synthesizer or a real Hammond with Leslie.

What Can You Do without a Computer?

On the first glance it seems that the Modular always needs your computer as a ›remote control.‹

However, if you take a look at the front panel and fiddle with the control features, you'll soon see that you can achieve quite a bit. In fact, you can do everything except install and connect modules and assign controllers and morphs. Specifically you can:

- Store patches. (Since you have the option of storing patches in the computer *and* Modular, we highly recommend that you do so. Why? Better safe than sorry.)
- Control any of the assigned synthesizer parameters with the eighteen front panel knobs. Guess how many of today's synthesizers are equipped with eighteen knobs!
- Control any of the parameters (even those not assigned to knobs) using the navigator buttons and data wheel.
- Edit and save all the global and patch system settings.

► **Example** As soon as you have finished building a Nord Lead in the Editor and programmed the appropriate knob assignments, you can unplug your computer, take your Modular to a comfortable location such as your bed and program hundreds of sounds without the benefit of a computer.

You can also remotely control the Editor software from the Modular using the knobs, navigator buttons and value wheel, so you don't have to deal with the mouse and keyboard. For instance, you can set the Modular on a master keyboard, place the screen at a convenient location in the immediate proximity and work solely from the Modular. As a musician, you will presumably prefer a studio-type atmosphere rather than a sterile office environment.

Even without a computer, the Modular is still more versatile than most hardware synthesizers.

Patches and Models

In this book, you'll repeatedly come across the terms ›patch‹ and ›model.‹ So you won't have any trouble distinguishing between the two, here's a brief explanation: the term model refers to the actual synthesizer—the modules and their connections—and a patch is a specific setting on one of these synths.

► **Example** You decide to build a Modular copy of a Minimoog™ consisting of three oscillators, a filter, two envelopes and so forth. You choose the requisite modules and connect them. The result is what in this context we call a model. Now you can program basses, leads or noises in this Minimoog replica by twiddling knobs and activating buttons. The result of your programming efforts is what we call a patch.

The fact is that you can build a simple analog synthesizer model consisting of four modules and use it to create dozens or hundreds of patches.

► **Note** The Modular only stores complete patches (i.e. a model with all its settings)—you can not store individual ›snapshots‹ of settings without storing the entire patch, modules and all. Modular patches are very small text files, however, and don't take up much memory so within its 891 patch memory, you have plenty of room for your favorite Minimoog™ variations.

What Distinguishes It from Other Analog Modular Systems?

You wouldn't be doing your Modular a disservice if you used it solely as a stand-in for an analog synthesizer. Although no one would seriously argue that analog modular synthesizers don't have some favorable attributes that simply can't be emulated by a virtual model, the Modular has a substantial advantage: it isn't subject to the same hardware-induced limitations, a few of which are listed below:

- The number of modules and cables you have at your disposal is not dictated by your bank account; the only limitations are your imagination and the amount of DSP power you have available. You'll never be confronted with damaged or missing cables or the great mystery of which cable goes where. You can simply hide and display cables as well as clean up the mess at the touch of a mouse button.
- You don't need a separate dedicated oscillator, filter or envelope module for each voice. The modules in the Modular are polyphonic.
- You can switch from one modular system to the next in a matter of seconds, which for those of us who aren't Keith Emerson, will find hard to beat.
- For yet another neat trick, you can operate four separate modular systems simultaneously.
- Notes, parameters and functions are controllable by knobs on the Modular as well as by incoming MIDI. You

Say you wanted to implement a relatively simple 16-voice modular synthesizer (two oscs, one filter, two envs, two LFOs) by a hardware module system. You would need 112 modules—and to add to the general fun—you would have to dial in the settings individually. In contrast, the Modular does the job with just seven modules.

can integrate the Modular fully with your sequencer songs, synchronize its sequencer modules by MIDI or turn a synth bass into a lead sound by sending a couple of controller values.

- The box doesn't force you to move out all of your furniture and your mate so you can make space for it, you don't need a truck to transport it and its pitch stability will add years to your life expectancy.
- Software updates add new modules to your setup—for free and without ever having to touch a hardware tool.

Obviously the Modular has a lot more to offer, but you'll see, hear and experience more of its advantages as we explore other topics in this book.

2 Unpacking and Getting Started

You're probably raring to go, but a word of advice before you install the Modular or even continue reading this book: take a look at the included user's manual. Miraculously, it's actually complete and well-written.

We managed to keep this book as brief as it is by concentrating on the exciting stuff and leaving the boring bits out. We were free to make use of this option, but the author of a user's manual has to cover all contingencies. The object of a manual is to plod through the functions one by one as precisely as possible. Surely not the most intuitive manner for gaining knowledge of and experience with, a device such as the Modular, but this book should cover the ›hands on‹ and practical (we call it *fun*) stuff to your liking.

Take the time to familiarize yourself with the manual, it complements this book perfectly—and vice versa.

Connecting the Modular Expediently…

To connect the Modular to a computer, MIDI keyboard/sequencer and an audio system, you need four MIDI cables and at least one (but no more than four) audio cable/s. For a detailed description, please consult the manual. The following section is a condensed version just in case you are absolutely determined to try out your new Modular immediately and we are unable to persuade you to read the detailed instructions in the manual first.

… to a Computer

The MIDI ports labeled ›PC‹ are located on the rear panel of the Modular. These are used exclusively for communication

with the Editor software on the computer. No matter what you are up to with the Modular directly or in the computer's Editor, the data is continuously compared and updated to match the current status at both ends. So be sure you always connect both inputs and outputs at the Modular and your computer to allow for this constant communication.

► **Note** If you want to run your sequencer software and the Modular Editor on the same computer, you'll need a MIDI interface equipped with several ports or a second add-on MIDI interface at the computer end. The Editor and the sequencer *must* be routed by separate MIDI circuits.

To find out if your MIDI interface can handle SysEx data, use the MIDI Tester; you'll find it was installed to the same directory as the Modular Editor. This program is self-explanatory, but be sure to hook up the Modular and power it up before you start the program.

If the test fails, then …

1. Check out the MIDI cables. Your best bet is to swap them around, i. e. disconnect each cable and connect it to the other port.
2. Check out the MIDI connections in the dialog box of the MIDI Tester (In and Out).
3. See if SysEx data is filtered at the MIDI interface and if necessary, try out the interface's other options.

… to a Computer or Keyboard

Normally, you'll control the Modular by a MIDI keyboard or a sequencer. It does come with controllers—even though the keyboard model only features a small set of test keys. We highly recommend that you use a MIDI keyboard equipped with aftertouch, pitchbend and a modulation wheel, if at all possible. You should give yourself the opportunity to try these out in conjunction with the Modular and integrate them into your Modular patches.

You can assign all parameters of the Modular to MIDI controllers, so it is also highly advisable to connect the Modular and keyboard/sequencer in both directions.

... to an Audio System

If you want to connect the Modular to a mixing console, we recommend that you use the first two audio outputs as a stereo pair and the other two as two separate mono outputs. With this setup you could route out and mix a stereo sequence, a bass line and a lead sound. Set your mixing console up accordingly, but keep in mind that the design of the output module in the Modular will actually determine how the signals are routed.

If you decide to stick with this basic setup and design your output modules accordingly, you'll find that it is a fair compromise between uniformity and versatility.

► **Tip** Since the Modular can process incoming audio and is also capable of playing four patches at once, you have the option of using two of the outputs (typically #3 and #4) to route the output of a synth patch to the input of a processing patch. You might want to keep a short pair of patch cords handy for this purpose.

► **Note** The MicroModular has only two outputs so the options outlined here don't really apply. Simply connect its outs to your mixing console or audio monitoring system.

Check the audio connection by one of the internal patches, you won't need the Editor software for this purpose.

... to an External Signal Source

You can connect all kinds of signal sources to the two audio-in jacks—a CD player, tape deck, synthesizer (including the Modular itself), sampler or similar device. The incoming signal is routed from the AudioIn module and on to the Modular sound engine, where you can do all kinds of wicked things to it. While reading this book, you might want to connect a CD

player to process some of the examples on the audio portion of the accompanying CD.

Optimizing Your Computer Monitor Setup

The Modular Editor is kind of like your ex: it needs more space. So if you want to set up your screen for the best results in conjunction with the Modular, do yourself a favor: go ahead and sacrifice a bit of color depth for a resolution of 1024×768 pixels.

If you want to find out if your monitor is flickerfree, position yourself at your regular viewing distance and glance past the screen.

► **Tip** Many PC users do not set their monitors to the optimum possible refresh frequency. When you're programming the Modular, you will be working long hours concentrating on small displays. For utmost comfort, set the refresh frequency to at least 70Hz.

The Monitor settings are located in the Control Panel option Display.

By the way, if you use the Modular primarily at home or in the studio, we highly recommend that you choose the keyboard version. This way when you place the Modular keyboard next to or behind your computer keyboard, you'll always have it handy when you want to check something out. The keyboard model becomes a handy entertainment device when placed next to the bath tub or on a bedside table (until the ex returns).

Installing the Editor Software

On the PC, simply start the `setup.exe` program from the disk—everything else is self-explanatory. On the Macintosh, copy the Editor program to any convenient location on your hard drive and double-click it or any Modular patch to start the Editor. The Editor program is fairly simple and relatively small, so you should be able to knock out the whole procedure in just a few minutes.

Once you have established all MIDI and audio connections, you can start the software.

After you start the program, it will tell you if it managed to locate the Modular. If you used the MIDI Tester to check out the MIDI connections, you shouldn't encounter any problems here.

Installing Patch Examples

We recommend that you copy the patch examples from the ROM partition of the included CD to your harddisk:

1. Insert the CD-ROM in the drive.
2. Double-click on the CD-ROM symbol.
3. Drag the directory entitled `Patch Examples` to the same directory to which you installed the Modular Editor on your harddisk.

In total, the examples only require a few hundred kilobytes. Even the smallest harddisk has this much space available.

3 Around the World in 80 Minutes ...

First of all, we'll familiarize you with the Editor software and the front panel of the Modular. With a solid background in the basics, you'll be able to breeze through the following chapters and concentrate on the really intriguing stuff.

You will learn how to assign modules, create and install cables, set and modify parameters and load and save patches. We'll also spend some time on the front panel functions and how to edit patches by the front panel. Additionally, there are a few handy tips and tricks that you should be aware of when you are working with the front panel control features.

If this book is your first introduction to the Modular, and you haven't read the manual, this chapter will key you in on all the essentials. On the other hand, if you are already familiar with the Modular, you'll surely find a trick or two that you haven't come across before.

To follow the experiments in this chapter and apply them as we move along, ensure the Editor and Modular are installed completely and are ready to roll.

Audio Examples

The included CD features an audio example for almost each section of the book. You can play this part of the CD-ROM on a conventional CD player. However, we recommend that you use a CD player control panel on your computer since this allows easy parallel use of patches and audio examples.

► The first audio track on the CD is a data set-up track which does not contain any audio. This will show up as ›Track 1‹ on most commercial

CD players and we have started our numbering of the audio examples accordingly—the first example is labeled ›Track 2.‹ If you play the audio CD in your computer's CD-ROM drive, the data set-up track may not show up as an audio track at all. In this case, numbers in the text are off by 1—e.g. select ›Track 1‹ when the text refers to ›Track 2,‹ etc.

As you work your way through this book, in many sections you will see a reference to the appropriate track on the CD. Take full advantage of this resource as it will make things a whole lot clearer and will help you to become a Modular guru faster.

This is hands-on material you are reading. If you have your Modular handy, apply the examples as we go so you can hear what we are up to. If for some reason you are reading this book without the benefit of the Modular, you should go through the examples again when you have it available. This is essential so that you become familiar with the results of your actions.

Starting the Editor

Start the Editor. The Modular will take a few seconds to communicate its status and the current patch banks to the editor—you can probably see this activity on the LEDs of your MIDI interface. It's a good idea to wait for this process to complete before you load a patch or create a new one.

- Go to the File menu and select the option New and once the dialog box appears select Slot A. (On the MicroModular, there is only one slot.)

You should now see a blank patch, the Editor menu bar and the symbol bar featuring the modules and few other items.

Notice that the blank patch is divided horizontally into two sections. The top section is where you'll be doing most of your patching—it is called the PVA meaning ›Poly Voice Area.‹ Patches you create here will be duplicated in the Modular hardware for each voice.

The lower section is called the CVA meaning ›Common Voice Area.‹ Patches you create here will apply to the mix of all audio outputs—this is a good place for effects processing, and it uses much less processing power for multi-voice patches.

Loading a Patch

- Select the item Open from the Editor File menu. Find the directory `Patch Examples` and in it, the directory `Tutorial`.

The patches are numbered in sequence of the tutorial.

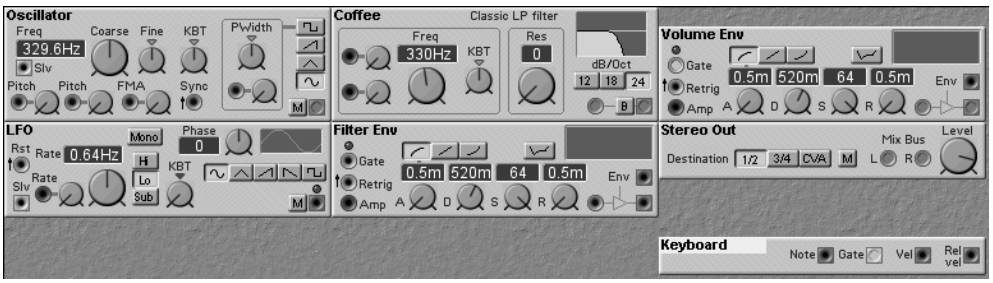
1 Open Patch 01 and select Slot A.

2 As soon as you have finished loading a patch, the LED A at the Modular will illuminate.

01 Data Track—never play on an audio CD Player!

02 Preset

A stripped-down configuration for the patch has already been prepared so you don't have to start completely from scratch. You should definitely be able to hear a sound when you play a note.



On your screen, you should see a stripped-down synthesizer with the following configuration:

- Oscillator
- LFO
- Filter with an envelope module below it

- Volume envelope module
- Output and keyboard module

The fact that you are manually dealing with output and keyboard modules tells you that you can and actually must set and hook up the Modular yourself. As you can see, it really is a modular synthesizer.

► **Exception** The Note output of the keyboard is equipped with a fixed circuit connecting oscillators and filters. Later on you'll see that this minor exception to the modular concept will radically reduce the amount of cables when you are dealing with complex patches.

What's wrong with this picture? You might have noticed two items:

- For some inexplicable reason, the filter is labeled ›Coffee.‹
- No cables are in sight.

Naming Modules

We're about to change all of that. First of all, we'll give the filter a name.

You can give the module any name, but we recommend that you use a term that makes some kind of statement about what it does. It should be something you can remember and has some relevance to its function.

1 Double-click on the name of the filter module.

2 Enter ›LP Filter‹ to replace ›Coffee‹ and hit enter.

Hiding and Showing Cables

On the right-hand side of the menu bar, you'll see seven multi-colored buttons followed by a button labeled ›S.‹

Click on the red button. You are now looking at the audio cable through which the audible signal is routed. It is patched from the output of the oscillator to the filter, then to the volume envelope and finally to the stereo out.

- Click on all of the other buttons to show all cables.

The standard colors for cables are red for ›Audio,‹ blue for ›Control,‹ yellow for ›Logic‹ (clock, trigger, gate) and gray for ›Master.‹

The corresponding color is assigned automatically to new cables, but you can re-assign any cable's color by right-clicking (ctrl-click on the Macintosh) and choosing the desired color from the pop-up menu. Notice that there are also two ›User‹ colors (green and purple) which you can use to make your patches easier to follow.

So what's with the S button? ›S‹ stands for ›Shake‹—try it and see. When you start accumulating lots of patch chords, you'll love this feature!

The Four Signal Types in the Modular

The Modular features four types of signals.

Audio Signals

Of all outputs in the Modular, the real audio outputs have the highest sampling rate. This is why an audio mixer soaks up more DSP power than a control mixer.

These signals carry the actual sound of the synthesizer. They feature the maximum sampling rate of 96kHz (24bit). Generally audio signals are generated by oscillators, but in principal they could be routed through any module equipped with an input and an output.

In the Modular, all audio connections are displayed in red, although you should keep in mind that these could also be controller inputs featuring audio bandwidth, i. e. FM inputs.

Control Signals

Basically, control signals influence or modulate something. For example, a few of the components that generate control signals are the control output of the LFO, an envelope or even a switch. The control connections at the modules are colored blue.

Logic Signals

These are simple on and off signals that activate/deactivate a note or switch a sequencer to the next step.

In the Modular the three basic logic signals are:

- Trigger: Simple, brief impulse
- Gate: Much like a trigger, this is an on/off signal, but when it is activated it stays ›energized‹ for a certain period of time. For instance, when you press a key, the gate opens and doesn't close until you release the key.
- Clock: This is a time-based signal sent at a specific interval, for instance four times per quarter note. The intervals between clock impulses are set in bpm (beats per minute). The Modular can also process external MIDI clock, so you can synchronize the Modular sequencers with an external MIDI sequencer.

► You can't start an envelope without a gate signal or run a sequencer without a clock signal.

To reiterate, the Modular is a real modular synthesizer—it enables you to set up any conceivable configuration of modules. For instance, you can use audio modules as controllers and vice versa. Feel free to ›abuse‹ modules at will, i. e. use them for something for which they're not really intended. This is exactly the type of experimentation that makes a modular system so much fun to play with. Also don't be afraid of ›feedback‹ connections—you can't hurt the Modular (though you can hurt your ears and speakers).

Master Signals

The Modular system has a limited amount of DSP power available. So the designers decided to integrate slave versions of several oscillators and LFO modules which soak up less power. These slaves should generally be connected to the Slv output of a master module although slaves will generate a fixed-pitch (i. e. can only be set by the panel knobs) output without being connected to a master. Master signals are irrelevant to modules that are not being used as slaves.

Drawing Cables

Setting Cable Options

Take a look at the item entitled Editor Options in the Properties menu. Here you can set the width, curve and appearance of the cables. Our recommendation: Curved Thin although the illustrations in this book use Curved 3D for better visibility.

The color of a cable doesn't affect a signal in any way, the color-coding just helps you to avoid confusion and distinguish cables in a patch. You'll see later on that this is a very helpful feature indeed.

Connecting Cables

► In the Modular, the round jacks are the outputs and the square jacks are the inputs.

The envelope module for the filter envelope hasn't been connected to the filter yet. So we'll go ahead and take care of that ›right quick.‹

Click on the blue output jack of the Filter Env module, hold the left mouse button down and drag a cable to the bottom blue round Freq input of the filter module as shown.

You probably noticed that the cable has the correct color—it's blue. Smart, huh? On release of the mouse button the Modular automatically assigns the cable the same color as the output jack (even if it goes to a different colored input jack).

There are two more techniques for disconnecting and reconnecting cables you should become familiar with. The manual describes these in greater detail, so we'll stick to a condensed description.

Disconnecting Cables

1 Double-click on the blue cable, hold the mouse button down and drag it over to the gray area of the screen. Release the mouse button.

After you have disconnected the cable, drag it back and plug it in.

2 Now click on the end of the cable at the filter module by the right mouse button.

3 Select Disconnect in the pop-up menu.

The two options are different means to the same end. Choose whichever seems most comfortable or logical to you.

Re-connecting Cables to another Jack

Let's assume that you would prefer to patch the cable to the PulseWidth input of the oscillator. No problem, simply unplug it and re-connect it at the desired jack:

1 Double-click on the cable end at the filter module and hold the mouse button down.

2 Drag the pointer to the new input and release the mouse button.

You have just re-connected the cable at another location.

If you are now looking at two cables, then you clicked on the cable just once rather than twice. This function actually extends the cable. Delete the cables and try again.

Setting Parameters and Navigating

Setting Up Controllers

◆ Load ›Patch 02.‹

You should come up with basically the same results as for Patch 01, with a few minor differences: the controller input for the blue cable is turned up a bit at the filter module and the filter cutoff, resonance and envelope are set in a way that ensures that the filter envelope is clearly audible.

Now it's time to have some fun:

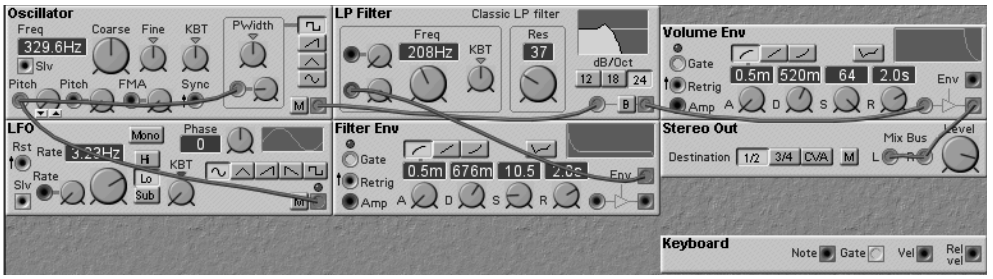
- Experiment as much as you like with the settings so that you get a feel for how the different parameters interact. Select another waveshape in the oscillator, vary the envelopes and fiddle with the filter parameters.

When you are experimenting with filter and envelope parameters, note how the small graphical displays in the modules mirror your modifications.

Time to jump into the deep end and see how well you swim:

1. Load Patch 02 again.
2. Establish the same cable connections as we did in the previous experiment for the filter: patch a cable from the LFO output to an oscillator pitch input and dial in a slight vibrato by turning up the pitch input control by the mouse. Also adjust the LFO rate accordingly.
3. Extend the circuit by dragging a cable from the pitch input to the PulseWidth input of the oscillator.
4. Select a square wave for the oscillator by the waveshape switch. Deactivate the vibrato and instead, turn up the PulseWidth input.
5. Increase the release time of both envelopes to approximately two seconds. Unfortunately, you can't change the values in the numerical fields, even though at first glance it looks as if you could.

Your results should look like this:



04 Patch 03

Notice that there are two ways to cable one output to two different inputs: in parallel (two cables from the output) or in series (one cable from the output to the first input and another from the first input to the second input). Since the connections are functionally the same, choose the most convenient one when creating your own patches.

You can load this patch directly—it is Patch 03a. To avoid deleting your settings:

1 Load the patch to Slot B. Enter the slot to the dialog box that appears when you are loading the patch.

2 Press the button for Slot B located at the bottom right of the Modular front panel.

Setting Values

The Modular offers a variety of options for setting parameter values—either by mouse or directly on the Modular.

We'll dial in a lower PWM rate so that the bottom end of the patch doesn't sound quite so out of tune.

You've probably figured out how to turn a knob. However, there is a hidden option for setting values very precisely:

1 Click on the big button below the Rate display in the LFO.

2 You'll find a +/– field (up/down arrows on the Macintosh) located below the button. When you click on this field, you can set the value in individual steps. This feature is particularly handy when you are tuning oscillators and we recommend that you use it for this purpose.

► The ⊞/⊟ keys on your computer keyboard have the same function.

It's tempting to try to use the Modular's Navigator buttons for this, but they serve another function—they navigate between different knobs and modules.

3 Go to the Modular and press the Edit button located below the display. It shows the value of the currently selected parameter. You can change the value by rotating the value dial.

Selecting Parameters and Modules

With the mouse, this task is a piece of cake: simply click on a parameter, hold the mouse button down and rotate the knob in the usual manner.

You can also roam around the patch and edit it on the Modular itself or by your computer keyboard.

When you are working directly on the Modular, always press EDIT first:

◆ Use the Modular Left/Right keys to move from parameter to parameter within a module.

- To go from one module to another, press and hold the Shift key at the Modular and follow the same procedure described above.
- When you are working with your computer keyboard, the procedure is identical, except that you have to press ctrl (⌘ on the Macintosh) rather than shift.

Assigning MIDI Controllers

Let's assume you wanted to control the filter cutoff frequency by MIDI and the modulation wheel. No problem, go ahead and try it out using the example patch:

1. Click on the cutoff parameter in the filter module by the right mouse button.
2. Then click on Controller ...
3. Select a controller from the list—in this case ›1 Modulation-Wheel.‹

You can assign any patch parameter to any MIDI controller. Keep in mind that you can only assign a single parameter to each controller. However, there is a way around this using the Morph knobs—more later.

Now when you crank the modulation wheel of your external keyboard, you will see the cutoff knob move right along with it and hear the sound change in response to this modification—not bad for a few seconds of work.

Assigning Real-time Knobs

The eighteen knobs located on the front panel of the Modular (three on the MicroModular) are among the coolest features the device has to offer. You are free to assign functions to the knobs at random for every patch. Like most ultra-versatile features, this one has an upside and a downside: on the one hand, incredible flexibility and on the other, the potential for mind-boggling confusion when you are desperately trying to figure out the knob assignments for every new patch. To preserve our collective sanity, the boys and girls at Clavia inte-

grated a couple of helpful tools which we will take a closer look at in the following section and in Chapter 6.

Assigning Functions to Knobs

You can assign just one parameter to each knob and vice versa.

You are free to assign any function to any knob. There are two ways to go about this task.

On the Modular (not possible on the MicroModular):

1. Select a parameter.
2. At the Modular, press and hold the ASSIGN button down; it is located below and to the right of the display.
3. Turn the knob to which you want to assign the parameter. That's all there is to it.

From the Editor:

1. Click on a parameter by the right mouse button.
2. Select a knob from the Knob flip menu.

In both cases, the green LED located next to the knob will illuminate, so a quick glance tells you which knobs have already been assigned.

Assigning Several Functions to One Knob

There is an exception to the one function, one knob rule. At times you may have the urge to use a knob for more complex tasks where it has an influence on several parameters simultaneously. The Modular gives you this option—you can even program a knob so that each parameter is influenced to a different degree. This function is called ›Morphing.‹ We'll take a closer look at these in the section ›Morphing‹ on page 95 simply because these functions are interesting enough to deserve—and complicated enough to require—in-depth treatment.

Viewing Knob Assignments

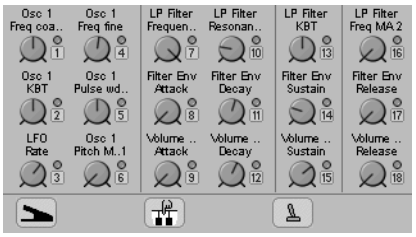
◆ Load ›Patch 03b.‹

In this patch, the knobs have already been assigned to parameters.

If you want to check out if a specific parameter is assigned to a knob press F8 and see if a knob number appears. Alternatively, on the knob assignment menu (click on the knob with the right mouse button) the assigned knob (if any) has a black dot next to it.

If you want to view the assignments for all knobs:

◆ Select the Knob Floater option from the Tools menu or simply press K (with ⌘ on the Macintosh).



Knob Floater

In the Knob Floater each of the eighteen knobs is labeled with the name of the parameter to which it is assigned—just like on the front panel of a synthesizer.

The Knob Floater indicates the current module names. If you give the modules suitable names, you will find it a great deal easier to read and figure out the knob references.

1 Tweak the knobs on the Knob Floater. You will begin to get an idea of how you can derive dozens of sounds from a single modular patch.

2 Try to find out which knob is assigned to the oscillator waveshape.

► Print out the Floater for your most cherished patches.

► **Note** When you save a patch either in the Modular or on your hard drive, all the knob settings are saved with it. If you want to keep the original settings, save it under a new name. Patches are small files—you can easily afford to save several versions of the same ›model.‹

... and Creating Sounds

► You're probably wondering how you go about adding velocity sensitivity to the patches. Easy enough, by the Morph function. But we'll get to that a little later.

05 Patch 04
06 Patch 05
07 Patch 06
08 Patch 07
09 Patch 08

Now you can create a variety of sounds using just the knobs. If you're skeptical, see for yourself: go ahead and load Patches 04 to 08 from the Tutorial folder—all of these were created using just the knobs in this simple patch.

Finding Knob Parameters

In an exceptionally complex patch, you may have a hard time finding the parameter assigned to a particular knob.

Help is near by the Find button (not on the MicroModular):

◆ Press and hold the button on the Modular labeled Find; it is located to the left of the knob panel. Turn the knob for the parameter you are attempting to find.

The parameter is activated on your screen. To prevent inadvertent knob twiddling, the crafty Modular designers built in another handy little feature: rotating the knob has no influence on the sound as long as you hold the Find button down.

► Notice as you turn the knob while holding the Find button that one or two arrows and a ›–‹ or ›+‹ sign appear in the bottom right corner of the window. These are to let you match the knob to the current setting—turn the knob until it displays ›→+←‹ to find the current knob position.

Working with Modules

Now you're ready for a bit of module merry-go-round. First we'll add a second oscillator to the patch.

Adding a Second Oscillator

1 Select the module group Osc from the symbol bar.

2 Click on the seventh module from the left—a multi-oscillator slave.

3 Hold the mouse button down, drag the module to the patch and drop it between the oscillator and LFO.

4 Re-name the first oscillator—you guessed it—›Osc1‹ and the second ›Osc2.‹

If you accidentally grabbed the wrong module, click on it by the right mouse button and send it back to where it came from by del.

In order to hear the new oscillator, you have to integrate it in the signal chain. The filter input can only take a single cable, so you'll have to patch in a virtual mixing console.

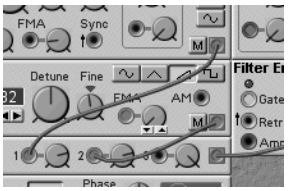
Adding a Mixer

1 Open the module group Mixer and drag the ›3 Inputs Mixer‹ to a location directly beneath the second oscillator. Give this new component the name ›Osc-Mix.‹

2 Unplug the cable from the oscillator output and plug it into the mixer output. (I.e. connect the mixer output to the filter input.)

3 Connect the two oscillators with the first two inputs of the mixer and turn up the level control at the mixer to 100.

The result should resemble Patch 09.



10 Low-volume Second Oscillator without Transposition

Now when you play a couple of licks, you'll note that the second oscillator is not transposed by the keyboard and that it is relatively quiet.

Master and Slave

As we mentioned earlier, the second oscillator is a slave, so you have to connect it to its master.

1 Drag a cable from the Slave output (Slv) of Osc1 to the master input (Mst) of Osc2. Notice that the cable is automatically colored gray.

► Now the pitch control is routed from Osc1 to Osc2—which doesn't mean that both of them always have the same pitch.

2 To perk up the sound a tad, select a sawtooth wave for Osc1 and Osc2.

3 Use the Fine controls to set Osc1 to –4 and Osc2 to +4. You can determine any interval you want by clicking on the small ›Partials‹ arrows in Osc2.

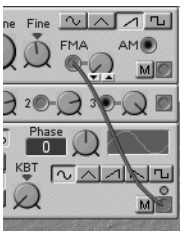
11 Two Oscillators

You can load the result as Patch 10.

Testing Oscillator Modulations

FMA and pitch are distinguished by the fact that pitch responds to an input signal with exponential curve, whereas FMA responds with a linear curve. More on this later.

Although Osc2 is connected to Osc1 as its slave, this doesn't preclude the option of modulating them individually and independently.



1 Simply turn up Knob 6—it is *not* linked to Osc1. Nevertheless, the vibrato affects Osc2.

2 Click on the blue cable plugged into the pitch input of Osc1 by the right mouse button and select Delete Chain.

3 Now connect the LFO output to the FMA input of Osc2 and turn up the knob a bit. Give it another listen, you will hear that only Osc2 is being modulated.

12 Independent Oscillator Modulation

The results you come up with should sound like Patch 11.

Add a Sequencer

The Modular features several (monophonic) sequencer modules which are based on step sequencers in modular analog synthesizers. Even without the benefit of MIDI, you can create music with the Modular.

These sequencers enable you to program simple bass lines, complex rhythmic sequences and MIDI controller patterns. Using MIDI clock, you can even run the sequencers in sync with external sequencers or a tape machine equipped with a synchronizer!

◆ Load ›Patch 12.‹

This patch does not generate any sound just yet. Take a quick look at the modules involved:

- The upper row is a simple bass synthesizer.
- Below it, you can see three different sequencer modules.
- A clock generator is located at the bottom.
- Rotate Knob 1 clockwise (i. e. fully up).

The Modular plays a rhythmic sequence that you can transpose from the keyboard. This is how it works:

Knob 1 is assigned to the On/Off switch of the clock generator. As soon as you turn the knob up, the sequence starts, although it doesn't sound too riveting just yet. Your MIDI keyboard modulates the sequence through the automatic connection between it and the Bass Osc module indicated by the KBT button.


13 Sequencer without Melody and Tone Color Modulation

Make sure all the cable colors are visible and notice that there are only red, yellow and green cables at this point. The red cables are the audio path: the oscillator passes through the filter and amplifier/envelope to the output.

The yellow cables carry the clock pulses to the three sequencers, but the note and control sequencers are not connected to anything, so only the event sequencer has any effect at this point. Actually EventSeq1 is two event sequencers in one but only the top one is being used—it triggers the amp envelope causing the pattern you hear with notes 14 and 16 dropped.

The green cables (these would normally be yellow, but we have changed them to green for clarity) reset each of the sequencers each time the clock starts so that you always get the same, sync'd sequence.

Now you will add a melody and tone color (timbre) modulation.

Recording a Melody

The Modular has two sequencer modules intended primarily for notes: NoteSeqA and NoteSeqB. NoteSeqB offers a few extra features, but they are very similar and use equal pro-

cessor time. We've chosen the simpler NoteSeqA for this patch.

On the right of the the NoteSeqA module you'll find (from top to bottom) the Record, Start/Stop and Step buttons. To record a sequence:

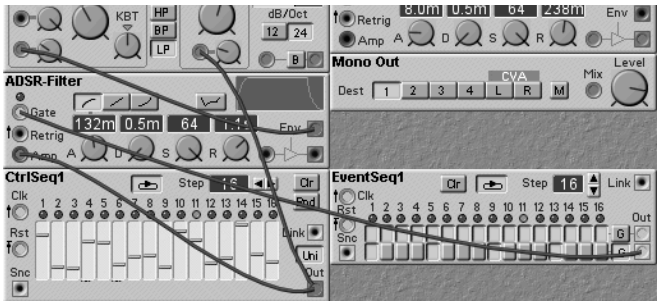
1. Stop the sequencer (click the Start/Stop button).
2. Connect a cable from the output of NoteSeqA1 to the pitch input of Bass Osc and turn its amount knob clockwise to fully up.
3. Click the left Step button to get to step 1.
4. Click on the Record button to start recording.
5. Play a sequence of notes on your MIDI keyboard. The Record button will switch off automatically after you've played sixteen notes.

14 Sequencer with Melody

Start the Sequencer by clicking the Start/Stop button again and you'll hear the melody you just created. (See Patch 12a.)

Tone Color Modulation

- Load ›Patch 12b.‹



Only the purple cables should be visible. You can see that the output of CtrlSeq1 is cabled both to the amp input of the ADSR-Filter envelope and to the res input of the filter. The envelope output is cabled to the frequency mod input of the filter. The control values coming from this sequencer will therefore control the amount of the envelope applied to the filter frequency and the filter resonance. Notice also that the

output of the bottom row of events from EventSeq1 is cabled into the ADSR-Filter gate input. The triggering of this envelope is therefore controlled by the event sequencer instead of being triggered by every clock pulse.

1 Restart the sequencer by Knob 1. You still can't hear a tone color modulation? You're right, the control values of the sequencer are set to neutral values.

2 Click on the Rnd (Random) button of the Ctrl sequencer and there you have it.

 **15** Sequencer with Tone Color Modulation

► Experiment with different melodies and CtrlSeq settings.

Rhythms

Although the event sequencer generates only logic signals, it does feature two rows per module. For instance, the small gaps in the note sequence in the above examples are the two deactivated steps in the upper row.

◆ Try to come up with some interesting phrases by programming the three sequencers so that they mesh for maximum effect.

Patch 13 is an example of what you might come up with. Notice the slight change in the patching.

 **16** Growing Bass Line

Hardcore Experiments

Of course if you really want to, you can pull out all the stops with this sequencer. For instance you could:

◆ Assign a knob to each step in the NoteSequencer—just like in the vintage original that inspired this sequencer.

◆ Control the cutoff frequency, resonance and decay time by MIDI controllers or by knobs as in the example above.

◆ Add an LFO as in Patch 13a to control timbre and resonance.

◆ Add a second voice a 5th higher and add some output processing in the CVA as in Patch 13b. (Notice that both

You can also synchronize the sequencer by MIDI. More on this subject in section ›Synchronizing Several Sequencers to MIDI‹ on page 111.

the audio and the LFO output are passed from the PVA to the CVA.)

Copying Modules

In the editor you can copy and paste groups of modules either within the same patch or between patches. This is especially convenient if you want to duplicate part of one patch in another—e.g. the entire sequencer setup or the oscillator/filter configuration. It is also a handy way of quickly creating another module of a type you already have in the patch.

► When you copy & paste a group of modules, all cables which stay within the group are also duplicated.

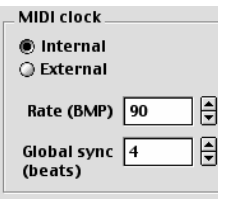
Two or More Patches

MicroModular owners should skip to Chapter 4.

Each of the four slots in the Modular can hold a different patch. You can assign the four slots to any combination of MIDI channels (all the same, each different, etc.) for playback from an external MIDI keyboard or sequencer. You can also assign whether the built-in keyboard on the Modular plays only the active slot or all selected slots. These options together with the Keyboard Split module allow almost any imaginable kind of MIDI control of the slots.

Although you can layer or split a single patch into several sounds, you should be sure to check out the interplay of several patches in the Modular—especially the interaction of the Modular and Editor, which is truly impressive.

To get an idea of what we're rambling about, let's look at the interplay of four separate patches—your own ›modular quartet‹ if you will:



1 Go to the Synth menu. Open the Synth Settings window and set the keyboard mode to Selected slot. This allows the internal keyboard to play all slots simultaneously.

2 While you're in there, set the MIDI clock to Internal with a rate of 90 BPM and sync of 4 beats as shown.

3 Ensure that all slots are active on the Modular. You can do this from the front panel by pressing all four slot buttons simultaneously or from the Editor by *shift*-clicking each of the slot buttons on the Toolbar.

4 Load Patches 14a through 14d into Slots A through D respectively. Do this from the Editor by selecting each slot, loading the patch from your hard drive or the CD-ROM.

5 If you are using the keyboard model of the Modular, shift the keyboard one octave down and play the lowest key (C). Now shift the keyboard back up one octave to the center range.

6 If you are using an external keyboard play MIDI note #36 (the C two below middle C) on channel #2.

17 Song Minus You

With any luck, you should now be hearing drums, bass and a pulsating, etherial pad. All we need is a soloist—that would be you.

7 Play a burning solo on MIDI channel 4 using MIDI notes #48 (C below middle C) and above. On the Modular, don't worry about the channel, just keep the keyboard set to the middle or higher range.

► **Tip** The bass line is drawn from the C pentatonic scale with the possible substitution of E♭ for E and the possible addition of B♭. To change the root go back to steps 5 and 6 and play another note in the C2 to B2 range.

Take a moment to look at the four patches. The easiest way to bring a slot (and its patch) to the top is to either select it in the Editor's toolbar or on the Modular's front panel.

Patch 14a in Slot A is the drum patch. It uses a pattern generator to apply a pitch pattern (16,384 to choose from) to a steady stream of 16th notes. Keyboard splitters route the notes to one of three drum synths.

Patch 14b in Slot B is the bass synth. It passes a random sequence of 16th notes through a Key Quantizer to force

them into a particular scale (see above). The accents are generated by Control Sequencer (click the Rnd button to change the accent pattern). An Event Sequencer together with a Logic Delay control the amount of swing applied to the pattern.

Patch 14c in Slot C is the pad synth. It plays a fixed chord whose root corresponds to the selected bass pattern key. The chord is enveloped at random intervals.

Patch 14d in Slot D is the lead synth. It uses a triangle wave for the fundamental and a bank of six sine waves for the harmonics. Random generators control the amount of each harmonic—the timbre changes randomly as you play.

Knobs have been assigned to various controls in each of the patches. You can assign up to eighteen knobs per patch corresponding to the eighteen knobs on the Modular's front panel. Selecting a slot makes its knobs active.

You can also have the front panel knobs split between the patches in the four slots:

- At the Modular, activate the Split button located below the Volume knob.

The Knob Panel is split into the four gray zones depicted on the panel. Knobs 1 through 6 are assigned to Slot A, Knobs 7 through 12 to Slot B and so forth. In this mode, disregard the front panel knob numbers—each section uses the lowest knob assignments from the patch—knobs assignments #1 to #6 for slots A and B and knob assignments #1 to #3 for slots C and D.

For our four patches, the upper left knob of each section controls the volume. The knob below it has some effect on the pattern, and the remaining knobs have some effect on the timbre of the sound. (For the bass section the middle knobs control major/minor third and minor 7th in/out respectively.)

There is a limitation to using the four slots simultaneously: you can't save a four-patch configuration as a performance.

Consequently, if you want to have immediate access to a group of sounds at any time—for instance four sequencer lines that belong together—we recommend that you program these to a single patch.

Audio Processing

In the above example we used each of the four slots for a separate musical part—i. e. we used them in parallel. The slots can also be used in series with one slot processing the output from another.

To follow this example, you will need a short patch chord:

1. Load Patches 15a and 15b into Slots A and B respectively.
2. Ensure that both (and only) Slots A and B are active using the buttons on the Modular or in the Editor's Toolbar.
3. Take the patch chord and cable it from the Modular's #3 output back to its left audio input.

Play the Modular and you will hear a complex FM waveform playing through some sort of moving filtration. Here's what's happening:

Patch 15a generates an FM waveform. At the bottom center of the patch, you'll see that its output is directed to the Modular out #3. If you click the out #1 button, you will hear the unprocessed FM waveform.

You can use the knobs 1 to 3 to balance the three components and knobs 4 to 6 to control the amount of FM for each. Notice that there is no filter or envelope contour here—the sound is rich in harmonics but pretty bland.

Now switch Patch 15a back to out #3 and look at Patch 15b. The AudioIn module at the top-center brings the left audio input (now patched from the output #3) through Vocoder and an LFO'd Delay to the output. On the left, noise is passed through a VocalFilter to the Vocoder's control input. The Vocal Filter's frequency and vowel-select is modu-

lated by the output of a clocked pattern generator. Knobs 1 to 3 control the output level, clock rate and modulation amount. Knobs 4 to 6 select the length, bank and number of the pattern.

► If you'd like to use this patch as a standard Vocoder, flip the ›4-1 Switch‹ in the upper middle of the patch to position 2 and patch the desired audio control signal (voice for example) into the Modular's ›Input R‹ jack. Note that the audio must be line level—plugging a mic in won't work unless you add one or more Amplifier modules and this may raise the noise level unacceptably high.

Now that you've had an initial look at the most important functions of the Modular, you can move on to the next chapter, where you'll build a complete synthesizer and take an in-depth look at the modules.

4 Designing a Synthesizer

In this chapter we'll take you through the process of designing a complete synthesizer in the Modular, from choosing the modules to setting up the controls necessary for a finished, playable instrument.

You will build a simple but fully functional analog synthesizer and play it, control it by MIDI and use it to create sounds.

► For this chapter, you can use two slots in the Modular: one for your patches, the other for the examples prepared for you.

► You can compare your patches with the examples to monitor if you are on the right track. Create your patches in Slot A and load the examples to Slot B.

Examples for this chapter are located in the `Synthkit` folder.

Our Objective

The synthesizer we are aiming for is an eight-voice polyphonic analog synth with the following features:

- Two oscillators with variable waveshapes, envelope, sync, mixer and noise
- Two LFOs
- A multi-mode (LP, BP, HP, BR) filter with a dedicated envelope
- Amplitude envelope
- Velocity
- Real-time control by MIDI controllers
- Comprehensive front panel knob assignments

You'll be able to use this *model* to create a virtually infinite number of patches. We're not kidding when we talk about the versatility of this device—for all intents and purposes, a single Modular model will give you the same thrill—not to mention all the options and features—as you would get by buying a brand new synthesizer.

›Pouring the Foundation‹

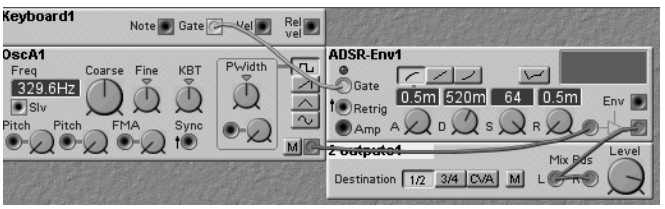
Following the obligatory house-building analogy, we will start with a very basic foundation. First we'll ›pour the concrete:‹ one oscillator, one envelope and one output. This is the most minimal, stripped-down configuration you can set up which still allows you to play notes.

1. Load the patch ›WizInit‹ into Slot A.
2. In the Toolbar, set the number of requested voices to 1. (This is the R setting which is the only one you can change. The C setting displays the actual number of allocated voices—i. e. the number of voices that fit into the Modular's RAM.)
3. Drag an Osc A module to a position below the keyboard module and drop it.
4. Place an ADSR envelope to its right.
5. Place a stereo output module below the ADSR.
6. Route an audio cable from the oscillator to the ADSR input and from there, on to the L input of the output module. Drag another cable from the L input to the R input (i. e. left and right outputs are the same).

Of course, before you can play any notes, the envelope requires a gate signal. You've probably figured out how to route this signal on your own, but for the record, here's the procedure:

7. Drag a cable from the Voice Gate output of the keyboard module to the gate input of the envelope.

If you've done everything right, your results should look something like this:



If not, try again or simply load the patch ›Kit01‹ if you're in a major hurry. Now you can ›play‹ your minimal synthesizer.

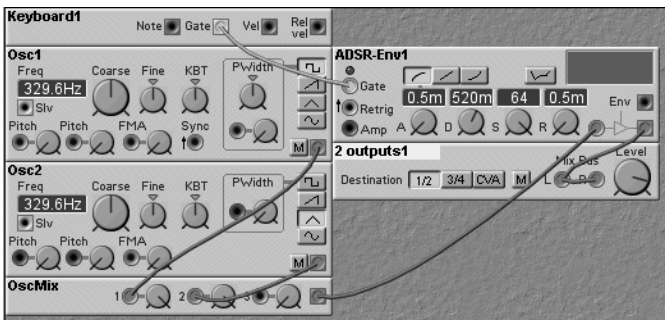
18 Oscillator—Envelope—Output

Adding a Second Oscillator

In Chapter 3 we added a slave oscillator as the second oscillator to a patch. Here we will add a totally independent oscillator, however, we'll pass on initial pulse width (we'll still have pulse width modulation) and sync and settle for a ›low-budget‹ version:

1. Drag an Osc B module to a position below the first oscillator. This module only soaks up 8.3% rather than 11% DSP power.
2. Position a ›3-Inputs-Mixer‹ below the second oscillator.
3. Connect the oscillators to separate mixer inputs and connect the mixer's output to the envelope.
4. Set the input controls to the following values: 100, 100, 0, starting at the left hand and moving to the right.
5. Name the modules ›Osc1,‹ ›Osc2‹ and ›OscMix,‹ respectively.

Your results up to now should resemble the following illustration. You can find the same setup in ›Kit02‹ located in the Kit folder:



Adding a Filter

Now we'll add an enveloped, multi-mode filter to the signal chain.

1 Move the ADSR module and the output module to the right by about the same distance as the width of a module.

2 Insert a FilterE module in the space you've just cleared and place another ADSR envelope above it.

3 Name the modules as follows: Filter, Filter Env, Volume Env (the ›old‹ ADSR), Stereo Out.

4 Try to figure out how to integrate the filter in the signal chain and how to connect it to the filter envelope.

5 Compare what you came up with to our results in Kit03.

19 Oscillators in Fifths w/Enveloped Filter

A Bit of Patch Management

We'll take a break from the fun and games and give the patch a proper name and address, in other words, we'll store it in the Modular and on your hard drive:

If you don't store a patch in the Modular, you'll have to reload it from your computer every time you want to access it.

1 Select Save As from the File menu.

2 Locate the desired destination on your hard drive, type ›KitSynth‹ into the Name field and click the Save button.

Take a look at the Modular display (not available on the MicroModular), the new name of the patch is already indicated in it—the Editor and the Modular exchange these data in real-time.

3 Press the Store button on the Modular.

The display indicates the memory slot that you selected and the name of the patch that is currently stored there.

4 Choose a slot with a patch you can do without using the value dial. Press Store again—that's it, you've just saved your patch in the Modular.

► You can also accomplish this by choosing Save in Synth... from the Editor's Patch menu.

If at some point you forget to store a patch on your computer or if you just want to edit a Modular patch at your computer, you can simply upload it from the Modular:

1 Select the patch at the Modular.

2 Select Upload Active Slot from the Synth menu—the patch is retrieved from the Modular and displayed on your screen.

► If you turn on Auto Upload in the setup options, the Editor will automatically load any patch you select on the Modular.

Panning

Since we've used a stereo output module with this synth, we might as well add panning.

◆ Select the panning module from the mixer group and place it between the volume envelope and the stereo out. Connect the requisite cables—input from the volume envelope and outputs to the stereo outs.

► The existence of the control input labeled Pan on the panning module may suggest some possibilities to you (especially the fact that it's red!!!).

Installing a Modulation Mixer

Our synthesizer could do with a couple of LFOs, so we'll add two of them to the patch. There are many ways you could route the LFOs to the various control inputs of the other modules. We'll show one example of a fairly flexible multiple-routing which gives each LFO three possible uses.

Although many of the modules have multiple control inputs for the same thing (oscillator pitch or filter freq for example) others like pan have only one. To apply multiple controls to these modules we need a control mixer:

◆ Select a control mixer from the Ctrl Mod group and position it just above the panning module. Connect its output with the control input

of the panning module and turn the input knob all the way up. Later, you will control the actual modulation at the mixer. Name the module Pan Control.

Routing the Filter Envelope to the Pan Module

- Drag a control cable from the blue control output of the filter envelope to the first input of the pan control module. Turn the input knob at the mixer.

Play the Modular and you will notice some right-to-left panning happening for each note. This may not be as extreme as you would expect. The reason is that the change caused by the envelope is starting from the initial pan-center position—rotate the initial pan knob full left and you will notice the change. You may also be wondering why it's right-to-left. The envelope applies a ›positive‹ change to the pan position—if you click the control mixer's Inv button and rotate the initial pan to full right you will get left-right panning. (Bear in mind that the shape of the envelope also affects what panning you hear.)

If you want, you can compare your results to Kit04.

Installing LFOs

Now let's install the LFOs. To avoid confusion, we'll draft a short routing plan for the LFOs before we install them. This is fairly easy, we just have to define the modulation targets for each LFO:

LFO1: Osc1 PWM, Osc1 Freq, Osc2 Freq
LFO2: Osc2 PWM, Osc2 Freq, Filter, Pan

Drag two LFOs into the patch:

1. Position an LFO A above Osc1.
2. Position an LFO Slave A above Filter Env.
3. Name the two LFOs ›LFO1‹ and ›LFO2,‹ respectively.

4 Drag a master cable from the Slv output of LFO1 to the Mst input of LFO2.

► We save 0.6% CPU usage by making the second LFO a slave. This may not seem like much, but it adds up and there is no real sacrifice making the second LFO a slave, we can still adjust its frequency arbitrarily relative to the master.

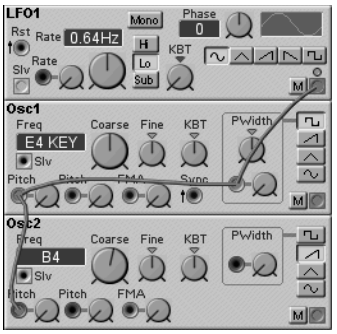
► You can use a slave LFO by itself, in which case viewing the readout in Hertz (click it if necessary) gives the correct frequency.

► There's no real mystery about what the Mst input to an LFO or audio oscillator does—if you patch a constant module into it, you'll hear that each step in value transposes the oscillator's frequency to the next partial. Negative values have the same effect on frequency, but reverse the phase of the output waveform.

Connecting the LFOs

Drag a blue control cable from the output of LFO1 to:

- the pulse width input of Osc1,
- from there on to the left pitch input of Osc1,
- and on to the left pitch input of Osc2.



Cable Chain

► Using a ›serial‹ cable chain produces the same results as connecting separate (parallel) cables from the LFO to each of these inputs. The advantage of a cable chain is that the diagram on your screen appears less cluttered.

Now drag a control cable from the output of LFO2 to:

- the pulse width input of Osc2,
- from there on to the second pitch input of Osc2,
- and drag a new cable from the LFO2 output to the second frequency input on the filter.

► If cables obscure your view of modules or their names, you can shake them a bit:

Press and hold ctrl (⌘ on the Macintosh). Every time you hit ⌨ a helping virtual hand shakes the cables up. Alternately, you can use the S button next to the colored ›visible cable‹ buttons on the Toolbar.

You can also load this semi-complete synthesizer as ›Kit05.‹

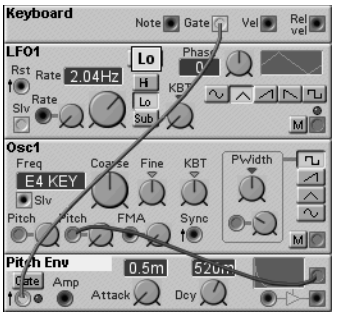
► If you play the patch you will notice a conspicuous absence of LFOing. This is because all the mod-input controls are turned down—season to taste...

Pitch Envelope

A few more details and our house is finished. Let's add a small envelope for the two oscillators:

1 Select an AD module from the Env group and drop it between Osc1 and Osc2.

2 Name it ›Pitch Env‹ and connect it to second pitch input of Osc1. Don't forget the gate cable.



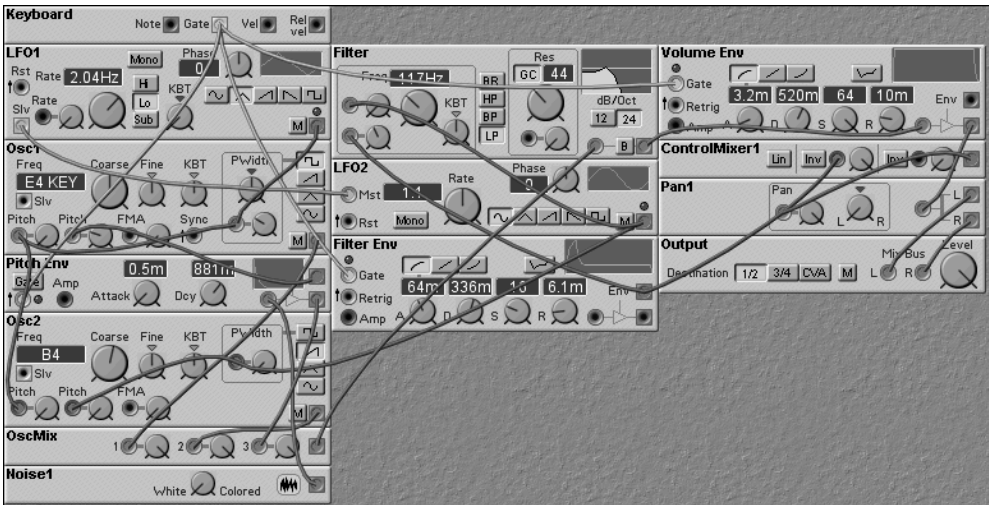
Noise

Now for the noise module and we're ready to party.

- ◆ Select a noise module from the Osc section and drop it below the OscMix.

- ► For a neat trick, we'll let the pitch envelope do double duty as the amplitude envelope for the noise. Route a cable from the noise output to the audio input of the Pitch Env and from there on to the last unoccupied input of the Osc mixer.

If you followed the instructions fairly closely, you are now the proud owner of an analog synthesizer that could leave many a hardware synth choking in the dust. If for some reason you didn't follow along with all the steps, you can always load ›Kit06‹ to see what we are getting at:



► All modules are installed, now we'll fine-tune them ...

Velocity

Take a look at the keyboard module. You should be able to locate the Vel On output. However, we don't recommend that

you use it. Why? Because if you wanted to come up with a truly responsive, playable velocity you would have to

- drag a separate cable to each parameter and
- locate or create an input and a knob for each cable.

There is a much spiffier method: the morph function—invented by Clavia and originally popularized in the Nord Lead. If you are curious as to what a morph actually is, feel free to read the section ›Morphing‹ on page 95. Here's a brief introduction to this handy little feature:

- You assign a start and end value to one or several morph knobs.
- You then assign a controller to the morph function—velocity, mod wheel, MIDI controller, panel knob, etc.
- When you turn the controller up, all the knobs you defined for ›morphing‹ are rotated simultaneously within the range you determined.

There are four morph knobs available in each patch. Another elementary morph application is a ›detune‹ knob that turns the Fine parameter of one oscillator down while turning the Fine parameter of the other oscillator up.

Follow these steps for a simple velocity morph of our kit:

We don't want to go overboard with this example, so we'll only apply velocity to two parameters: volume (stereo out level) and tone color (filter cutoff).

1. Right mouse click on the red (left most) morph knob in the Toolbar and select Velocity from the Keyboard section of the pop-up menu.
2. Set the level knob in the stereo-out module to 80. This knob defines the value of the patch at minimum velocity.
3. Click on the Level knob by the right mouse button and select Group 1 from the Morph menu.

► You can also accomplish this by first ensuring that the desired morph knob is selected then double-clicking the knobs you wish to assign to it.

4. Press and hold ctrl (⌘ on the Macintosh) and turn the same knob to 127—the volume at maximum velocity. You can see the morph section is now displayed in dark red. Go ahead and try it out. The patch

responds dynamically to your attack—louder when you pound on the keys and quieter when you caress them.

5 Repeat steps 2 through 4 for the lower Freq modulation amount knob, but set the range limits to 32 and 127, respectively.

6 You can check ›Kit07‹ to compare results.

A Little Dab Will Do You ...

The initialized settings of the modules are not necessarily the best ones. Here are a few dabs of cosmetic enhancement to polish up the sound of the patch before we dive into sound programming:

1 Set the requested number of voices in the Toolbar to 8.

2 Set the LFO1 rate to 3.42Hz, LFO2 to × 1.260, the waveshape to ›triangle› and both LFOs to ›mono‹.

3 Set the attack and release parameters of the filter and volume envelopes to 2.1ms (to eliminate clicks).

You can also hear these modifications in ›Kit07.‹

Mod Wheel to Vibrato

Now we'll assign the mod wheel to vibrato. You can apply this basic technique to all other MIDI controllers. For this effect, two pitch input knobs (Osc1 and 2) have to be rotated, so we'll work with a morph group.

1 Assign Morph Group 2 as a controller for the modulation wheel.

2 Assign the first pitch input knob of each of the two oscillators to Morph Group 2.

3 Set a morph range of 0 to 37 for both knobs.

When you crank the mod wheel on your external keyboard, you will hear vibrato generated by LFO1.

► You could assign a knob instead of or in addition to the mod wheel.

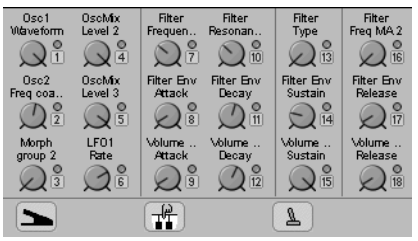
The complete patch is ›Kit08.‹

And Now for the Knobs...

We would like to assign all the important parameters to front panel knobs and with eighteen knobs, the Modular is certainly not under-engineered, but we would need substantially more knobs to cover every parameter. If we choose carefully, we can cover the most important parameters—those that have the most interesting effects on the sound.

If we described each step in detail, we would seriously tax your attention span. So instead we went ahead and prepared a setup for you, which you can check out in ›Kit09.‹ As you probably recall from the tutorial, you can view the knob assignments in the knob floater—simply press K (⌘K on the Macintosh). (Pressing F8 will temporarily flash the knob assignments onto the editor front panel graphic.)

One of any number of possible knob panel setups



Your synthesizer is finished and ready to roll. ›Kit09‹ contains an example of one of the many sounds it can generate.

A few more sounds are stored under ›Exp01‹ through ›05.‹ Try and figure out how these are programmed and which minor changes we made to create them. Enjoy!!!

◎ **20** to **24**

20	Exp01	SyncBass	Sync Cable from Osc2 to 1
21	Exp02	DynoPad	Attack/Release Times by Morph Grp 1 to Velocity
22	Exp03	VeloWire	FM from Osc1 to Osc2, by Morph to Velocity
23	Exp04	PWMorph	LFO Rate by Morph 1 to KeyTrack
24	Exp05	NegaBass	Filter Env Switched to Negative Polarity

You can find the init patch for this synthesizer in ›KitInit.‹

1. Now it's your turn—you could fill an entire soundbank with just this synth model.
2. Keep in mind that you can change not only the parameters but also the modules, cables, morphs and knob assignments in every patch.

Creating Sounds without a Computer

Shut your computer down and give it a shot using just the knob panel. (MicroModular users can skip to the next section.)

Here are a few tricks that should make it easier for you:

- When you press the Edit button at the Modular, you can view the knob's parameter assignment and values in the Modular display.
- If you want to find out which parameter is assigned to a knob before you change a value, press and hold the Find button on the Modular and rotate the knob—only the parameter name is displayed, the value does not change while you hold the button down.
- You can save your edited patches in the Modular using the Store button and in the computer using Upload Active Slot and Save.
- Stick white adhesive tape under the knobs and label them or print out the knob panel assignments (in the Editor, ⌘K and then select Print or take a screenshot).

5 The Modules

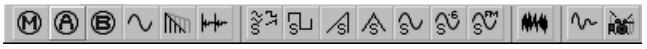
This is the chapter where you'll get to know the modules—and we mean that quite literally. We're not going to bore you by wading through the list of modules and counting off the parameters one by one. Many of the over a hundred available modules are slave versions or cut-down clones of the primary modules. Our reasoning was that you have eight different oscillators at your disposal—Oscillator A features all of the available functions, so why analyze each individually when this oscillator gives you an insight into all of them?

Besides, the manual gives these oscillators an in-depth treatment, so we'll concentrate on their practical application and let you in on some of the wicked stuff you can do with them.

By the time you've finished working your way through this chapter, you'll be ready for some hard-core excursions we have planned for you in Chapters 6 and 8.

We'll assume that you have a basic handle on analog sound synthesis. If you feel fairly confident with your skills, the Modular is the best medium for testing and improving them immeasurably. If you know what oscillators, filters and envelopes are and what they do, you'll have some good, clean fun with this chapter's experiments and might learn a trick or two to boot!

Oscillators



Oscillators are the Modular's sound-generating components. The ›heaviest‹ of the bunch is Oscillator A and at 11%, it certainly is a sumo-style glutton when it comes to DSP power.

All other oscillators are light-to-feather-weight versions of this mother of all oscillators. You should make a habit of using these to conserve DSP power in applications where you don't need all of Osc A's functions. Unfortunately, you often won't know exactly what you need until you have finished

assembling your model, but eventually you'll get a feel for what you need in terms of essential functions.

The folder for this chapter is named `Modules`. Please download Patch ›Osc01‹ from it.

The Cadillac of oscillators: ›Osc A‹

We pre-configured the patch for you so you can get right down to business:

- A gain controller module (Note On/Off) is in turn controlled by the keyboard gate so that the oscillator is only audible when you play a key.
- An output module is already installed.
- Below the oscillator, you can see a constant module named ›Value.‹ It is assigned to Knob 1; you should use it as your test controller. By simply unplugging and re-connecting the blue cable, you can check out what influence the modulation inputs have on the sound.

► The oscillator's modulation inputs are ready for action. Just unplug and re-connect the blue cable. For the time being, leave the sync input as it is.

You should keep the following in mind:

- You can view the oscillator's basic pitch in either Hertz values or as MIDI note values. To change the mode, click on the display field.
- KBT (keyboard tracking) is ›hard-wired,‹ but there is always a knob or switch to adjust/defeat it. This spares you a whole mess of cabling hassles. (This does not apply to slave oscillators which track only their masters.)
- The only difference between the FMA input and the pitch input is its linear and quantized response to input signals.

We'll show you what this means in practice a little later on, but try manipulating FMA then Pitch with the constant module to hear for yourself.

Master and Slave

◆ Load Patch ›OscSlv.‹

Here we gave the lonely master some company in the form of a slave oscillator and a mixer. When you play a tune on your keyboard, you'll notice that the slave doesn't follow the master.

◆ Drag a master cable from the Mst jack of the oscillator to the Slv jack of the other oscillator.

Good-to-know stuff: the slave frequency is always a multiple of the master frequency, so all you need to do when you want to transpose a patch is re-tune the master!

Now you're all set—the slave follows the pitch control for the master. You can dial in individual settings for all the knobs on the slave without influencing the master module, but independent pitch modulation is no longer possible.

FM

The Modular has the legendary Yamaha synthesizers' frequency modulation synthesis down pat. With a much wider range of options such as independent modulation of all operators, randomly definable waveshapes, etc., it actually eclipses the original in terms of versatility.

Go ahead and give it a shot. Load ›OscFM.‹

25 FM

The output of the slave oscillators is connected to the FMA input of the first oscillator by an envelope module. You can vary the Partial parameter to modify the sound as desired. We went ahead and assigned this function to Knob 1, so all you have to do is tweak it and see what happens.

Cool as this is, things get better. The Modular has a slave oscillator designed especially for the classic FM effects—its FM input is labeled ›FMB‹ and it responds somewhat differently than the standard FMA inputs.

- Load patch ›OscFMB‹ and play around with it. Several other modifications make this a very usable, basic and cheap (15.3%) FM synth.

Sync

This is how sync works: every time Oscillator A starts a new periodic oscillation, Oscillator B also slams hard on the brakes and then starts up again. This process generates a waveshape with a drastic cut-off (as well as the smell of burning rubber), which is responsible for the serious overtone content.

The sync function lets you come up with sound shapes featuring heavy-duty harmonics.

1 Load ›OscSync.‹

In this case we had to replace the slave oscillator with a second master—our motives are probably pretty obvious. Hint: the sync cable from the second to the first oscillator is crucial for this application.

2 Use Knob 1 to determine to what extent Osc A is influenced by the envelope.

3 Use Knob 4 to determine the sync timbre by changing the frequency of SyncOsc.

Note that although it would seem that SyncOsc should follow the pitch envelope, it remains stable. Additionally, SyncOsc is audible, but PitchOsc determines the basic pitch. The reason for this is that the signal at the Sync input determines the duration of the oscillation and consequently the frequency.

26 Oscillator Sync

For the most playability, leave PitchOsc frequency set to ›E4‹ so that it accurately follows the keyboard and vary SyncOsc frequency to vary the sync effect. Note that frequencies above E4 are the most effective.

PWM

PWM generates shimmering effects similar to chorus and flanging with just a single oscillator.

You can generate pulse width modulation by connecting the pulse width input of the oscillator to a modulation source.

1 Load Patch ›OscPWM.‹

The LFO modulates the pulse width, so you can hear the type of effect it generates very clearly.

27 PWM

2 Turn Knob 1—it controls the LFO rate—and note how PWM sounds in conjunction with slower and faster modulation.

Using an Oscillator as a Master for the LFO

We'll take this opportunity to take a look at a nifty little trick that saves some CPU:

Although the slave LFO in the PWM patch does not have a master input, it still operates, which tells us that LFOs do not always require a master.

- Route a master cable from Osc A to LFOSlv1.

Now the frequency of the LFO is transposed by the keyboard—it tracks the master oscillator 5 octaves lower. Note that the LFO rate is also affected by any pitch modulation of the master.

LFOs

While we're on the subject of oscillators, we'll have a look at LFOs. LFO stands for ›Low Frequency Oscillator‹—it is just an oscillator running at a sub-audio frequency (well, not always as we'll see). You can think of an LFO generating controller values conforming to the usual oscillator waveform patterns: pulse, sawtooth, triangle and sine.

As hinted above, the Modular's LFOs can operate at audio frequencies—the difference is that they use the controller sample rate of 24kHz rather than the audio sample rate of 96kHz. Therefore, the audio quality is lower. In some cases this is unnoticeable and in others it might be just the grittiness you're looking for.

1 Load the patch ›OscLFO‹ and play a few notes.

You're hearing OscA play a standard sawtooth waveform.

2 Press the ›2‹ button on the switch Osc vs LFO and play again.

This time you're hearing the LFO—not as nice or twice as nice? Try the same comparison with the other waveforms. For the sine and triangle waveforms (with few harmonics) there is little difference but with the harmonic rich waveforms you can hear a significant difference.

Although you can also use them as audio signals or logic signals, the LFO signals in the Modular are normally used as control signals.

The ›LFOTest‹ patch features the essential LFO effects. Run through them to hear what they do:

If you're wondering what the deal is with the yellow logic cable to the LFO's Rst input, wonder no more. It connects the keyboard gate to the reset input of the LFO so that an LFO oscillation is re-triggered every time you hit a key.

1. Use Knob 1 to select any of the different switch settings, Knob 2 to select LFO waveshapes and Knob 3 to vary the modulation depth.
2. The keyboard transposes the LFO rate, but not the pitch—so you can try out each modulation type at a different rate.

Switch Setting	Destination	Sine/Tri	Saw
1	Osc Pitch	Vibrato	Sirene
2	Filter Cutoff	WahWah	Repeat
3	Amplitude	Tremolo	AutoTrigger
4	Pan	AutoPan	AutoPan

And Now for Something Completely Different: LFO PWM

You can modulate the pulse width of LFO B (second LFO from the left), which is a rather unusual feature. Since LFOs can also generate triggers or gates, you could conceivably modulate the pulse width to create notes that sustain or decay continually. Check out the results in the patch ›LFOPWM.‹

- Turn Knob 1 up to activate the sound (Warning: prolonged exposure to this sound will seriously grate on your nerves).


28 LFO PWM

Check out the green LED on the LFOB1 module. It indicates the on/off phases that are modulated by the slave LFO.

Setting Up a Conventional LFO

In conventional synthesizers, LFOs feature a delay and a fade-in parameter. If you find that something similar would come in handy in the Modular, you'll locate what you need in the patch ›LFODly.‹

- LFO Delay routes a delayed keyboard gate to the LFO Fade In/Out envelope.
- The envelope controls the amount of LFO modulation.

► As you can see, some of the complex results you can achieve with a modular synthesizer are actually pretty easy to come up with. The downside is that this principle also works in reverse; sometimes it takes a lot of effort to achieve fairly simple effects.

 **29** LFO Delay/Fade-In/-Out

Talking about My Generator

The LFO module with the cryptic name ClkRndGen1 is a random generator that produces a new control value for each incoming gate signal. If you're curious as to how this effect sounds when it modulates the filter and the pulse width of the oscillator simultaneously, then check out the patch ›LFORnd.‹

 30 LFO and Random Generator

Talking about My Other Generator

As mentioned above, you can drive the LFO into the audio range by setting the rate parameter to ›Hi.‹ You can use this to generate some truly beautiful effects, or if you care to explore your darker side, some exceptionally ugly stuff as well.

In this patch you will see that an LFO can also be used as a master for an oscillator.

›LFOaudio‹ is a good example. Here the LFO is used as the Master source for the oscillator. This time knob 1 and 2 are your ticket to dementia.

► You're probably wondering why we haven't gotten around to discussing the note generator. Don't worry, we'll cover it in the next chapter on sequencers.

 31 AM Synthesis with an LFO

Envelopes

Envelopes generate shapes that change as a function of time. The Modular has five types of envelopes plus an envelope follower:

- ADSR: This is the standard, gated four stage envelope we all know and love/hate.
- AD: This is a gated or triggered, two stage (attack and decay) envelope.
- MOD: This is the same as the ADSR envelope except that each stage has a ›modulation‹ input.
- AHD: This is a triggered, three stage (attack, hold and decay) envelope with ›modulation‹ inputs for each stage.
- MULTI: This is a gated, five-stage ›breakpoint‹ envelope. Any of the first four stages can be optionally designated as a sustain stage.
- EnvFollower: This module creates an AD control envelope from an audio input. Use it to track the amplitude of an external audio signal or any point in a patch's audio signal path.

► **Note** The difference between triggered and gated envelopes is that triggered envelopes complete their entire cycle after receiving the leading edge of a pulse (i. e. a trigger) while gated envelopes jump immediately to their ›Release‹ stage when they receive the trailing edge of the pulse.

Load and play with patch ›EnvTest‹ to get a feel for each of the envelope types. The changes in pitch are caused by the envelope follower module.

Below, we'll take a closer look at some of the special envelope features:

Modulating Envelope Rates

Of course, you can modulate any of the envelope parameters using MIDI controllers. Although you can assign controllers directly to the envelope parameters, we recommend that you use the morph functions which allow you to:

- control several parameters simultaneously,
- set the modulation range.

You can also modify the rates of the MOD and AHD envelopes based on other parts of the patch by using their modulation inputs. For example, you can use the output of the keyboard module to modulate the decay and release times and the sustain level of acoustic instruments (piano, guitar) on higher pitched notes.

- Load Patch ›EnvKs.‹

32 Key Scaling

Notice as you play up the keyboard that the notes decay faster.

Extending Envelopes

You can set up more complex envelopes by piling them on top of one another—a procedure called cascading. However, the process does take some time and effort to get the timing just right.

The patch ›EnvXtnd‹ cascades two ›Multi‹ envelopes to control the pitch of the whistle (created by passing noise through a resonant band pass filter):

33 Envelope Noise-Whistle

- The ›Keyboard‹ sends a gate to the first envelope (named ›Start‹) and to the pulse delay module named ›Delay.‹
- After the delay time, the pulse delay module sends the gate to the second envelope (named ›End‹).
- Each envelope controls the frequency of the filter (i. e. the pitch of the whistle) while the AHD envelope named ›VolEnv‹ controls the volume contour of the entire sound.

Chord Trigger

No one passed a law that envelopes have to be triggered by a keyboard gate—although this is the most conventional approach. You can also use sequencers, LFOs or any other module capable of generating logic signals.

◆ Load the ›EnvGate‹ patch.

In this patch, you'll see two modules you haven't dealt with yet, the clock generator and event sequencer. The former generates logic signals at each beat and the latter generates a logic signal at each ›On‹ step in its sequence.

The volume envelope is controlled by the keyboard gate in the usual manner. The filter envelope is triggered by the top row of the event generator, the PWM envelope by the bottom row.

◎ **34** Chord Trigger

► Notice that all three AD envelopes are in ›trigger‹ mode. This relieves you from having to sustain the chords—try playing staccato.

Envelope Roller-coaster

You can also use the wavewrapper module in the audio mod group for envelopes. This is another example of tossing the rule book out the window and ›abusing‹ components to come up with some happening results:

◆ Load ›EnvWrap.‹

◎ **35** Envelope Wrapper

Knob 1 controls how often the envelope is wrapped. The effect gets even wilder when you turn up Knob 2 so that the envelope actually modulates the wrapper.

Retrigger

Have a look at the Retrig input on the ADSR envelope. This is a logic input that can be used to restart an envelope while it is already gated on (e. g. in the middle or its cycle). In practical terms, this feature lets you trigger an envelope by another gate source (e. g. an LFO) while you are still holding a key on your keyboard down.

Enough beating around the bush, let's give it a shot and let you find out for yourself.

- Load Patch ›EnvRetrig‹ and play a chord.

You'll notice that the chord repeats in a kind of sloppy arpeggio. The reason for the arpeggiation is that each voice in the chord is retriggered by its own, independent LFO. If you click the Mono button, the LFOs from the different voices become sync'd and the arpeggiation goes away.

Filters

Filters are what put the ›subtract‹ in ›subtractive synthesis.‹ The Modular offers a broad range of filters in four basic categories:

- Static: High, low and multi-mode filters with no control inputs.
- Dynamic: High, low and multi-mode filters with control inputs for frequency and (in one case) resonance.
- Equalization: 14-band, parametric and shelving filters.
- Vocal: Vocoder and vocal formant filters.

Simply play around with the different filter types in the Modular—the standard definitions of filters won't help you a bit when you are trying to figure out how they affect sounds.

Filter effect visualization: check out small graphic at the top right of the filter module.

In ›FilterExp,‹ we've set up a parallel test patch featuring all the filters except the 14-band and the vocoder. Knobs 2 and

3 let you switch between various filters according to the following table:

Filter Selector

Knob 3	Knob 2			
	1	2	3	4
1	Static 6dB Low Pass	Dynamic 12dB Low Pass	Vocal Filter	No Filter
2	Static 6dB High Pass	Dynamic 12dB High Pass	Shelf	No Filter
3	Static 12dB Band Pass	Dynamic 12dB Band Pass	Parametric	No Filter
4	Static 12dB Low Pass	Dynamic 24dB Low Pass	Classic 24dB Low Pass	No Filter

Note The knob values change at approximately the 10, 12 and 2 o'clock positions.

If you just want to dampen the highs of a distortion module, you don't have to ›waste‹ an entire dynamic E filter on it—a simple static filter such as Module A does the trick.

We've set up morphing to let you use a single knob to change the most significant parameters of all the filters simultaneously so that you have an A/B comparison. The knob assignments are:

1	Filter Cutoff
4	Oscillator Waveform
5	Oscillator Pulse Width
6	Filter Resonance
7	Filter Envelope Amount
8	Filter Envelope Attack
9	Filter Envelope Decay
10	Vocal Formant

◎ **36** Nord Lead Filter/ Classic Filter
37 Lowpass—Bandpass—Highpass—Bandstop

► Feel free to experiment with this patch for as long as it takes to get a feel for the many things filters can do. Try out different resonance, slope and filter modes to hear how these parameters affect the sound.

Needless to say, the dynamic and vocal filters are the biggest CPU ›hogs‹ with the Vocoder weighing in at a hefty 49%. At 18% the FilterBank is no lightweight either. As with the oscillators and LFOs, always choose the most economical way to do the job.

Little Detour: Filtering and Delay

Many books can and have been devoted to the subject of filtering but one thing to keep in mind is that there is a strong relationship between delays and filters.

You can get an inkling why by remembering that any complex wave can be analyzed as a sum of sine waves of different frequency, phase and amplitude. Now consider what happens to the individual sine components when you mix a slightly delayed version of the complex wave with the original—some of the sine wave components will be enhanced and others will be attenuated (some to the point of complete cancellation).

For an example load the patch ›FiltDly.‹ The moral of the story is: consider using modulated, cascaded delay lines for unique filtering effects.

Filtering Modulation Signals

It might not be obvious, but you can use filters for more than just conventional audio signals. Modulation signals can also do with some filtering. For instance, you could do wicked things to the sound of an FM or ring modulation before it is patched through the actual modulator.

1 Load ›FiltFM.‹

The signal of the modulator is routed through the filter prior to the audible oscillator (carrier).

38 Filter Sweep and FM

2 Manipulate the filter cutoff with knob 1 to radically alter the FM sound.

3 Change the filter type with knob 2.

4 Increase the filter resonance with knob 3.

5 Increase the filter cutoff envelope amount with knob 4.

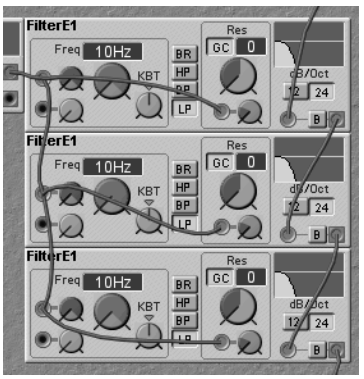
Ultra-fat Filters

You can devise as steep a filter slope as desired by connecting several filters in series and dialing in identical settings. (Bear in mind that the entire slope gets cascaded—this will not produce a ›brick wall‹ filter.) The patch ›Filt72dB‹ features a pre-programmed 72dB lowpass—load and listen, you'll soon hear what we're on about.

39 Ultra-fat Filters

In conventional synthesizers, it's fairly difficult to come up with this type of ›ultra-fat‹ filter.

Three filters in series = pure power!



Setting Up More Complex filters

40 Complex Sound Effects by a Parallel Filter Circuit

To come up with some truly modular sound effects, you can set up a parallel circuit consisting of two, three or even more filters and modulate them each in a different direction using velocity, envelopes or a controller. With this type of setup, phaser, vocoder or formant effects are a piece of cake.

◆ Load ›FiltComp.‹

Try the same thing with different controllers (key scaling, modulation wheel, knobs).

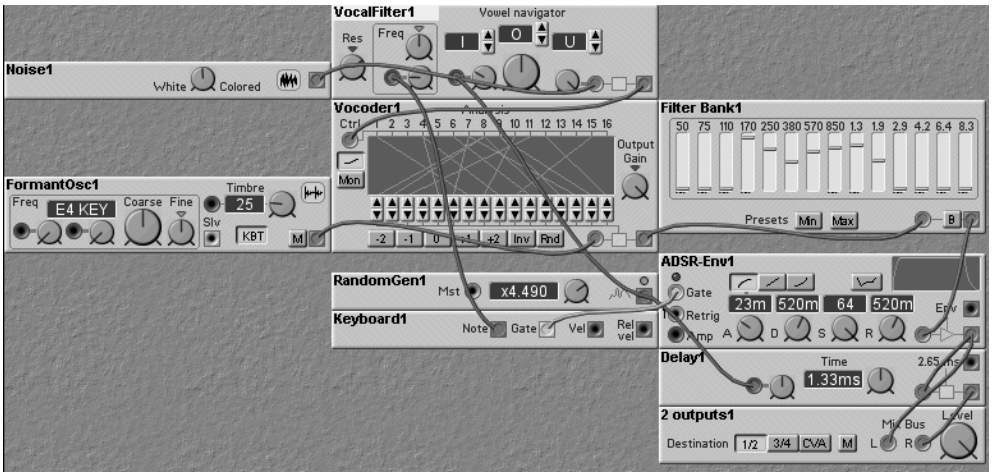
Play this patch dynamically and note how the three filters are modulated independently of one another. Again, morphing is the key—Grp1 is controlled by the Velocity controller. We added a chorus module to thicken up the sound a bit.

Vocalization Filters

For the last patch in the filter section we're going to pull out all the stops and introduce three real gluttons: the Vocoder (49%), the FilterBank (18%) and the VocalFilter (7.6%). Together these weigh in at nearly 75% of the CPU, and though they don't leave much room for other modules, their effect makes up for the difference.

- Load ›FiltVox‹ and play the keyboard.

Knobs 1 to 14 control the fourteen banks of the filter bank and knob 18 sets the timbre of the formant oscillator we're using to generate the ›carrier‹ for the vocoder. The ›program‹ for the vocoder is generated by passing colored noise through a VocalFilter module whose formant is modulated by a random generator. (Notice the delay module which is also modulated by the random generator for depth.)



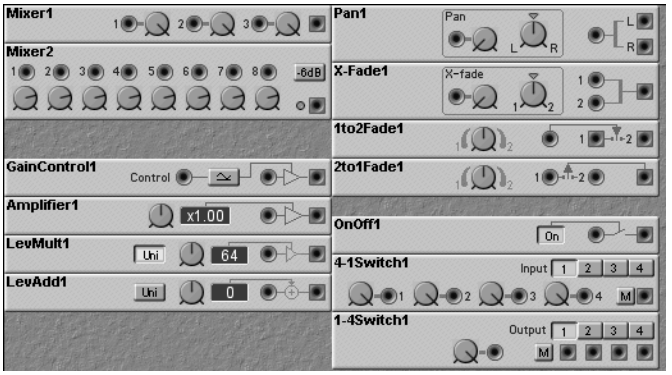
- Play with the buttons at the bottom of the vocoder for radical changes in the vocoding effect.

Saving Memory

Notice from the Toolbar that the PVA and ›∑‹ load indicators are both at 97.6%—each voice is nearly max'd out. In a standard Modular you can have four of these voices with no other slots active.

If you load patch ›FiltVox2‹ you will notice that the two heftiest filter modules have been moved to the CVA. We've had to sacrifice the delay module so the total load is now 93.3% (no great savings). But more importantly, the PVA load has been reduced to 22.7%—this is the amount required for each additional voice after the first. In a standard Modular you can now have eight of these voices or you can use the other slots. The downside is that you don't have separate vocoding of each voice—hold an octave on each patch and you'll hear the difference.

Mixers



This group of modules might better be called ›routers‹ since it includes much more than just mixers. We'll only briefly touch on several of the modules here, since in the previous patch examples you've used these components often enough. Here are a few helpful insights on the mixer modules:

3- and 8-Inputs Mixers

The difference between the 3-inputs mixer and the 8-inputs mixer—except for the number of inputs they offer—is the amount of DSP power they consume. They're designed for audio signals, so they don't settle for snacks. For control signals, the control mod section features a 2-input control mixer which is the advisable alternative for these types of signals. However, if you want to mix more than two control signals you should use one of the audio mixers to reduce the profusion of cables.

Gain Control

This module is already integrated into the envelopes. You only need the gain controller when you want to control an audio signal with something other than an envelope (velocity, LFO, gate). For example, you can create a simple organ envelope without an envelope module by connecting the gain controller directly to the gate output.

You can also use the gain control for amplitude modulation effects although the RingMod module gives more flexibility (at higher cost).

► Keep in mind that the gain control module only reduces the amplitude of the signal—when you need to boost a signal, use the amplifier module.

Level Multiplier and Level Adder

Like the gain control, the level multiplier is used to attenuate an audio signal, but it is not remote controllable. In ›bipolar‹ mode, negative values invert the signals phase.

The level adder adds/removes a DC offset to an audio signal.

X-Fade/Pan

Although it might not be apparent at first glance, the X-fade module routes two signals to a single output and the pan module routes one signal to two outputs.

The X-fade module is a good alternative to a mixer when you want to mix two audio signals (e. g. oscillators). We recommend that you use it because it lets you determine the mix by a single knob so you don't have to deal with a morph group.

The two Fade modules behave differently than the X-fade module. For these modules, the center (12 o'clock) position is full off, and moving the knob to either side fades in the corresponding input/output. They are also not remote-controllable. Think of them as switches with a pot added.

Switch Modules

You can assign the buttons or button bar of a switch module to a knob or MIDI controller and thus switch from two to four steps. Simply click on the button bar by the right mouse button.

You can use the on/off module to cut off a connection between two components. For example, say you want to use oscillator sync. Drag the cable from the sync oscillator to the slave by one of these buttons.

Normally you'll use the 4-1 switch to select modulation sources. For instance, you could patch this module into the oscillator pitch input and switch between the LFO, envelope, random module and velocity.

The 1-4 switch offers a special feature: it can be controlled by a modulation source. The best example of this type of application is a velocity switch. Simply route velocity to the modulation input, four different sounds to the audio inputs and switch between these by playing a key at different velocities.

Amplifier

Unlike the gain control, the amplifier module can be used to both boost and attenuate signals. This can be especially useful when processing incoming audio.

In/Out

You are already familiar with the In/Out group's keyboard module from some of the earlier examples. We'll discuss MIDI global, audio input, poly area in, morph, key splitter and note detector modules in the next chapter, for now we'll concentrate on a few handy tips concerning output module (1, 2, 4) assignments.

You should use ›1 Output‹ when you

- want to output several patches simultaneously,
- have connected the Modular to four mono busses, or
- want to control the volume of each channel in a stereo patch individually. In this case, use two of these modules and select Outputs 1 and 2 or 3 and 4, respectively.

You can route several output modules to a single output and thus ›abuse‹ the outputs as a mixer.

›2 Outputs‹ is designed for stereo patches. If you connected the Modular in stereo, you can also use this module for mono patches, but be sure you connect the two channels, otherwise the signal is only routed to one side.

You should only use ›4 Outputs‹ when you want to output and mix several parts of a patch separately.

Audio Mod

Here is the chapter's tongue twister: the audio modulator modules in the Modular are basically what a guitar player calls stomp boxes, i. e. little effects devices. You'll find a bunch of neat stuff here such as distortion, chorus and delay, plus a few more unusual treats like a bit quantizer and sample & hold.

Clip/Overdrive/WaveWrapper

Please keep in mind that you can patch in these types of effects at any point—for instance prior to an FM input or a control circuit.

For an in-depth technical explanation of these modules, please consult the manual. We'll skip the how's and why's and concentrate on what they actually do to a sound—basically they all distort it, but to a different degree and with different tonal characteristics.

- Load ›Audio3Fx.‹

Use Knob 1 to switch between the three effects named clip, overdrive and wavewrapper and—for a quick A/B/C comparison—use Knob 2 to determine the degree of modulation for all three effects simultaneously.

Notice that we've started with a sine wave, so that you can hear how overtones are added to the spectrum by each effect.

41 Clip, Overdrive, WaveWrapper

You will hear that the three effects become more prominent as you move from the top to the bottom. The wavewrapper manipulates the signal beyond what you would normally consider distortion and generates its own harmonics within the sound.

Quantizer, Diode and Digitizer

These three modules produce digital ›distortion‹ effects and hence are not normally associated with modular synthesizers. The quantizer scales the level—not the time axis—of the input signal in increments that increase as the bit number decreases. The diode either throws away the negative part of the waveform (i. e. all negative samples) or flips it positive. The digitizer is a combination of quantizer and downsampler—it resamples the incoming wave at the chosen sampling rate and bit resolution. (With a high sampling rate, its effect is nearly identical to the quantizer.) You can use any of these effects on control signals as well as audio.

- Load the ›AudioDIGI‹-Patch.

Use knob 1 to switch between the three effects. Knob 2 sets the bit quantizer's bit rate, knob 3 selects the diode mode and knobs 4 and 5 set the digitizer's sampling and bit rates, respectively. The input waveshape is a sine wave, so you can hear the effects in the form of overtones.

The chart below shows the number of steps at different bit resolutions for the quantizer and digitizer bit rate settings:


42 Bit Quantizer—Off, 11, 9, 7, 5 Bits

Bit		Steps	Bit		Steps	Bit		Steps
1	On/Off	2	7	MIDI	128	13		8,192
2		4	8		256	14		16,384
3		8	9		512	15		32,768
4		16	10		1,024	16		65,536
5		32	11		2,048	20		1,048,576
6		64	12		4,096	24	Modular	16,777,216

Delay

The delay module has a maximum delay time of 2.65ms. So it isn't very useful in the standard sense, but as mentioned above in the section on filters, mixing various delays with the original signal results in all kinds of harmonic cancellations. Since it does feature a modulation input, it's a great tool for creating all types of flanging and chorus effects. More on this topic in Chapter 10. For standard delay effects, we suggest using one of the many available outboard effects units.

► Although you can't get audio delays in the range suitable for echo and reverb effects, you can simulate many of these effects using logic delays. (See the ›Logic‹ section starting on page 90.)

Sample & Hold

This classic synthesizer module samples its input when it receives a logic signal and holds this value until it receives the next logic signal.

Typically the input of a sample & hold module is connected to the noise source and generates a random sequence which

is usually applied to oscillator pitch. (In the old days when oscillators weren't exactly stable, the result was often called ›sample & drift.‹) Of course you don't need to restrict yourself to noise input—interesting arpeggio-like effects can be achieved using other waveform inputs.

43 Classic Sample & Hold

◆ Load ›AudioSnH.‹

This patch has four modes selected by knob 4. It illustrates two modules: sample & hold (modes 1 and 2) and the note quantizer (modes 3 and 4) which can function like a sample & hold with some added features. Modes 1 and 3 use a noise source and modes 2 and 4 use an LFO. Use knobs 5 and 6 to control the LFO's rate and waveform—this is how you create interesting patterns. Notice that the clock rate control (knob 2) is what controls the speed of the pattern. Also note that a percussion oscillator has been used in this patch—this oscillator has a built-in envelope module so no separate envelope is required.

► This patch is decidedly polyphonic—why? (Hint: in mode 2 or 4, click the LFO's mono button.)

Stereo Chorus and Phaser

The chorus module is much more than just a simple chorus. You might call it a symphonic effect—it really thickens up the sound and spreads some ›seriously sweet stereo.‹ But, you will have to pay a fairly high price in terms of power consumption, so using it in the ›Common Voice Area‹ is highly recommended.

◆ Load ›AudioCho.‹

44 Chorus Ensemble

This patch demonstrates how you can whip a convincing string section into shape using just five modules. This version conserves DSP power (20.4%), which is substantially less than a stereo chorus with two delay lines would require.

Note that the chorus module automatically controls phase shifting between the left and right channels.

The phaser module is a mono effect useful for all kinds of phasing and flanging effects. Like the chorus module, it is fairly expensive and preferably used in the CVA.

◆ Load ›AudioPha.‹

This is another five module patch that shows what you can do with a basic waveform and a little phasing. (The phaser replaces the chorus in the previous patch.) Play with the knobs 1 through 6 which are all devoted to the phaser's controls to get a feeling for what this module can accomplish.

Signal Shaper and Inverter/Shifter

You've probably encountered velocity curves in conventional synthesizers. The signal shaper does basically the same thing, except that it operates at the audio sampling rate (96kHz) and is therefore appropriate for audio as well as control signals.

This module ›bends‹ the input signal using one of the five available curves.

◆ Load ›AudioSSh.‹

You can see that velocity is routed directly from the keyboard module to the first signal shaper. Here you can use a curve to bend it—use Knob 1 to select a curve.

► Play on your keyboard while varying your attack and note how the velocity curve influences the response.

The second shaper is used to shape the oscillator's output—with the various waveforms, use knob 2 to select the shape.

The inverter/level shifter will invert the polarity of an audio signal and optionally shift its level into the positive range. (I. e. it will convert a bipolar signal into a positive or negative unipolar signal.) Although you can also use this

module with control signals, the control signal mixer module will also invert control signals and at a lower cost.

◆ Load ›AudioInv.‹

Here two sync'd oscillators are crossfaded while one of their signals is inverted. Careful adjustment of the crossfade amount (knob 1) will cause the second oscillator harmonics (knob 2) to be cancelled from the first oscillator's output.

Compressor/Expander

The compressor and expander modules operate exactly like outboard audio compressors and expanders with which you are no doubt familiar. In the next section, we'll see how to use the expander as a noise gate.

Ring Modulator

The ring modulator actually provides a continuous crossfade from no modulation through amplitude modulation (AM) to ring modulation. Without going into the details, ring modulation differs from AM in suppressing the carrier.

◆ Load ›AudioRngMod.‹

Knob 1 (assigned to Morph Group 1) switches between three effects: the ring modulator, AM using an oscillator's AM input and FM using an oscillator's FMA input. (Notice that FM produces many more ›sidebands‹ than AM and ring modulation which only produce two sidebands for each sine wave component.)

If you're wondering why you need a ring modulator when you have the oscillator's AM input, the thing to remember is that the ring modulator can have anything as a carrier input—e.g. external audio.

Knob 2 (assigned to Morph Group 2) controls two things: the AM to RM crossfade of the ring modulator and a level shifter inserted in the AM patch. A more technical way of describing the difference between ring and amplitude modulation is that in ring mod, the modulator is ›bipolar‹ while in AM it is ›unipolar.‹ Twiddle knob 2 with knob 1 in the ring mod position (full left) and the AM position (center)—in the

ring mod position you will hear the sound morph between RM and AM, but in the AM position you will simply hear it switch between the two.

Knob 3 sets the pitch of the modulating oscillator. This determines the frequency of the two sidebands—i. e. their distance from the carrier (measured in Hertz).

Control Modifiers

The modules in the control modifier section do not use audio quality and are designed primarily to manipulate or generate controller signals. (Recall that the control sampling rate is 24kHz while the audio sampling rate is 96kHz.)

Constant

The constant module is perhaps too obvious for words, but note that it takes 0.0% CPU time (i. e. it is free) and that if you need a knob to control some parameter with a modulation input but no knob of its own (OscB's pulse width, for example)—the constant module will do the job.

► Don't forget you can scale and quantize the output of the constant using the control mixer and note quantizer. This allows you to make a wide variety of ›custom‹ knobs.

Smooth

This module smoothes out rapid changes in control signals—it's kind of like a control signal ›portamento.‹ You might use it, for example, when deriving a trigger or gate signal from the signal peaks of an external and therefore hardly predictable audio signal.

Portamenti

There are two portamento modules with slightly different purposes. ›PortamentoA‹ is turned on/off by a logic signal at its ›On‹ input while ›PortamentoB‹ is turned off/on by a logic signal at its ›Jump‹ input.

◆ Load ›Porta.‹

Knob 1 switches portamento on/off and also switches between two portamento effects—normal portamento and ›legato‹ portamento. Normal portamento is turned on when the knob passes the half-way position—legato portamento is turned on when the knob passes the three-quarters position. Legato portamento operates only while some note is being held—when notes are played staccato, no portamento occurs.

► Notice that the on/off switch has no input—when used in this way the output switches between 0 and 64.

► The KeyboardPatch module is used to gate the PortamentoB module. This gate output stays high as long as any notes are being held and falls to zero when all are released. Each leading edge (i.e. transition from low to hi) causes PortamentoB to jump to the current input control value.

Control Mixer

Although you can use mixers from the Mixer section to mix control signals, this module is much cheaper and adds a few control-specific twists including inversion and linear/exponential options.

Note Scaler, Note Quantizer and Partial Generator

These modules all affect control inputs related to notes and are primarily intended for pitch processing.

45 NoteScaler with LFO

The NoteScaler module scales the incoming control signals so that its total range is equivalent to the number of preset semi-notes.

Use the note quantizer whenever you want to use a modulation signal to generate notes.

46 NoteQuantizer

The NoteQuant module is in a sense the opposite of the note scaler—it spreads incoming control signals out to specific note intervals. The note interval is set with the Notes buttons. The Range setting works exactly like the note scaler. In fact, if you set the note interval to ›Off‹ the note quantizer acts exactly like the note scaler (but it's more expensive so use the note scaler when it will do the job).

The Partial generator is kind of like the note quantizer except it quantizes the incoming control signal to values which produce partials of the fundamental pitch (i. e. 12, 19, 24, 28, etc. semitones).

◆ Load ›CtrlNotes.‹

Knob 1 chooses the input: constant (use the knob), keyboard or a sawtooth LFO. (Note the inverter/shifter after the LFO.) Knob 4 controls the output: note scaler, note quantizer, partial generator or raw input.

Key Quantizer

The KeyQuant module is a basic scale corrector—it quantizes incoming control values (typically notes) to the ›pitch classes‹ chosen using its buttons.

The Range setting scales the incoming control voltages as with the note scaler module—use it to reduce the octave range of the output. The Cont button determines whether notes are corrected to the nearest allowed note (button out) or are allocated in equal intervals across the scale (button in).

► This module is great for forcing random patterns (e. g. from a sample & hold module) into a particular key.

Note/Velocity Scaler

While less than intuitive, this module can produce very interesting results. It is intended for velocity processing, but it can be used in many contexts.

The BrkPnt setting determines the note number (a.k.a. controller value) at the Note input where the velocity scaling will change slope. The Vel Sens control sets how much the Vel input affects the output.

- Load ›KqNVs‹ for a very non-standard application of these modules.

Logic Modules

This module group is designed to manipulate and generate logic signals, in other words, for everything that starts something else or switches it on or off remotely.

The only thing that differentiates a logic signal from a control signal is that it has two values: ›On‹ and ›Off.‹ In Nordspeak, On is 64 and Off is 0. You can use logic signals for control (blue) inputs when convenient and you can use other control signals for logic (yellow) inputs, though in the latter case you may be surprised at the results—a logic input will recognize any positive value as On but it will not recognize another positive value as another On until it has seen a value of zero or below.

In the descriptions to follow we'll use the term ›positive edge‹ to describe any signal changing from a value ≤0 to a positive value. We'll use the term ›negative edge‹ for a signal which changes from a positive value to a value ≤0.

Pulse

This module sends out a pulse of fixed duration (set by the knob) whenever it receives a positive edge. You can use this to generate fixed length gates from controller generators like LFOs and envelopes as well as other from logic signals like triggers.

1 Load ›GTrgPls.‹

2 Briefly tap one of the keys on your keyboard and keep an eye on the green gate LED on the ADSR module.

The pulse module extends the brief impulse to a length of 1.6 seconds.

3 Press and hold another key.

Here the gate is also 1.6 seconds regardless of how long you keep the key depressed.

In this case, the duration of the impulse at the input of the pulse module is irrelevant—the length of the pulse is always the same when it comes out of the other end of the module.

4 Press the key twice in rapid succession.

Only one note is generated—the pulse module must close the gate before it is ready to accept another input signal.

► You can of course use the pulse module to generate square impulses from continuous modulations. Try replacing the keyboard module with a sine LFO.

Pulse Delay Modules

There are actually three modules in this category: positive edge delay, negative edge delay and logic delay. These modules do exactly what their name says, they delay one or both edges of a logic signal.

When you delay the positive edge, you make the gate shorter, but what happens if you delay it longer than the gate time? In this case nothing happens—the pulse is lost. When you delay the negative edge you make the gate longer. When

you delay the entire pulse (logic delay) the gate time doesn't change, the pulse just starts and ends later.

Logic Process and Logic Invert Modules

These modules are a little treat for the computer freaks among us—they apply a little logic to logic signals, combining them to create complex logical processes. Ok, what does that mean? The logic invert module sends out a positive edge when it sees a negative edge and vica versa. You could use it with a pulse LFO to alternately gate separate envelopes, for example. The logic process module combines two logic inputs using the ›logical operations‹ of AND, OR and XOR (which stands for ›exclusive or‹ and means ›at least one but not both‹).

- Load ›GTrgLog.‹

This patch uses two pulse wave LFOs, a logic inverter and a logic processor to gate three oscillator envelopes. The top oscillator's envelope is gated directly by the pulse LFO. The second oscillator's envelope is gated by the inverted pulse from this same LFO—i. e. these two oscillators alternate producing the typical police horn pattern. The pings are produced by the percussion oscillator at the bottom. (Remember this oscillator has its own built-in envelope.) A second pulse LFO is combined with the output of the first using the logic processor. Knob 1 changes between the AND, OR and XOR processes—listen to the ping pattern and see if you can figure out what is going on.

Compare Modules

There are two compare modules: one for comparing an input (labeled ›A‹) with a constant set with the module's knob and the other to compare two inputs (labeled ›A‹ and ›B‹). The modules generate a positive edge (i. e. a ›gate on‹) when input A is greater than or equal to the compared value (con-

stant or input B). They generate a negative edge (i.e. a ›gate off‹) when input A falls below the compared value. Here's a little spot quiz to test your logical reasoning faculties:

- Load ›GTrgComp.‹

The patch generates the sound automatically, but knob 18 mutes (up) and unmutes (down) the output. Three drum-sound oscillators play kick, tom and clap sounds. LFOs and compare modules control the pattern. See if you can figure out the logic behind the patterns. Note that a footswitch patched into the Modular's Sustain Pedal jack can be used to change the pattern by resetting the master LFO.

47 Compare Generated Drum Patterns

Summary

You've now had a look at all the module groups except the Sequencer group which we'll examine in detail in the next section. This might be a good time to spend some time experimenting on your own—building some patches with the modules discussed in this section.

In the next chapter we'll look at some of the more advanced features of the Modular.

6 Advanced Features

Now that you've had a good long look at the modules, in this chapter we'll turn our attention to some of the more hard-core stuff: morphing, drumkits, audio in and sequencing.

These are all functions that you probably won't need when you begin exploring the Modular. You might even be a little dubious about trying them out—and if so, your wariness is entirely understandable. After all, there aren't too many among us who can program a morph or construct a sequencer from scratch at the drop of a hat.

This chapter is designed to make it easy for you to learn the hard stuff. Of all the fun you can have with the Modular, the advanced functions might give you the biggest kick. Besides, here's your chance to prove that—in terms of creativity—you and your Modular can put the average synth to shame.

Morphing

The morph function—did we mention this already?—is one of the coolest features that the Modular has to offer and one that owners of conventional modular systems can only dream of.

As you are no doubt aware, ›morphing‹ means going smoothly from one sound to another. In the case of the Modular it means going from one group of control settings to another. Each Modular patch can have four separate morphs and each morph can affect up to 25 separate controls.

► **Note** A total of 25 controls can be assigned to morphs—you can assign these all to one morph knob or spread over several, but there is an absolute limit of 25.

1 Load ›MorphSyn‹ and rotate knob 1 fully counterclockwise.

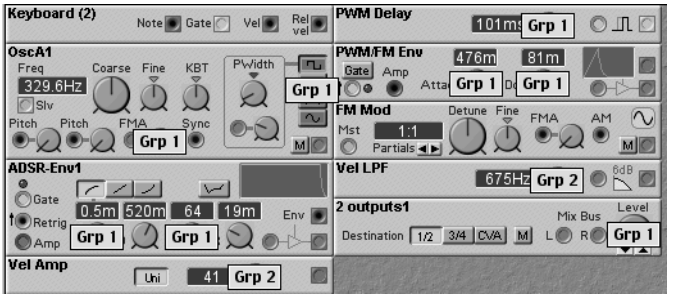
2 Play a tune or two using this sound and focus on the timbre of the sound.

3 Rotate Knob 1 clockwise as far as it will go.

4 Notice any change in sounds?

◎ **48** Morphing from Clav to Rhodes

This example was designed to show you that the morph function can have a devastating effect in even the simplest of patches—with just one knob, you can turn a clavinet into a rhodes with a variety of stops inbetween. When you rotated Knob 1, you were actually changing eight parameters, each in different directions and by a different value.



The affected parameters are all labeled ›Grp 1‹ in the illustration. In the editor, they are also red. You can ›morph‹ these controls on-screen by moving the red morph knob with the mouse and/or you can assign a MIDI controller or Modular front-panel knob to the morph. (We've assigned both knob 1 and the mod wheel to it.)

► You can view temporary labels of the morph-group assignments by holding F7 on your computer keyboard.

Viewing and Changing Morph Ranges

You can see the range of a knob assigned to a morph by mousing over it (no need to click). When you move the knob, you change the beginning and end of the range simultaneously (i. e. the size of the range stays fixed until you top or bottom out). If you hold ctrl (⌘ on the Macintosh) and move the knob, only the top (right indicator) of the range will change. So, mouse the knob to set the start then ctrl/⌥-mouse the knob to set the end.

Morph Groups

You can see that there are actually four separate groups—red, green, blue and yellow—each with a dedicated controller.

- Fiddle with velocity a bit—the sound becomes louder and quieter, brighter and darker.

View the green morph group (labled ›Grp 2‹ in the illustration). You'll see which parameters are responsible for these effects.

Here are a few morphing tips:

- Use a morph when you want to control *several* parameters by a *single* knob or MIDI controller.
- You can morph almost any control on any module (there are a few exceptions like the partials on slave oscillators). The 1-4 switch (velocity switch), oscillator waveshape switches and filter modes switches are especially intriguing candidates for morphing.
- You don't have to assign a controller to a morph, you can also control the morph by its knob in the Toolbar. This is more practical when you're programming patches because you can try out the morph with specific values before you activate velocity or aftertouch.

- Use the morphs sparingly, the number of available morphs is limited—sooner or later you'll be screaming for that fifth morph group or 26th morph assignment.

Morphing Single Knobs

Assigning a parameter directly to a knob can have a major disadvantage: the knob covers the entire value range of the parameter. This can be a pain when you're dealing with waveshape or filter mode switches because they have an Off position. With morphs, you can limit the value range of a knob or switch. The downside is that you have to sacrifice an entire morph group.

The Easiest Method of Programming Morphs

There are two ways to assign a module control to a morph group: you can right-mouse the control and select the group from the Morph pop-up menu or you can double-click the control while the desired morph group knob is selected. One of the four morph group knobs is always selected—it's the one with the blue box around it.

Two values are saved in the Modular for each morph—the start and end values.

As mentioned above, once you've assigned a control to a morph, any change you make in the control changes both the beginning and end of the morph range. To change just the end of the morph range, mouse the control while holding ctrl (⌥ on the Macintosh).

► Keep in mind that the end of the range can be either above or below the beginning—i.e. you can morph controls in opposite directions.

Morphing from Sound to Sound

As demonstrated by our little morph synth, you can morph from one sound to a completely different one. Here's the easiest method of programming this type of patch:

1. Set up the sound you want to start with.
2. Turn the morph group knob all the way up.

3 Now select the parameters that you want the morph function to influence.

4 Set the morph end value. The morph knob is turned all the way up so you can hear the effect immediately.

5 If you are satisfied with the results, turn the knob down again and assign a controller to the morph group.

Morphing and Velocity

Morphing is by far the most effective method of adding velocity to a patch. Not only does it reduce the number of cables, mixers and controls you have to deal with, it also lets you ›precision-program‹ the influence of velocity.

Here are a couple of tips:

- Always use morphs to control velocity, preferably make it a habit to use Morph Group 1 for this purpose.
- Use the direct velocity output of the keyboard module only when you need to shape the velocity curve (with the control shaper module) or when you have used up all of the morph modules.

Controlling and Switching Morphs

You can use any MIDI controller, aftertouch and—as discussed above—velocity as morph controllers. For functions that cannot be addressed by a switching module—for instance two pre-programmed tempos or sound settings—use switch controllers such as soft pedal or portamento to switch back and forth from one operating status to another by morph.

► In the ›MorphSyn‹ patch, replace velocity with a succession of other controllers and spend some time trying them out.

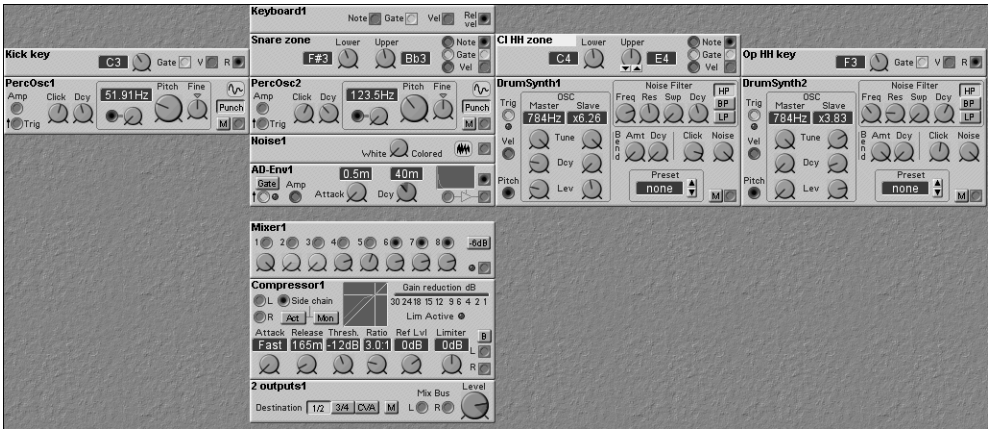
Programming Drumkits

You may recall that we postponed discussing the percussion oscillator, drum synth, note detector and keyboard splitter in the chapter on modules. We will take an in-depth look at them in this section.

These four modules are ideal for programming ›real‹ analog drumkits:

- The note detector is a note filter that allows just a single note to pass. It lets you assign the kick drum to C3 and the open hihat to D3 for example.
- The keyboard splitter allows a range of notes to pass. It lets you assign the snare to F#3 through A#3 and the closed hihat to C4 through E4 for example.
- The percussion oscillator and drum synth are both sound sources optimized for producing drum sounds.

- Load the ›Drumkit‹ patch.



In this patch, you can see that four components of a drumkit are arranged side by side: kick, snare, closed hihat and open hihat, playable by the keys C3, F#3 to A#3, C4 to E4 and F3, respectively. On the Modular keyboard, you'll find these keys

in two octaves with the Oct Shift in the center (default) position. Of course no electronic drumkit is worth its salt without a compressor, so we've added one at the bottom.

To make this kit as playable as possible, we've set up the first four columns of knobs to control the kick, snare, closed hihat and open hihat, in that order. The top knobs control volume, the middle ones are for pitch and the bottom ones affect some aspect of timbre. Knobs 14 and 17 control the compressor's threshold and compression, respectively.

Note Detector and Keyboard Splitter

Note detectors are used for the kick and open hihat sounds. They send out gate and velocity signals when a note matching their setting comes from the Modular's keyboard or MIDI input. If you want to set up a sizable drum map, you'll need a note detector for each note, but since they use 0.0% DSP your real problem will be with the other modules for each voice.

Note splitters are used for the snare and closed hihat sounds. Although these use a little DSP, they are the best way to assign key zones which make two-finger rolls easier—typically you'd want this with a closed hat and snare.

The Sounds

We used several methods to get the percussion sounds. The kick drum uses a single percussion oscillator which provides its own amplitude envelope (decay only) as well as adding click and punch elements to the basic sine wave produced by the oscillator. The snare sound also uses a percussion oscillator with enveloped noise added for the rattle of the snares. Both the hihats use drum synth modules. At 12% DSP these are expensive but still the most economical way to get convincing cymbal sounds. The drum synth module comes with thirty presets covering kick, snare, cymbal and percussion sounds. These make a good starting point from which to tweak that perfect drum sound. They combine two sine wave

oscillators, noise and click generators with enveloped filters and pitch bend envelopes—quite a lot in a small package.

Velocity

Without velocity, you'll have a hard time playing a drumkit—unless you prefer MIDI controller programming. Here we've used our SOP, velocity is programmed to Morph Group 1 for volume, but added velocity cables from the individual keys and zones for added effect with each sound:

- Kick: percussion oscillator envelope amplitude
- Snare: percussion oscillator and noise envelope amplitudes
- HiHats: drum synth velocity input

49 Drumkit

The Modular as a High-end Signal Processor

Like every true modular synthesizer, the Modular is equipped with an audio input. You can use this input to route external audio sources such as other keyboards, a mixing desk, effects sends, CD player and even the Modular's outputs into the Modular and pipe their respective signals through other modules (typically filters and audio effects).

What at first may look like a novelty is actually an ingenious feature: it lets you use the Modular as a high-end signal processor. If you spend any time at all in a studio, you'll find the conventional effects and the really bizarre stuff that the Modular delivers are not only a great recording tool, but can also be an inspiration when you're stuck for ideas.

The Modular's signal processor ›personality‹ wears a lot of hats: compressor, noise gate, mix automation, chorus, Leslie effects and so forth. All you have to do is route it into the

appropriate channel by an insert or aux circuit just as you would any other signal processor.

A Two-in-One Device

For example, you could reserve Modular Outputs 3 and 4 and Slot 4 for audio effects (this is not possible on the Micro-Modular). You still have the rest of the slots and all voices save one at your disposal. In other words, you can simultaneously use the Modular as a synthesizer *and* a signal processor.

Things start to get wild when you control effects by MIDI tracks, MIDI clock or controllers and use these to rhythmically ›chop up‹ drumloops, vocals and strings, apply synchronized flanging or automatically fade them in.

Activating Audio In

Simply drop the AudioIn module into the patch and connect the requisite cables as you would for any other module. The input is not variable, so we recommend that you slap an amplifier module on each output of the audio module. You can of course use it for two mono signals—you can even route the two inputs to two separate patches or ›bend‹ a stereo signal by four patches.

Ensure that you always use just one voice for patches with an audio-in feed, otherwise the audio-in signal is duplicated and the signal will suffer phase cancellations.

Tacking on Audio Tracks

The Modular is a great medium for manipulating and reversing drumloops for backward effects. Combined with an audio sequencer (e. g. Logic Audio, Cubase Audio/VST), you have an unbeatable system: you can cut, loop and invert drumloops in the sequencer and manipulate them further in the Modular by filtering, gating or delay effects.

Both systems operate in perfect sync by MIDI clock and note events. For instance, you can run an audio track in the audio sequencer and a MIDI track in parallel and use the lat-

ter to trigger the Modular envelopes or manipulate sound-shaping elements by MIDI controller.

If you don't own an audio sequencer but you do have a sampler, you can control the sampler and the Modular by MIDI. Even with just a sampler, you have more sound manipulation options than Bill Gates has Deutsch Marks. The only limitation: the Modular processes signals routed into its audio input monophonically, i. e. if you send a grand piano sound from your sampler to the Modular, rather than one filter per voice, you only have a maximum of two for the stereo signal.

Stereo Multi-effects Device

With two separate inputs and four outputs, the Modular can emulate two MIDI as well as real-time-controllable stereo effects devices simultaneously. You'll have to agree that this facility is a blast when compared to conventional peripheral devices!

◆ Load ›StMFX.‹

In this patch, the left signal circuit has an auto-wah configuration. Pipe a guitar or vocal track through this input and make that baby cry.

50 WahWah/Chorus with Drumloop Input Signal

For the stereo chorus, we used the right audio in as the mono send and outputs 1/2 as the stereo outs.

Leslie

◆ Load ›StLeslie.‹

Sounds fairly decent, doesn't it? Unless you happen to be an electronic engineer with your own design workshop, this is presumably the first effects device you can custom-build from scratch. The Leslie you're hearing is discussed in section ›Leslie‹ on page 130. It is one of the main features used for Hammond simulations. In this patch, we simply jettisoned the sound-generating section and dropped in an

AudioIn module instead. Use the soft pedal (MIDI controller #67) to turn it on/off and use an expression pedal (MIDI controller #11) to set the maximum rotation speed!!

Noise Gate

We briefly touched on the compressor and expander modules in the last section. The expander features a gate mode which makes it perfect as a noise gate.

◆ Load ›NoizGato.‹

51 Cat in the Wind

Typically you would use a noise gate on an external audio signal, so we've put it in the Common Voice Area of the patch and included an unused audio input module for your convenience. In order to demonstrate the patch, we've created our own noisy signal in the PVA—you might think of it as a cat caught in a windstorm. The idea, of course, is to gate out the wind while keeping the cat. There's nothing we can do about the noise when the cat is ›speaking,‹ but we can get rid of it the rest of the time.

Use the top row knobs as indicated in the table to control the noise gating. Without pressing any keys on the Modular keyboard, tweak knob 1 until the noise just disappears. Then play any note (pitch doesn't matter) and you'll hear the cat. Notice the effect of turning the threshold up higher. Now play with the other top row knobs to see their effect.

Knob	Parameter
1	Threshold
4	Attack Time
7	Hold Time
10	Decay Time

Gater

◆ Load ›StSequ.‹

You can rhythmically ›chop up‹ an external audio signal in the Modular, create stereo panning and generate backwards effects.

► We used an internal clock generator for this patch. We'll show you how to synchronize it to MIDI clock in the following section on sequencers.

52 Trigger Signal

In this example, the stereo input signal is routed by two separate channels. Each signal runs through an ADSR envelope. Each envelope is triggered by a dedicated row of event sequencers. This type of setup is great for ping-pong effects galore!

► Notice that the top row knobs control both envelopes' ADSR parameters using the four morphs.

As above, we've put this effects processer entirely in the CVA so you can use it as-is with an external audio signal or copy/build a patch in the PVA and process that.

Building and Programming Sequencers

The Modular doesn't absolutely require a keyboard or other external controller. It is equipped with a series of sequencer modules so you can run the Modular autonomously. You can link up to four sequencers with a maximum of sixteen steps each and use the setup to generate complex melodic/rhythmic structures.

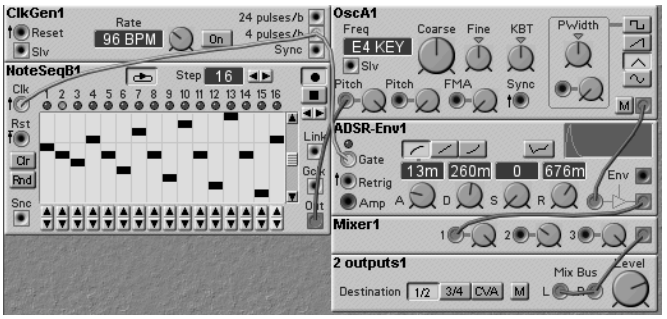
Having said this, the Modular doesn't feature a one-stop ready-made sequencer shop, you have to build your own module consisting of at least two components:

- Clock generator—This can be a standard clock generator, an LFO, keyboard gate or external MIDI clock.
- One of the four sequencer modules—an event sequencer for either triggers or gates (rhythm), a control sequencer for controller values (e. g. timbre) or a note sequencer for tempered controller signals (note).

We'll run through the entire process step by step. Even if you've already dealt with these sequencers, you should nevertheless take the time to work your way systematically through these steps at least once. It certainly won't do any harm.

Simple Sequencer

The most basic sequencer that is capable of playing notes looks something like the one in the patch ›SeqSimpl.‹ Go ahead and load it.



The clock generator delivers a trigger signal. It switches the sequencer to the next step and simultaneously triggers the ADSR envelope.

Knob 1 controls the clock generator's On/Off button. Although this feature doesn't seem significant, in less than a minute you'll gratefully use it to kill this annoying patch.

◎ **53** Minimal Sequencer

Programming Sequences

You can enter the desired sequence of notes by mouse, MIDI keyboard or Modular panel. Our tip:

The Modular is the way to go. Use the cursor button to move the cursor to the first step, turn the value knob to determine the pitch, move to the next step by the cursor and so forth. You can let the sequencer run while you're performing these rather rudimentary programming gymnastics.

This is a great method when you're creating e-music or techno styles. Since you're entering everything step by step without actually playing, you won't find yourself falling back on old habits and reeling off standard lines.

Recording Sequences

If you find a particularly compelling melody has just popped into your head and you want to get it ›in the box‹ as soon as possible, you can play it in the conventional manner and record it.

In the upper right corner are four buttons. From top to bottom they are: Record, Run/Stop and Step-forward/Step-back. When the record button is on (pressed in), each incoming note will set one sequencer step and advance to the next. The arrow buttons at the bottom allow you to move forward and back through the sequence steps. The run/stop starts and stops the sequencer when it is receiving clock pulses but *it does not affect the record position,* so you can hear the sequence play while entering notes step by step from the keyboard. (This option is probably more ›creative‹ than helpful.)

Building a Recording Monitor

The sequencer doesn't route the notes that you're playing through. So if you want to hear what you are playing, you have to first disconnect the gate cable from the output of the clock generator and re-connect it to the output of the keyboard patch.

1. Load ›SeqRec.‹ Everything you need is pre-programmed; the sequencer is ready to record.
2. Use Knobs 3 and 6 to reset the sequencer by turning both knobs counterclockwise then clockwise.
3. Turn knob 4 fully up (clockwise).
4. Play in the desired sequence (up to sixteen notes).
5. Make sure the Steps setting matches the number of notes you played.
6. Turn knob 4 fully down and turn knob 1 up to play the sequence.
7. Repeat from step 2 as necessary.

Creating Rhythmic Structures

If you want to add note lengths and/or pauses to your sequences, you have to drop an event sequencer into your setup. It triggers only the note positions that you activate. Every event sequencer features two rows so that you can trigger two events separately, for instance the sequence clock and the ADSR gate as in this example.

- Load ›SeqRy.‹ Same stuff as ›SeqSimpl‹ plus event module.

This shouldn't need further explanation, but there is one important feature that you should know about; it is used to generate note lengths:

- Turn Knob 2. It switches the event sequencer from ›Trig‹ to ›Gate.‹ Instead of two notes, the two sequential steps are interpreted as a single note with twice the duration.


54 Event Sequencer —1. Trigger, 2. Gate

Triggering Sequences

If the sequencer is not set to Loop mode, it will cycle once only when it receives a reset signal. This lets you pre-program sequences of notes or beats. There's no rule against say pre-programming an arpeggio and triggering it by pressing a key. Random note sequences are also possible:

- Easier done than said: simply click on the Rnd button in the note sequencer or assign the function to a knob. Unfortunately, you can't assign a knob to this function, but there's a next best thing: use a clocked random step generator and route it through a note quantizer so that the note sequences remain at the tempered pitch. The note quantizer will also allow you to control the range and note intervals used in the random sequence.
- Load ›RndSeq‹ for a look at what we mean.

Dive Right In ...

1 Load ›SeqKnobs.‹

55 Knob Sequencer with Step-by-Step Activation

Don't be alarmed by what you're looking at—there's nothing hidden away in this patch that you can't analyze on your own.

This should bring out the explorer in you: put on the Sherlock Holmes outfit and try to figure out what's going on in this patch:

2 Turn Knobs 1 through 16 up at random, i. e. find out what they do.

3 How does the serial sequencer chain work?

4 How are two serial sequencers routed to just one modulation input?

5 What does the Env-Depth sequencer do?

6 Click on the bottom row of the Filt/Vol Trig module. Find out what it does.

7 Record a new sequence of your own.

8 Add dynamics to the sequence.

Go on—it'll be fun, guaranteed.

9 Expand the trigger chain to 32 steps and program your own rhythmic structure.

MIDI Sequencing

The Modular sequencer functions can be synchronized with an external MIDI system using the system's MIDI clock. All you need to know is how to route MIDI clock to the patch. Curious? Take a look at the next patch, it will show you how:

1 Load ›SeqMIDI.‹

This patch is virtually identical to ›SeqKnobs‹ except that the sequencer will not run without external MIDI clock.

2 Connect an external sequencer, drum computer or workstation equipped with a sequencer to the Modular MIDI-in port.

3 Set the external device to ›Transmit MIDI Clock = On.‹

4 Now when you start up the external device, the Modular sequencer also runs. If you play a track with note events along with it, you can transpose the Modular over it.

The tempo of the Modular sequencer is determined by the external sequencer.

MIDI clock is routed in by the MIDI Global module available in the In/Out group. MIDI clock operates with a resolution of 1/96 steps per bar. In other words, each quarter note is subdivided into 24 steps. You can—as a matter of fact you *must*—convert the resolution of the Modular sequencer by a clock divider. In this case, it is set to 6: it puts out 1 clock pulse for each 6 MIDI clock ticks—i. e. 16 pulses per bar (1/16 notes).

In this example, the reset input of the sequencer is linked to the keyboard. Every time you play a key—i. e. at every note event—the sequencer melody is retriggered from the left.

Synchronizing Several Sequencers to MIDI

- The sync output of the MIDI clock module should be connected to the reset inputs of all sequencers. This ensures that all sequencers within a patch run in sync. Consequently, the Modular responds accurately to the song position pointer. You can determine the number of quarter notes that are played before the sync output sends a reset signal by the Global Sync parameter in the Synth options of the Settings menu.
- The active output sends a gate signal when the Modular receives a start or continue event from an external sequencer and closes the gate when it receives a stop event.

You can use the sync output as a clock generator—it sends a gate signal at the beginning of each beat. This is a handy feature when you want to automatically transpose by a second sequencer.

Synchronizing Several Slots

The name of the MIDI global module is misleading, it can also ›keep time‹ for the internal system clock of the Modular.

You can set the system clock to Internal in the Settings menu's Synth options. The MIDI global module will then generate internal clock. This option has a huge advantage over a

A minor irritation: the tempo of the internal system clock cannot be controlled by a knob or MIDI controller—too bad.

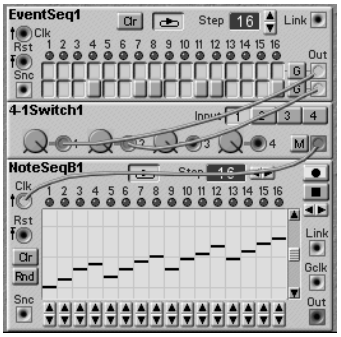
simple clock generator: you can use it to synchronize several slots.

All you have to do is connect the reset inputs of all sequencers in all slots to the sync output of the MIDI global module and you're ready to roll.

Programming Song Patterns and Variations

Although the sequencer modules don't recognize song positions or arrangement lists, you can program several different sequencer lines—each with its own note, event and control sequencers—and use a switch module to switch between them by a MIDI controller.

► You can often produce interesting variations on a theme by simply switching between two rows of an event sequencer as shown here.



Experiments

Hopefully, what you've done thus far will inspire you to experiment. You can do so much more with the Modular than just clone an analog sequencer, construct a chord automation or trigger a few drums.

Would you care to find out what other fantastic stuff you can do with logic modules, audio in or MIDI? Here are just a few examples—the tip of the proverbial iceberg:

Sequencing Other Stuff

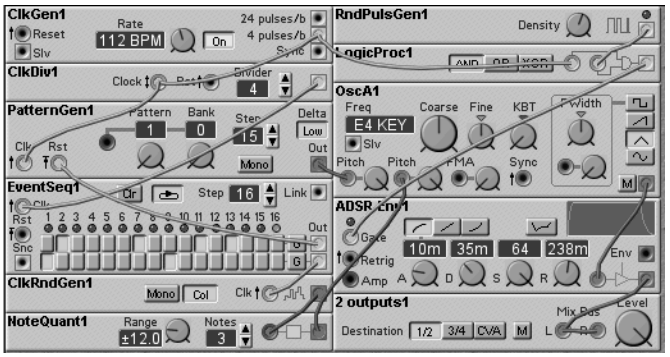
A sequencer can control all kinds of stuff—you aren't limited to pitch, timbre or volume. Try these on for size:

- Set a control sequencer to the pitch of an FM operator: timbral sequencing.
- Route two event sequencers with different step lengths to a logic module (XOR): random rhythm.
- Route a control sequence to a 1-4 switch: sequencer controlled switching between four signal sources (or four note sequencers?).

Perpetual Motion Machine

If you have a lot of time on your hands, you can use relatively rudimentary tools to construct a melody machine that generates sequences for hours on end without repeating itself. Here's a simple example to get you started.

- Load ›PMM.‹



Here are some questions to help you figure out what's going on:

1 There is a basic sequence that is being transposed and retriggered. What is generating the basic sequence? What is transposing it? What is retriggering it?

2 What is the event sequencer doing? What else is it doing?

3 What is the purpose of the clock divider? (Try changing the Divider amount.)

4 What is causing the irregular rhythmic pattern?

5 What are each of the six assigned knobs doing?

MIDI Gater

1 Program a gater consisting of an audio in, event sequencer and ADSR envelope module.

2 Connect the audio output of a synthesizer or tape track to the audio input of the Modular.

3 If the source in #2 supports MIDI clock, set up MIDI clock synchronization for the event sequencer, including start/stop control.

Now you can chop up drumloops, vocals or synthesizer strings in sync with the song. If you want to hear the whole thing in stereo, simply use two ADSRs.

Drum Machine

If you connect the drumkit that we used above with two event sequencers, you'll come up with a hip analog drum machine that you can also hook up to your MIDI sequencer.

We'll give you three guesses as to how you can create drum patterns …

7 The Modular as a Performance Synth

The Modular seems a home studio enthusiast's dream come true: the privacy of your own studio, a cozy atmosphere where you can experiment, create patches and compose songs into the wee hours. It is also popular in the academic arena, where professors and instructors use the Modular as a medium to convey sound synthesis theory in their seminars, tutorials, etc.

In these situations, there's plenty of time to adapt the Modular to a new song, a different mixer routing setup or MIDI configuration.

Don't be fooled. In contrast to the cumbersome image the name invokes, the Modular is a first-class, extremely versatile and easy-to-handle sequencing synthesizer for studio productions as well as live performances.

This chapter will demonstrate how you can configure the Modular as a MIDI sound generator for a sequencer or master keyboard and quickly adapt it to new situations when you're pressed for time.

Synth and Patch Settings

Both the Modular (except the MicroModular) and the Editor feature settings named Synth and Patch. There are some differences that you should be aware of:

- Synth settings apply to the entire Modular. In this menu, you can determine tuning, panel and MIDI settings for the four slots. These settings pertain to all patches.
- As the name implies, Patch settings apply to an individual patch. You can create different versions of the same

patch, for example split and full-range versions or versions with different numbers of voices.

Programming Keyboard and Velocity Zones

You can pre-program a keyboard zone and a velocity zone for each patch. The zones are saved along with the patch. Using a combination of several slots, you can implement up to four splits and sound changes by velocity switches.

Before you can get started with splits and velocity switches, you have to pre-configure the Modular Synth settings as follows:

Internal Keyboard

Keyboard mode in Synth Settings must be set to Selected Slots so that you can play velocity switches and splits on the Modular keyboard. The Synth settings are located in the Editor as well as in the Modular:

- In the Editor, press S (⌘P on the Macintosh)…
- … on the Modular, the System button and then Synth.

MIDI

Before splits and velo switches are MIDI-enabled, you have to assign a common MIDI channel—Synth Settings is the place to do it.

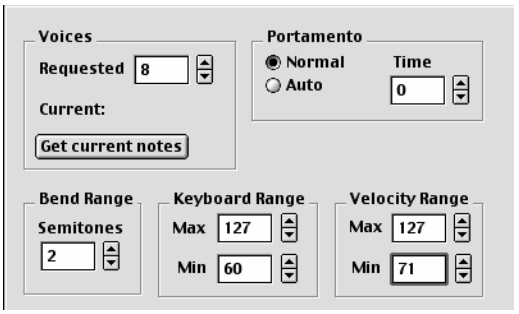
Setting Split and Velocity Zone

1. Load the following four patches to Slots 1 through 4, respectively:
   ›SplitLoLV‹ to 1
   ›SplitLoHV‹ to 2
   ›SplitUpLV‹ to 3
   ›SplitUpHV‹ to 4
2. On the Modular, press all slot buttons simultaneously.
3. Try the setup out on a keyboard.

Two velocity-switchable patches are assigned to the lower and the other two to the upper half of the keyboard. The split point is C3 (60), the velocity threshold is 70.

Press the slot buttons to work your way through the patches and edit each individually.

56 Split and Velocity Switch



Split and velo settings in the patch window

Layer

In the Modular, playing several patches simultaneously is extremely easy: load the patches to the slots. Then press the desired slot buttons simultaneously—you will hear all of the sounds at the same time. If not, check out the settings for Internal Keyboard and MIDI.

If all four slots are active and you want to deactivate this combination of sounds, again press all four slot buttons at the same time.

Multimode

When you want to use the Modular in a MIDI system, you will generally assign a dedicated MIDI channel to each slot. The pre-configured assignments are Channels 1 through 4. You can change these assignments in Synth Settings.

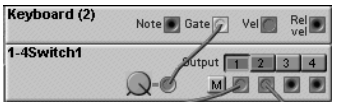
Velocity Switch in a Patch

You can also implement a velocity switch directly in a patch. This option is not quite as versatile and requires some pro-

gramming gymnastics. However, it does come in handy when you're convinced that you need a particular split and aren't planning on changing it.

Both functions are morphed and use a ›1-4 Switch‹ module.

This morph/switch module setup switches between different sounds within a patch.



1 Load ›MorphSw.‹

2 Play up the keyboard—when you play harder, the sound switches from the left synth on the screen to the one on the right.

This is how it works:

- The outputs of the switch modules carry the gate signal to the left and right envelopes.
- The first (red) morph group switches between the two outputs.

3 The controller for Morph Group 1 is Velocity.

Now velocity switches back and forth between the two sounds.

► Disadvantage: you can not change the velocity split point.

► Advantage: you can control the split with any MIDI controller.

Programming Performances Externally

You can only save patches in the Modular, not performances. In other words, you can't change the patch, split and MIDI settings of all slots simultaneously at the touch of a button. But this limitation applies only to the Modular *directly.* The everything-at-the-touch-of-a-button option is possible with a little external help. Although you could program a setup in

the Modular that approximates this function, you'll find that the external method is much easier.

In the Modular, you always need two memory locations with different settings in the Patch window to alternate between split and full versions of a Modular patch.

If you own an external MIDI patchbay that enables keyboard and velocity zones and can also send program changes, then this is definitely the preferred alternative. Of course, you can also get the job done by a workstation or master keyboard—provided there are enough performance memory locations with at least four zones available.

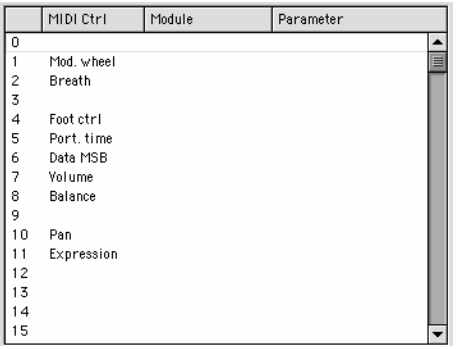
Set the zone parameters on the external device. In the Modular, all you have to do is save each patch once, kick back, relax and let the diverse performances do the patch activation work for you.

Controlling Sound Parameters Remotely by MIDI

You can assign almost any parameter on any module to a MIDI controller. The possibilities are virtually infinite: here are a few examples:

- Rotary knobs can be controlled by a sequencer or master keyboard if the Modular is out of your reach.
- Sound parameters can literally be ›played‹ by non-keyboard controllers such as wind controllers, pedals, guitar interfaces or drum pads.
- Sequencer programs such as Logic or Cubase let you program user interfaces for synthesizers. In Logic, the medium is called Environment, in Cubase Mixer-Maps. If you ›hook up‹ the entire patch by MIDI controllers, you can program it in your custom-designed Editor without using SysEx data.

To assign MIDI controllers to a parameter click on it with the right mouse button; select MIDI Controller from the pop-up menu, then select a number in the Controller window.



This menu lists programmed controller-to-parameter assignments.

Assigning Controllers

In principle, you can assign any controller number within a Modular patch freely. There are conventions for some controllers and if you adhere to these, you'll find that the setup of the patch is much clearer and it is substantially easier to locate the right controller at a later date.

Our recommendation: use the Nord Lead controller number scheme. For one, the assignments are practical and parameters such as cutoff or oscillator coarse appear in all Modular patches. For the other, if you own a Modular *and* a Nord Lead (lucky you), you can use the latter to control your Modular patches remotely—and the knobs are already labeled!

You'll find the Nord Lead-to-Modular controller map in ›Nord Controller Table‹ on page 170. Sure it works with a Logic environment for the Nord Lead as well.

The following chapter features a ›Nord Lead 3‹ model which you can use to try out all kinds of options.

8 Analyzing Patches…

We talked a little about ›models‹ verses ›patches‹ in chapter 1 (page 16). In this chapter, we'll give you several complete models demonstrating various types of synthesis Modular-style. For each of these synthesis types, we'll also include a ›mini-model‹ which you can use as a starting point for building your own models.

The sounds for this chapter are located in the Soundz folder.

Don't be bewildered by the complexity of some of these module ›mazes.‹ Once you've read the accompanying explanations, you'll understand them thoroughly and end up wondering what all the fuss was about—we promise.

► You'll find more tips on how to make it easier to ›read‹ a Modular patch in section ›More Insight, Less Clutter‹ on page 155.

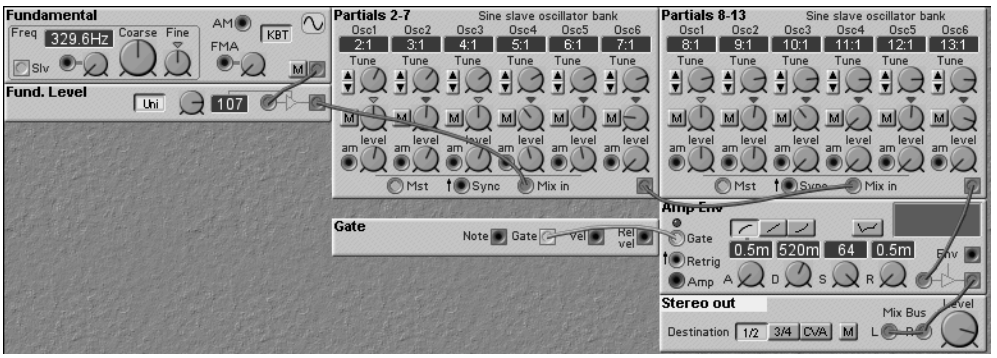
Additive Synthesis

The Modular is a multi-talented performer; it can also imitate a fully-blown, exceptionally versatile additive synthesizer with an astounding level of quality.

Mini Additive

◆ Load ›miniAdd.‹

This mini-model is a good place to start with additive synthesis. It features a master sine wave oscillator and two ›six packs‹—the Modular's oscillator sine bank modules which contain six slave sine wave oscillators each for a total of thirteen partials (including the fundamental).



The ›level‹ knobs become amount controls when something is plugged into their inputs.

Each oscillator in the sine bank has its own level control and we've assigned these to Modular knobs 2 through 13 (knob 1 is assigned to the level control for the fundamental). I. e. you can use the knobs to dial in the desired additive mix. Here are some suggested mods:

- Add LFOs, envelopes or even audio sources to modulate the individual sine wave levels. For example, apply separate envelopes to the even and odd partials or add another audio oscillator to create a monster ring modulation by applying different amounts to each partial.
- Apply filtering or audio processing at the output either for each voice or in the CVA.
- Use separate envelopes for the outputs of the two sine banks.
- Use different tunings for the partials (e. g. the B3 drawbar tuning shown on page 128).

Additive Model

57 Additive Synthesizer

This additive model patch uses separate sine oscillators and adds an unusual FM option which makes it optimal for metallic, powerful, percussive sounds with a certain ›digital‹ coloring.

- Load ›Additive.‹

Oscillators

We're going to use one master and eleven slave sine wave oscillators. As usual in additive synthesis, we're going to tune the slaves to partials of the master oscillator's frequency—handily, the Modular provides buttons and a display option to tune quickly to the partials. (Unhandily, you can't assign knobs or MIDI controllers to the partial buttons.)

Envelopes and Mixing

The partials are routed by mixers to the four groups Low, Lo Mid, Hi Mid and Hi. Each group has a dedicated volume envelope.

Grouping the overtones has two distinct advantages: it's easier and quicker to modify the shapes of an interaction between the groups, plus this structure saves DSP power.

In the Groups Mixer module, the knobs for Groups 1 through 4 are morphed. Note that at this point in the signal chain, velocity already controls the overtone content of the sound.

Add a Dash of FM

You probably couldn't help but notice the blue FM cables? Each sine oscillator modulates the FM input of the oscillators located below it. Certainly the trick is simple, but it enables just twelve oscillators to generate a spectrum as complex as this. Use knobs 15 (even partials) and 18 (odd partials) to morph the FM effect.

The Finishing Touch

A combination consisting solely of sine tones will always sound thin and sterile to some degree. It simply lacks a bit of detuning and some grit. So we've routed the entire sound—with all its sound-shaping sequences and dynamics—

through phaser and chorus modules which add considerable shimmer and thickness to the patch. The phaser's built-in LFO provides the shimmer and the chorus provides the motion.

Modification Tip: Additive FM Synthesizer

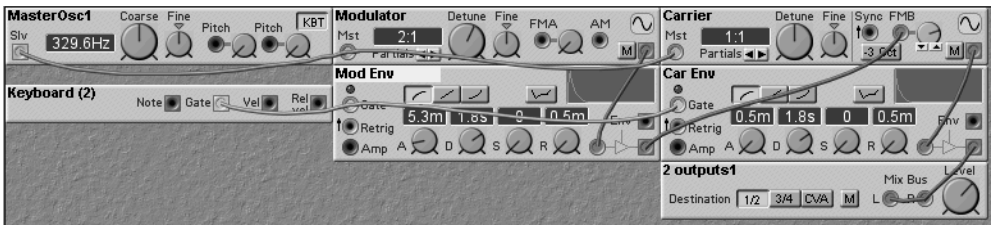
In case you have trouble getting it to work, we've done it for you in ›AdditFM.‹ Twiddle knobs 7 to 16 to bizarrify the patch.

1. ›Decimate‹ the number of oscillators until you have just eight left over.
2. Group these eight survivors in pairs.
3. Create an AD envelope for each group, position these to the left of the oscillators and name them Pitch Lo, Pitch Lo Mid …
4. Route the control output of the pitch envelope to the FM input of the first oscillator in each group. Leave the FM input of the second oscillator as it is—i. e. allow it to be modulated by the first.
5. Now it's time for your sound design skills to kick in—with this module you can generate some truly bizarre spacey lead and effects sounds.

FM Operators

In the modular it is a simple task to create the FM ›operators‹ found in classic FM synths. Here is a mini model in which a sine wave is passed through an envelope (the modulator) and patched into the FM input of another sine wave oscillator (the carrier).

- Load ›miniFMop.‹



Things to notice:

- The tuning of the Modulator oscillator controls the FM timbre while the tuning of the Carrier oscillator controls the pitch.
- The Osc Slave FM used for the carrier—although slightly more expensive than the Osc Slave E used for the modulator—has its FM input optimized for FM sounds. (Try replacing it with another Osc Slave E and you'll hear the difference.)
- The Mod Env envelope determines the ›shape‹ of the FM effect and the FMB input knob determines the amount of FM.

Enhanced Dx

58 Enhanced Dx

Are you the proud owner of a Dx7 synthesizer? If so, you'll have big fun with this patch. It emulates the FM sound of the Dx and adds a few Modular spices such as morphing and chorus to the stew, hence the qualifier Enhanced rather than Classic.

- Load ›EnhancDx.‹

For Dx7 Owners Only

If you don't own a Dx, just skip this section and mosey on down to the next section. If you do, here's a few interesting insights for you.

Go to your Dx and activate the typical e-piano sound. Normally it is programmed with algorithm 5 or 6 and that's exactly what the Modular patch simulates. The oscillators are named accordingly. Compare the parameters settings of the Dx and the Modular. The essential differences are:

- Operators can be connected and combined freely in the Modular.
- Every operator can be detuned and the pitch can be modulated individually.

- The ›operator‹ envelopes in the Modular are separate—i. e. not combined with the oscillators.

There are also similarities which aren't immediately apparent:

- The OP2 detune value ›14:1‹ is equivalent to the ratio ›14.00‹ in the DX.
- In OP5 in the Modular, key tracking is deactivated, which is essentially the same as Fixed Frequency mode in the DX.
- You don't need to be Nostradamus to predict the outcome of one operator modulating another (but it helps).

Algorithm

A standard DX piano setup consists of three chains. OP1 and OP2 generate the chiming attack sound, OP3/4 and OP5/6 are usually programmed by identical settings, although they're mutually detuned. We have the luxury of refining the metallic elements of the sound by OP5/6 simply because we can achieve detuning by other methods.

In the modular, a modulator must always consist of *two* modules—an oscillator and an envelope, whereas in the DX it is always a single unit.

The cable configuration shouldn't be too perplexing: the output of an FM modulator (OPS 2, 4, 6) wanders through an envelope and then on to modulate the carrier.

Chorus

The soft, dark sound of an e-piano is generated by the duo OP3/4—the frequency ratio of 1:1 tells us that much. The sound is thin and dull, so we routed it through a chorus. Its rate (parameter Chorus) is also influenced by velocity: heavy attack = wider sound. The chorus is routed to the first stereo output module, OP1/2 and OP3/4 into the second. This setup

saves us from adding at least two mixers to the configuration.

► Whenever you want to route several sounds within a patch to the stereo master, try to make a habit of using several output modules rather than power-grabbing audio mixers.

Velocity and Tracking

Velocity is implemented in Morph Group 1, key tracking in Morph Group 2. Observe the knob colors or press F7 to find out *which* parameters are influenced by velocity and keyboard as well as *how* they're influenced.

Knobs

A couple of knobs already have assignments—choose a few more parameters that you would like to control directly by the panel—Dx7 owners will envy you no end …

◎ **59** Knob Modulation Examples

Drawbar Organ with Leslie

The patch ›B3‹—inspired by the legendary behemoth by Hammond—is a complete simulation of an electromagnetic organ with a Leslie cabinet. At its heart it is just another additive model, but we think you'll agree it presents a number of interesting twists and turns.

This is by far the most complicated of our example patches, so we'll dedicate a great deal more visual and aural analysis to it.

Remarkably, the Modular sounds better than many organ clones featuring sound generation systems designed specifically for the purpose of emulating a Hammond. This observation kind of makes a statement about the sound quality and versatility of this type of modular synthesizer, doesn't it?

◆ Load the patch ›B3‹ and play around with it for a while. Try out the knobs—they let you register the entire organ and control the Leslie.

Drawbars

The nine drawbars of the traditional Hammond organ are fairly easy to imitate by nine sine oscillators. Only the first (16') of these is a master, the others are all subjugated to slavery to save DSP power.

60 Drawbars only

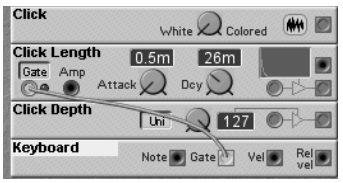
These nine drawbars are patched to the mixer modules ›16-5 1/3,‹ ›4-2‹ and ›1 3/5-1,‹ where they are mixed down. The knobs of the mixer modules also act as drawbars—the top and bottom row Modular knobs are assigned to the drawbars (check the Knob Floater). The master signal is created in the Drawbar Sum mixer.

Percussion

For percussion, the three footpedals are routed out individually and mixed down in the PercMix mixer. From there, the signal is routed to a simple AD module, the decay time of which can also be controlled by a knob. As in the original template, percussion only gets a single envelope for all notes. What this means in practice is that the AD module is triggered by a separate keyboard *patch* module rather than a keyboard *voice* module.

The output of the percussion generator is routed to the DB/Perc mixer, which combines percussion with the drawbars.

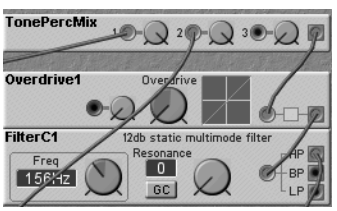
Key Click



The characteristic key click of the Hammond is virtually impossible to imitate by conventional analog means, so we improvised an approximation. The noise generator named ›Click‹ is routed to an AD module, where the signal is condensed to a short burst of noise. This is passed through an adjustable gain controller (assigned to knob 16) to the FM input of each oscillator.

In all humility, here's a perfect example that—in the Modular—imagination can prevail over a perceived limitation: the click signal doesn't roll right onto the audio rails—we route it to the FM input of all sine generators because with this configuration, the sine tones start up with a very distinctive clicking sound—which is a vast improvement over using the noise signal directly.

Overdrive

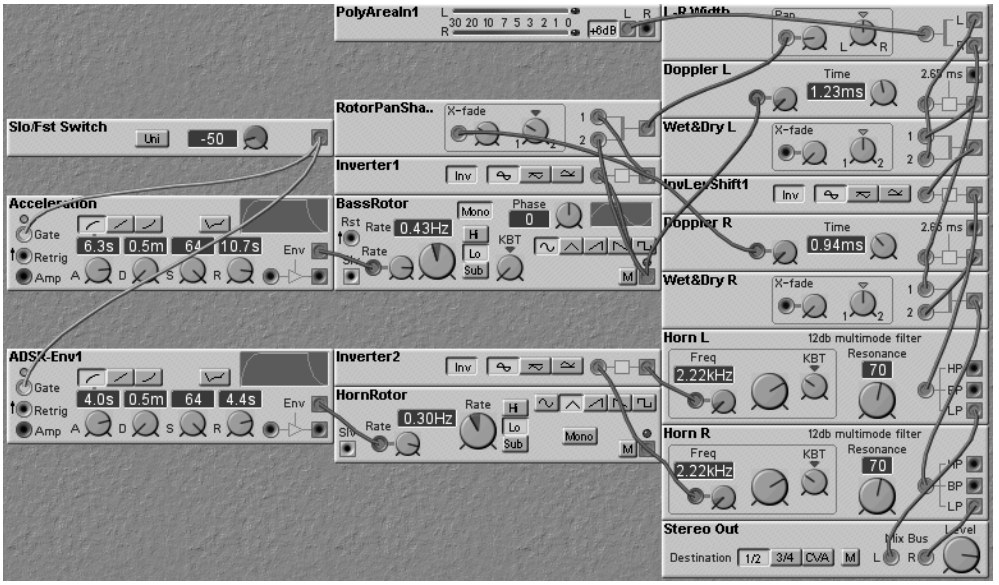


61 Overdrive only

In earlier versions of the modular we had to resort to unadulterated trickery to simulate the B3 Leslie overdrive.

Now with the Modular's warm overdrive module, all we need to do is add a little morphing and a high pass filter to achieve the same thing. The morphing brings the overdrive in with the Leslie and peels off some of the bottom of the signal at the same time.

Leslie



This part of the setup is truly hardcore. The Leslie sound is derived from the composite signal of a bunch of modules that were painstakingly micro-tuned so that—when added up—deliver a decent Leslie sound. Accurate electronic Leslie simulation is generally regarded as a higher form of art, so you can imagine what it takes to squeeze something convincing out of a purely modular synthesizer.

We've put the Leslie in the CVA to save a bunch of DSP—This nearly doubles the number of voices to seven (fifteen on an expanded modular). Bear in mind that a real B3 only has one Leslie—not one for each voice. We've also taken the opportunity to ›kick it up‹ 6dB for a free bit of punch that comes along with the PolyAreaIn module.

Here are the blocks:

- The rotation originates in the two LFOS BassRotor and HornRotor, which—as the names might lead you to

believe—actually generate the modulation signal for the two rotating speakers in a Leslie cabinet. Both LFOs run in sync but out-of-phase and with slightly different waveshapes.

- The rate of each LFO is controlled by its own ADSR generator to mimic the characteristic acceleration and deceleration effects. When the ADSR is triggered, it slowly revs up the LFO rates with slightly different curves. A constant module (0% DSP) is used to gate the envelopes. It is part of Morph Group 1 which is assigned to Knob 4 and the soft pedal (MIDI #67). Note that the rotation amounts are assigned to this same morph group so the rotation completely stops when the pedal is released.
- Morph group 1 controls the final rotation speed providing continuous control rather than a fast/slow switch. It is assigned to knob 8 and the MIDI expression pedal (controller #11).
- The first stage is the panning generator. It splits the signal into the two stereo circuits to reproduce the sweep of a rotating speaker.
- The two Doppler modules are actually delays. Their delay time is modulated by the motors and thus generate a chorus effect.
- In the next module—Wet/Dry—the Doppler and direct signals are mixed down to reinforce the effect of the chorus.
- The HornL and HornR modules are filters. Their cutoffs are also modulated by the motors to make the sound a bit darker when the ›speaker‹ faces away in the course of the rotation.

62 Accelerating Leslie, Panning and Depth Control

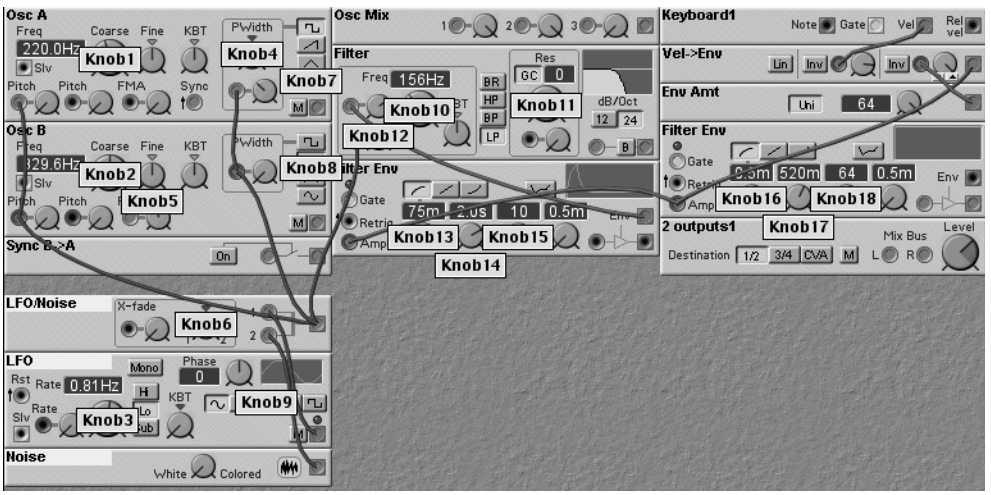
All in all, pretty simple stuff wouldn't you agree? Seriously, this is undoubtedly one mean Modular patch.

Modifications:

1. Create a low-budget version of the Hammond sans Leslie.
2. Create a Leslie-only version without sound generation (refer to the patch ›StLeslie‹ on page 104).
3. Edit the Leslie rotation, overdrive characteristics and the frequency response to taste.

Mini Lead Synth

- Load ›MIDILead.‹



This is a basic two oscillator synth with a multi-mode filter, plus LFO/noise modulator and two ADSR envelopes. It is reminiscent of the early portable synths like the Minimoog, Arp Odyssey and Oberheim Xpander. The concept is taken to its 21st century extreme in the next model, but you can do a lot with just this basic mini-model. For starters, just twiddle the knobs then adjust the on-screen controls to add modulation and finally begin adding new modules as the spirit moves you.

Nord Lead 3

Those of you who already own a Nord Lead may have discretely asked yourselves if the Modular is a fully-fledged surrogate for the Nord Lead. Well, read and weep, the answer is yes, right down to the most insignificant parameter. Take heart though, there is some good news: it takes a monumental effort, which leads us to this example.

Here are some examples of sounds you can get from this model without any additional modules or cabling—just from changing the parameters on the modules:

- A Vocoder sound that can be played and modulated dynamically. **63** RobotVoice
- A Happy, friendly pad. **64** ChorusPad
- A wiry sound that mimics a the snap of a single-coil pickup. **65** Pickup
- An exceptionally dynamic synthbrass sound. **66** SynthBrass

These sounds were programmed with the ›Nord Lead 3‹ model and are in part more complex than normal Nord Lead sounds.

Let's take a look at the model:

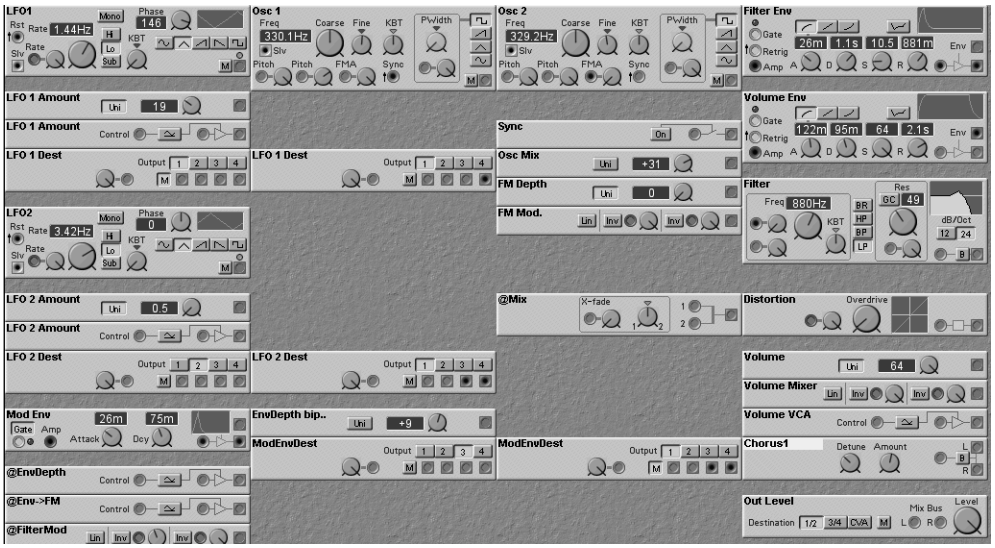
- Load ›NL3.‹

The Panel

You can have a ball building a ›duplicate‹ of a compact, internally hardwired synthesizer in the Modular. Obviously, you can't nail down the exact tonal qualities of your favorite vintage synth with just a few oscillator and filter models, but then again, at least you can store the model and control it by MIDI.

Inevitably, you'll run into challenging obstacles in the Modular, for instance …

- ... if the original is equipped with an oscillator such as the legendary Prophet V that can generate and mix sawtooth, pulse and triangle waves simultaneously.



- when you have too many controllable modulation sources and destinations. In the Modular, you'll end up creating a nightmarish cable configuration.

► The boys and girls at Clavia were obviously pretty impressed with the Sequential Circuits Prophet V and Moog Minimoog because, in terms of sound, they certainly captured some of the spirit of these legends in the Nord Lead and Modular. Not to be disregarded is the influence of the Oberheim, Roland and ARP dinosaurs, which the Modular can also copy quite admirably. If you happen to own one of these synthesizers or even just the documentation, take a shot at emulating it!

Panel Layout

Take a very close look at the panel of the Nord Lead 3 in the Modular Editor. The layout and functions imitate the original and just like in the original you don't see any cables.

This ›Nord Lead 3‹ model does feature some goodies that are an improvement over the Nord Lead and its successors.

- Pulse width is independent for both oscillators.
- LFOs are completely independent and feature five waveshapes each.
- A selection of four modulation destinations is available for each LFO.
- Keyboard tracking is a viable option for all modules (by morphs) and in some cases installed directly.
- Integrated stereo chorus.
- Four simultaneous morphs: velocity, mod wheel, key scaling, expression.

Cabling

Let's take a closer look at the wondrous conduits that channel the lifeblood of this synth's sounds:

- Make all of the cables visible.

Now you can divine the motives of the original's designers: take one look at this *mess* and you can see why they hid the cables. What this tells us is that the copying of a hardwired synthesizer by a Modular system is a complex endeavor: it exacts a high price in terms of clarity, requires a horde of helper modules and the final result is not what you might call transparent.

- Hide all of the cables.

The modules in this patch are positioned so that—when the cables are hidden from view—they imitate the Nord Lead front panel. This creates a situation where some cables run smack dab through the middle of your screen.

If you have a hard time tracing a cable, drag the module as close as possible to the source of the cable and press ctrl.

Helper Modules

If you want to accurately duplicate the front panel of a synthesizer, helper modules such as gain controllers, control mixers, switches and all of those other humble modules that toil away for you in total anonymity are bound to get in the way. Besides, you shouldn't tamper with these anyway.

In this patch, all of these programmer's little helpers are indicated by the prefix ›@‹ and are bunched at the bottom left hand of the patch.

If you discover a switch or knob on the synthesizer that doesn't have a counterpart directly on a module, then you have to reconstruct it by several helper modules. The following modules are good examples for you to get some practice with these:

- LFO 1/2 Destination
- Sync
- EnvDepth bipol
- All @-modules

Modifications

You probably noticed that the synthesizer is lacking a few features. Now that you know everything that you need to know, you can let your sense of adventure run rampant. The following modifications in the Nord Lead 3 are your finals for this chapter. If you manage to deal with these tasks, you pass with flying colors. So go ahead and jump right in:

- Assign the knobs. Come up with some sort of scheme first though. You'll have to be choosy about the parameters, you don't want to assign obscure stuff to the eighteen knobs when you can use them much more effectively.
- Portamento isn't on the menu—add a helping (see page 88).

- The Nord Lead arpeggiator does not have a counterpart in the Modular. Build a step sequencer that is able to generate—as a minimum—transposable octave patterns. Ensure that it is MIDI controllable (switchable!).
- That leaves us with noise—you shouldn't have any trouble with this fairly simple function.

Sounds Galore

You may have been too busy to notice but you can, in all seriousness, fill an entire patch bank using the NL3 model without changing a single module or re-connecting even one cable.

In the introduction to this book we touched on the difference between a patch and a model. It may not have meant much to you then, but it should be clear enough now. This Nord Lead 3 is not just a sound, it is a synthesizer inside a synthesizer. Although that may sound like new-age philosophizing, there's one analogy that counts and it has to do with cash: for the price of a ›real‹ Nord Lead, you bought something that is just as good, with the added bonus of a theoretically infinite number of other synthesizers thrown in for free!

9 FAQ and Help

Over the course of this chapter, you'll find the answers to many of the frequently asked questions and solutions to some of the problems that inevitably crop up. Unfortunately, due to space constraints, we can only address the most serious problems you might encounter. If you can't find the solution that you're looking for here, check out our support page at the Wizoo site; it is updated continuously.

In any case, you should take the time to read this chapter thoroughly—some of the preventive measures may spare you potential headaches and help you to avoid unnecessary exasperation.

Wizoo Online Support

Web Site

If you run into problems that this book can't help you with, Wizoo offers comprehensive online support for a wide range of topics in the field of electronic sound generation, synthesizers and Midi. When you're in a major hurry to solve a problem, go directly to our site:

`http://www.wizoo.com/`

- Take a look at our FAQs—here you'll find answers to frequently asked questions on a wide variety of topics.
- Our link database will help you find other Internet sites that deal with the Modular, sound synthesis and related subjects.

- You'll find basic information on and a general introduction to digital audio and related topics in our Newbie Section.
- You can also search our Web site for a specific term: simply click on the Search button located on the navigation frame to go to the Search page.

Mailing List

There is a very active Modular users group with an email list hosted by Wizoo. You can subscribe to the list in individual-posts or digested form. I strongly recommend the individual-posts form because the attached patches come through without need of further ›decoding.‹ This is where you'll find out what the seasoned veterans are doing and more importantly, how they're doing it.

Email

If neither the book nor the Web site can help you find a solution to the problem you're confronted with, feel free to use our free-of-charge trouble-shooting hotline. Email your question to:

Address: `userinput@wizoo.com`
Subject: `Modular <Brief description of the problem>`
(e. g.: ›`erratic event generator`‹)

Anyone who owns a Wizoo guide is welcome to use this service—we do however ask that you do us a favour and stick to these basic prerequisites:

- One question per email only,
- keep your email short and to the point,
- please be patient with us, our crew handles up to several hundred questions on peak days,

- bear with us when we are unable to give you a comprehensive solution to a particular problem; in these cases, we'll forward your email to the manufacturer's hotline.

Try to keep these items in mind when you are dropping us a line and we should be able to help you out. Not much to ask in return for a free-of-charge service, is it?

No Sound

This is the most frequent problem associated with synthesizers and in the Modular, the fault has a dozen or more potential causes. If you follow this check list in the proper sequence, you shouldn't have any trouble identifying the problem:

Audio and MIDI

- Are the volume knobs on the Modular (Len's favorite mistake), mixer and power amp turned up?
- Incorrect mute switch, solo, source selector settings on the mixer?
- Did you connect your cables to audio in rather than audio out?
- Did you reverse the MIDI-in and -out or computer and MIDI slot connections?
- Did you load the patch to Local rather than to a Modular slot?

Every mistake looks incredibly foolish when someone else makes it! We certainly don't mean to insult your intelligence, but even gear gurus sometimes make glaring mistakes. So before you invest in a sledgehammer, check out these few basic items!

Panel

- Did you select an empty slot?
- No patch loaded? Every time you select a patch, you must press the Load button to activate it.

Patch Error Sources

Drag a cable from the oscillator to the output. If you can hear some type of sound, the error is in the patch and is most likely very well hidden.

- Volume at the output module is set to zero.
- Envelopes are not receiving a gate signal.
- Filter cutoff set to zero or too low a value.
- A gain controller in the signal path is not receiving a control signal.
- A mixer input in the signal path is turned down.
- Output module routed to the wrong output (e. g. 4).

Level Problems

Audio signals are mixed at numerous locations within a Modular patch, so you may encounter undesirable distortion. On the other hand, some modules surprisingly dampen the signal level. Here's how you can prevent and/or troubleshoot these problems:

- You should never turn all knobs up fully in the audio mixer. If you add them up, the sum of all signals often exceeds the clip threshold. Subtract six increments from the maximum level of all mixer inputs for each input of the mix module that you are *using*. The ›8-Input Mixer‹ module also features a 6dB damping switch.
- In the filter, resonance tends to push the signal over the clip threshold at peak levels. Some filter modules feature a Gc button, which decreases the gain level substantially. If you want to control the gain attenuation individually, drop a ›gain knob‹ into the signal path—prior to the filter. More on this topic in the next chapter.
- Conversely, some sounds suddenly register a significant drop-off in level when you patch a filter into the signal path. In most cases, the reason for this phenomenon is that the gain correction (Gc) is activated automatically. Switch it off, but make sure that the signal doesn't distort.

If necessary, lower the level of the signal before you route it through a filter.

- As a rule, to obtain the best possible signal level, you should turn the output knob of the Modular well up and adjust the input gain controls at your mixing console accordingly. Undoubtedly, the low noise levels and excellent frequency response of the Modular are hard to beat—but why not exploit all the headroom that you can?
- You want the signal level at the audio in to be as powerful and as stable as possible, so you should patch a limiter in between your signal source and the audio input jack. The audio in is an analog/digital converter. These little beasts have an extremely ornery nature and react fairly viciously to even minor spikes that exceed the maximum level. Any annoying clipping is usually due to these impulse peaks. With a limiter, you can route in a high-level signal and still avoid distortion. This type of device is especially beneficial when you are dealing with extremely dynamic sound sources (vocals, acoustic instruments, etc.).

Questions Regarding DSP and Voices

In some patches, the display indicates fewer voices than the Editor does. Why is that?

The number of voices depends on the complexity of the patch and the number of simultaneously active slots.

You only have the option of determining the *maximum* number of voices. The number in the modular LCD (not available on the MicroModular) refers to how many voices the Modular is still able to handle.

How can I expand the DSP power of the Modular?

Simple answer: you can't.

How can I increase the number of voices in the Modular?

There is an optional expansion board available for the Modular (not available on the MicroModular). It doubles the polyphonic capacity of the device, from 16 to 32 voices. Personally, we recommend this board highly. For a fraction of the cost, you get what roughly amounts to another Modular.

What's more, once you have installed the expansion, the minimum number of available voices per patch is eight, without expansion, four. The expansion is well worth it even when you use just one slot.

Is the DSP power divided between the slots?

Fortunately, no. You can assign 100% DSP power four times. However, the Modular does have a rather clever feature where—upon selection of a patch—the voices are automatically reassigned among the slots. For obvious reasons, the Modular does not feature a dynamic voice assignment capability.

How can I determine the distribution of voices in the slots?

The only thing you can do is assign less voices to a slot than it has by default. Simply enter a lower value for the voices parameter (in the Editor or under Patch in the System menu). The ›extra‹ voices are then distributed among the other slots. The Modular assigns them automatically—as soon as you deactivate a slot, the display will indicate that in one second the voices will be re-assigned.

Whenever I press a key, the previous notes I played sound even though everything seems in order with the envelope.

This phenomenon occurs when several voices are assigned to a patch and the envelope is triggered by the keyboard *gate* module.

Replace the keyboard gate module with the keyboard voice module to take care of this problem.

Clock Problems

The sequencers in different patches are out of sync.

If you are operating several sequencers simultaneously on several slots and you want to synchronize these, you have to link their clock rates to the global MIDI clock. The manual features a section where this procedure is described in detail.

A sequencer refuses to run.

Normally, a sequencer runs through a particular sequence once only in response to a gate signal.

If you want it to run indefinitely, you have to activate the Cycle symbol.

If you want to reset the sequencer every time you play a key, route a gate cable from the keyboard module to the Rst input of the sequencer.

Tuning Problems

These errors are a great deal easier to find in the patches: simply take a close look at the oscillator modules.

1. Set all oscillator KBT parameters correctly. If it's a knob, center it by clicking the green triangle above it. If it's a switch then be sure it's pushed in.
2. Ensure all slaves are connected to a master.
3. Double-click on all green triangles located above the Fine parameters.
4. Is the pitch input at the oscillator turned up?
5. Are you using a note scaler?
6. Did you accidentally turn a knob? Simply reload the patch.
7. Are you using an oscillator to modulate itself? Use another oscillator to modulate the first one.

Editor-induced Headaches

The Editor is unable to establish a connection with the Modular.

Don't panic, in most cases the problem is minor.

1. If everything is in order, check if a MIDI cable came loose.
2. Switch the Modular off and back on again, re-start the Editor.
3. Try rebooting your computer.

Editor Alarm: Lost Connection to Modular

In this case, the Modular most likely has crashed. Although the software in the computer and the Modular runs in an extremely stable fashion, it is impossible for the programmers to test every conceivable configuration of modules, cables, slots and MIDI equipment. Serious errors are highly unlikely, but theoretically possible.

If you should ever encounter this type of situation, you can still save the patch. As a precaution, give it a new name—the new version of the patch might be the cause of the crash.

Re-start the Modular and the Editor.

Big-Time Disasters

If your Modular won't start at all or freezes up after you have managed to start it, then it is highly likely that something in the flash memory system has gone awry.

In this case, the only thing you can do is reset the Modular system software or re-install it. You'll find the files and the instructions on the system disk.

Patches located in the Modular's RAM are definitely history. This is when you discover the value of keeping your banks backed up on your hard drive—use the Synth menu's Bank Upload and Bank Download options.

10 Tips and Tricks

As far as systems go, the Modular is about as open as it gets, to say the least. We could conceivably describe thousands of tips and tricks (if we only knew that many). In this chapter, we'll focus primarily on tips that will help you to become more familiar with the Modular; that will hopefully inspire you to try some of the more unconventional techniques and that will help you come up with some wild and wacky stuff on your own. Enjoy!

You'll find the patches for this chapter in the `TpsnTrix` folder.

Breaking with Conventions

If you have spent the majority of your time dedicated to music with conventional digital synthesizers over the past few years, you'll need some time to adjust to the Modular. At first you may find it hard to cast off those conventional ›chains‹ and get into the groove of treating the Modular as a *modular* DIY kit with an almost overwhelming amount of creative potential.

When you stop to think about it, it's all so easy: is there any compelling reason why you can't route the amplitude envelope post-oscillator or an overdrive effect pre-filter? Why not use an LFO as a clock generator? What could possibly prevent you from using the quantizer to turn an envelope into a glissando?

Consciously avoid using the standard method of doing things when you're experimenting. Don't be timid, go ahead and get weird. Try to position modules at totally unconventional locations within the signal chain or ›abuse‹ them for bizarre purposes.

Try these on for size:

Due to the low sampling rate, expect sounds to change when you patch logic or control modules into the signal path. Different, yes—bad, not necessarily.

- Position effects such as chorus (see below) or overdrive before a filter.
- Assign amplitude envelopes to individual oscillators, but not to the overall patch.
- Route one output to two separate amplitude envelopes and then on to stereo out: auto panning.
- Use audio signals as controllers—e.g. oscillators as cutoff modulators.
- Use LFOs or envelopes as gate generators.

67 Weird 1
68 Weird 2
69 Weird 3
70 Weird 4
71 Weird 5

► Try out the patches ›Weird1‹ through ›Weird5.‹

In each of these patches, we used at least one module for something for which it wasn't originally designed.

► Try to figure out which module we abused and how we abused it.

Try building your own simple but ›eccentric‹ patches. Use primarily unfamiliar modules—the less you know about their purpose, the better. You'll soon figure out what they do!

Shortcuts

Central Pitch Knob

If you want to pitch or transpose an entire sound, you don't have to program a morph to the coarse parameters of all oscillators. This option—a great one for the more indolent among us—works just as well:

1 Replace all but one of the oscillators with slaves.

2 Assign the coarse parameter of the master to a knob.

This function is preprogrammed to Knob 1 in section ›Additive Synthesis‹ on page 121.

Now when you change the coarse tuning of the master, all the slaves will follow its lead.

3 If you slave LFOs to the master oscillator, you can also change the LFO rate by this knob. Note that the LFO will track the oscillator five octaves lower.

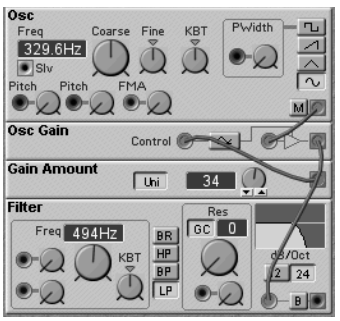
Using a Control Mixer Input as an Additional Knob

A mixer input that does not have a cable routed to it does absolutely nothing—you can turn the knob until Doomsday, but nothing will happen. Without an input signal, there's not much to control.

If you connect a constant (free of DSP charge!) to this input, you can use the knob constructively—it now adds an offset which is some proportion of the constant value.

Patching In a Knob

To ›splice‹ an ›amount‹ knob into a cable, use a gain controller and a constant module. Connect the output of the constant module to the control input of the gain controller and patch this setup into the circuit.



Patching In a Control through an Envelope

Remember that envelopes are not just made for audio signals. You can pass any thing through an envelope to contour its effect.

Here an LFO is passed through an AD envelope before modulating an oscillator's pitch. This provides a contoured vibrato.

Switching Off Flashing LEDs

Constantly flashing LEDs can be an annoying distraction after a while, especially when your computer is relatively slow or you're dealing with a patch chock full of sequencers and clocks. To put a lid on the Vegas vibe, go to the Synth Settings on the Synth menu and uncheck the LEDs active checkbox.

Adjusting the Velocity Range to MIDI Keyboards

We'll use the Dx7 as an example for all those unfriendly keyboards that do not send the entire velocity range of 0 to 127. The first Dx7—miser that it is—only sends in the range of 0—99. You can adapt the Modular to it by going to Synth Settings on the Synth menu and setting the maximum value for the MIDI Velocity Scale to 99—pretty practical stuff!

Which Morphs, Knobs and MIDI Controllers

If you want to know exactly which parameters are assigned to which morph group, simply press F7. To see the knob assignments either open the Knob Floater or press the F8. For the MIDI controller assignments use F9.

Poly and Mono

Building Monophonic Patches

Normally, you'll prefer to create polyphonic sounds in your Modular. In contrast to a hardware modular system where you would need a separate oscillator for each module, here an oscillator module represents up to 32 physical oscillators. However, polyphonic lead or bass sounds are not always where it's at—sometimes you want to spread some mono mayhem.

Whenever this is the case, use the Keyboard Patch module instead of the Keyboard Voice module. Retrieve all gate signals from this module and set the number of voices to 1.

Now the Modular is a monophonic synthesizer in Last Note mode.

► You can of course add a monophonic lead or bass voice to a polyphonic patch.

Multi/Single Trigger

With the Keyboard Patch module, the Modular operates in Single Trigger mode. What this means is that when you hold a note and then play the next note, the gate is simply held rather than retriggered.

If you would prefer to use Multi-Trigger mode, add a Keyboard Voice module to your setup and use it exclusively for the gate.

◆ Load the ›Trigger‹ patch from the TpsnTrix folder.

This patch is a simple synth bass. In the Trig Mode switch module, the first two positions switch back and forth between the two trigger modes.

◎ **72** Single Trigger
73 Multi Trigger

Fingered Portamento

The portamento module located in the Ctrl Mod section is pretty much self-explanatory (see page 88).

What is not immediately apparent is how you can use it to generate portamento that activates exclusively when you play legato (fingered) notes.

◆ Load the ›PortaBs‹ patch.

74 Fingered Porta

In the portamento B module, the Jump input ensures the portamento is ignored (jumped over) when the notes aren't played legato. For this purpose, the gate has to be retrieved from the Keyboard Patch module.

Phaser/Flanger/Chorus

You're not limited to the stereo chorus and phaser modules for these kinds of effects. The delay module can be used for very creative effects of this type because you can modulate the delay time.

75 Flanger

◆ Load ›Flanger.‹

Here a simple synthesizer sound is routed through the delay module. The delay signal is modulated by the Flange LFO to generate the effect. The effects signal is routed from the delay output back into the Wet mixer, which tells you that the second level knob located on the delay represents a feedback parameter.

► Experiment with different settings and signal routing setups.

Conserving DSP Power

Unfortunately, you only have a limited amount of DSP power in the Modular. If you're working without the benefit of the expansion, you'll all too soon explore the ›outer limits‹ when you are playing relatively complex patches simultaneously or if you enjoy using a lot of voices.

In this section, we'll share a couple of tips on how you can conserve DSP power from the start and ›trim‹ the fat after you've finished a patch.

Keep an Eye on the Percentage Indicators on the Modules

When you drag the mouse pointer over a module on the toolbar (use the modules pop-up menu on the Macintosh), its energy needs will appear on your screen. Whenever you're selecting modules, compare these stats and try to use the most conservative module that will get the job done for what you have in mind. You'll find that some of the oscillators, LFOs and filters have a voracious appetite. You can save up to 5% DSP power by simply selecting a lighter-weight version of the same component.

If you're unsure the stats for a module you're already used, double-click on some blank portion of the module to see its DSP requirements.

A few rules-of-thumb:

Use Slave Oscillators instead of Master Oscillators

Generally, you only need a single master in a patch. The slave frequencies can be modulated individually, which means of course that you can use them independently.

A slave soaks up a lot less power than a master—use a slave in place of a master and in some cases you can reduce power consumption by half. LFOs are also prime candidates for a quick switch to slaves.

Use Simple Rather than Complex Modules

Versatility costs. A multiwave oscillator is on a champagne budget, whereas a simple sine oscillator will settle for beer. You can drastically reduce the ›bill‹ by replacing each multiwave oscillator with a simple sawtooth or a square oscillator in a finished patch. The same applies to LFOs and filters. A

multimode filter hogs over 5%, the fattest oscillator a whopping 11%. We won't mention the Filter Bank (17%) or the Vocoder (49%).

Use Modules Economically

Take a close look at your patch before you archive it. Are you certain that you used the most economical module available at every junction in the signal chain? Often we're in hurry to follow our inspiration, and we'll use whatever seems expedient at the time. Think like Scrooge and conserve resources by avoiding these common ›transgressions:‹

- Make sure all modules actually *do* something. It's easy to leave behind modules that you've decided not to use.
- Don't use audio modules for control signals.
- Don't use an ADSR envelope when an AD envelope does the job.
- If you created an envelope or an LFO specifically to generate a modulation signal, see if you can do without this component and ›grab‹ the signal at some other point in the patch.

► The hassle-free method of replacing a module is to position the replacement next to the original, double-click and drag the cables over to your new-found friend and send the old one back to module limbo.

Serious Words of Wisdom

Once you have ›purged‹ your patch of all of those insatiable gluttons, go back through it again. You're sure to squeeze out at least another 5%.

More Serious Words of Wisdom

Use the Common Voice Area whenever possible. The CVA does not replicate its modules for each voice. For example, a Vocoder module in the PVA takes up half a DSP slot for each

voice whereas in the CVA it takes up half a DSP slot for the whole patch!

In many cases you'll need polyphonic processing, but in others (take our monster Leslie simulation for example) you not only don't need it—it's unrealistic.

More Insight, Less Clutter

Here are a few handy tips on handling and managing a patch so you won't be totally mystified by it when you take a look at it a few weeks down the line:

- Take notes on the patch—especially when you have to store an unfinished patch. I don't know about you, but when I jot down a few observations on paper and leave the note lying around my desk, it always disappears into some hardcopy Hell. The Notes Floater on the Tools menu is a much friendlier environment for your notes.
- Name the modules—preferably right after you've finished creating them. Use names that have a direct connotation to what a given module does. The default names are helpful, but when you're dealing with a pile of modules, something like ADSREnv1 or Quantizer4 will not ring any bells. If you stick with the module's purpose or function—something similar to Filter Env or Glissando—rather than a type description, you'll find it easier to identify.

If You Have Trouble Understanding a Patch ...

... it may be because the patch designer didn't put much effort into arranging and naming the modules.

1. First hide all cables.
2. Now make the red audio cables visible and try to trace the audio signal path. Usually, it will originate at an oscillator at the top left hand of the patch and terminate in an output module.

3 Hide the red cables and make the blue cables visible to try to figure out the controller setup.

4 Try to order the chaos in the patch. Group the modules in a logical array—an oscillator section, filter section and sequencer section. Buddy up the related components—drag the envelope next to the filter, the pitch LFO to the oscillator, and so forth.

5 Straighten out the ›viper's nest‹ of cables by the strange but effective feature Shake Cables (ctrl) and name as many modules as possible with more descriptive terms.

6 If you still can't figure out what the patch is all about, simply play it, enjoy it and think Zen thoughts: maybe the patch doesn't want to be understood. (What is the sound of one patch mapping???)

Nurse, Pass the Stethoscope

You can construct a little probe that we'll call a stethoscope—with it you can hear what the signal is up to at any given point in the patch. If you place this little listening device before and after a module, you can hear exactly what influence the module has on the sound. Obviously, this trick will only work on audio signals.

1 Drag a 1 Output module to an unoccupied area of the screen.

2 Assign an unused audio output to it.

3 Drag a red cable from a random position in the patch to this module.

4 Turn the main output off and ›probe‹ diverse spots within the patch by temporarily docking the red cable to a particular spot.

Assigning and Labeling Knobs

One problem you will inevitably encounter has to do with knob assignments: the front panel of the Modular doesn't indicate them. There is one exception—Edit mode—but in this case, the front panel indicates the currently active knob only. Without a computer, it's virtually impossible to ›x-ray‹ a patch to see what's in it.

Don't despair though, there are a few simple tricks that you can use:

Multimode Knob Assignments

In Split mode (press the Split button at the left hand of the knob panel), the knob panel is—you guessed it—split up into the four slots. These are indicated graphically by the four gray areas on the panel. Slot 1 is assigned Knobs 1 to 6, Slot 2 gets 7 to 12. Slots 3 and 4 have to make do with three knobs each.

Be sure to consider Split mode—not to be confused with keyboard split—when you are planning knob assignments so you can readily access crucial sound parameters.

In the following recommendations, we're referring to sound characteristics—which parameters are responsible for shaping these characteristics depends on the patch. For example in an analog patch, the filter cutoff frequency often has the strongest influence on the tone color or timbre, in other patches the primary sound shaper is the oscillator FM input knob or morphed pulse width and overdrive.

1	Timbre	Cutoff, FM depth, waveshape, effect depth (wave-wrapper, overdrive)
2	Attack Time	Attack time of the volume or filter envelope—both simultaneously by morph
3	Release Time	Same as 2
4	Detune	Oscillator detune, PWM depth or rate, chorus depth
5	Velocity	Volume, timbre
6	Volume	Master volume of the patch

With this scheme, the three most important variations are assigned to the first three knobs so you have immediate access to them even when the patch is assigned to Slot 3 or 4 in Split mode.

Labeling the Modular

If you're extremely self-disciplined and always use the same knob assignment scheme for all patches or if you have a photographic memory, skip this section. For the rest of us, it's a pretty good idea to label the knobs. Here are two options:

- Magnetic strips—The front panel of the Modular is magnetic. Pick up a few small—if possible gray—magnetic

strips and label these with the names of your standard knobs. If you can manage to place a strip over the entire breadth of the knob section (six knobs), it won't be as likely to slip.

- Adhesive tape—I think we can skip an in-depth description, just make sure you use the kind that doesn't leave a trail of gummy residue when you pull it off.

Color Printout of a Patch

It's no bad idea when you can view a patch even when you don't have your computer handy—e.g. on tour, in the rehearsal room, etc. Besides, whenever you're stuck next to someone where escape is impossible—aircraft, train, prison, etc.—and your new friend whips out the pictures of the kids, you can always counter with your patches.

Not particularly elegant and low-tech, yes. Practical, you bet: simply print out a screenshot. You need a printer with—as a minimum—gray levels; a color printer is even better. A B&W printout wouldn't be much help. Even with a gray level printer, you'll have to select your cable colors carefully so you can tell them apart when they're just different shades of gray.

The printout will show the arrangement of modules, names and cables. In conjunction with Modular Edit mode, you can work with a patch even when a monitor is unavailable.

Storing and Managing Patches

Where to Store Patches

Personally, we recommend that you use your computer to manage patches. It enables you to create folders, copies, duplicates, or backups.

You should only store a collection of patches that you need on stage or that you want to travel with you. It's a good idea to reserve a specific memory bank of the Modular—say bank 1—for your favorites so that you don't accidentally overwrite them.

Don't store new patches in this reserved bank either—refer to Murphy's law. The likelihood that something will go wrong is too great. In an instant, several hours worth of work is down the drain—unless, of course, you conscientiously stored it all on your computer.

Managing an Internal Bank in a Computer

You can use the Patch Browser from the Tools menu to explore the patches currently in the Modular as well as those on your hard drive. Double-clicking on any patch will load it into the modular for previewing. If you have Auto Upload turned on in the Options menu, the patch will automatically appear in the editor, also.

Appendix

CD-ROM Table of Contents

Data Section

We'll publish updates and additions at regular intervals. You can check these out at our Modular Book Update page; see page 139 for the URL.

Patch Examples	all patch examples for this book	
Supplements	Clavia software:	
	Software	Modular system software
	Factory Patches	factory patches Version 3.0.3
	Manual	manual for Version 3.0, the pentultimate, reference source when you're desperate

Audio Section

The audio section features 74 examples designed to accompany the book.

All examples were recorded ›dry,‹ i. e. directly from the Modular without effects to give you an unadulterated impression of the sound—but don't let this stop you from spicing up the sound to taste, for instance adding a touch of reverb to lively it up.

If at all possible, you should listen to the audio CD on the same sound system as that you're using for the Modular—you'll find this kind of setup especially helpful when you are making comparisons during patch experiments.

► The first audio track on the CD is a data set-up track which does not contain any audio. This will show up as ›Track 1‹ on most commercial CD players and we have started our numbering of the audio examples accordingly—the first example is labeled ›Track 2.‹ If you play the audio CD in your computer's CD-ROM drive, the data set-up track may not show up as an audio track at all. In this case, numbers in the text are off by 1—e. g. select ›Track 1‹ when the text refers to ›Track 2,‹ etc.

Find below a list of the examples and the pages that refer to them.

Glossary

Additive Synthesis	The technique of creating sounds by adding sine waves together.
ADSR	Short for **A**ttack, **D**ecay, **S**ustain, **R**elease—most common envelope model in analog synthesizers—the ›Sustain‹ level is held as long as the envelope ›gate‹ is held.
AHD	Short for **A**ttack, **H**old, **D**ecay—envelope with three time zones but without a sustain phase. A single trigger usually causes the entire envelope pattern to be executed.
Amplifier	A device which increases the level of a signal.
Amplitude	Amplitude is a term used to describe the amount of a signal. It can relate to volume in an audio signal or the amount of voltage in an electrical signal.
Amplitude modulation	Using one oscillator to control (modulate) the amplitude of another. This effect typically produces clangorous ›sideband‹ frequencies.
Audio input	Modular audio input to which you can connect external signal sources.
Audio signals	Signals that determine the sound of the Modular. These have the highest sampling rate of all the signal types.
Band Pass	A type of filter that attenuates (lowers) the amplitude of frequencies outside of a certain frequency ›band.‹ As with all filters, the boundaries are gradual.
Band Reject	A type of filter that attenuates (lowers) the amplitude of frequencies inside of a certain frequency ›band.‹ As with all filters, the boundaries are gradual.
Chorus	A voice doubling effect created by layering two identical sounds with a delay and slightly modulating the frequency of one or both of the sounds to ›liven up‹ the sound.
Classic Filter	A special filter model in the Modular that simulates the ›grit‹ of an analog synthesizer.
Clock	A steady pulse from a generator which is used for synchronizing sequencers, drum machines, and others.
Common Voice Area (CVA)	The part of a Modular patch that applies to all voices simultaneously. This is the lower section of the Editor window. (Compare with ⇨Poly Voice Area (PVA).)
Compressor	An audio processor (in this case a module) that compresses the dynamic range of the signal.

Control Signal	This is the Modular's answer to control voltages and refers to all signals that influence or control a parameter.
Controller	Control feature in the form of a wheel, stick, knob, pedal, etc. that allows you to change information continuously. Controller information can be routed via a MIDI line.
Cutoff	The frequency at which a filter will start attenuating signals; it can be modulated.
Delay	A time parameter. An event is initiated after this predetermined amount of time.
Digitizer	A module that ›resamples‹ an incoming audio signal at a different bit resolution and sample rate. This module is frequently used to introduce distortion by downgrading the signal.
DSP	Short for **D**igital **S**ignal **P**rocessor—a computer component designed specifically for processing audio signals.
Envelope	An envelope is used to modulate a sound-shaping component within a given time frame so that the sound is changed in some manner.
Envelope Follower	A device (in this case a module) that generates an envelope control signal by ›following‹ the amplitude of an incoming audio signal.
Event Sequencer	A step sequencer that generates logical pulses at specified steps.
Expansion Board	Optional plug-in that doubles the processing power of the Modular.
FAQS	Short for **F**requently **A**sked **Q**uestion**s**.
Filter	An audio processor (in this case a module) that affects the amplitude of different frequencies in different ways. ⇨Low Pass, High Pass, Band Pass, Band Reject.
Filter Bank	An institution where you can deposit your filters with little or no compensation.
Flanger	Delay effect much like a chorus. The effect signal is routed back to the input (feedback) to create the typical swirling sound.
FM	Short for **F**requency **M**odulation—FM synthesis hit the big time with the Yamaha DX synthesizers. FM is the encoding of a carrier wave by variation of its frequency in accordance with an input signal, which is a complicated explanation for when an oscillator's output signal modulates the frequency of another oscillator.
Gate	A gate is defined by two values, threshold and time. Once the incoming signal exceeds the defined threshold, a trigger is initiated that lasts for as long as the signal remains above this threshold. In other words a gate signal starts and ends an event.

High Pass	A type of filter that attenuates (lowers) the amplitude of higher frequencies while leaving lower frequencies unchanged. As with all filters, the boundary is gradual. ⇨Cutoff.
Inverter	A module that inverts (changes from plus to minus and v. v.) the sample values of a signal. This can apply to audio, control or logic signals.
Key Scaling	Basically, this term describes a process where a parameter is changed via the keyboard.
Layer	The ability to place or stack two or more sounds on the same area of the keyboard.
LFO	Short for **L**ow **F**requency **O**scillator. An oscillator used for modulation whose range is below the audible range.
Logic	All switching circuits in the Modular that exclusively deal with the two conditions On (value +64) or Off (value 0).
Low Pass	A type of filter that attenuates (lowers) the amplitude of higher frequencies while leaving lower frequencies unaffected. As with all filters, the boundary is gradual. ⇨Cutoff
MIDI	**M**usical **I**nstrument **D**igital **I**nterface—MIDI enables synthesizers, sequencers, computers, rhythm machines, etc. to be interconnected through a standard interface and exchange notes controllers, clock and sounds. MIDI dictates a uniform data format and connector standard for all manufacturers.
Morphing	Function in the Modular where a single controller controls a number of parameters. The range and direction of knob movement can be determined individually for each parameter.
Multi-mode	MIDI mode where several sounds within a device—for instance the Modular—can be addressed individually via different MIDI channels.
Multi-trigger	A mode in which a Modular patch will respond to multiple triggers by creating new voices. (The Keyboard Voice Module is used for multi-trigger operation while the Keyboard Patch Module is used for single-trigger operation.)
Noise	In this context, the term refers to a random signal. ›White Noise‹ is the standard noise type where all frequencies are represented equally; in ›Colored Noise,‹ the emphasis is on lower frequencies.
Noise Gate	An audio processor (in this case a module) which blocks a signal when its amplitude falls below a certain ›threshold‹ level. The threshold is typically set just above the background noise level in the signal.
Oscillator	This component generates the audio signals in a synthesizer; its pitch can be modulated.

Overdrive	Distortion effect that simulates an overloaded tube.
Panorama	Position of the audio signal in the stereo picture.
Partial	Technically a partial refers to any component (i. e. sine wave) in the frequency spectrum of a signal. In our context, it refers to the ›harmonic‹ partials—those whose frequencies are integer multiples of the fundamental.
Patch	A storable configuration of modules, cables and settings in the Modular. A patch can comprise several sounds.
Performances	Combination of sounds or patches. The performance parameters are usually split zones, MIDI channels or program change numbers.
Phaser	A signal processor (in this case a module) that changes (usually by 180°) the phase of some frequency while leaving others unchanged. Typically the affected frequencies are spread across the spectrum and modulated by an LFO. When mixed with the original signal, varying ›phase cancellations‹ result adding motion to the sound.
Pitch	The element of the sound determined by the frequency of the vibration. The greater the frequency, the higher the pitch.
Poly Voice Area (PVA)	The part of a Modular patch in which each module is duplicated for each voice. This is the upper section of the Editor window.
Polyphony	The number of voices in a synthesizer. Each voice of the Modular contains a duplicate of every module in the patch. Each voice generates one note.
Portamento	Continuous gliding from one tone to another, also referred to as glide.
Pulse	A signal typically used to gate a process such as an envelope. Its value will instantly change from 0 to +64 where it will be held for a while (the ›pulse width‹) before returning to a value of 0.
PWM	Short for **P**ulse **W**idth **M**odulation.
Quantize	The effect of rounding or truncating incoming values to specific incremental values. The process can be applied to audio or control level signals. For example, an LFO signal could be quantized to derive a note sequence and an audio signal could be quantized to reduce its ›bit rate.‹
Resonance	A frequency at which a material object will vibrate. In a filter with variable resonance, a signal will be accentuated at the cutoff frequency. Resonance lends the filter a clearer, more ›electronic‹ sound.
Ring Modulator	A particular form of amplitude modulation in which the ›carrier‹ frequency is cancelled and only the generated sidebands remain.
Routing	In this context, the term describes the path of a signal.

Sample & Hold	Basically, all the S&H function does is check out (sample) an input when it receives a signal and routes this value to its output until it receives the next incoming signal (hold).
Sequencer	A module that steps through a series of signals called a sequence.
Slot	A ›synthesizer within a synthesizer‹ in the Modular. Each slot can take one patch.
Split	In this context, the term refers to a keyboard split which describes the assignment of specific sounds to an area of the keyboard.
Sync	1. Oscillator sync is an effect created by the interaction of two oscillators whereby the waveform of one is forced to restart each time the other's is. In this case, syncing oscillator will control the pitch. 2. Short for **Syn**chronization or **sync**hronization signal.
Trigger	In a synthesizer, trigger usually starts an envelope.
Velocity	The speed at which a key is depressed; this corresponds to the dynamics with which the player plays.
Wizoo	⇨http://www.wizoo.com/
X-Fade	A process akin to mixing in which one signal is reduced (a. k. a. faded) while another is increased.

Knob Table

You can enter knob assignments to this table. This may not be as elegant as a display on the knob panel—but is still fairly effective when you don‘t have a computer monitor handy.

The table is designed to fit onto the space right to the Modular keyboard. My tip: copy the blank template. Stick the table to the panel or archive all of the tables for the diverse patches in a ring binder.

#	Parameter	#	Parameter
1		4	
2		5	
3		6	
7		10	
8		11	
9		12	
13		16	
14		17	
15		18	(:wizoo:)

Nord Controller Table

If you adhere to these parameter and MIDI controller assignments when you are cooking up Modular patches, you'll be able to control the majority of the Modular patch parameters remotely via

- Nord Lead Environment (Logic)
- Mixer Map (Cubase) for the Nord Lead
- Nord Lead!

CC#	Nord Lead	Parameter	Modular Module	Parameter
7	Gain		Output	Level
5	Porta Time		Portamento	Time
19	LFO1	Rate		
20	LFO1	Waveform		
21	LFO1	Destination		
22		Amount		
23	LFO2	Rate		
24		Destination		
25		Amount		
26	Pitch/Mod Envelope	Attack	Ad Env	Attack
27		Decay	Ad Env	Decay
28		Destination	1-4 Switch	Output
29		Amount	1-4 Switch	Input Gain
30	Osc1	Waveform	Osc1	Waveform
31	Osc2	Waveform	Osc2	Waveform
78	Osc2	Semitones	Osc	Coarse
33	Osc2	Fine Tune	Osc	Fine
70	Oscillator	Fm Depth	OscFM Input	Input Gain
34	Osc2	Key Tracking	Osc	KBT
79	Oscillator	Pulse Width	Osc	PulseWidth

CC#	Nord Lead	Parameter	Modular Module	Parameter
35	Oscillator	Sync	Switch[1]	On/Off
8	Oscillator	Mix	Xfade	Xfade
73	Amplifier Envelope	Attack	ADSR Env	Attack
36		Decay	ADSR Env	Decay
37		Sustain	ADSR Env	Sustain
72		Release	ADSR Env	Release
38	Filter Envelope	Attack	ADSR Env	Attack
39		Decay	ADSR Env	Decay
40		Sustain	ADSR Env	Sustain
41		Release	ADSR Env	Release
44	Filter	Mode	Filter	Mode Switch
74		Cutoff		
42		Resonance		
43		Envelope Amount		Cutoff Input Gain
45		Velocity	Constant[2]	Value
46		Keyboard Track		

1 ›Splice‹ the switch module into the cable running from Osc X output to Osc Y Sync input.
2 Use the constant module to control the gain controller located between the envelope output and filter mod input.

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Art.No. WIZLH00002E