DPM® 3 SE

Owner's Manual

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DPM® 3 SE Owner's Manual

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Chapter 1: Introduction

Congratulations on your purchase of the DPM 3 SE. Peavey's engineers have taken the award-winning technology of their DPM 3 synthesizer and added sample editing capabilities, along with other enhancements, to make the DPM 3 SE both a high-performance synthesizer and sampler.

The DPM 3 SE is designed to give many years of use not just because of the features it offers today, but because it uses general-purpose Digital Signal Processing (DSP) chips to perform all sound generation and modification. Since the DPM 3 SE doesn't take the traditional approach of using custom chips dedicated to a particular type of sound generation, it can be reprogrammed via software updates to provide alternate types of sound generation. Furthermore, new sound programs and wavesamples can be loaded in to increase the DPM 3 SE's existing capabilities.

Highlights of the current configuration include:

- 200 programs available at all times—100 on-board user-editable RAM programs, with another 100 available from an optional RAM (user-editable) or ROM (preset, non-editable) cartridge.
- Multi-timbral MIDI operation (with four individual memorized setups) so that a single DPM 3 SE can provide up to 16 different sounds simultaneously.
- Four Megabytes of 16-bit PCM wavesamples, including both acoustic and electronic instrument sounds.
- Sample editing capabilities including loop adjust, automatic loop finding, unity pitch adjust, naming, etc.
- 16 voice, dual oscillator operation—play up to 32 notes simultaneously on 16 keys.
- Stereo outputs.
- System exclusive data librarian.
- 9-track sequencer with automated mixdown.
- Optional non-volatile memory for storing new wavesamples (expandable to 1 Megabyte).
- Two on-board programmable digital signal processors, each with two independent signal processing modules, (reverb, EQ, chorus, delay, etc.) means you may not need to bring outboard signal processors with you to the gig.
- Alternate tuning tables for creating alternate and non-equal tempered tunings.

...and much more, which you'll find out about as you read this manual.

Before doing anything else, send in your warranty registration so Peavey can advise you of any future updates and enhancements.

1.1 ABOUT THIS MANUAL

This manual includes ten chapters:

- *1 Introduction.* This chapter helps you make some great sounds right out of the box.

- *2 The Most Common DPM 3 SE Operations.* Here are the most common operations you'll do with the DPM 3 SE—save and load files, change MIDI settings, edit often-used parameters such as pitch bend range, and so on.

- *3 Programming the DPM 3 SE.* For those who want to create their own sounds or edit existing sounds, this presents the basics of sound programming as well as a reference section of programming parameters.

- *4 Programming the Onboard Signal Processors.* To further enhance your sounds, this chapter includes details on programming the onboard signal processors.

- *5 Programming Drum Kits.* The DPM 3 SE offers a full complement of drum sounds.

- *6 Sample Editing.* How to load, save, and edit samples. Also includes a short tutorial on sample editing.

- *7 The Sequencer.* The on-board sequencer lets you compose on the DPM 3 SE, drive other MIDI equipment, or both.

- *8 Advanced Applications.* This chapter offers information on slaving multiple DPMs together, alternate tunings, and system exclusive data librarian functions.

- *9 Programming Tips and Background Material.* Contains information about synthesis, disk care, envelope generator subtleties, programming tips, and other background material.

- *10 MIDI Supplement.* It is important to know the basics of the MIDI specification to make the best use of the DPM 3 SE's MIDI features. If you are not very familiar with MIDI, please read the MIDI supplement before proceeding.

Beginners please note: Chapters 9 and 10 contain background material about synthesizers and programming. Grouping this material together allows those familiar with synthesis to use the body of the manual as a reference manual, yet background material is available for those who want it.

1.2 TUTORIAL /SETUP:
ON THE AIR IN 20 MINUTES WITH THE DPM 3 SE

1.2A Cable Setup

1. Unpack the DPM 3 SE. Save all packing materials in case the unit needs to be sent for updating or servicing.
2. Plug the female end of the line cord into the matching socket on the DPM 3 SE's rear panel.
3. With *all devices in your system turned off and the volume controls turned down,* hook up the connectors according to your particular needs, as described below.

1.2B I Just Wanna Hear the Demo!

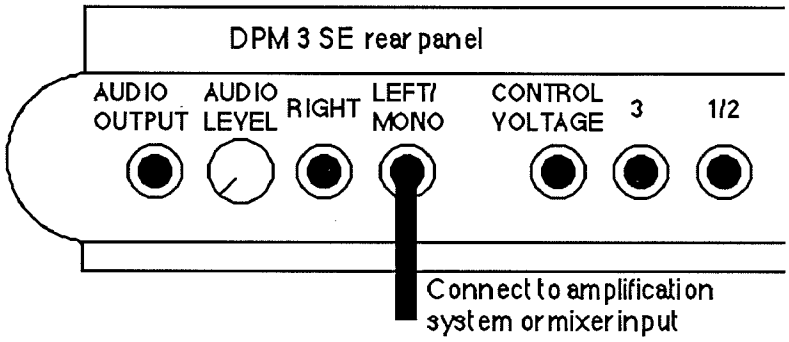
1. Either run a mono cord from the Left/Mono Audio Output to your amplifier, or connect two mono cords from the Left and Right Audio Outputs to a stereo amp or two mixer inputs.
2. Turn on (in this order) the DPM 3 SE, mixer (if present), and amplification system. Turn the volume controls up part way; turn them up to normal volume once you're satisfied that the system is working properly.
3. Press the **Select** Sequencer button. The display should show some sequence names. Press the button above one of the names in the display. If the display askes "Save last sequence edits?", press the button above the part of the display that says **-NO-**.
4. Press the > (Play) button in the Sequencer button area (lower right area of the DPM front panel) to play the selected sequence. The sequence should start playing. If not, then the default parameters have been changed. Refer to Chapter 7 on sequencing for information on sequence playback.
5. After the demo has finished, press the ❑ (Stop) Sequencer button, even if the sequencer appears to be stopped.

1.2C Using the DPM 3 SE as a "Workstation"

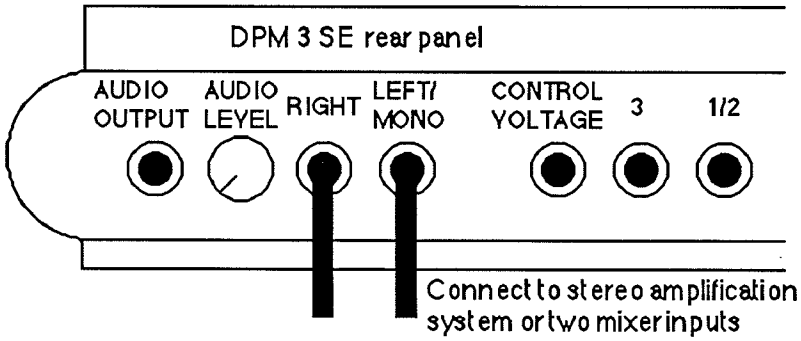
The DPM 3 SE, thanks to its onboard signal processing and sequencer, can serve as a complete composition center that requires no equipment other than an amplifier or set of headphones. Hook it up as described next.

Audio: Referring to the diagrams below, plug the Audio Outputs into a suitable amplification system or mixer. You have three options:

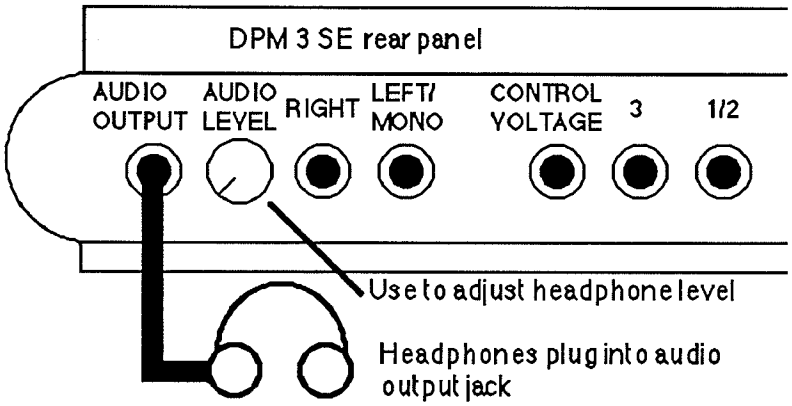
• **Mono** Connect a mono cord from the Left/Mono Audio Output to a mono amplification system or individual mixer input.



• **Stereo** Connect two mono cords from the Left and Right Audio Outputs to a stereo amplification system or two mixer inputs.



• **Stereo headphones** Plug a set of high-quality stereo headphones into the rear panel headphone jack. A separate volume control regulates the headphone level.



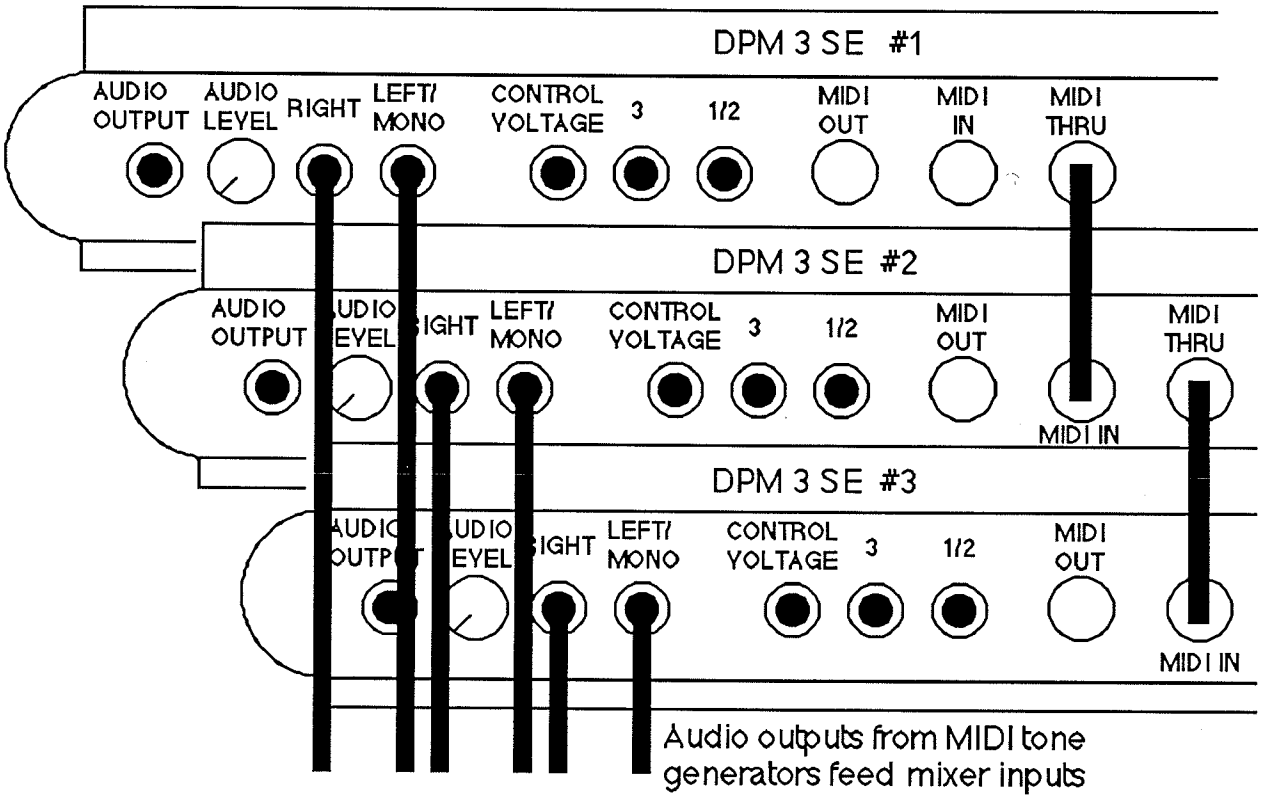
1.2D Live Use as a MIDI Keyboard/Master Controller

Most live applications use the DPM 3 SE to generate sounds, with (possibly) the MIDI output driving other expander modules, such as a Peavey DPM V3 rack module.

Audio: Plug the Audio Outputs into a suitable amplification system or mixer. You have two options:

- **Mono** Connect a mono cord from the Left/Mono Audio Output to a mono amplification system or individual mixer input (see section 1.2C).
- **Stereo** Connect two mono cords from the Left and Right Audio Outputs to a stereo amplification system or two mixer inputs (see section 1.2C).

MIDI: When driving other MIDI units (*e.g.*, expander module, MIDI-responsive signal processor, etc.) run a MIDI cable from the DPM 3 SE MIDI out to the 2nd unit's MIDI in. To drive additional MIDI modules from the same keyboard, patch the 2nd unit's MIDI thru output to the 3rd module's MIDI in. Connect the expander module audio outputs to your amplification system via a mixer. *Caution:* Do not attempt to connect more than three or four units together using thru connections as this may affect the integrity of the MIDI data.



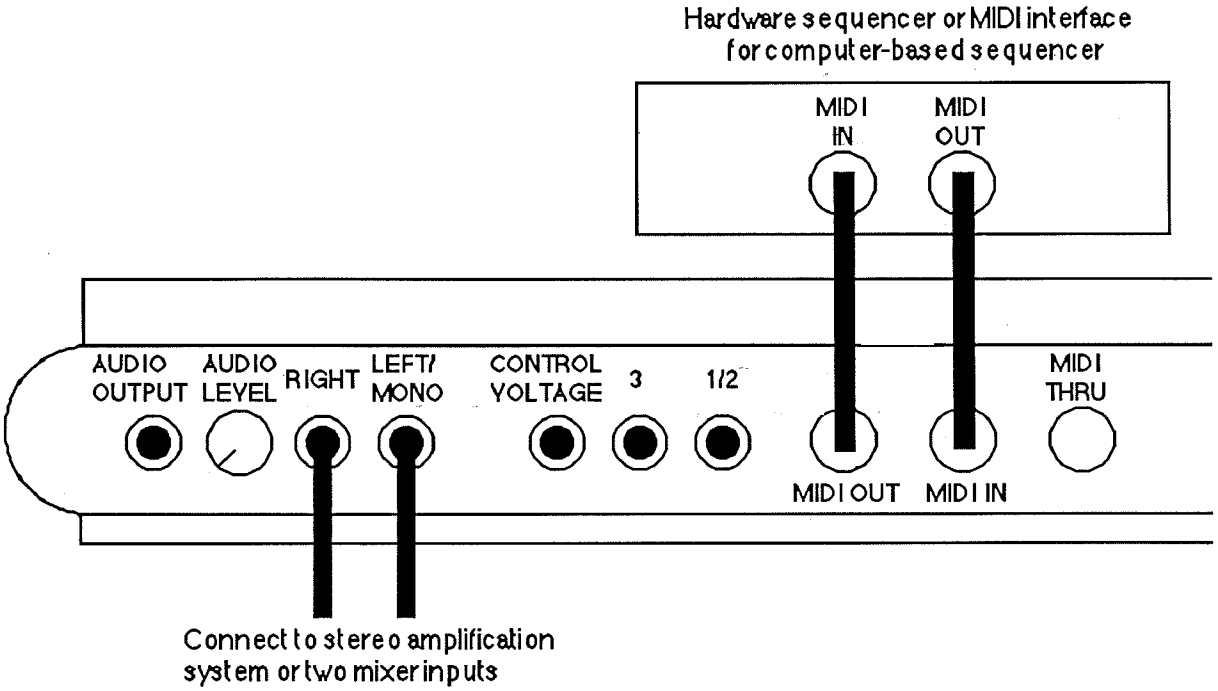
1.2E Studio Use with an External Sequencer

In some studio applications, the DPM 3 SE will generate master controller signals that are recorded by a sequencer. On playback, the sequencer will send this data back into the DPM 3 SE, which then serves as a multi-timbral sound module. The sequencer will probably generate data over several channels; the DPM 3 SE can be programmed so that individual programs play sequenced data from specific channels.

Example: If the sequencer transmits a piano part over channel 1, a bass part over channel 12, and a string pad over channel 14, the DPM 3 SE could be programmed so that a piano sound plays only the MIDI data assigned to channel 1, a bass sound plays only the MIDI data assigned to channel 12, and a string pad plays only the MIDI data assigned to channel 14. This is called a *Multi* setup; the DPM 3 SE holds four such Multis, named Multi01-Multi04.

Audio: The DPM 3 SE's panning and signal processing options allow you to set up a stereo submix within the DPM 3 SE, which can serve as the stereo master output or be recorded on tape.

The diagram below shows a typical sequencer-based setup that interfaces with a sequencer and provides mixed stereo outputs.



MIDI: If you are driving other MIDI gear such as an expander module or MIDI-responsive signal processor, the usual procedure is to drive these from the sequencer

if it has additional MIDI outputs. However, you can also use the DPM 3 SE MIDI thru connector to drive other modules, as described in section 1.2D.

1.2F Powering Up

Turn on your equipment in the following order (this is good practice for any MIDI/audio setup, not just the DPM 3 SE):

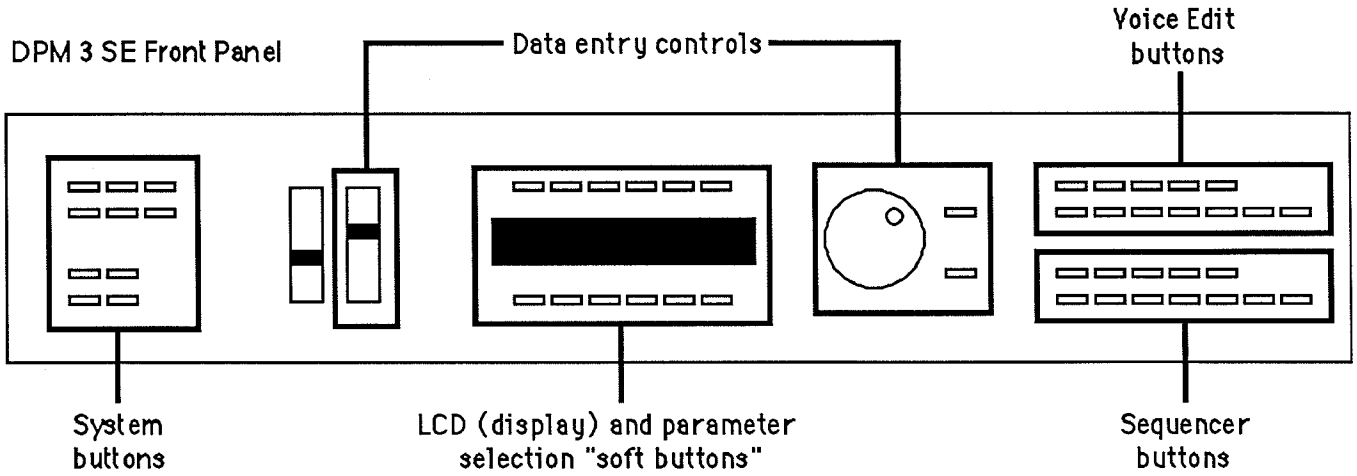
- Computer or sequencer (if present)
- Synthesizers, sound generators, and signal processors
- Mixer (with master outputs turned all the way down!)
- Amplification system

Turn up the mixer master output controls to a low level as you test out the system. Turn up to normal volume once you're satisfied that the system is working properly.

We'll audition the on-board programs soon, but first let's look at how to communicate with the DPM 3 SE.

1.3 GETTING AROUND THE DPM 3 SE: THE FRONT PANEL

There are five main front panel programming tools.

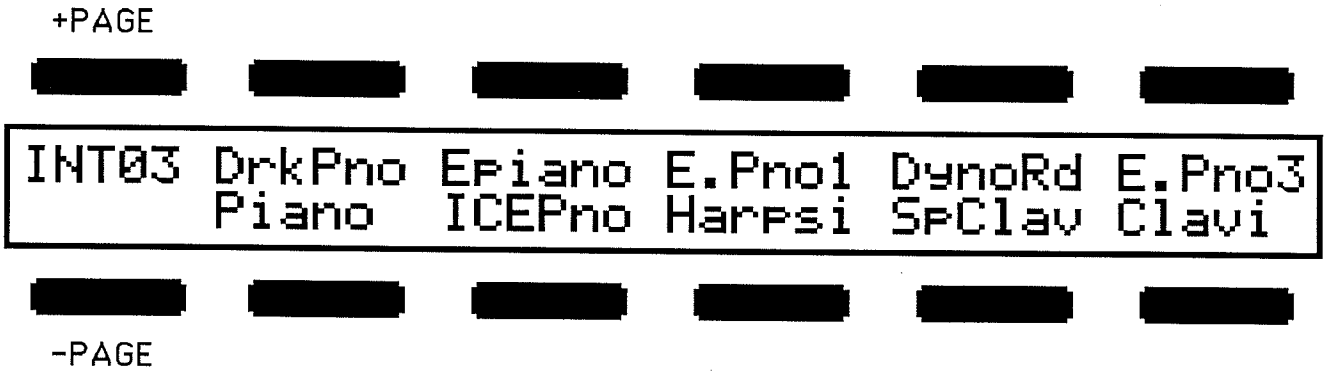


• **System buttons** These select sound programs and various "master" functions such as mass storage options, MIDI parameters, signal processor editing, sampling parameters, and so on.

• **Voice Edit buttons** When programming sounds, these choose the particular module to be programmed such as oscillator, filter. etc.

• **Sequencer buttons** These buttons control all sequencer functions—record, playback, overdub, edit data, and the like.

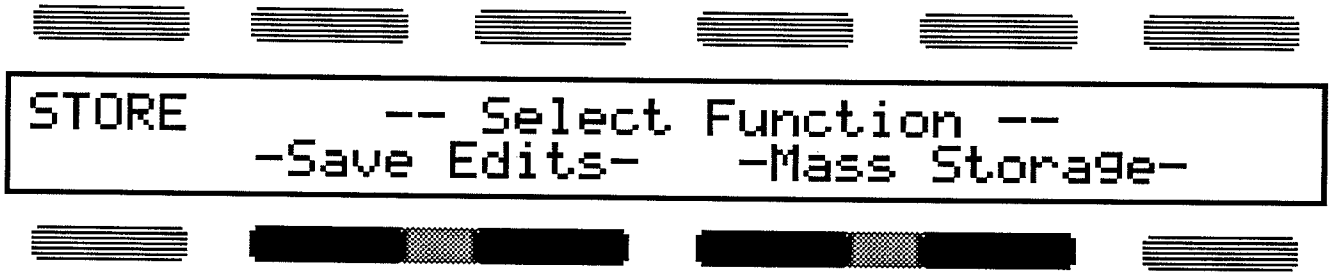
• **LCD and parameter selection "soft buttons"** The Liquid Crystal Display (LCD, or simply "display") is surrounded by two rows of six "soft" buttons, so called because their functions change depending on what the software wants them to do. Selecting a function with the System, Voice Edit, or Sequencer buttons calls up a particular screen, which identifies the button functions. For example, suppose you select a patch program bank, such as Internal Program Bank 03. The display identifies the program bank and shows the available programs (the programs in your unit may vary; these are typical):



Each button selects the corresponding program; when you select a program, an asterisk appears to its left.

Examples: Pressing the upper right-hand button selects the program E.Pno3. Pressing the third button from the right on the lower row selects Harpsi. Pressing **+Page** takes you to Internal Bank 4 (the next higher-numbered Bank), and **-Page** to Internal Bank 2 (the next lower-numbered Bank). There are 10 Banks of 10 programs each.

For convenience, sometimes more than one button can select a function. In the following display:



...either of the two buttons under **-Save Edits-** select that function, and either of the two buttons under **-Mass Storage-** select that option.

Important notes: In this manual, if a button does not select anything on a particular display page, it will be "lined" (*e.g.*, the upper row of buttons above). If more than one button selects a function, each will be "linked" with a gray strip, as shown above under **-Save Edits-** and **-Mass Storage-**.

Although in most cases the button under both the value to be changed and the

parameter name are "active," thus letting you select a parameter for editing, sometimes this is not possible due to space limitations. In this case, the button directly under the value to be changed is usually the active button.

• **Data entry controls** Parameters to be changed are usually selected via soft buttons on the LCD, but once selected you will often need to enter a particular parameter value ("data"). The DPM SE 3 offers several methods of data entry which accomplish the same function, but in different ways.

Data slider Use to scan through a wide range of values with a single motion.

+/Inc and -/Dec buttons These change data one value at a time. *Example:* To change a value of 20 to a value of 21, press the **+/Inc**(rement) button. To select 19, press **-/Dec**(rement).

Data wheel This is often the fastest way to change values. Spin it to cover a wide range of values, then rotate it more slowly to zero in on a particular value.

When we talk about "selecting" a parameter value while programming, it means that you can use any of the data entry devices. A parameter is available for editing if it is preceded by a flashing = or * symbol.

Important: If you ever want to bail out of an editing operation, hit any button other than a "soft" button or the **Inc** or **Dec** button.

Other front panel controls and features are:

• **Volume control** This controls the master volume level for the entire instrument. Individual programs can also have their own individually programmed volumes, controlled proportionately by this master control.

• **Memory cartridge slot** This is located toward the rear of the front panel. Peavey and other manufacturers offer alternate programs for the DPM 3 SE, stored in cartridges. Blank cartridges, such as the Peavey Cache Card (part #0071023), are available for saving your own programs to cartridge.

• **Modulation wheels** The left Pitch wheel is dedicated to controlling pitch bend. The right Modulation wheel can be assigned to any of several parameters, such as volume, vibrato depth, timbre, etc..

• **Disk drive** Located just above the wheels, this is the DPM 3 SE's main data storage and retrieval device. It allows for storing and loading programs, sequences, samples, signal processor settings, MIDI system exclusive data, etc.

1.4 QUICK PARAMETER SETUP

1.4A Auditioning Programs

Now that all the connections are made and you know how the front panel controls work, let's hear what the DPM 3 SE can do.

1. Set up the DPM 3 SE.
2. Press one of the **Bank** System buttons. A display appears showing the various patches in that Bank (the following is a typical display; your unit might have different programs).

3. To select a particular program, press the associated button above or below the program name. Play away! Check out the modulation wheels and apply pressure to the keyboard after keys are down to see if these physical gestures alter the sound for a given program. If you don't hear any audio:

- Make sure the output connections are properly hooked up.
- Check that the amplifier is on and the mixer volume turned up.
- Make sure the DPM 3 SE's front panel volume control is turned up.

4. To select the next higher-numbered Bank of programs, press the **+Page** button. To select the next lower-numbered Bank, press the **-Page** button.
5. An alternate way to select Banks is to "reclick" on a Bank button. Note that the legend for each Bank button shows two numbers, such as 1/6. This indicates that if one of the Bank numbers is selected, clicking on that button will call up the alternate Bank. *Example:* If Bank 3 is selected, reclick on the **Bank 3/8** button and Bank 8 will appear. You can also "double-click" to go directly from one Bank to another. *Example:* Suppose Bank 1 is selected and you want to select Bank 9. Press the **Bank 4/9** button twice; on the first press Bank 4 appears, and on the second press, Bank 9 appears.

6. Selecting cartridge programs is similar. The **Cart** button "toggles" between Cartridge and Internal banks; pressing **Cart** while in Internal memory selects Cartridge memory, and pressing **Cart** while in Cartridge memory selects Internal memory. Cartridge Banks are selected the same way as Internal Bank programs.

1.4B Setting Parameters for Use as a MIDI Keyboard Driving a Second MIDI Module

1. Determine the MIDI channel over which the second module (signal processor, synth, etc.) receives data. If you do not know, assume it's channel 1.
2. Press the DPM 3 SE's **MIDI** system button. The following display appears:

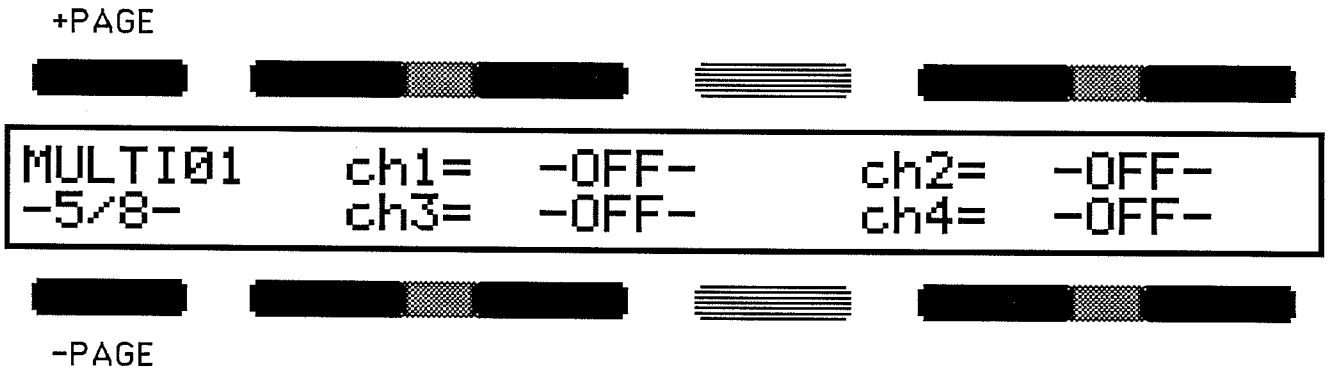
```
+PAGE

MIDI Ch.IN= 01 OUT= 01 MidC= 60 Ovf= OFF
-Filt- -Mult-    Local= ON  Mode= POLY

-PAGE
```

3. Press the **OUT** soft button to change the MIDI channel to something other than 01. The = sign will flash, indicating the parameter is selected for editing. Use any of the data entry devices to select the desired MIDI channel. The DPM 3 SE will transmit data over this channel to the expander module. If playing on the DPM 3 SE does not trigger the expander module, check your MIDI cables and try different channels; perhaps the expander module is set to a channel other than the one you selected.

1.4C Multi Mode: Setting Parameters for Studio Use with a Sequencer

In this situation you will probably want to set up for multi-timbral operation. There are four independent multi-timbral setups, Multi01-04. Each "instrument" in a Multi must be set up individually.

1. Press the **MIDI** System button then press the **Mode** soft button.
2. Select Multi01, Multi02, Multi03, or Multi04.
3. Press the **-Mult-** soft button. A display similar to the following appears:



The upper left hand of the screen reminds you which Multi is selected (01-04). The rest of the display shows the program assignments for MIDI channels 1-4 (if no program is assigned to a particular channel, the display shows **-OFF-** for that channel).
4. Determine the MIDI channels to which you want to assign DPM 3 SE programs. The DPM 3 SE will play back up to sixteen channels simultaneously. If needed, the same program can be assigned to more than one channel. *Caution:* The DPM 3 SE cannot play more than 16 voices at a time. Therefore, assigning multiple programs to multiple channels increases the odds that newly-played notes will "steal" older notes that are still sounding. See section 1.5 for more information about how the DPM 3 SE reacts when asked to play more than 16 voices at a time.
5. Press one of the soft buttons over ch1 and the = will flash. Select the desired program with any data entry device. This is the program that will be played by sequencer data appearing over channel 1.
6. Similarly choose program assignments for channels 2-4, if desired.
7. Press the button under **-5/8-** to choose a display that shows the program assignments for MIDI channels 5-8, and set the program assignments similarly to how you selected programs for channels 1-4.
8. The display now shows -9/12- where -5/8- was on the previous screen. Press the **-9/12-** soft button to assign programs to MIDI channels 9-12.
9. The display now shows -13/16- where -9/12- was on the previous screen. Press the **-13/16-** soft button to assign programs to MIDI channels 13-16.

As you become more familiar with the DPM 3 SE, you'll probably want to program setups for Multis 2-4 as well. Multis are also useful for guitar synthesists, who often set up a separate sound for each individual string.

Caution: Remember that no matter how many programs you assign, the DPM 3 SE cannot play more than 16 voices at a time.

1.5 ABOUT DYNAMIC ALLOCATION

The DPM 3 SE can play up to 16 voices at a time. However, each voice can consist of two oscillators making different sounds or tuned to different pitches, allowing 16 keys to play up to 32 notes simultaneously.

If 16 voices are playing (or sustaining) and you play a new key, this will "steal" the least useful voice that is still playing—for example, one that has almost reached the end of its decay. This intelligent voice selection process is a considerable improvement over synths that merely steal voices on a "first-played, first to be stolen" basis.

Combi programs (see sections 3.3K through 3.3O for more information), which can layer two or more programs, use up more voices since layering two programs halves the number of available voices. A Combi with two layered programs allows up to eight voices, and a Combi with four layered programs, up to four voices. A Combi with three layered programs will play five voices but if you play a sixth note while the five are sustaining, one of the Combi programs will play the one remaining voice.

Chapter 2: The Most Common DPM 3 SE Operations

The DPM 3 SE is a very "deep" instrument with lots of options, so to help make the learning curve a little easier, some of the most important operations—saving and loading data, communicating with other MIDI gear, and editing crucial sound parameters—have been collected in this chapter.

Important: As you experiment, remember that any changes made to the the factory patches shipped with the unit will, if you save those changes, be remembered by the DPM 3 SE. You can recall the factory patches at any time by loading in the Edition 1 Setup file that came with the DPM 3 SE factory disk.

2.1 TUNING, KEYBOARD RESPONSE, AND VIEWING ANGLE EDITS

2.1A Master Tuning

This tunes the DPM 3 SE to other instruments or concert pitches other than A=440.

1. Press the **Master** System button.
2. Press the **-Tune-** soft button. The display shows:

```
TUNING Coarse= +00 Fine= +00 Feel= MEDM
-user-  Scale= EQUAL
```

3. To change the master tuning in semitone steps, press one of the **Coarse** soft buttons and enter a value between -12 and +12 semitones.
4. To change the master tuning in cents (1/100th of a semitone), press one of the **Fine** soft buttons and enter a value between -99 and +99 cents.

The scale and user tuning functions are described in section 8.2.

2.1B Keyboard Velocity Response

Different players play their keyboards with different degrees of force. This function matches the DPM 3 SE to your playing style.

1. Press the **Master** System button.
2. Press the **-Tune-** soft button. The display shows:

```
TUNING Coarse= +00 Fine= +00 Feel= MEDM
-user-  Scale= EQUAL
```

3. Press the **Feel** soft button and select the desired keyboard action: Soft (light playing gives the full velocity range), Medium (standard velocity response), or Firm (requires a heavy touch to give the full velocity range).

2.1C Display Viewing Angle

The display is easier to read at some angles than at others. This adjusts the display for the best contrast for your particular viewing angle.

1. Press the **Master** System button and while holding it down, press and hold down the **MIDI** System button.
2. While holding down both buttons, move the data slider for the best display readability. The Inc/Dec buttons and data wheel are not active for this function.
3. After choosing the desired display angle, release the **Master** and **MIDI** buttons.

2.2 MAIN MIDI EDITS

Any MIDI edits are remembered *except* for the Local Control setting, which always reverts to On after power-up.

All MIDI edits start by pressing the **MIDI** System button. The display says:

```
MIDI Ch.IN= 01 OUT= 01 MidC= 60 Ovf= OFF
-Filt- -Mult-    Local= ON  Mode= POLY
```

2.2A Change MIDI Mode

The DPM 3 SE can choose between Omni, Poly, and Multi (multitimbral) modes.

1. Press the **Mode** soft button.
2. Select the desired MIDI mode. Note that there are four individual Multi modes (Multi01-Multi04), each of which stores the settings for a particular Multi setup (section 1.4C).

2.2B Change MIDI Input Channel

This sets the DPM 3 SE's *base channel,* the channel over which data is received in Poly mode and also, the channel over which program changes are received in any mode. The input channel can be set independently of the output channel.

In Omni mode, the DPM 3 SE plays all 16 MIDI channels back through whatever patch program you've selected; in Multi mode, channel and program assignments are set under the Multi menu, described in section 1.4C.

1. Press the **Ch.IN** soft button.
2. Select a MIDI channel between 1 and 16.

2.2C Change MIDI Output Channel

This sets the base channel over which data is transmitted (however, it is possible in Combi mode to transmit over several channels simultaneously; see section 3.3M). The output channel can be set independently of the input channel.

1. Press the **OUT** soft button.
2. Select a MIDI channel between 1 and 16.

2.2D Set Middle C

You can offset Middle C to any any note within the MIDI note range of 36 to 84 (60 is the default for middle C). Think of this as a "global transposition" option.

1. Press the **MidC** soft button.
2. Enter the desired MIDI note number from 36 to 83.

2.2E Turn Local Control On or Off

With Local= On, the DPM keyboard plays the internal sounds and sends data out over MIDI. With Local= Off, the DPM keyboard sends data out over MIDI but does not play the internal sounds.

When used as a master keyboard in conjunction with a sequencer program, the sequencer will often include a "software MIDI thru" feature that rechannelizes incoming MIDI data from the DPM 3 SE and sends it out over any channel you want. In this situation, Local Control should usually be off.

1. Press the **Local** soft button.
2. Select On or Off.

2.2F Filter Out MIDI Data

When using the DPM 3 SE as a master keyboard, you may want to suppress certain types of data from being transmitted; when playing back from a sequencer, you may want the DPM 3 SE to ignore certain types of data. This option allows for both.

1. Press the **-Filt-** soft button. The display shows something like:

```
FILTR PWhl= BOTH  MWhl= BOTH  SysX= RECV
-more- Vol= BOTH Progs= XMIT Press= OFF
```

2. Select the MIDI data to be filtered by pressing the corresponding soft button:

- **PWhl** Pitch wheel
- **MWhl** Mod wheel
- **SysX** System Exclusive data
- **Vol** Volume
- **Progs** Program changes
- **Press** Pressure (also called aftertouch)

3. Enter the desired filter status:

- **Off** The associated data is neither received nor transmitted.
- **Xmit** The associated data is sent from the DPM, but incoming data of the specified type is ignored.
- **Recv** The associated data is received by the DPM, but not transmitted.
- **Both** The associated data is both received and transmitted by the DPM.

4. An additional page provides more data filtering options. To access these options, press the **-more-** soft button on the main MIDI filter page. The display shows something like:

```
FILTR  Sus= BOTH Parms= BOTH XCtrl= BOTH
-main-                      Notes= BOTH
```

5. Select the data to be filtered:

- **Sus** Sustain pedal data
- **Parms** DPM parameter changes, sent or received as DPM System Exclusive data
- **XCtrl** External MIDI controller signal that controls DPM parameters when receiving, or MIDI controller signal generated via the data slider when transmitting
- **Notes** MIDI note data

6. Enter the desired filter status:

- **Off** The associated data is neither received nor transmitted.
- **Xmit** The associated data is sent from the DPM, but incoming data of the specified type is ignored.
- **Recv** The associated data is received by the DPM, but not transmitted.
- **Both** The associated data is both received and transmitted by the DPM.

7. To return to the main MIDI screen from the main filter screen, press the **+Page** button; to return from the second MIDI filter page, press the **-main-** soft button.

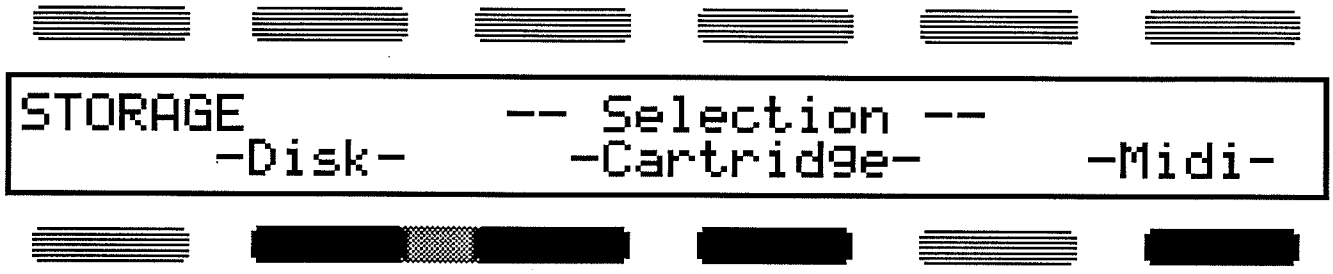
Caution: When driving the DPM from a different keyboard, note that some master keyboards assign the footpedal to controller 7, reasoning that it will be used as a volume pedal. If you have problems ignoring pedal information, this might be why.

2.3 STORAGE FUNCTIONS

2.3A Cartridge Memory Management

The DPM 3 SE's internal memory can be transferred to a cartridge as a block, and cartridge data can be transferred to the internal memory as a block.

1. Press the **Storage** System button.
2. Press the **-Mass Storage-** soft button. The display says:



3. Press the Cartridge button. The display says:

```
CART: Block Copy - Programs/Effects
  -Internal to Cart- -Cart to Internal-
```

4. Press the **-Internal to Cart-** soft button to copy the internal programs and effects to the cartridge; press **-Cart to Internal-** to copy the cartridge programs into internal memory.

If you attempt to write to a memory-protected cartridge, after pressing **-Internal to Cart-** the display says:

```
Cart is Write Protected.....
```

Disable write protection by changing the position of the cartridge's write protect switch, and try again.

2.3B Format a Disk Prior to Saving Data

Although the DPM 3 SE's memory is non-volatile (*i.e.*, is battery-backed up to prevent loss of data while the unit is turned off), accidents can happen, from a battery going bad to operator error (Ooops! Didn't mean to load the cartridge data into internal memory after all...). As a result, it's vital to save your data periodically.

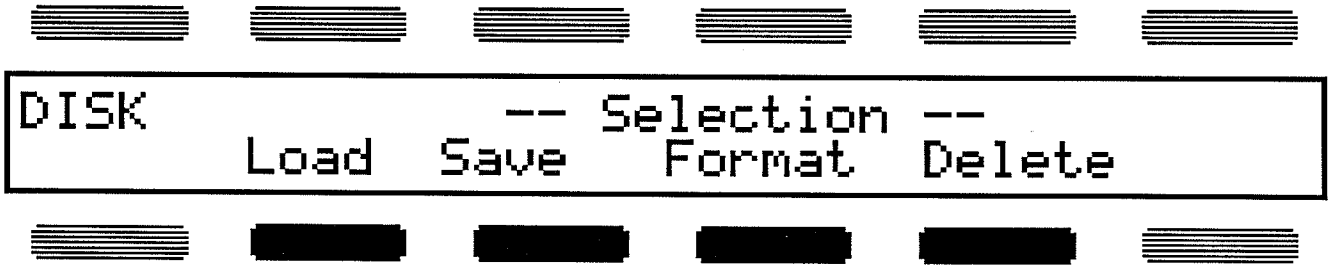
You may also become sufficiently seduced by the DPM 3 SE's programming options to make up sets of your own sounds. These should also be saved.

Although cartridges are a convenient storage medium, they are mostly used to extend the number of programs available at one time. It is much less expensive to store data to disk. However, a blank disk must first be *formatted* to accept DPM data. This is like putting the lines on a parking lot so the cars know where to park. Also note that disks must be handled with care. If you are not familiar with how to handle disks, see section 9.7.

To format a disk:

1. Press the **Storage** System button.
2. Press the **-Mass Storage-** soft button. The display says:

3. Press the **-Disk-** soft button. The display says:

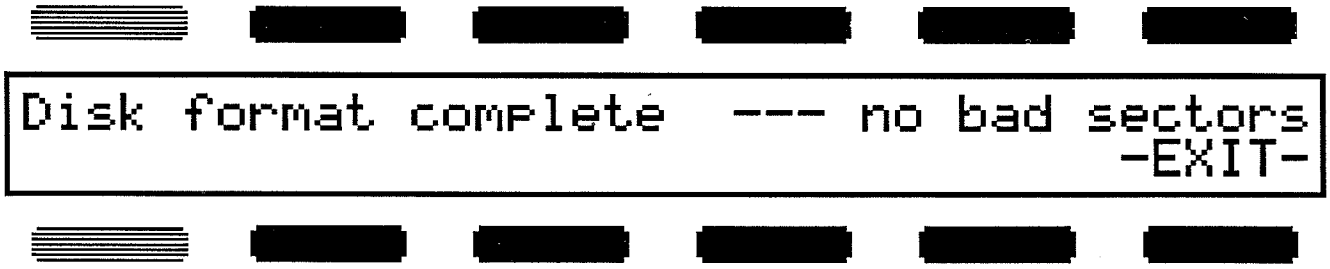


4. Press **Format**. The display says:

5. Insert the disk into the disk drive (if you're not familiar with disk insertion procedures, see section 9.7) and press the **-Continue-** soft button. If you change your mind about formating, press **-Exit-**.
6. The DPM will examine the disk. If it is not empty, the display will alert you and let you either continue (which erases everything on the disk) or exit to cancel formatting.
7. While the disk is formatting, the display will show which track and side of the disk are being formatted.

are being formatted.

8. When the DPM reaches track 79, side 01, the format is complete. The display says:



The disk is now ready to store DPM data. Press **-Exit-** to leave the disk formatting function. If the disk is damaged or there is some other formatting problem, the display will indicate the number of bad sectors.

2.3C Saving Data to Disk and Naming Data Files

You can save a variety of data to disk, from a single effects patch or program to all parameters in the DPM. Each data file can be saved under its own name.

Important: When saving individual pieces of data (single sequence, single program, single fx), the desired sequence, program, or program containing fx parameters must be selected prior to saving.

1. Press the **Storage** System button.
2. Press the **-Mass Storage-** soft button. When the Storage menu appears, press the **-Disk-** soft button. The display says:

```
DISK              -- Selection --
        Load  Save   Format  Delete
```

3. Press the **Save** soft button. The display shows the type of data you can save:

```
DISK -Progs- -Seqs-  -fX- -SysEx- -Glbl-
SAVE -1Prog- -1Seq- -1fX- -SetUp- -EXIT-
```

- **Progs** Saves all 100 programs in internal memory as a group.
- **Seqs** Saves all 50 sequences and 10 songs in internal memory as a group.
- **fX** Saves all 100 effects (signal processing) programs as a group.
- **SysEx** Saves any MIDI system exclusive data in memory (see section 8.3).
- **Glbl** Saves all Global data (MIDI and master menu settings)
- **1Prog** Saves one program.
- **1Seq** Saves one sequence.
- **1fX** Saves one effects patch.
- **Setup** Saves all programs, sequences, and effects patches. Most beginners may want to just save a Setup, as it saves a "snapshot" of all DPM 3 SE parameters including Global data.

4. After selecting the data type to be saved, the display lets you name the data. The following shows the display when saving a Setup, but the other functions use a similar screen.

```
SAVE            as = ?                -EXEC-
SETUP            <-            ->     -EXIT-
```

5. A small circumflex (^) symbol shows up underneath the character that will be edited with the data entry devices. Select the desired letter, number, or symbol. To move the circumflex under a different character, use the left arrow or right arrow cursor buttons to move left or right respectively.
6. After naming the data to be saved, press the **-Exec-** soft button. (If you change your mind about saving, press the **-Exit-** soft button.) The disk drive will whirr into action, and the display will indicate data is being first saved, then verified to insure data integrity. Press **-Exit-** when you're done, or select a different function.

Note: Characters available for naming are (in order of appearance as you turn the data wheel clockwise:)

Letters **A-Z** and **a-z**	**0-9**
+	-
=	(
)	*
&	^
%	$
#	@
!	-> (right arrow)
`	{
}	[
]	| (vertical line)
' (single quote symbol)	:
;	?
/	, (comma)
. (period)	space

2.3D Loading Files from Disk

You can load a variety of data from disk, from a single effects patch or program to all parameters in the DPM. Each data file can be loaded by name.

Important: When loading a single program, effect (fx), or sequence, this data is stored in a temporary memory buffer for auditioning. To retain this data it must then be saved to the desired program, effect, or sequence memory location, as described later in this section.

1. Press the **Storage** System button.
2. Press the **-Mass Storage-** soft button. When the Storage menu appears, press the **-Disk-** soft button. The display says:

```
DISK              -- Selection --
        Load  Save   Format  Delete
```

3. Press the **Load** soft button. The display shows the type of data you can load:

```
DISK -Progs- -Seqs-  -fX- -SysEx- -Glbl-
LOAD -1Prog- -1Seq- -1fX- -SetUp- -EXIT-
```

- **Progs** Loads a group of 100 programs from disk.
- **Seqs** Loads a group of 50 sequences and 10 songs from disk.
- **fX** Loads a group of 100 effects from disk.
- **SysEx** Loads a MIDI system exclusive data file (see section 8.3).
- **Glbl** Loads a Global data file (MIDI and master menu settings)
- **1Prog** Loads a single program.
- **1Seq** Loads a single sequence.
- **1fX** Loads a single effects patch.
- **Setup** Loads a "snapshot" of all DPM 3 SE parameters—programs, sequences, and effects patches.

4. After selecting the data type to be loaded, the DPM 3 SE searches the disk for the specified file type. If such files are present, the display shows something like:

```
LOAD        file : EDITION1 -Next- -EXEC-
SETUP                       -Prev- -EXIT-
```

5. In this example, the DPM 3 SE was asked for Setup files; it has searched the disk and displayed the first Setup file it found. Pressing **-Next-** selects the next Setup file. Keep pressing **-Next-** to catalog additional files of the same type. Pressing **-Prev-** selects the previous Setup file.
6. After selecting the data to be loaded, press the **-Exec-** soft button. (If you change your mind about loading, press the **-Exit-** soft button.) The disk drive will whirr into action, and the display will indicate that it is loading data from disk. Press **-Exit-** when you're done, or select a different function.

Note: If you load a program based on a drum kit wave, the display will ask whether you want to replace the current drum kit with the kit used by the program. Press the **-Yes-** soft button, and the program with its drum kit parameters will be loaded. Press **-No-** and the program will be loaded, but without replacing the current drum kit. A final option, **-EXIT-**, lets you back out of the loading process.

7. If you loaded an individual program, fx, or sequence, do the following:

- **Program** See section 2.4A on how to save the buffer memory to a program location.
- **fx** Follow the same steps as for saving a program, as described in section 2.4A, since saving a program also saves the associated fx parameters.
- **Sequence** Press the **Select** Sequencer button. The display shows a Bank of sequence locations; you can change Banks with the **+Page** and **-Page** buttons. Press the soft button corresponding to the location where you want to store the sequence or song. When the display says "Save Last Sequence Edits?," press **-YES-**. You will be given a chance to rename the sequence before pressing **-EXEC-**. Press the soft button again that corresponds to the location where you want to store the sequence or song and storage is complete.

2.3E Deleting Files from Disk

Any file type can be deleted from disk if the file is no longer needed, or if you want to free up additional disk space.

1. Press the **Storage** System button.
2. Press the **-Mass Storage-** soft button. When the Storage menu appears, press the **-Disk-** soft button. The display says:

```
DISK                -- Selection --
        Load   Save    Format   Delete
```

3. Press the **Delete** soft button. The DPM 3 SE catalogs the disk files and displays something like:

```
DISK   Name: EDITION1.SET   -Next- -EXEC-
DELETE Size: 99K            -Prev- -EXIT-
```

To scroll through the file directory, press the **-Next-** or **-Prev-** buttons. Each file will have an identifying three-letter extension:

- **.APG** All programs
- **.ASQ** All sequences
- **.AFX** All effects
- **.PRG** Single program
- **.SEQ** Single sequence
- **.EFX** Single effects program
- **.SAM** Sample wave
- **.ASM** Group of samples
- **.SET** Setup file
- **.GBL** Global parameters
- **.SYS** System exclusive data

The size of each file is also shown in Kilobytes to help you determine which files should be deleted to free up a desired amount of disk storage space.

4. After selecting the file to be deleted, press the **-EXEC-** soft button to delete the file. If you change your mind, press **-EXIT-**, or select a different function.

2.3F Sending Data via MIDI System Exclusive Messages

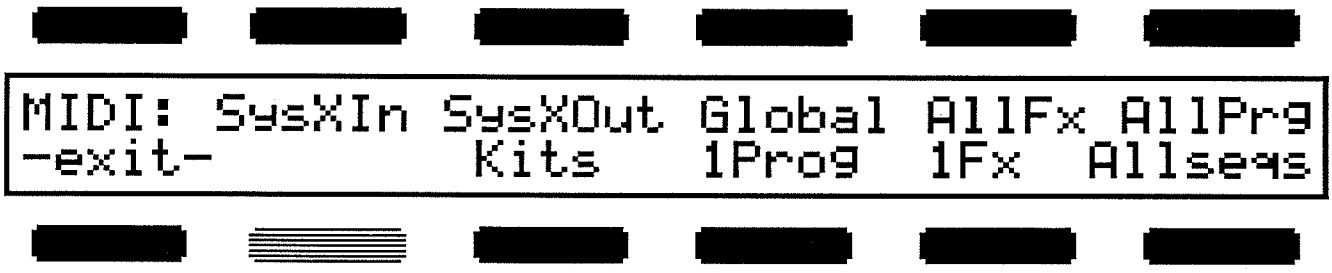
In addition to disk saves and loads, many DPM 3 SE data files can be sent over MIDI. These appear over the DPM 3 SE's MIDI out port as MIDI system exclusive (sys ex) messages. This feature has three main applications:

- Send the data to a MIDI system exclusive storage device (such as the Peavey MIDI Librarian). This data can then be played back into the DPM 3 SE to reload whatever data you saved. This provides another form of backup that could prove very useful if the disk drive should fail.
- Record MIDI system exclusive data into a sequencer. On playback, the sequencer can automatically send out new patches to the DPM 3 SE. *Caution:* Most sequencers cannot cope with long system exclusive files. In most cases, this should be limited to single programs and fx.
- Transfer data from one DPM 3 SE to another. To do this, connect the source DPM 3 SE MIDI out to the destination DPM 3 SE MIDI in. As soon as the destination instrument recognizes a system exclusive message, it will grab that data and stuff it in memory.

Notes: When sending individual pieces of data (single program or single fx) over MIDI, the desired program or program containing fx parameters must be selected prior to sending.

The DPM 3 SE can also serve as a system exclusive storage device for other devices in a MIDI system. *Example:* You can store your drum machine system exclusive data on a DPM 3 SE disk instead of saving to something like a cassette interface. This is an entirely different function compared to sending and receiving DPM 3 SE data over MIDI; system exclusive storage is covered in section 8.3.

1. Press the **Storage** System button.
2. Press the **-Mass Storage-** soft button. When the Storage menu appears, press the **-Midi-** soft button. The display says:



3. Pressing **-exit-** or the soft button above MIDI takes you back to the main storage menu. The other soft buttons determine the type of data to be sent over MIDI:

- **SysXIn** Used for MIDI sys ex storage operations. See section 8.3.
- **SysXOut** Used for MIDI sys ex storage operations. See section 8.3.
- **Global** Sends all Global data (MIDI and master menu settings)
- **AllFx** Sends all effects (signal processing) programs.
- **AllPrg** Sends all patch program data.
- **Kits** Sends all drum kit data.
- **1Prog** Sends one program.
- **1Fx** Sends one effects patch.
- **Allseqs** Sends all sequences and songs in internal memory.

4. Press the appropriate soft button. The display confirms which type of data is being sent out over MIDI.

2.4 EDIT MENU TWEAKS

The Voice Edit buttons call up screens that contain a wealth of commands for modifying the DPM 3 SE's sounds, or creating your own from scratch. Chapter 3 describes these options and provides information on basic synthesis techniques (also see Chapters 9 and 10 for more information on synthesis and MIDI), but here are some of the most common tweaks.

Important: Any changes you make must be saved to the current program or a different one. Selecting a different program without saving the program you modified will cancel any edits you made. Therefore, we will first describe how to save an edited program.

2.4A Save/Rename an Edited Program

1. After modifying the program or loading a single program or fx, press the **Storage** System button to select the Store menu.
2. Press the **-Save Edits-** soft button.
3. You can rename the program before storing. The display says something like:

```
STORE  Program Name= PianoL     <--    -->
-EXEC-
```

4. Press the soft button over the name, and a small circumflex (^) symbol shows up underneath the character that will be edited with the data entry devices. Select the desired letter, number, or symbol. To move the circumflex under a different character, use the left arrow or right arrow cursor buttons to move left or right respectively. Moving right past the sixth character selects the first character; moving left past the first character selects the sixth character.
5. After naming the program, press the **-Exec-** soft button. (If you change your mind about saving, press any system button to bail out.)
6. The memory Bank containing the program you modified will appear, with a * symbol to the left of the edited program. To overwrite this program with the new data, press the program's associated soft button. To write to a different location, use the **Cart**, system **Bank** switches, and/or **+Page/-Page** buttons to select the desired Bank. Then press the soft button for the program location where you want to store the edited program.

2.4B Change Overall Timbre ("Brighter/Duller")

Although there are many ways to change timbre in the DPM 3 SE, the following method is fast and takes care of many situations where you want to modify timbre.

1. Press the **Filter** Voice Edit button. The display shows something like:

```
FILT   freq = 94        res = 10
       mods = velo    * +59 = keybd * -32
```

2. Press the **Freq** soft button, and increase the value.

2.4C Increase/Decrease Timbre "Dynamics"

Sometimes the timbre responds dynamically over time, perhaps according to keyboard velocity or to the DPM 3 SE's internal envelope generators. The DPM 3 SE offers two different *modulators* (modules that create control signals that change dynamics over time) for the filter, as shown on the lower Filter screen line. The following process involves editing one, the other, or both to create the desired effect.

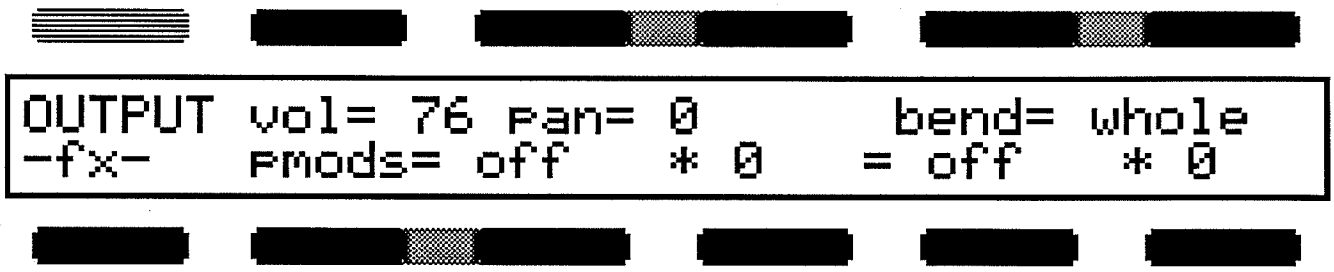
1. The Filter screen "mods" line shows two modulators (following the =), and their values (following the *). In the example screen shown in section 2.4B, the velocity modulator value is +59, and the keyboard modulator value is -32.
2. If the first modulator is off, proceed to step 4. If the first modulator is set to anything other than off, then the filter is being modulated by some option.
3. Press the first modulator parameter's soft button. The further the value is from 0, either positive or negative, the wider the range of timbre variations; values closer to 0 give a narrower range of timbre variations.
4. If the second modulator is set to anything other than off, then the filter is being modulated by an additional option.
5. Press the second modulator parameter's soft button. The further the value is from 0, either positive or negative, the wider the range of timbre variations; values closer to 0 give a narrower range of timbre variations.

Note: If only one modulator is active, this is a fairly simple edit. If both modulators are used, the edit becomes more complex since these two settings may interact.

2.4D Change Program Volume Level

This changes a program's level relative to the other programs.

1. Press the **Output** Voice Edit button. The display shows something like:



2. Press the **vol** soft button.
3. Select the desired volume.

In some cases, turning this volume parameter down will not turn down some of the volume routed to the signal processing section. To turn down the processed level:

4. Press the **-fx-** soft button. The display shows something like:

```
OUTPUT effect name= 04:Revrb1
-output- fx 2 send= 20 %
```

5. Press the **fx 2 send** soft button.
6. Reduce the send level.

2.4E Change Stereo Pan

This changes a program's position in the stereo field.

Note: Like the filter, the pan position can be modulated by two different modulators. If the pan position is being modulated, then that will also affect the stereo position as well as any changes you make to the Pan parameter.

1. Press the **Output** Voice Edit button. The display shows something like:

```
OUTPUT vol= 76 pan= 0        bend= whole
-fx-   pmods= off    * 0    = off    * 0
```

2. Press the **pan** soft button.
3. Select the desired pan position. 0 is center; more negative numbers pan left (up to -100, full left) and more positive numbers pan right (up to +100, full right). Going past -100 or +100 selects a Spread option, which spreads notes randomly in the stereo field.

2.4F Set Pitch Bend Range

This determines how much the pitch of a program will vary in response to either upward or downward travel of the pitch bend wheel. *Example:* If set to a whole tone, rotating the pitch bend wheel all the way away from you will raise the pitch by a whole tone, and rotating the pitch bend wheel all the way toward you will lower the pitch by a whole tone.

1. Press the **Output** Voice Edit button to select the output screen.
2. Press the **bend** soft button.
3. Select the desired bend amount—off, half, whole, m3rd (minor third), third (major third), 4th, dm5th (diminished or flatted fifth), and fifth.

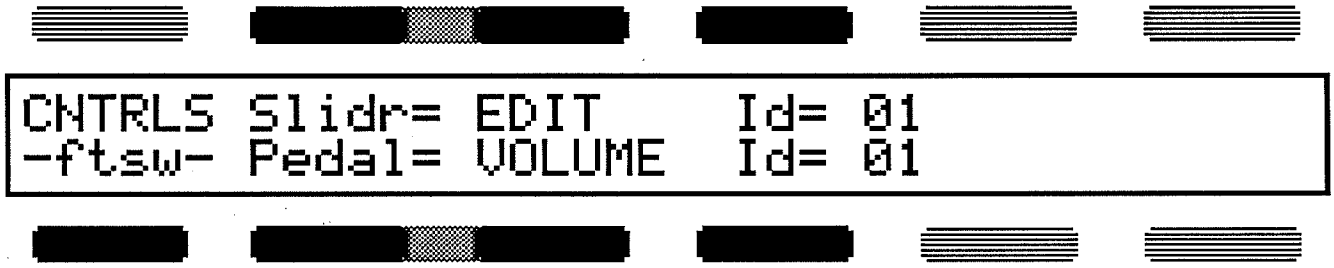
2.5 ASSIGN DATA SLIDER, FOOTPEDAL, AND FOOTSWITCH

The DPM 3 SE Data Slider, footpedal (if one connects to the footpedal jack), and footswitches can perform several functions and/or transmit particular types of MIDI data over the MIDI out connector.

The Control Voltage jack accepts a Peavey synthesizer control pedal or equivalent. The 1/2 jack accepts a dual momentary footswitch unit, and the 3 jack accepts a single momentary footswitch unit.

The footswitches plugged into the 1/2 jack are called footswitches 1 and 2; the one plugged into the 3 jack is called footswitch 3. Footswitches can be normally open or normally closed types, as the DPM 3 SE can be programmed to accept either type.

1. Press the **Master** System button.
2. Press the **-Ctrls-** soft button. The display shows something like:



3. The Data Slider (Slidr) can be assigned to:

- **Edit** The slider is a data entry device
- **XCtrl** The slider generates controller data over the controller number specified under Id
- **ModSrc** The slider can modulate module parameters (*e.g.*, filter frequency, pan position, oscillator pitch, etc.) if you select XCtrl as the module modulator. For more information on modulation, see section 3.2.

To assign, press the **Slidr** soft button and select the desired slider function. If you choose XCrtl, press the upper line **Id** soft button and select the desired controller number. *Caution:* Once the slider is set to something other than Edit, it can no longer edit parameters. Use the Inc/Dec buttons or Data Wheel instead.

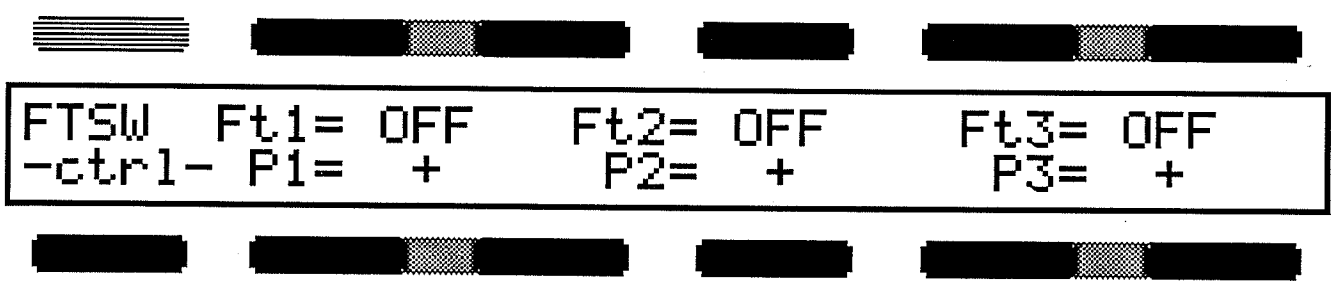
Regardless of which function is selected, the slider ID number specifies the controller that will be used for external MIDI control of the DPM 3 SE. *Example of how to use extenal controllers:* If you use a breath controller (controller 02) and want it to control particular voice parameters, set the data slider ID to 02, then assign the desired voice parameters to XCtrl.

4. The Pedal can be assigned to:

- **Volume** The pedal serves as a volume pedal, and also generates controller 7 data over the DPM 3 SE MIDI out connector
- **XCrtl** The pedal generates controller data over the controller number specified under Id
- **ModSrc** The pedal can modulate module parameters (*e.g.*, filter frequency, pan position, oscillator pitch, etc.) if you select Pedal as the module modulator. For more information on modulation, see section 3.2.

To assign, press the **Pedal** soft button and select the desired pedal function. If you choose XCrtl, press the lower line **Id** soft button and select the desired controller number to be transmitted by the pedal.

5. To assign footswitch parameters, press the **-ftsw-** soft button on the controls menu. The display shows something like:



Each footswitch can be assigned to one of the following functions:

- **Off** Footswitch has no effect
- **Sustn** Footswitch acts as a sustain switch
- **+Edit** Footswitch duplicates Inc button
- **-Edit** Footswitch duplicates Dec button
- **+Prog** Pressing footswitch calls up the next higher-numbered program than the one currently selected
- **-Prog** Pressing footswitch calls up the next lower-numbered program than the one currently selected
- **Play** Footswitch duplicates the sequencer Play (>) button
- **Record** Footswitch duplicates the sequencer Record (o) button
- **Pause** Footswitch duplicates the sequencer Pause (I I) button

To assign, press the **Ft1, 2,** or **3** soft button and select the desired function.

If the "sense" of the footswitch is reversed *(e.g.,* releasing a footswitch initiates a function but you'd rather initiate the function by pressing on the footswitch), set the footswitch's associated P parameter to the opposite of the current selection *(e.g.,* + instead of -, or - instead of +). This also allows you to use normally open or normally closed footswitches, and simply program the P parameter as needed to give the correct footswitch response.

2.6 MASTER EFFECTS SELECTION

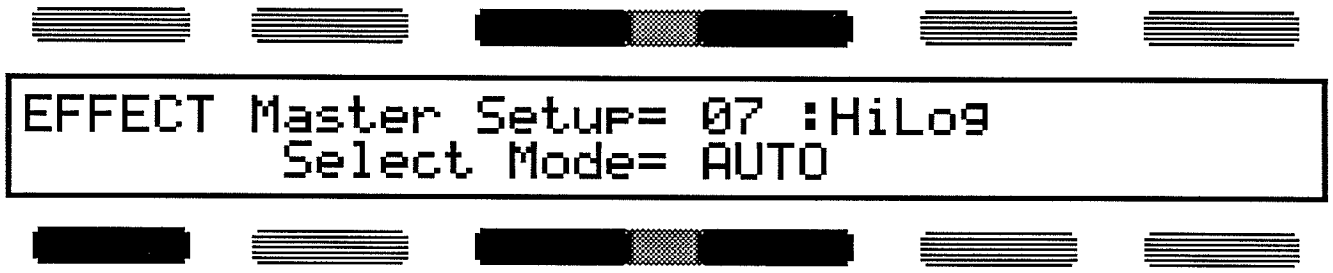
Master effects selection determines how the DPM 3 SE will choose a particular signal processing (effects) program. Options are:

- **Program** Selecting a program calls up the effects parameters associated with that program.
- **Master** Retains an effect you specify, regardless of what program or sequence is selected.
- **Sequence** Each sequence has an associated effect. With this option, calling up a particular sequence will call up its associated effect.
- **Auto** If you select a program, its effects parameters will be used. If you select a sequence, its effects parameters will be used.
- **Bypass** No effects are used.

To select one of the above options:

1. Press the **Master** System button.

2. When the Master menu appears, press the **-FxSelect-** soft button. The display shows something like:



3. To specify the mode (Program, Master, Sequence, Auto, or Bypass), press the **Select Mode** soft button and select the desired option.
4. If you select Master as the mode, press the **Master Setup** soft button and select the effects program to be used as the Master program.

Note: To edit the currently selected effect, press the soft button under EFFECT. This takes you to the Effect menu where effects parameters can be programmed. For more information on effects programming, see section 4.3.

2.7 INITIALIZE ENTIRE UNIT

This operation restores the original factory global and MIDI settings, erases any samples stored in user RAM (if present), restores *all* programs to a default patch (not the factory patches shipped with the unit), and *erases any edits you have made.* Initialization is useful if, for example, you want to create a set of sounds from scratch.

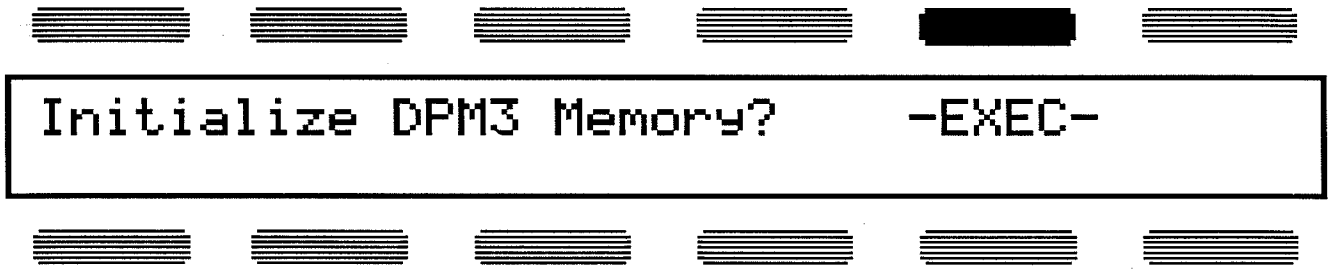
Initialization is also a service procedure. Sometimes microprocessor-controlled devices will "lock up" due to spikes or surges on the AC line, a static electricity jolt, or other gremlins. Initialization will reset the unit and in many cases, prevent a trip to the repair shop.

Remember—any patches will be lost during initialization! Back up your patches and save your work often so that your edits will not be lost if you initialize.

To initialize:

1. Plug a standard mono (not stereo) guitar cord or 1/4" mono phone plug into the rear panel Pedal 1/2 jack. Having to do this step minimizes the chance of doing an accidental initialization.

2. Press the **Multi** voice edit button and while holding it down, also press and hold down the I I (sequencer pause) button directly below the Multi button. The display shows:



3. Press the **-Exec-** soft key and the DPM 3 SE will be initialized.
4. Remove the mono guitar cord or dummy plug from the rear panel Pedal 1/2 jack.

Chapter 3: Programming the DPM 3 SE

Synthesizer programming is the art and science of altering the parameters of various modules to shape sounds in a particular way. Like most artistic and scientific endeavors, synth programming cannot be mastered in a day, a week, or even a year. Although this manual presents much information about synthesizer programming, it is beyond the scope of any manual to offer a complete course in programming. The best way to learn is to adjust different parameters as you play to discover how different parameter values affect the sound. Also, study the signal and modulation flow within the DPM 3 SE (as shown in following block diagrams) so that you can understand what happens to a signal as it works its way from oscillator to output.

3.1 HISTORY AND BACKGROUND

Early synthesizers consisted of various hardware modules, some of which generated signals, and some of which modified those signals. To create as general-purpose a device as possible, *patch cords* connected the inputs and outputs of the various signal generating and processing modules (which is why particular synth sounds were called *patches)*. Changing a patch involved manually repositioning patch cords and adjusting knobs and switches; recreating a patch at some later time required writing down all the patch settings on paper so they could be duplicated later. Even then, due to the vagaries of analog electronics, the patch might not sound exactly the same.

Over the years, certain combinations of modules seemed to work better than others, and since patch cords were troublesome to deal with, eventually these modules were wired together in a "normalized" configuration. Synthesizers such as the Minimoog, Prophet-5, and others eliminated the need for patch cords by containing a normalized collection of sound modules.

3.1A How the DPM 3 SE Generates Sound: Analog Synthesizer Emulation and Sampling

The DPM 3 SE uses general-purpose Digital Signal Processing (DSP) chips for sound generation. These chips are essentially computers designed to generate and/or process digital audio signals, and can even do special effects like chorusing and reverb. The DPM 3 SE's three DSP chips are in turn controlled by a central computer. Because the function of these chips depends on the software controlling them, it is possible to upgrade the DPM 3 SE with entirely new methods of sound generation by writing new software for the central computer.

The current generation of DPM 3 SE software offers two different but related options.

• Analog synthesizer emulation. This offers the types of sounds and programming functions associated with a top-of-the-line classic analog synthesizer, but with digital sound-generating capabilities. Instead of being limited to a few basic waveforms, the DPM 3 SE includes traditional analog waveforms (sine, sawtooth, square, etc.) but also a wide variety of sampled waveforms for extremely realistic sounds.

Each synthesizer "module" is a page on the display (also called a display *screen),* and each "knob" or "switch" is a parameter on the screen, which you can edit. All "patching" is done via software, eliminating the need for patch cords; you simply specify which inputs should receive which outputs in those cases where connections are not normalized.

You can take a "snapshot" of the DPM 3 SE's parameters for a particular sound and save this in memory as a *program.* The DPM 3 SE stores 100 programs onboard and another 100 on a RAM or ROM cartridge card that plugs into the rear front panel card slot, so 200 programs are instantly accessible at any time.

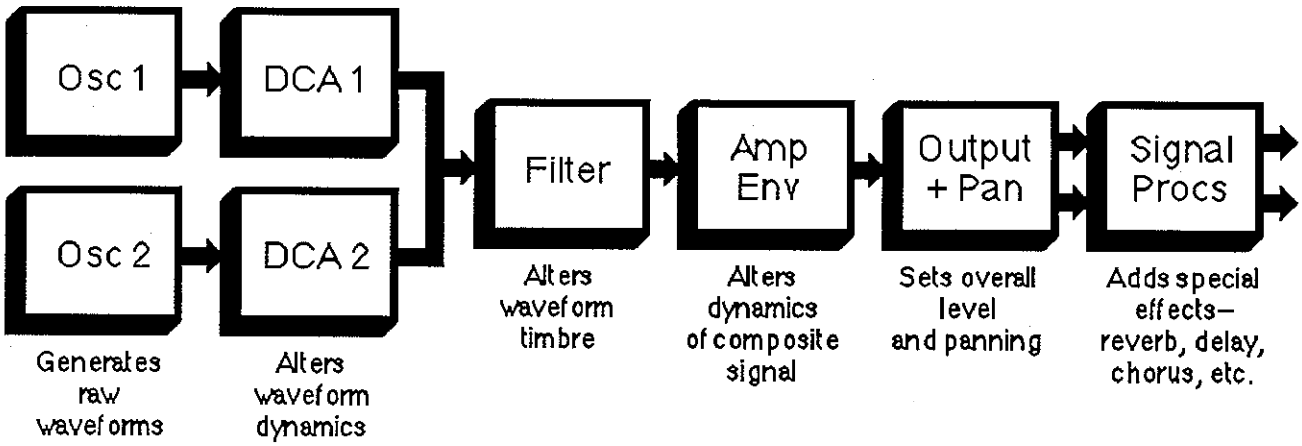
• Sampler. You are not limited to the waveforms that come with the SE, but can load in samples from a variety of sources via MIDI (another DPM 3 SE, computer visual editing programs, other samplers, etc.) or directly from disk. Samples can be up to 1 Megabyte long in a DPM 3 SE with fully expanded memory; the shorter the samples, the more of them you can fit in the DPM's memory. Several third party developers, including Prosonus, offer ready-to-use samples in DPM 3 SE format.

Samples can also be recorded from acoustic or electric sources into the Peavey SX Sample Expander. Once in SX memory, the sample or samples can then be transferred over to the DPM.

Once loaded into the DPM, samples can be looped, truncated, named, and variety of other functions. These samples can be programmed into patches, just like the onboard waves. The DPM memory is non-volatile, so samples remain in memory even if power is turned off. Samples can be saved to, and loaded from, the DPM's internal disk drive.

3.1B DPM 3 SE Synthesizer Architecture

The following figure shows the signal flow for a DPM voice (there are 16 identical voices total). We'll now describe the function of each module.



3.1C Oscillators

The two digital oscillators (OSC1 and OSC2) provide the actual raw sounds, called *waves*. These can draw from any of the 104 on-board wavesamples (and 5 drum kits) or from samples you load into memory. Both oscillators allow for adjustable wave pitch and two *modulation* sources. Modulation is the process of varying a parameter dynamically over time; with the oscillators, the pitch can be modulated by various control sources, as described later.

3.1D DCAs

Each oscillator is followed by a DCA, which can modulate the level of the wave either statically (you set a particular volume level), dynamically (the level changes over time in a specific way), or a combination of the two.

Having two DCAs allows for, among other effects, crossfades between the two oscillators. *Example:* One DCA could fade out a flute sound while the other DCA fades in a synth waveform to create a synth flute sound. Section 9.3 includes additional information on crossfade techniques.

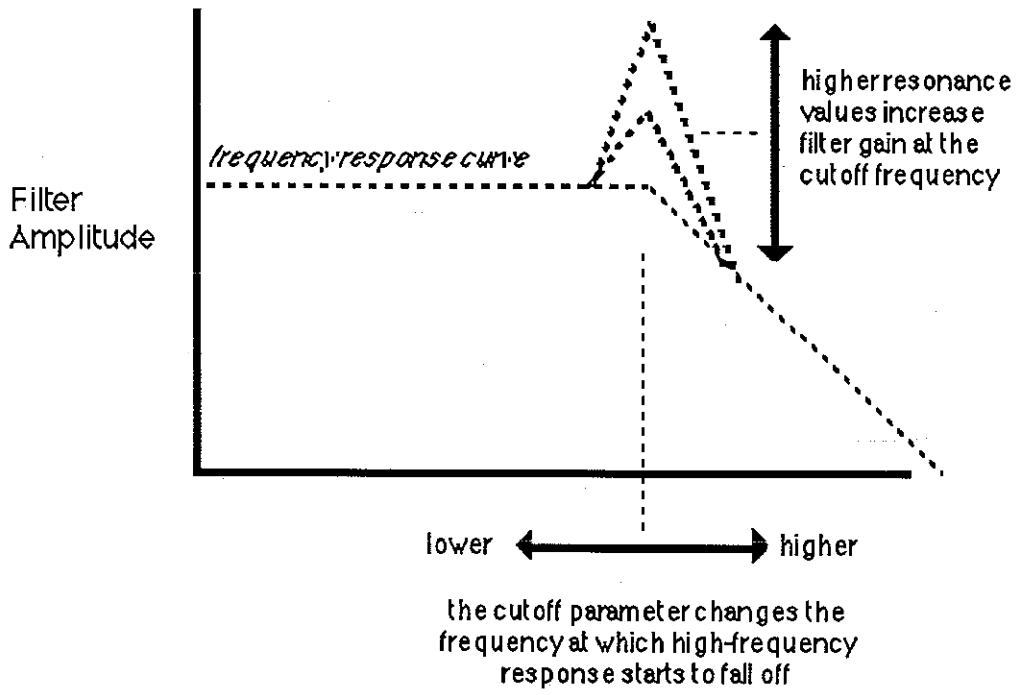
The "Amp Env" is a third DCA that follows the filter. It can only be modulated by Envelope 4, and generally sets the overall dynamics.

3.1E Filter

A lowpass filter varies a signal's harmonic content by progressively increasing attenuation above a specified *cutoff frequency*. Higher cutoff frequencies give a

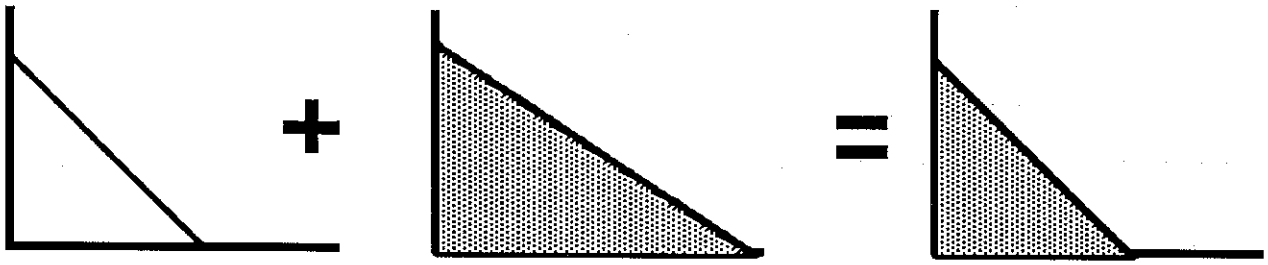
brighter sound; lower cutoff frequencies give a bassier sound since fewer harmonics are present.

The filter's *resonance* specifies the amount of gain at the cutoff frequency. Higher settings produce a sharper, more resonant sound. The following figure correlates the cutoff frequency and resonance parameters.



Although static filter settings are useful, varying the filter cutoff dynamically over time often produces more interesting effects. Modulating with velocity can produce brighter sounds with louder dynamics, giving a sound more like an acoustic instrument. Modulating with an envelope can create a particular change in harmonic structure, such as the increase in harmonics that happens when more wind is blown into a brass instrument.

Note that filter and DCA settings can interact. For example, the filter cutoff can be so low that no signal can get through. Also, if the DCA is set for a short decay, then you won't hear a long filter decay because the volume will reach zero before the filter decay finishes (see the following diagram).



If the DCA is set for a short decay...

...and the filter is set for a long decay...

...you won't hear the effect of the long filter decay because the signal level will have decayed to zero before the filter decay is complete.

The combination of two oscillators, two DCAs, one filter, a final DCA, and various modulation sources is called a *voice*.

3.1F Output Stage

This stage controls overall volume, panning (placement in the stereo field), panning modulation, pitch bend amount, and the amount of signal sent to one of the two effects processors.

3.1G Signal Processors

There are two independent effects (fx for short) units. Each one can include one (Single mode) or two (Dual mode) effects, giving a possible total of up to four signal processing "modules" in all. The basic signal processing options (in addition to Bypass, where the effect module has no effect) are Reverb, Delay, Chorus/Flange, EQ, Gated Reverb, Distortion, and Exciter. Dual mode effects include Reverb/EQ, Chorus/Delay, EQ/Gated Reverb, etc. (as listed in section 4.1A).

3.2 THE ART OF MODULATION

3.2A About the DPM 3 SE Modulation Matrix

Modulation modifies some aspect of a sound over a period of time. Since synthesizers inherently make static sounds (unlike acoustic instruments, whose timbre and dynamics change—often radically—over the duration of a note), modulation can be

the key to making rich and expressive sounds.
The DPM 3 SE has a variety of modulation sources, shown by blocks with heavy lines in the diagram on the facing page. Here's an overview of the main modulation categories (section 3.2B provides a more complete description):

- Modulation signals generated by the way you play the keyboard or other controller driving the DPM 3 SE (velocity, note position, and pressure)
- Envelope generators (these produce a programmable modulation change over time)
- LFOs (these produce periodic, cyclic modulation changes over time, such as vibrato or tremolo)
- Performance controls (modulation wheel, foot pedal, and data slider, which are designed to be manipulated in real time, as you play)
- External MIDI control. This allows external MIDI control signals *(e.g.,* from a sequencer) to control some aspect of the DPM 3 SE's sound.

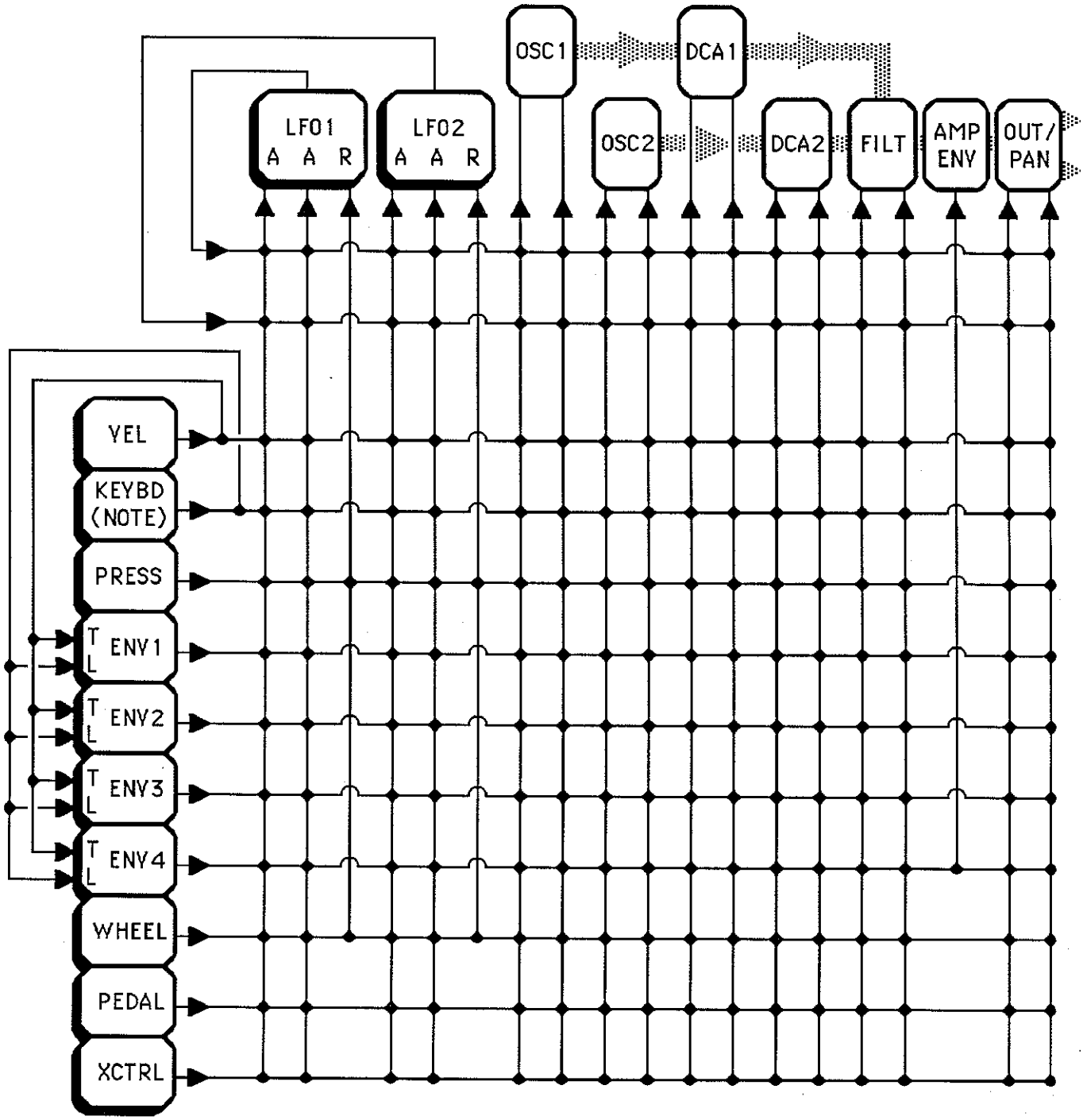
The DPM 3 SE arranges its modulation source outputs and modulation destination inputs into a "matrix" so that virtually any output can feed virtually any input. The Osc, DCA, Filter, and Pan modules have two independent inputs that can be assigned to any modulation source. The LFO has two independent inputs that control modulation amplitude (depth), but also has a third input that controls modulation rate.

There are also some normalled connections where a particular modulation input permanently connects to a particular modulation source. The AMPENV module is normalled to Envelope 4 only; the Envelope Generator Time and Level parameters are normalled to the velocity and note position modulation sources only.

Each non-normalled modulation input includes two parameters: *modulation source* (including Off if no modulation is desired) which lets you choose from the various modulation sources mentioned above, and *modulation amount.*

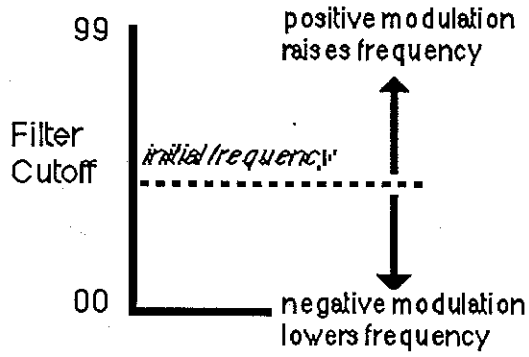
The modulation amount can be positive or negative. With positive amounts, an increasing control signal increases the value of the parameter being controlled. With negative amounts, an increasing control signal *decreases* the value of the parameter being controlled. A setting of 00 is equivalent to turning off the modulation source.

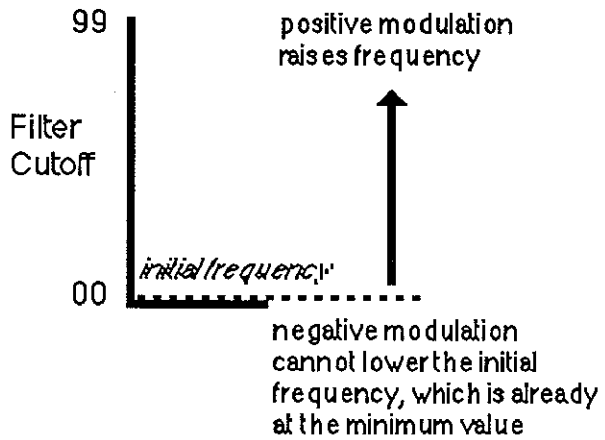
Note that having two modulation inputs available allows for interaction between two modulation signals. *Example:* If a parameter responds to keyboard velocity and an envelope generator, the parameter will follow the general envelope shape but also be influenced by the velocity.



The DPM 3 SE modulation matrix

If a "baseline" setting exists, modulation amounts add or subtract values from that setting. *Example:* If the filter cutoff is set to a certain frequency, positive modulation amounts will increase that frequency, and negative modulation amounts will decrease that frequency. However, modulation cannot force a value beyond its maximum range. *Example:* If the filter cutoff is at the lowest possible frequency, then maximum positive modulation will vary the filter cutoff from the lowest to the highest frequency. Applying negative modulation will not affect the filter frequency because if it's at its lowest value, it cannot go any more negative.





3.2B DPM Modulation Modules

The following provide modulation signals.

• **Keyboard Modulation Sources** These modulation signals are generated when you play a keyboard or other controller.

Velocity produces data relating to how fast a key goes from the key up (note off) to the key down (note on) position. This relates to the dynamics of your playing.

Note Position produces data relating to the note played on the keyboard. You would use this modulation source if you wanted, for example, a different sound in the upper and lower registers.

Pressure produces data relating to how hard you press on the keyboard after the keys are down. One way to use this would be to add vibrato, or increase brightness, as a note sustains.

• **Pedal** The pedal can not only serve as a modulation source where the value depends on the pedal position, but as a volume pedal or an assignable external controller. This is covered in section 2.5.

• **Wheel** The mod wheel is traditionally used for adding vibrato, but can also vary volume, level, filter cutoff, LFO rate, or any other modulatable parameter.

• **External MIDI Control** If you need more control than that afforded by the pedal and wheel, controller signals from a sequencer, breath controller, other synthesizer, etc. can enter the DPM 3 SE via MIDI and vary modulatable parameters in real time. See section 2.5.

• **LFOs (Low Frequency Oscillators)** The DPM 3 SE includes two independent LFOs, each of which creates a cyclic (periodic) modulation of synthesizer parameters such as pitch, volume, or filter cutoff. The amount of LFO modulation can be constant and/or modulated. *Example:* Applying a periodic modulating signal to the oscillator produces vibrato.

Applying LFO modulation to the VCA produces tremolo; modulating the filter cutoff with an LFO signal produces a wa-wa effect or, if used subtly in the higher registers, a shimmering type of sound.

• **Envelopes** There are four independent envelope generators, each of which provides a modulation signal that varies over time. Applying it to different modulation destinations produces different results. *Example:* Sending the envelope to a DCA creates changes in level. If the amplitude decays over time, percussive effects (plucked strings, drums, etc.) will result; brass, woodwind, and some bowed instruments have amplitudes that increase over time. A note-on message triggers each envelope.

Each envelope generator has five Level and four Time parameters. The Time parameter sets the transition time from one Level to another. Levels and Times range from 0 (minimum level or time) to 99 (maximum level or time). For background information on envelopes, see section 9.2.

3.3 DPM 3 SE PROGRAMMING TECHNIQUES

Now that we've covered the basics, let's look at the available synth parameters. The following pages show the displays called up by the Voice Edit buttons, along with descriptions of what each display's "soft buttons" do. This is intended as more of a reference manual; remember that Chapters 8-10 contain applications information in case you are not very familiar with synthesis, or are interested in additional information.

Important: In order to save space (there's a lot to discuss here!), we'll assume that you know how to select pages and parameters, as described earlier in the manual.

3.3A About the Compare Function

When you edit a DPM 3 SE program, you are actually editing a copy of the program that resides in a special memory buffer. This has two important ramifications:

- To retain the results of your edit, you must save it to a particular program location as described in section 2.4A. If you switch program locations before saving, your edits will be lost.

- Because the original program remains undisturbed, you can compare the edited version to the original program by pressing the **Compare** System button. The display will say "Comparing Edited Program to Original" and show the program name. Press the **Compare** button again to return to editing.

The following pages describe the screens and parameters that appear by pressing the Voice Edit buttons, and how adjusting these parameters affects the overall sound.

3.3B Oscillator Page

Oscillators 1 and 2 (access by pressing **Voice Edit** buttons **OSC1** and **OSC2**) include identical parameters.

Coarse (-24 to +24 semitones)

Adjusts the oscillator pitch in semitone steps, from -24 (transposed down two octaves) to +24 (transposed up two octaves).

Fine (-99 to +99 cents)

Adjusts the pitch from -99 to +99 cents.

Wave

Selects one of the available waveforms listed below.

```
OSC1   coarse= 0   fine= 0   wave= SINE
          mods= LFO1  * 0    = ENV1  * 0
```

Mod 1

Chooses the pitch modulation source. Select from Off, Velocity, Keyboard, Pressure, Envelope 1, Envelope 2, Envelope 3, Envelope 4, LFO 1, LFO 2, Mod Wheel, Foot Pedal, External MIDI Control.

Amount 1 (-99 to +99)

Sets the modulation degree and polarity (positive or negative) for the selected modulation source.

Mod 2 (same as Mod 1)

Amount 2 (same as Amount 1)

Waveform Reference List

- *Analog synth* Sine, Triangle, Sawtooth, Square, Pulse (25%, 20%, 15%, 10%, 5%)
- *Digitally generated* DGW1-5
- *Non-harmonic waveforms* Spec1-5
- *Combination loops* B Loop, C Loop, ABCHR, Koto
- *Organs* Pipes, Full B3, Jazz B3, Organ 1, Organ 2, Percussive Organ
- *Bells* Bell 1, Bell 2
- *Bass* Fingerbass, Pick Bass, Fretless, Slap Bass, Acoustic Bass, Syn Bass, Synth Bass 2-4
- *Pianos* Piano, Electric Piano Loop, Electric Piano 1-4, Harpsichord
- *Guitars* Acoustic Guitar, Electric Guitar 1-3, Guitar Loop 3
- *Orchestral* String, Orkhit
- *Voices* Abbey, Male
- *Accordians* Squeezebox
- *Noise* Lightning, Breath, Steam, Bottle
- *Wind Instruments* Flute, Flute 2, Clarinet, Oboe, Sax, Trumpet, Trombone, Synth Brass
- *Tuned Percussion* Woody (marimba), Metal (struck), Vibes
- *Drum Sounds* Tom 1, Tom 2, Conga, Timbale, Taiko, Gambng, Gamelan, Kalimba, Agogo, Cowbell, Clave, Tambourine, Cabasa, Claps, Triangle, Pole, Scratch (turntable), High hat closed, High hat open, Ride, Crash, Reverse Cymbal, Electric Tom, Kick 1-5, Snare 1-4, Sidestick, Kit 1-5

3.3C DCA Page

Digitally-Controlled Amplifiers 1 and 2 (access by pressing Voice Edit buttons **DCA1** and **DCA2**) include identical parameters.

Level (00-99)
Selects the DCA baseline level. Lower values are softer, higher levels louder.

```
DCA1    level= 50
        mods = ENV1   * +37 = LFO1    * +10
```

Mod 1

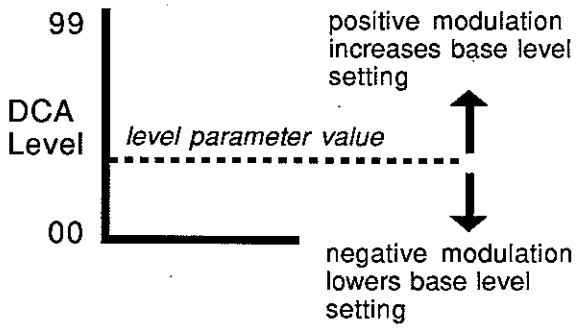
Chooses the level modulation source. Select from Off, Velocity, Keyboard, Pressure, Envelope 1, Envelope 2, Envelope 3, Envelope 4, LFO 1, LFO 2, Mod Wheel, Foot Pedal, External MIDI Control. When Off, DCA1's level is set solely by the level parameter.

Amount 1 (-99 to +99)

Sets the modulation degree and polarity (positive or negative) for the selected modulation source. This modulates the baseline level set by the DCA level parameter, as shown in the figure below.

Mod 2 (same as Mod 1)

Amount 2 (same as Amount 1)



Positive Modulation Amount Applications

- ***Velocity*** Level tracks the dynamics of your playing
- ***Keyboard*** Notes become louder as you play higher up on the keyboard
- ***Pressure*** Increases the oscillator level with increased keyboard pressure
- ***Envelopes*** Create specific changes in dynamics over time
- ***LFO*** Adds tremolo effects
- ***Mod Wheel*** Selects the mod wheel as a volume control for the oscillator
- ***Footpedal*** Provides foot-controlled volume
- ***External MIDI Control*** Alters parameters via a particular MIDI continuous controller sent by a sequencer or another keyboard.

3.3D Filter Page

Access the filter by pressing the **Filter** Voice Edit button.

Cutoff (00-99)

Edits the filter's initial cutoff frequency. Lower values remove more harmonics, giving a duller sound; higher values let more harmonics through, giving a brighter sound. Harmonically complex signals (like sax) are most affected by the filter.

Resonance (00-99)

The sets the amount of gain at the filter's cutoff frequency. Higher settings give sharper, more "whistling" effects. *Caution:* High resonance values can lead to distortion at high system levels.

```
FILT   freq = 67        res = 10
       mods = VELO    * +42 = ENV3   * +26
```

Mod 1

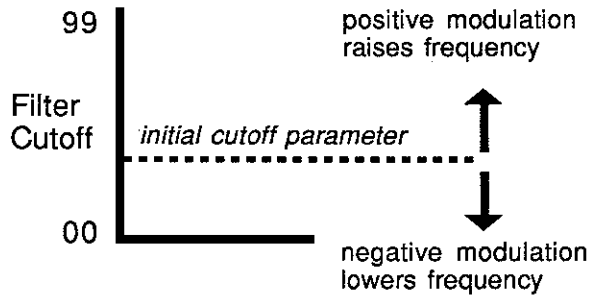
Chooses the level modulation source. Select from Off, Velocity, Keyboard, Pressure, Envelope 1, Envelope 2, Envelope 3, Envelope 4, LFO 1, LFO 2, Mod Wheel, Foot Pedal, External MIDI Control. When Off, the filter cutoff is set solely by the cutoff parameter.

Amount 1 (-99 to +99)

Sets the modulation degree and polarity (positive or negative) for the selected modulation source. This modulates the baseline level set by the filter cutff parameter, as shown in the figure below.

Mod 2 (same as Mod 1)

Amount 2 (same as Amount 1)



Modulation Applications

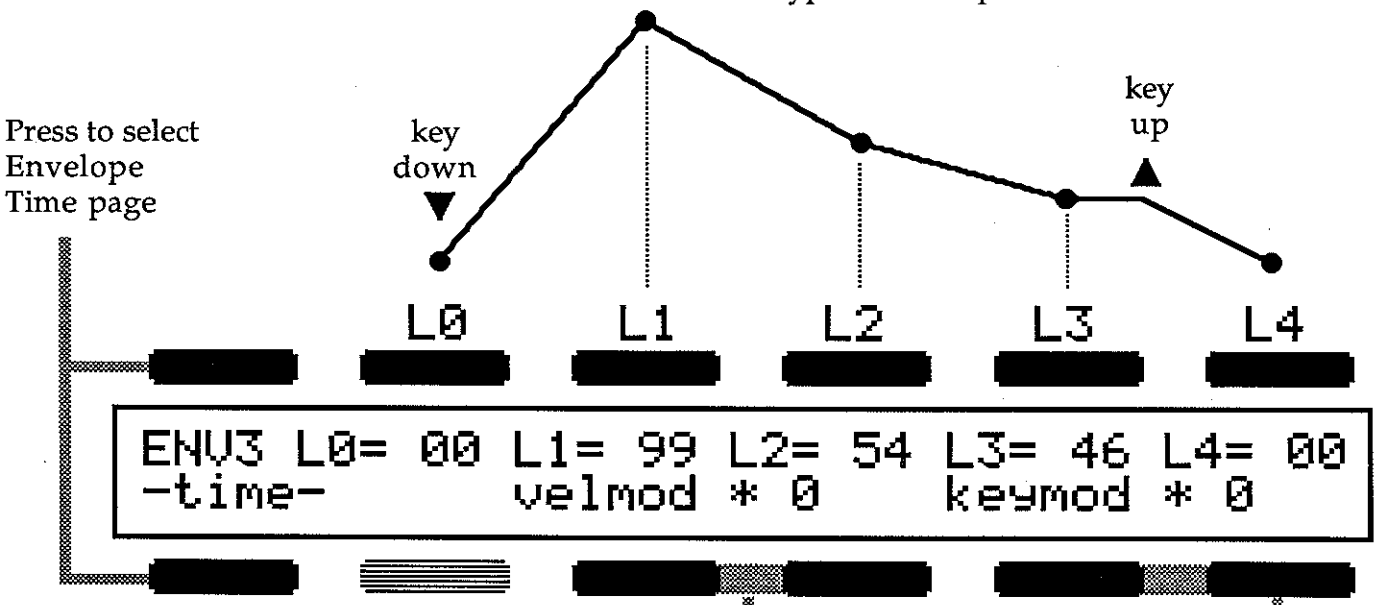
Use velocity as a modulation source, with a fairly low cutoff value and positive modulation amount, for a brighter sound as you play higher-velocity notes. This helps simulate the way acoustic instruments sound. When using negative modulation, the filter cutoff should be set to the upper limit of the intended range, since increased modulation will drive the filter to a lower cutoff frequency.

3.3E Envelope Levels Page

All four envelopes include the same parameters. *Exception:* with AmpEnv (Env 4), L0 always equals 0.

Levels (00-99)

The five envelope level parameters (L0-L4) are variable from 00 (minimum level) to 99 (maximum level). The line below traces a typical envelope.



Velmod (-99 to +99)

Keyboard Velocity (Velmod) scales envelope generator levels according to velocity.

With velmod= 0, velocity doesn't affect envelope levels. Higher values lower the envelope levels when you play softly. +99 gives the maximum dynamic range.

Negative values decrease the envelope levels according to your dynamics; the more negative the value, the more the envelope levels will tend to go toward 0 when you play harder. -99 gives the maximum dynamic range.

Keymod (-99 to +99)

Keymod scales envelope generator levels according to keyboard note position so that a note's overall amplitude depends on where you play it on the keyboard. With keymod= 0, where you play on the keyboard will not affect envelope levels. With positive values, the levels increase as you play from left to right on the keyboard. With negative values, the levels decrease as you play from left to right.

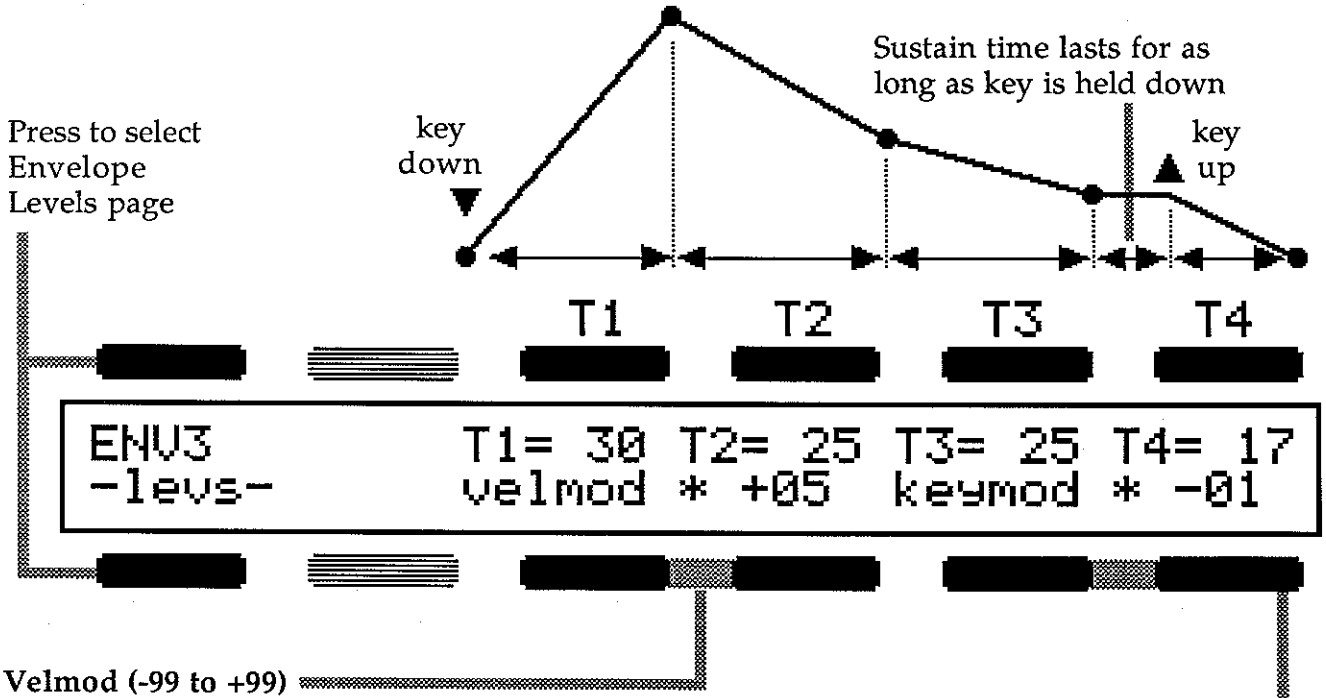
Caution: For values +97 through +99, the highest C will produce minimum levels; for values -97 through -99, the highest C will produce maximum envelope levels.

3.3F Envelope Times Page

All four envelopes include the same parameters.

Times (00-99)

The five envelope time parameters (T1-T4) are variable from 0 (minimum time to 99 (maximum time). The line below traces a typical envelope.



Velmod (-99 to +99)

Keyboard Velocity (Velmod) ties the T1 envelope generator time to velocity.

With velmod=0, velocity does not affect the envelope time. If T1 sets an attack time (*i.e.*, L1 has a lower value than L2), positive values increase the attack time as you play harder; negative values decrease the attack time as you play harder. The latter is useful for sounds (wind, voice, etc.), which have a sharper attack when played forcefully.

If T1 sets a decay time (*i.e.*, L1 has a higher value than L2), positive values increase the decay time as you play harder; negative values decrease the decay time.

Keymod (-99 to +99)

Keymod ties T4 to keyboard note position. Since T4 sets the release time, Keymod is most effective with percussive sounds. As you play higher up on the keyboard, positive values increase the release time and negative values decrease the release time.

The effect of Keymod increases drastically at longer delay times. Set Keymod to lower values at first (*e.g.*, -10 or +10, depending on how you want release time to track the keyboard) and try tweaking T4, the release time, to arrive at the desired decay curve. Go back and forth between T4 and the Keymod setting until you achieve the desired sound.

3.3G LFO Main Page

Both LFOs include the same parameters and a second page for modulation.

Shape

There are five LFO waveforms.

Tri (triangle) Equal rise and fall times. Useful for vibrato and tremolo.

Saw (sawtooth) Rises to maximum level, snaps back to zero.

Ramp Falls to minimum level, snaps back to maximum.

Sqr (square) Alternates between minimum and maximum values; useful for trills.

Rndm (random) Each LFO cycle produces a randomly-generated level; useful for sound effects and adding randomized pitch variations.

Amount (00-99)

Sets the maximum LFO signal level, from minimum (00) to maximum (99). Since each modulation input can also vary the level received from a modulation source such as LFO, this parameter may seem redundant. However, it can act as a"global" control. *Example:* If the LFO goes to several modulation inputs, reduce LFO amount to reduce the amount going to all mod inputs.

Caution: If the LFO amount doesn't seem to work, make sure LFO is selected as the modulation source for the parameter you want to vary.

Rate (00-99)

Varies the LFO speed, from slow (00) to fast (99).

```
LFO1  rate= 73   shape= tri   amount = 27
-mods- -LFO2-    delay= 00    fade-in= 12
```

Press to select Mods page

Press to select LFO2 (or LFO1 if LFO2 is selected)

Fade-In (00-99)

Sets a duration over which the LFO modulation fades in (unlike delay, where the modulation comes in at the programmed level after the delay period has elapsed). Delay settings greater than 00 deactivate fade-in.

Delay (00-99)

Delays the onset of modulation by an adjustable amount, from no delay (00) to maximum delay (99).

3.3H LFO Modulation Page

Both LFOs include a modulation page (selected from the main LFO page, section 3.3G) which allows for varying amount with two different modulation sources, and LFO rate by a single modulation source.

Amod 1

Chooses the LFO amount modulation source. Select from Off, Velocity, Keyboard, Pressure, Envelope 1, Envelope 2, Envelope 3, Envelope 4, LFO 1, LFO 2, Mod Wheel, Foot Pedal, External MIDI Control. When Off, the LFO amount is set solely by the amount parameter on the Main LFO page.

Amount 1 (-99 to +99)

Sets the modulation degree and polarity (positive or negative) of the selected Amod source. This modulates the baseline amount set by the LFO's amount parameter on the Main LFO page.

Amod 2 (same as Amod 1)

Amount 2 (same as Amount 1)

```
LF01  amods= PRESS * +30 = WHEEL * +50
-amt/rt-             rmod= OFF   * -07
```

Press to return to Main LFO page

RMod

Chooses the LFO rate modulation source. Select from Off, Pressure, and Mod Wheel. When Off, the LFO rate is set solely by the rate parameter on the Main LFO page.

Amount (-99 to +99)

Sets the modulation degree and polarity (positive or negative) from the previously-selected source. This modulates the baseline rate set by the LFO's rate parameter on the first page.

LFO Modulation Applications

(Amount) Use pressure to increase the amount of LFO modulation as you press harder on a key. This is very useful for adding expressive vibrato effects. Use the footpedal to provide foot-controlled LFO modulation.

(Rate) Use an envelope to change the rate over time; a slight attack time will increase the rate.

3.3I Output Main Page

This page edits volume, pan, and pitch bend. Pan can be modulated by two different modulation sources. A second page (section 3.3J) shows the associated effect and effect send parameter.

Volume (00-99)

This parameter sets the overall volume for single programs, or Link 1 of a Combi program (described later). Higher numbers give higher levels.

Pan (-99 to +99)

A program can be placed anywhere in a stereo (two channel) field. -99 pans full left; moving toward 00 moves the program toward center. Moving toward +99 pans the program toward full right.

Bend

Sets how much the pitch of the two oscillators varies in response to pitch bend wheel travel. *Example:* if set to a whole tone, rotating the pitch bend wheel all the way away from you raises the pitch by a whole tone; rotating the pitch bend wheel all the way toward you lowers the pitch by a whole tone.

Bend options are OFF, HALF (step), WHOLE (step), M3RD (minor third), THIRD (major third), 4TH, DM5TH (diminished or flatted fifth), and FIFTH.

Press to select Output Effect page

```
OUTPUT vol= 65 pan= +15     bend= whole
-fx-   pmods= LF01  * -05 = OFF    * 0
```

Pmod 1

Chooses the Pan modulation source. Select from Off, Velocity, Keyboard, Pressure, Envelope 1, Envelope 2, Envelope 3, Envelope 4, LFO 1, LFO 2, Mod Wheel, Foot Pedal, External MIDI Control. When Off, the pan position is set solely by the Pan parameter on the first line.

Amount 1 (-99 to +99)

Sets the modulation degree and polarity (positive or negative) from the pan modulation source. This modulates the baseline rate set by the Pan parameter on the first line.

Pmod 2 (same as Pmod 1)

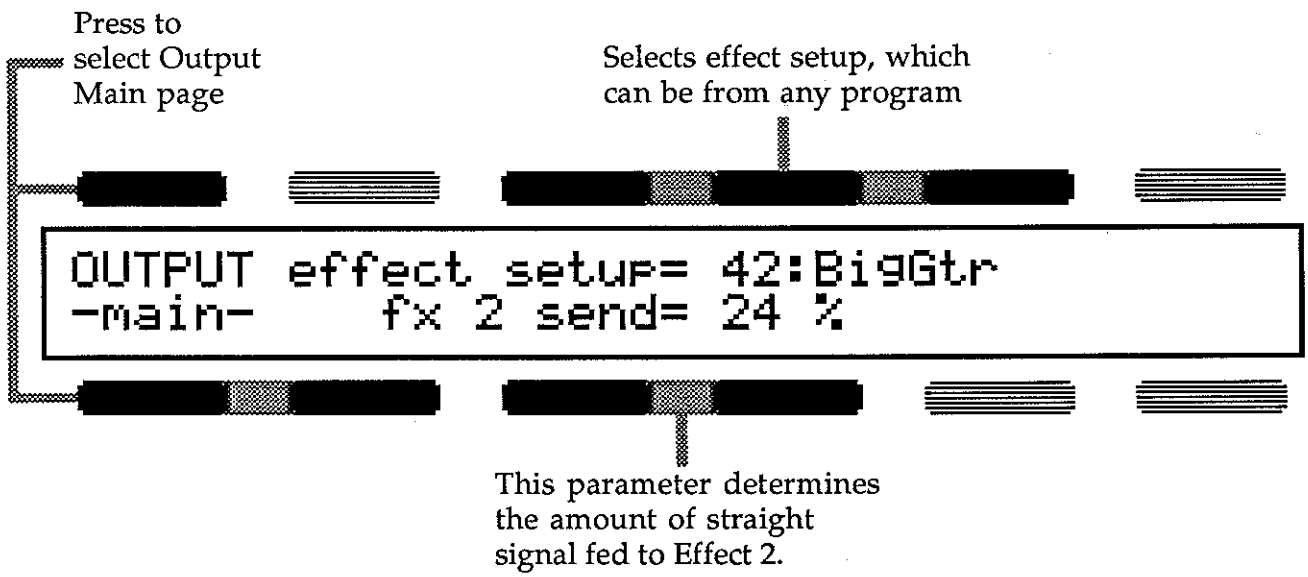
Amount 2 (same as Amount 1)

3.3J Output Fx Page

Each program has an associated signal processing effect, named and numbered the same as the program. This page shows the effect name and number, and lets you edit the amount of signal feeding effects processor 2 (the fx 2 send parameter). Chapter 4 has more information on effects.

Note that you can select another program's effect (which we'll call the "source" effect from the "source" program) as the effect setup. However, if you modify these parameters and save the current program, you will change the source program effect's parameters as well. To retain the source program's original effects parameters yet use that effect as the basis of the current program's effect:

1. Select the effects setup of your choice, from any of the onboard programs.
2. Program the effects parameters as desired.
3. Save the current effects program to disk as a single effects file (section 2.3C).
4. Select the effects setup that corresponds to the current program (*i.e.*, it has the same name and number).
5. Load the single effects file from disk. This places the modified parameters into the current effects setup but leaves the source program alone.
6. Save the current program. The new effects settings will be saved along with it.

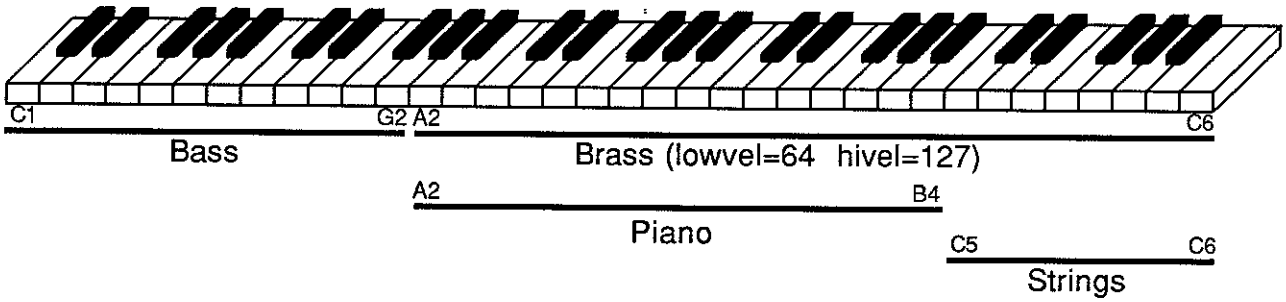


3.3K Combi Main Page

A Combi program links up to 3 additional programs to a "foundation" program to create split and layer programs. The first link is the foundation program; the other three links can be any other programs in the DPM 3 SE, which are specified as you program the Combi.

In a *split* program, certain sounds cover only a certain range of the keyboard. In a *layered* program, pressing down on a key will play two or more sounds simultaneously. Layered sounds use up more voices since each key triggers multiple sounds.

Each link can also respond to a specific velocity range, and splits and layers can be combined. The following figure shows a typical Combi "map"— Bass from C1-G2, Piano from A2-B4, Brass from A2-C6, and Strings from C5 to C6. Strings are layered with the upper octave of brass; play in the range C5-C6 to hear both strings and brass, and play from A2-B4 to hear both piano and brass. Brass has been set for a low velocity of 64 and high velocity of 127, so velocity values must be 64 or more to trigger the brass layer.



Each link can be delayed (up to 900 ms), detuned (±99 cents), transposed (±12 semitones), and have its own volume level and MIDI channel assignment. These parameters are selected on pages accessed from the Combi Main page. *Caution:* Make sure you have selected the desired foundation program before building a Combi.

Program Type (Single or Combi)

Select Single for standard programs or Combi if you want to link two or more programs together.

Selects Program Selection page

Selects Delay page

Selects Detune page

```
COMBI   type= COMBI   progs delays dtune
        levels  midi keyrng velrng tpose
```

Selects Levels page

Selects MIDI page

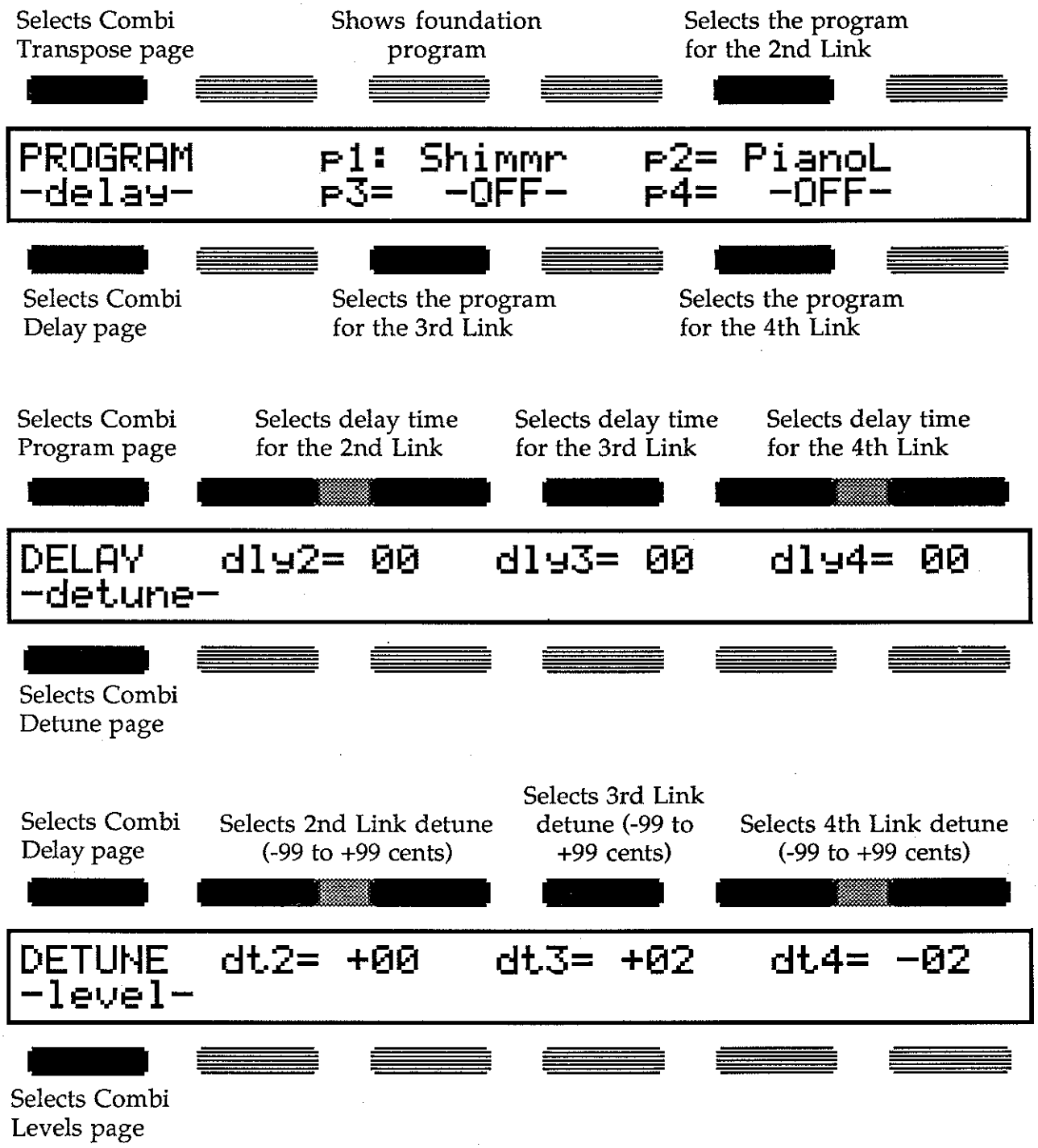
Selects Key Range page

Selects Velocity Range page

Selects Transpose page

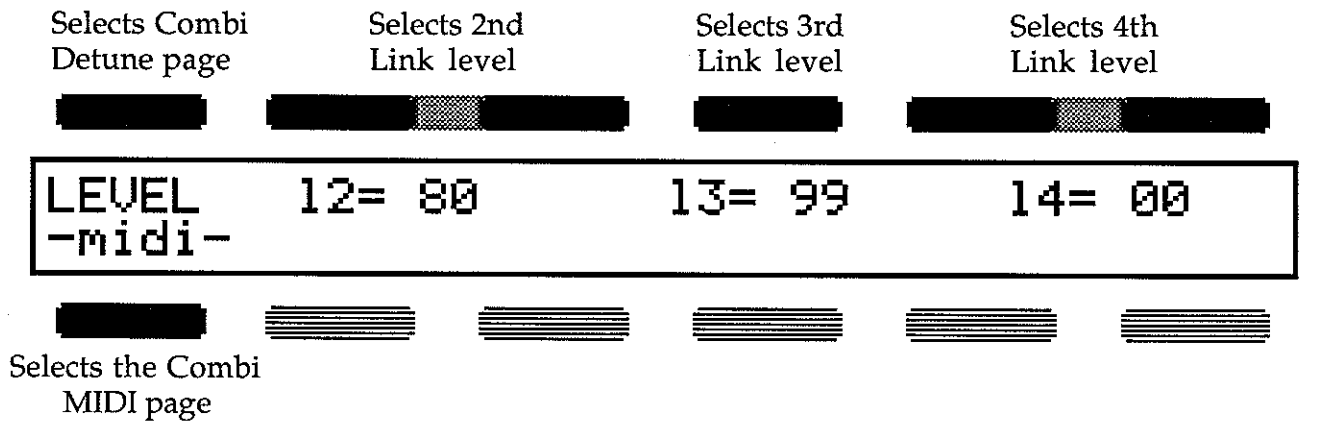
3.3L Combi Program, Delay, and Detune Pages

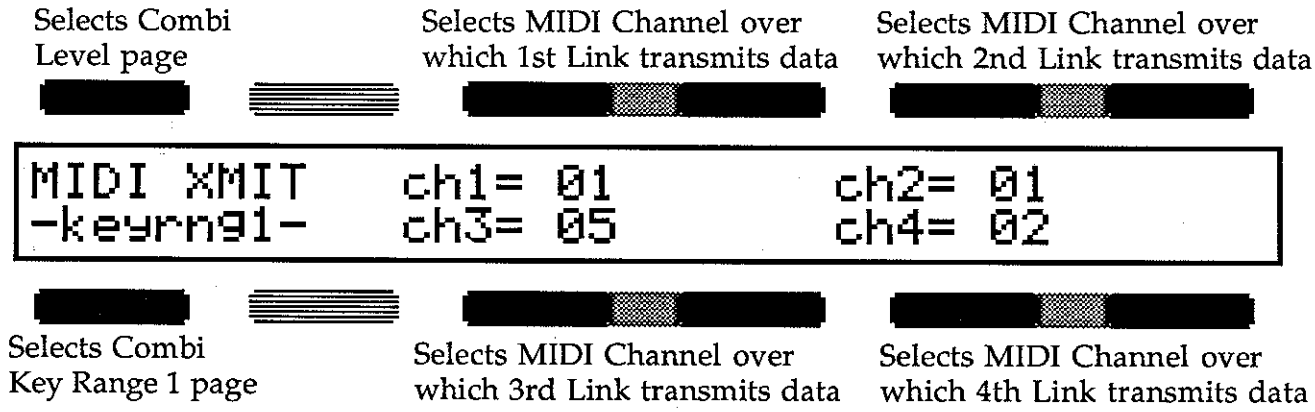
Note: Pressing the **-Page** button cycles through the Combi pages in the following order: Programs, Delay, Detune, Level, MIDI Xmit, Key Range (two pages), Velocity Range (two pages), and Transpose. The **+Page** button also cycles through pages, but in reverse order. To return to the Combi Main page at any time, press the **Multi** Voice Edit button.

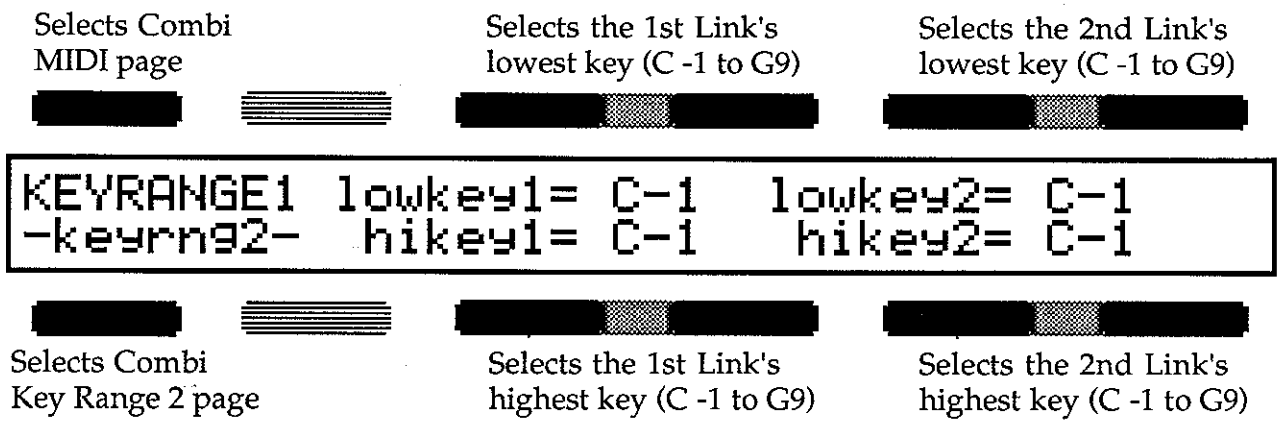


3.3M Combi Levels, MIDI, and Key Range 1 Pages

Note: Pressing the **-Page** button cycles through the Combi pages in the following order: Programs, Delay, Detune, Level, MIDI, Key Range (two pages), Velocity Range (two pages), and Transpose. The **+Page** button also cycles through pages, but in reverse order. To return to the Combi Main page at any time, press the **Multi** Voice Edit button.







3.3N Combi Key Range 2, Velocity Range 1 & 2 Pages

Note: Pressing the **-Page** button cycles through the Combi pages in the following order: Programs, Delay, Detune, Level, MIDI Xmit, Key Range (two pages), Velocity Range (two pages), and Transpose. The **+Page** button also cycles through pages, but in reverse order. To return to the Combi Main page at any time, press the **Multi** Voice Edit button.

Selects Combi Key Range 1 page

Selects the 3rd Link's lowest key (C -1 to G9)

Selects the 4th Link's lowest key (C -1 to G9)

```
KEYRANGE2 lowkey3= C-1   lowkey4= C-1
-velrng1-  hikey3= G9    hikey4= G9
```

Selects Combi Vel Range 1 page

Selects the 3rd Link's highest key (C -1 to G9)

Selects the 4th Link's highest key (C -1 to G9)

Selects Combi Key Range 2 page

Selects lowest velocity level that will trigger the 1st Link

Selects lowest velocity level that will trigger the 2nd Link

```
VELRANGE1 lowvel1= 00   lowvel2= 00
-velrng2-  hivel1= 127   hivel2= 127
```

Selects Combi Vel Range 2 page

Velocities above this value will not trigger the 1st Link

Velocities above this value will not trigger the 2nd Link

Selects Combi Vel Range 1 page

Selects lowest velocity level that will trigger the 3rd Link

Selects lowest velocity level that will trigger the 4th Link

```
VELRANGE2 lowvel3= 00   lowvel4= 00
-transpos- hivel3= 127   hivel4= 127
```

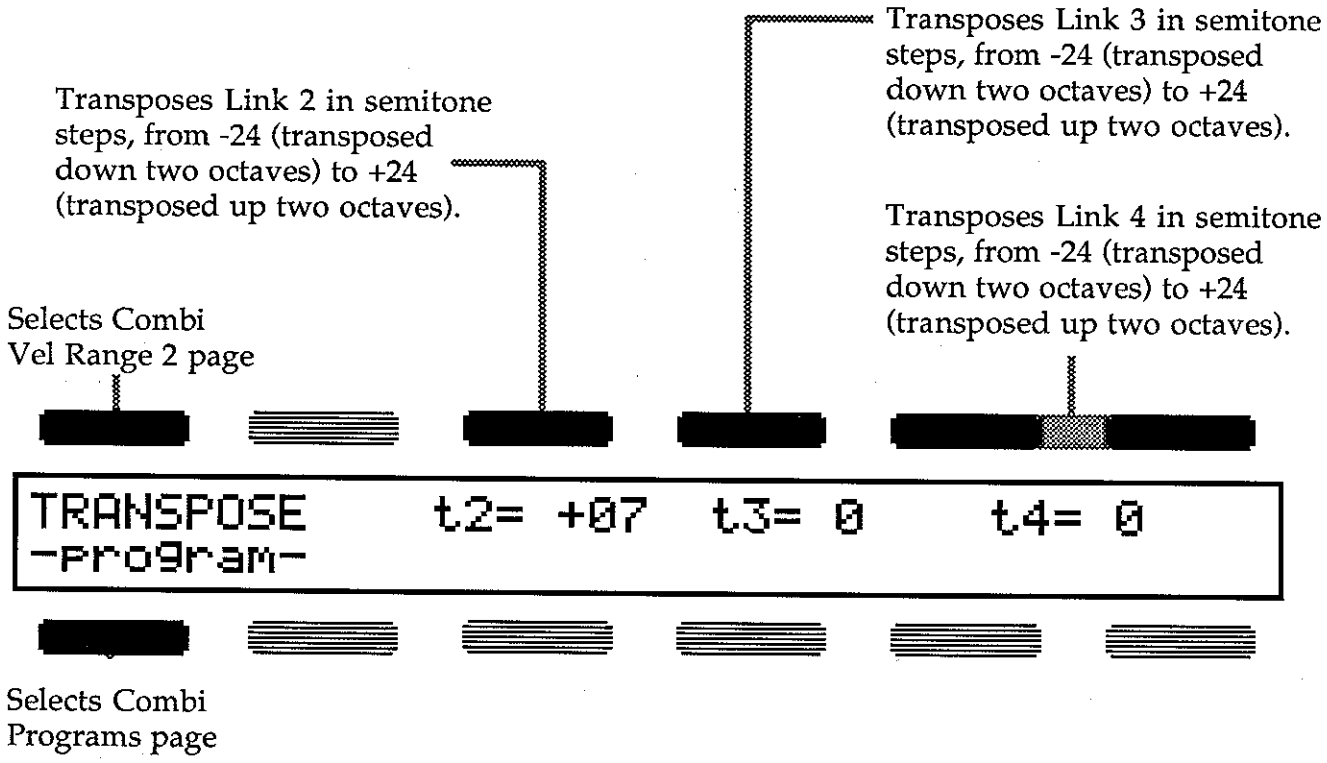
Selects Combi Transpose 2 page

Velocities above this value will not trigger the 3rd Link

Velocities above this value will not trigger the 4th Link

3.3O Combi Transpose Page

Note: Pressing the **-Page** button cycles through the Combi pages in the following order: Programs, Delay, Detune, Level, MIDI Xmit, Key Range (two pages), Velocity Range (two pages), and Transpose. The **+Page** button also cycles through, but in reverse order. To return to the Combi Main page at any time, press the **Multi** Voice Edit button.



Chapter 4: Programming the On-Board Signal Processors

4.1 ABOUT DPM 3 SE SIGNAL PROCESSING

The DPM 3 SE offers sophisticated signal processing options that modify the basic patch program sounds, with results comparable to what can be obtained from outboard rack-mount devices. Signal processing modules include time-based effects (reverb, gated reverb, chorus, flanging, stereo delay), equalization, distortion, and an "exciter" that enhances sounds through a combination of phase changes and equalization. Signal processing setups need not be global; each program has its own associated signal processing parameters, and can be processed in a unique way.

4.1A Effects Structure

There are two independent effects units (Effect 1 and Effect 2). Each one can include one or two effects (called Single or Dual effects mode respectively), giving a possible total of up to four signal processing "modules" in all. The signal processing options (in addition to Bypass, where the effect module has no effect) are listed below, along with a brief description of each function.

Single effects mode options

- **Reverb** (produces the type of ambience characteristic of rooms and concert halls)
- **Delay** (produces echo unit effects, where a sound is repeated at ever-lower levels)
- **Chorus** (simulates instruments playing *en ensemble,* giving a thicker, richer sound)
- **EQ** (equalization; a type of tone control used to alter frequency response)
- **Gate** ("gated" reverb has a more abrupt decay than standard reverb)
- **Distortion** (produces a fuzz effect that can create a dirtier, grittier sound)
- **Exciter** (provides equalization and phase change to enhance a signal's "presence")

Dual effect mode options (each includes a pair of the above single effects)

Chorus/Gate	Chorus/Distortion	Chorus/Exciter	Delay/EQ
Delay/Distortion	Delay/Chorus	Delay/Reverb	Delay/Exciter
Distortion/EQ	EQ/Gate	EQ/Distortion	EQ/Reverb
Distortion/Reverb	Distortion/Exciter	Distortion/Delay	Distortion/Chorus
EQ/Chorus	Exciter/Chorus	Exciter/Reverb	Exciter/Delay
Exciter/Distortion	Exciter/Gate	Gate/Exciter	Gate/Chorus
Reverb/Chorus	Chorus/Reverb	Chorus/Delay	Chorus/EQ
Reverb/Exciter	Reverb/Delay	Reverb/EQ	Reverb/Distortion

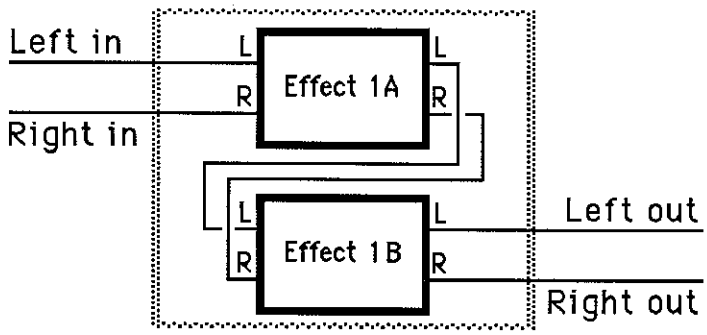
Note: The Chorus module can also provide *flanging* (a "swooping," jet-airplane-like sound) with appropriate parameter settings, described later. Also remember that the various synthesizer voice modules offer many signal processing options—delay for one or more links in a Combi patch, tremolo by modulating a DCA with an LFO, etc.

Important: Some combinations of effects, mostly those involving reverb, are not available because of the huge amounts of computer processing they would require. *Example:* Both Effect 1 could be assigned to Reverb/EQ and Effect 2 to Delay/Chorus, but Effect 2 could not be set to Reverb/Chorus. The display will advise you if a particular combination of effects is not possible.

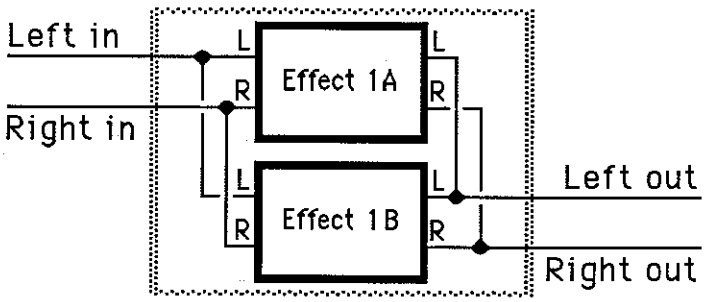
4.1B The Differences Between Effect 1 and Effect 2

If Effect 1 includes a pair of effects (such as Reverb/Chorus), these can be configured in three different ways: series, parallel, or dual.

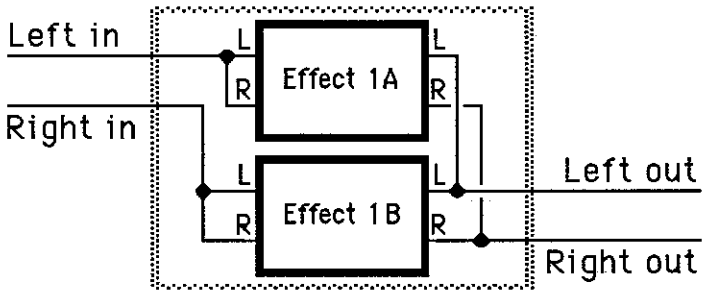
The following figure shows the *series* connection. The stereo audio outputs feed Effect 1's first stage, which then feeds the second stage. The second stage provides the master stereo outputs and provides a master level parameter.



The *parallel* connection routes the stereo audio outputs to both stages simultaneously; their outputs are then mixed together to provide the master stereo outputs. Each output has an associated level parameter.

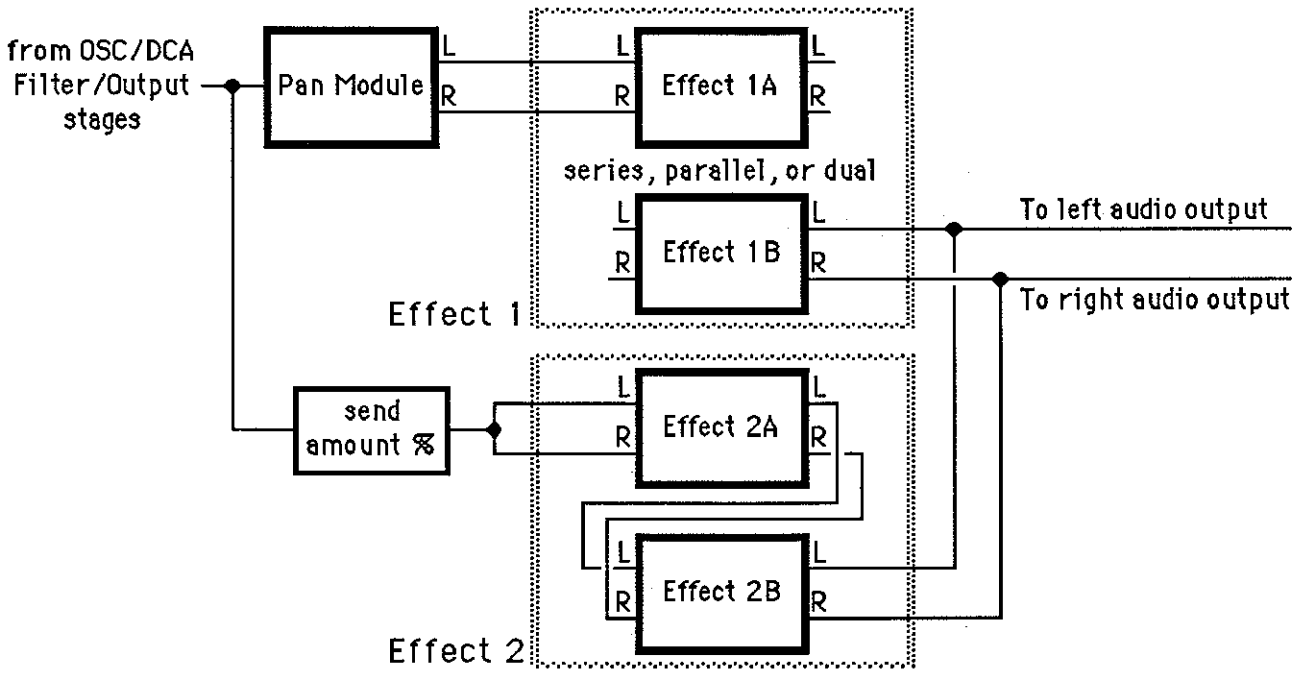


The *dual* connection feeds the left channel to one stage and the right channel to the other stage. Each effect synthesizes a stereo output, which are mixed together into a master stereo output. Each output has an associated level parameter.



Effect 2 does not offer different configurations. If Effect 2 includes a pair of effects, these are always set up in series (like Effect 1 when it's set up in series). However, Effect 2 does include a send control that "sends" some or all of the pre-panned program output to Effect 2. *Example:* To add a trace of the exciter effect, set up Effect 2 as an exciter, then send a small amount of the program sound to Effect 2.

The following diagram shows how Effect 1 and 2 are configured. The diagram assumes that both Effect 1 and Effect 2 are set up as dual effects, yielding four effects in total. However, either or both could also be set up as single effects, or be bypassed if you don't want any effects at all. (Effect 1 could also use a parallel or dual connection.) Note how the send parameter determines how much signal goes to Effect 2.



If this seems complicated, well, it can be if you want to use the signal processing options to their maximum potential. To get started, try working with single effects to hear how they affect the sound. Then try different combinations and modes to become familiar with the various possibilities.

4.2 SIGNAL PROCESSORS IN MULTI CONFIGURATIONS

Calling up a program calls up a particular set of signal processing parameters, identified by the same name as the program—but what happens in a MIDI Multi configuration, where you have multiple programs? The Multi will use one patch program's set of signal processing parameters, but *which* program's set depends on a variety of factors.

• **Base channel program parameters** The DPM 3 SE, even in Multi mode where different programs respond to different channels, nonetheless uses MIDI *base channel* information. This is the channel that would be selected if the unit was in MIDI Poly mode (the base channel is the first parameter in the MIDI menu). If any program in a Multi is set to the base channel, then the signal processing effects parameters associated with that program will affect all programs that are part of the Multi.

• **Last individual program selected** If no program in a Multi is set to the base channel, then the DPM 3 SE will use the parameters belonging to the program that was selected prior to entering Multi mode. *Example:* If you select Program 027, then switch over to a Multi and the Multi has no program assigned to the base channel, the effects parameters for Program 027 will affect all programs that are part of the Multi.

• **Program selected via MIDI program change commands** Sending a program change over the base channel to call up a different program will not only select that program, but also select the signal processing parameters associated with that program. This is particularly useful if you want to have the same patch program use different signal processing parameters at different times. Copy the patch program to two locations, set independent signal processing parameters for each, then call up the desired program and processing as needed.

Note that sequences can also have an associated effect. This is covered in Chapter 7 and in section 2.6.

4.3 FX PARAMETER PROGRAMMING

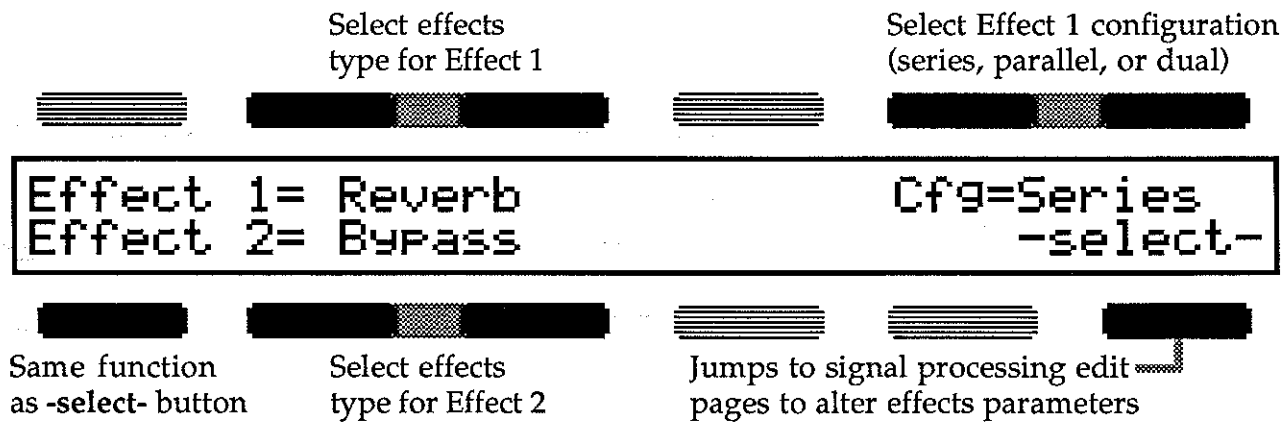
Programming effects parameters follows a consistent procedure. The following is an overview; sections 4.3A-4.3H describe the process in more detail.

1. Select the program with the effect whose parameters you want to modify.
2. Select the **-Effect-** soft button from the **Master** Voice Edit button menu.
3. The first screen will show the effects that have been selected for the patch. You can change the effects assignment and effects configuration on this screen.
4. Pressing the **-Page** (or **+Page**) button takes you through screens that let you edit the parameters for the selected effects.
5. The final screen lets you set the output mix of the two effects. This affects the overall output only and does not vary the mix between straight and processed sounds, which is set on the parameter editing screens.

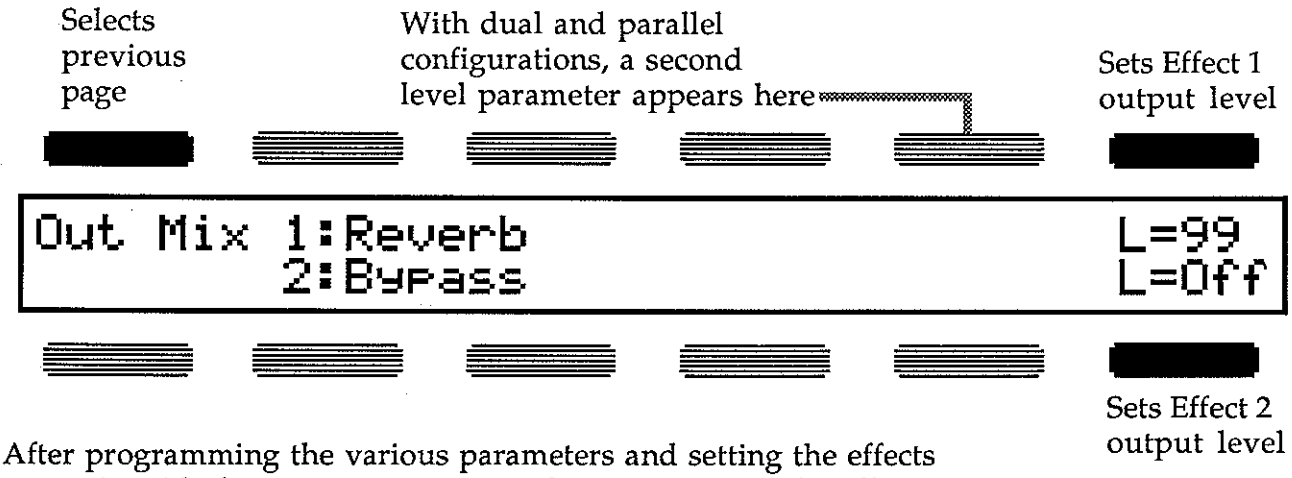
4.3A Programming Signal Processing Parameters

Programming effects parameters for individual programs requires certain common procedures.

1. Make sure that **-FxSelect-** (Master menu) is set to Program so that calling up program patch calls up the associated effects patch (see section 2.6).
2. Select the program whose effects parameters you want to modify.
3. Press the **Master** button and select the **-Effect-** soft button. The Effects selection screen appears, offering the following options:



4. Pressing the **-Page** button goes through pages in the following order: Effect 1 parameters (one page for each Effect 1 effect), Effect 2 parameters (one page for each Effect 1 effect), and output mix page. Pressing **+Page** backs up through these pages. The parameter edit pages are described later; the output mix screen is similar for each effects patch:



5. After programming the various parameters and setting the effects output mix with the L parameters, save the program and the effects parameters will be stored with the program. If you do not save the program then select a different program, your effects edits will be lost.

4.3B Reverb Parameters

You'll find that different types of reverb sound best with particular types of signals. *Example:* "smooth" reverb works well with percussive sounds, whereas "medium" reverb seems well-suited to piano sounds.

Selects previous page

```
Effect 1: Reverb
     Typ=Room S=Lrg Dp=4K  T=3.4 M=65:35
```

Selects next page

Type (Typ)

Select among Plate, Room, and Hall. Each provides a different reverb character.

Size (S)

Select among small, medium, large, huge, and smooth. This alters the apparent size of the reverberant space.

Damp (Dp)

Determines the high-frequency "absorption" of the room by using a low-pass filter to simulate a more acoustically-"dead" environment. Select from cutoff frequencies of 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, or OFF (full high frequency response).

Time (T)

Sets the length of the reverb "tail." Select from 0.0 to 8.0 seconds in 100 millisecond increments, and from 8 to 30 seconds in one second increments.

Mix (M)

Adjusts the ratio between dry and effected (wet) signals, as well as DRY for all-dry and WET for all-wet signals. The mix value affects only the wet/dry balance within the effect; it is independent of the mix levels for Effect 1 and Effect 2 (the L parameter described in section 4.3A).

Note that after pressing this soft button, the upper right line shows Mix Dry:Eff to remind you that the display shows the ratio of dry to wet (effected) sounds, not the ratio of wet to dry sounds.

4.3C Delay Parameters

This is a stereo delay system with feedback. It's useful for slapback echos, long echoes, and polyrhythmic echo effects (try setting one delay time to 67% of the other's delay time).

Setup
previous page

```
Effect 1: Delay
     L=02.5  R=250.0        FB=15 M=60:40
```

Selects
next page

Left Delay Time

Sets the left channel delay time, from 2.5 milliseconds to 250 milliseconds, in 2.5 millisecond increments.

Right Delay Time

Sets the right channel delay time, from 2.5 milliseconds to 250 milliseconds, in 2.5 millisecond increments.

Feedback (00-99)

Determines how much of the echo signal feeds back to the input for re-echoing. Higher values give longer echo "tails."

Mix (M)

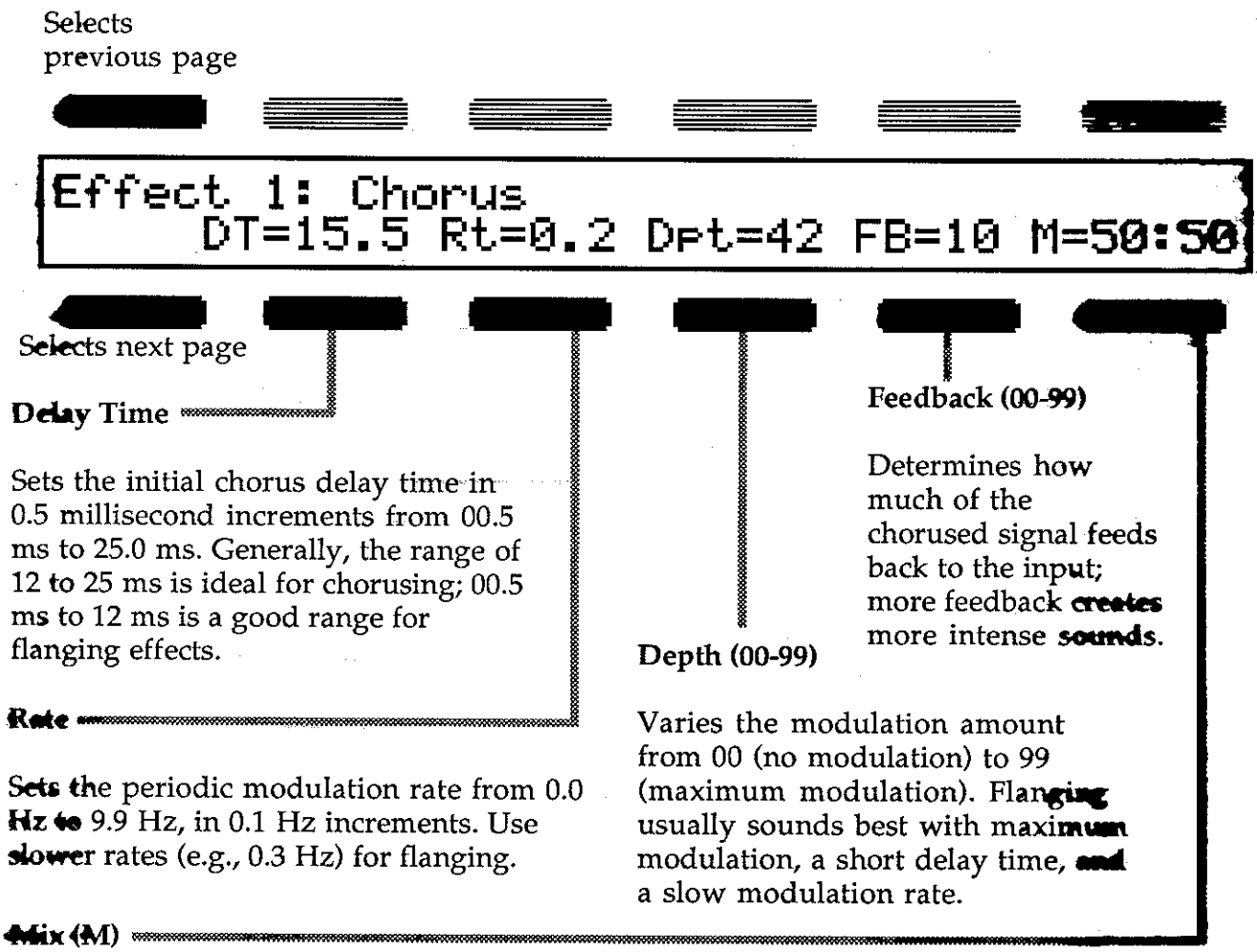
Adjusts the ratio between dry and effected (wet) signals, as well as DRY for all-dry and WET for all-wet signals. The mix value affects only the wet/dry balance within the effect; it is independent of the mix levels for Effect 1 and Effect 2 (the L parameter, section 4.3A).

After pressing this soft button, the upper right line shows Mix Dry:Eff to remind you that the display shows the ratio of dry to wet (effected) sounds, not the ratio of wet to dry sounds.

4.3D Chorus Parameters

Stereo chorusing thickens up a sound by delaying the sound by a small amount (generally less than 25 milliseconds), changing the delayed sound's pitch periodically with LFO modulation, then mixing the delayed and straight signals together. The various phase cancellations and additions that occur as the delayed and straight signals interact produce chorusing. Also note that the chorus effect can be used for flanging, as described below.

With many synthesizers, the recommended way to chorus is layering two identical sounds together and slightly detuning them. However, this cuts the available polyphony in half since two notes are layered on one key. Using chorusing signal processing lets you retain full polyphony (as does assigning the same sound to Osc1 and 2 in a voice, and slightly detuning them).

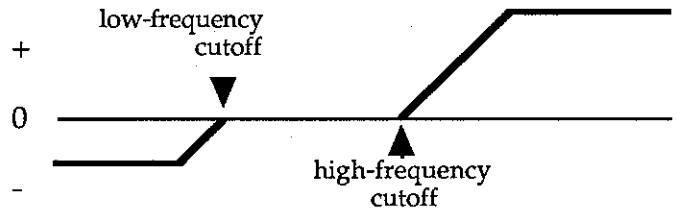


Adjusts the ratio between dry and effected (wet) signals, as well as DRY for all-dry and WET for all-wet signals. The most intense chorusing and flanging effects occur with a 50:50 mix of dry to wet. Tilting the ratio toward dry (e.g., >50:50) puts the chorus or flanging effect more in the background. The mix value affects only the wet/dry balance within the effect; it is independent of the mix levels for Effect 1 and Effect 2 (the L parameter, section 4.3A).

4.3E EQ Parameters

EQ alters a sound's frequency response. Example: boosting the lower frequencies gives a bassier sound; boosting the higher frequencies gives a brighter sound.

The DPM 3 SE's EQ is a two-channel, shelving type (so-called because the frequency response creates a "shelf" starting at the chosen frequency). The figure below shows a typical response curve available with the EQ.



slight low-frequency cut and substantial high-frequency boost

Selects previous page

```
Effect 1: EQ
       f=250   G=+02   f=4K   G=-05 M=60:40
```

Selects next page

Low Frequency Cutoff

Options are 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz.

High Frequency Cutoff

Options are 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 8 kHz.

Low Gain (-12 to +12)

Sets the amount of boost or cut affecting the low frequencies, in 1 dB increments, from -12 dB (maximum cut) to 00 (no affect) to +12 dB (maximum boost).

High Gain (-12 to +12)

Sets the amount of boost or cut affecting the high frequencies, in 1 dB increments, from -12 dB (maximum cut) to 00 (no affect) to +12 dB (maximum boost).

Mix

Adjusts the ratio between dry and effected (wet) signals, as well as DRY for all-dry and WET for all-wet signals. The mix value affects only the wet/dry balance within the effect; it is independent of the mix levels for Effect 1 and Effect 2 (the L parameter; see section 4.3A).

4.3F Gated Reverb Parameters

Gated reverb produces an effect which is similar to reverb, but has a sharper and more synthetic decay. It is frequently used with percussive signals to give more "punch" but is by no means limited to percussive sounds.

Selects previous page

```
Effect 1: Gated Rev
        Type=Gate 1    Density=03 M=60:40
```

Selects next page

Type

Chooses between three different types: Gate 1, Gate 2, and Gate 3.

Density (0-9)

Determines the reverb tail's envelope shape by altering the density of the early reflection patterns. Higher densities give a longer tail.

Mix

Adjusts the ratio between dry and effected (wet) signals, as well as DRY for all-dry and WET for all-wet signals. The mix value affects only the wet/dry balance within the effect; it is independent of the mix levels for Effect 1 and Effect 2 (the L parameter; see section 4.3A).

4.3G Distortion Parameters

Distortion is useful for creating fuzz guitar sounds or for adding a bit of "crunch" to otherwise clean sounds, such as organ. *Note:* The Distortion/EQ dual mode combination effect is very useful, as you can use EQ to remove some high frequencies for a "warmer" fuzz sound.

Selects previous page

```
Effect 1: Distortion
        Amount=05                  M=60:40
```

Selects next page

Amount (00-09)

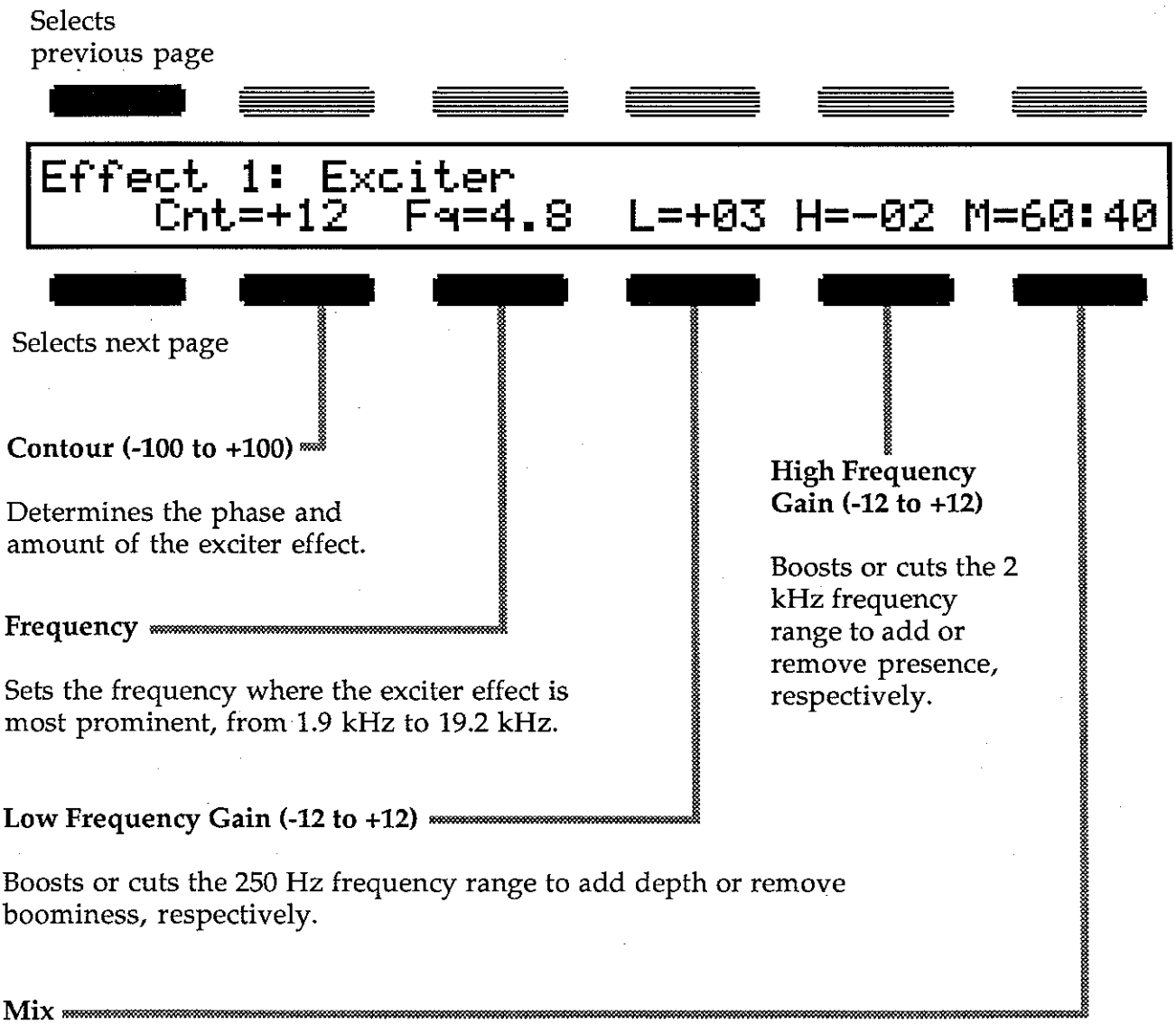
Chooses the distortion intensity; higher values create more distortion.

Mix

Same as for Gated Reverb above.

4.3H Exciter Parameters

The Exciter can increase a sound's presence and/or depth. It resembles equalization but makes use of phase changes and resonant frequency shifting.



Adjusts the ratio between dry and effected (wet) signals, as well as DRY for all-dry and WET for all-wet signals. The mix value affects only the wet/dry balance within the effect; it is independent of the mix levels for Effect 1 and Effect 2 (the L parameter described in section 4.3A).

Note that after pressing this soft button, the upper right line shows Mix Dry:Eff to remind you that the display shows the ratio of dry to wet (effected) sounds, not the ratio of wet to dry sounds.

4.4 COMBINATION EFFECTS OPTIONS

The combination effects use the same parameters as described in the previous pages. *Example:* Reverb/Chorus includes the same parameters as the individual Reverb and Chorus effects.

The order of effects can make a big difference in the overall sound. As always, experimentation is the key to learning these differences, but the following specific examples should help get you started.

Distortion/Reverb and **Reverb/Distortion**

Placing distortion before reverb gives a clean reverb effect superimposed on a distorted sound. Placing distortion after reverb distorts the reverb signal, giving a "dirty" reverb effect.

Delay/Chorus and **Chorus/Delay**

Placing delay before chorus means that chorus will produce an overall modulation of the delayed sound. Placing chorus before delay produces a more diffused sound as the echoes repeat different parts of the chorused signal.

Distortion/EQ and **EQ/Distortion**

With distortion before EQ, the EQ shapes the distorted sound. Placing EQ prior to distortion changes the character of the distortion by emphasizing or de-emphasizing those frequencies to be distorted.

Reverb/EQ and **EQ/Reverb**

This is an example of a combination effect where the difference between the two options is not particularly noticeable; EQing reverb or reverberating EQ makes little practical difference.

Also remember that you can obtain combination effects by using individual effects for Effect 1 and Effect 2. One very useful combination is assigning both effects to reverb. Due to the extensive computing power required to produce reverb effects, there is a noticeable periodic variation on long reverb tails. Using two reverbs set for different reverb times and equivalent levels can produce a much smoother sound.

Chapter 5: Creating Drum Kits

5.1 DRUM KIT BASICS

The DPM 3 SE contains five special "multi-sample" waves called drum kits. These waves consist of up to 32 percussive (or melodic) wavesamples, chosen from the DPM 3 SE's set of waveforms and assigned to specific keys. To prevent confusion with other wavesamples used in other programs, the 32 wavesamples used in a drum kit are called *instruments*.

Each instrument can:

- Cover a particular range of MIDI notes
- Be tuned over up to a six-octave range
- Have its own decay time
- Be panned anywhere in the stereo field
- Be mixed in relation to the other drum sounds
- Send some of the effect signal to Effect 2 for additional signal processing

After building a drum kit, it remains in memory until altered and can be assigned to a program, just like any other wavesample. However, the DPM 3 SE's program voice architecture is modified for drum kit construction:

- Osc 1 is enabled and drum waves should be assigned to it.
- The following modules are disabled: Osc 2, DCA1 and DCA2, ENV1-3, LFO1 and LFO2. Drum kits are not affected by pitch bend. The main parameters to adjust in the patch program using a drum kit wave are the Filter and AMPENV Vel Mod and Key Mod parameters.
- The drum kit pan assignment overrides the program's output pan parameter.
- The drum kit output level overrides the usual program output level parameter.
- The AMPENV envelope is active, but with release time set by the drum kit decay parameter.
- Velocity sensitivity should be assigned using the Vel Mod parameter in the ENV4 menu.

5.2 ACCESSING AND MODIFYING DRUM KIT PARAMETERS

The general procedure is to:

1. Press the **Master** System button.
2. Press the **-Kits-** soft button.
3. Select the kit to be edited (as shown in the upper left corner of the screen), with the **-Page** and **+Page** buttons.

The screen shows something like the following:

```
Kit1:   Pc=01 Os=70  Key=C2        TOM1
        Tun=-03 D=62 Pan=-50 Lev=76 Fx=09
```

Here's what the various soft buttons do.

• **Kit# (1-5)** Scrolls through the kit numbers into which you will program the various instruments.

• **Pc (01-32)** Chooses the instrument ("piece") to which parameters will be assigned.

• **Os** Chooses the "oscillator" waveform from any of the available DPM 3 SE samples, whether in ROM or user RAM, referenced to the sample number (samples in RAM are indicated with an R before the wave number). The upper right of the display shows the corresponding wave name. You are not limited to using traditional drum sound samples.

• **Key** Each instrument is assigned to a specific key range. This parameter sets the upper note of the range; the lower note of the range is one semitone higher than the highest note of the previously-selected instrument. *Example:* If Instrument 01 covers the range of A0-D1, and Instrument 02's Key parameter is set to G1, then Instrument 02's range is D#1-G1.

If you assign a drum sound "between" existing drum sounds, the existing sounds will be reordered to accommodate the new sample. In the example given above, if you assigned Instrument 03 so that the top key is F1, Instrument 01 would cover the range of A0-D1, Instrument 03 would extend from D#1 to F1, and Instrument 02 would cover F#1-G1.

Note: An initialized drum kit assumes that you are going to build the drum kit starting from the top of the keyboard and work your way down, so all keys are set to C-1. If you want to build a drum kit starting from the bottom of the keyboard and work your way up, you might want to set all keys initially to G9.

• **Tune** Adjusts the instrument's frequency in semitone steps, from -36 (transposed down three octaves) to +36 (transposed up three octaves).

• **Decay (D)** Sets the instrument's decay time from 00 to 99 by altering the ENV4 decay parameter (T4).

• **Pan** An instrument can be placed anywhere in a stereo (two-channel) field. -99 pans full left; moving toward 00 moves the program toward center. Moving off center toward +99 pans the program toward full right.

• **Level (Lev)** Determines the instrument's level. 00 is the lowest possible level. Higher values give higher levels, up to 99.

• **Fx** Sends the instrument signal to Effect 2 (see Chapter 4 on signal processing). 00 is the lowest possible level. Higher values give higher send levels, up to 99.

Application: This is useful if you want an overall drum effect but also a different effect on an individual drum. Effect 1 would provide the overall drum processing; Effect 2 the effect for the particular drum, with that drum sending some of its signal to Effect 2.

Chapter 6: Sampling

6.1 ABOUT SAMPLING

The DPM 3 SE oscillators play back sampled sounds called *waves*. These were recorded, digitized, and stored in ROM (permanent memory) chips by Peavey for use in the DPM 3 SE. However, the DPM can also include up to 1 Megabyte of battery-backed up RAM that contains your own samples. You can store real-world sounds (anything from an orchestra hit to a plucked guitar string to a dog bark) in this memory, which you can then play back from the DPM keyboard. With sampling, you are not limited to the on-board waveforms included in the DPM 3 SE; the world is your waveform, once you manage to get it into memory. Samples show up in the Osc 1 and 2 wave parameter, at the end of the on-board factory waves.

The DPM can load samples in four main ways:

• From the DPM disk drive. Samples can be stored on DPM disks and loaded into the DPM. Peavey and various third party developers (such as Prosonus) offer samples on disk for the DPM.

• From another sampler or DPM 3 SE. This takes advantage of a provision of the MIDI specification, the Sample Dump Standard (SDS), which specifies a universal way to exchange samples over the MIDI line between those instruments whose specifications conform to the SDS. (Unfortunately, not all samplers are SDS-compatible and may use their own methods of data transfer.)

For optimum fidelity the DPM 3 SE is a 16-bit machine, and therefore performs best with 16-bit samples. Although you can transfer 8 and 12-bit samples to the DPM, this does not convert them to 16-bit sample quality--they will play back with the same basic fidelity as they did on the source machine.

• From sample editing computer programs. These programs (such as *Sound Designer* and *Alchemy* for the Macintosh, *Avalon* and *Genwave* for the Atari, *Sample Wrench* for the Amiga, and *SampleVision* for IBM machines) exist for virtually all popular computers. Most programs can load samples into computer memory from a computer disk containing samples, a CD ROM disc containing samples, or another sampler. These samples can then be sent from the host computer to the DPM over the MIDI line.

As a bonus, sample editing programs usually provide a convenient workaround for samplers that don't conform to SDS. These programs can transfer samples between the computer and those samplers supported by the program, regardless of whether or not they support SDS. The program should also be able to translate samples that use

incompatible formats. Therefore, a non-SDS sample can be brought into the program, translated, and sent out over MIDI as an SDS sample to the DPM 3 SE, thus opening up a potentially huge library of samples.

• From the Peavey SX sample expander. This device is (among other things) a digital audio recorder that can record a sound, digitize it, store it in a buffer memory, and then send the sample to the DPM 3 SE.

After loading a sample, the DPM 3 SE creates a special "audition" program in the program memory buffer so that you can listen to and edit the sample. It is therefore not necessary to create a special program and assign a sample to its oscillators in order to hear the sample.

Note 1: With SDS-compatible devices, there are two possible ways to load samples. The device containing the sample to be transferred can send a sample to a DPM 3 SE, or the DPM 3 SE can request a particular sample (as identified by a number) from a sample-editing program or sampler capable of sending samples as SDS data. When transferring samples, loop and sample length parameters (as described later) in the source sample are retained in the DPM 3 SE.

Note 2: Different samples are often taken at different sample rates, with lower sampling rates trading off poorer fidelity for greater memory efficiency. In many sample transfer applications it is important to match sample rates, but the DPM 3 SE performs an automatic sample rate conversion routine to insure compatibility. This process does not alter the sample length, which will be the same in the DPM 3 SE as in the source. Also, please note that sample rate conversion cannot improve the sound of a sample originally recorded with a low sample rate. The DPM 3 SE will faithfully reproduce whatever you put into it; put in a horrible-sounding sample, and the DPM 3 SE will play back a horrible-sounding sample.

6.2 SAMPLE TRANSPOSITION

A sample is initially assigned to a single key on the keyboard. *Example:* If you record a plucked guitar string at middle C, this would be assigned to middle C on the keyboard (although you could assign it to another pitch if desired). The originally recorded pitch is called the *original pitch*. However, since each sample takes up a certain amount of memory, it is impractical to record one sound for each key. As a result, a single sample can be transposed over a range of notes.

Transposition can also be used as an effect. In *Raiders of the Lost Ark,* where a gigantic stone ball rolled toward Indiana Jones, the sound of that rolling ball was simply a microphone taping the rear wheel of a Honda car going down a gravel driveway. However, this source sound was slowed down and otherwise modified, thus producing the awesome sound heard in the movie.

6.3 ABOUT MULTI-SAMPLING

The further a note is transposed from its original pitch, the more unrealistic it sounds, especially with acoustic instrument samples. The problems are the same as changing speeds on a tape recorder; transposing up gives "munchkinization" (*i.e.*, the sounds are thin and unnatural), whereas transposing down creates "Darth Vader" effects with muffled, deep sounds. These effects are not always undesirable--transposing a bass up far enough can create an entirely new type of sound--but for maximum realism, it's best not to transpose a sound too far.

Because of this, the DPM 3 SE allows for *multi-sampling*, where several samples (perhaps at octave or fifth intervals) are used to cover the keyboard range. Thus, no note will have to be transposed over too wide a range, resulting in more realistic timbres.

The tradeoff is that more samples use up more memory. As a result, it's usually best to concentrate on grouping the greatest number of samples towards the most-played range of the keyboard. For example, some bassy sounds can be transposed downwards up to an octave or so without sounding too unnatural. Likewise, for some sounds--like cello--you're not going to play too much in the top octave. Therefore, one sample might suffice for, say, the top octave and a fifth.

For maximum user convenience, these multi-sampled waves are still saved as a single wave. For example, a multi-sampled guitar will show up as a single Guitar wave. (Of course, you can save each sample individually and assemble them in a Combi patch, but there is seldom any advantage to doing things this way.)

6.4 MEMORY AND SAMPLE TIME

Samples (in fact, any digital audio signals) use up a lot of memory. 1 megaword (2 Megabytes) of sample memory allows for about 13 seconds worth of samples, but that sample time can be partitioned in several different ways: a single 13 second sample, two 6.5 second samples, a 10 second sample and three 1 second samples, and so on. It is also possible to save memory in other ways, such as trimming and looping, which are described later.

6.5 DEFINITION: WAVES AND SAMPLES

A *wave* is what shows up in the Osc 1 and 2 wave parameter. A wave can consist of a single sample, or a number of samples arranged to form a multisample. All waves

contain samples, but not all samples are waves since some waves have multiple samples (*i.e.*, a multisampled wave).

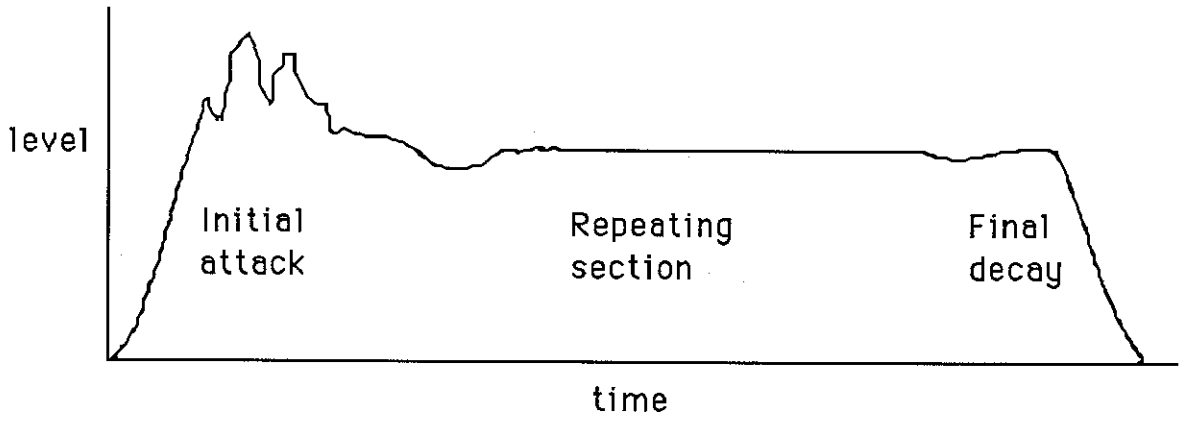
The DPM 3 SE holds up 32 waves and 48 individual samples (some waves will probably be multi-sampled, hence the ability to load in more samples than there are waves). Attempting to load more than 48 samples or 32 waves will produce an error message in the display.

6.6 ABOUT SAMPLE LOOPING AND TRIMMING

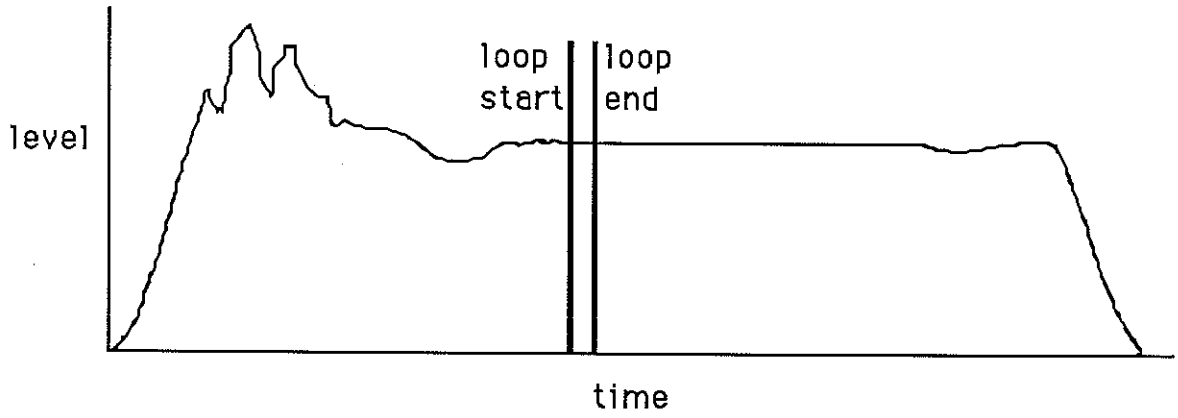
Looping is an important way to save memory. It takes advantage of the fact that many acoustic sounds start with a complex initial transient, then settle down into a steady, repeating waveform. Consider a flute; it starts off with a burst of noise and a fairly complex sound, but then settles into a sustained tone.

Rather than play back this entire sustained tone, we can mark off a small part of the repeating waveform and play it over and over again through a process called *looping*.

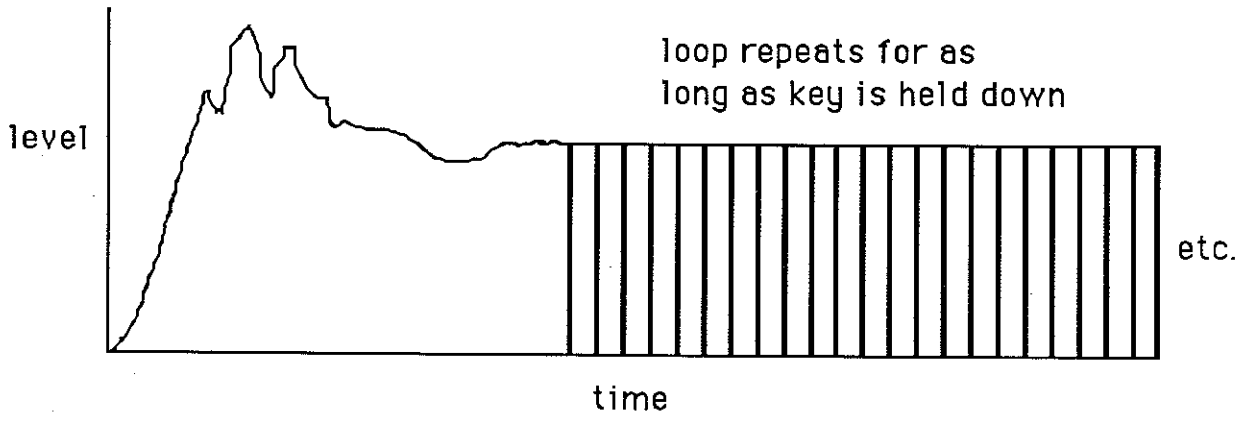
The following figure shows the amplitude envelope for a typical unlooped flute sound.



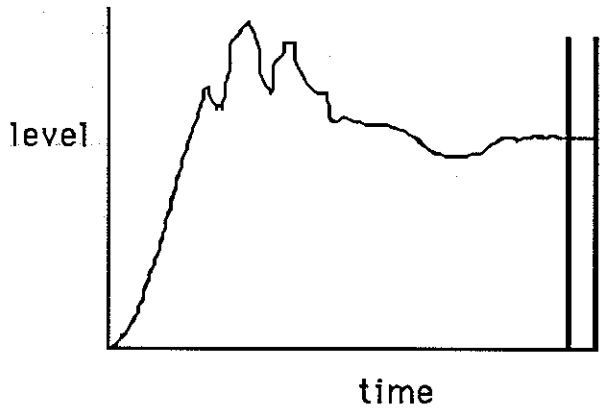
Note how there is a repeating section that occurs between the initial attack and final decay. This looks like a good place to create a loop; the following shows where we might put the loop.



When you press a key, the sample plays normally until it reaches the end of the loop. It then jumps back to the loop start point and plays the looped section again, jumps back to the beginning, plays through the loop again, and keeps repeating the looped section for as long as the key is held down. Thus, a looped sound can sustain indefinitely.

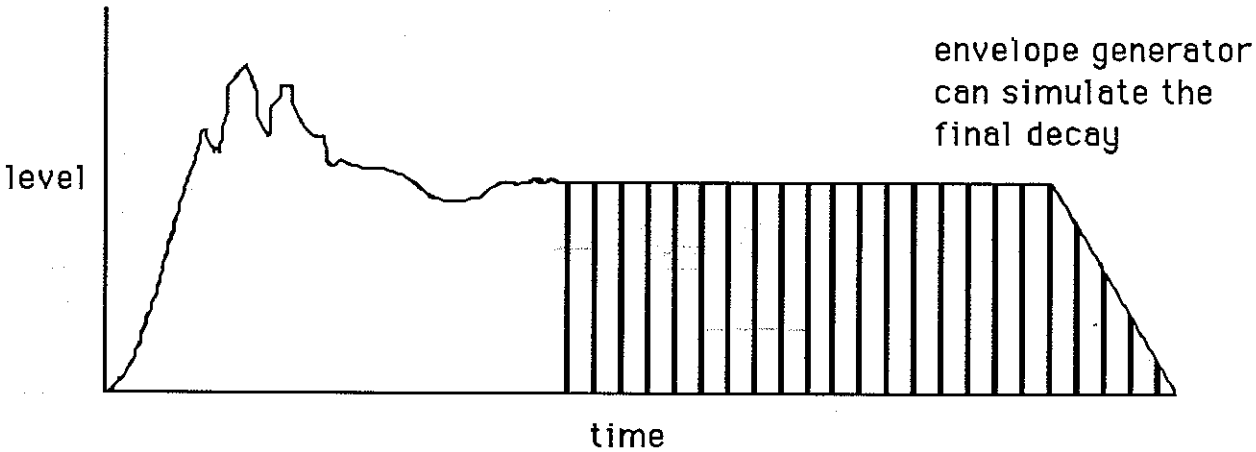


Since we no longer need the part of the sample that extends past the loop end, we can trim it off and reclaim a bunch of memory. Compare the figure below the original flute sample; the sample size has been cut in less than half, thus cutting memory requirements by more than half as well.



Trimming can trim the beginning of the sample, which is useful if some "dead space" got sampled before the attack kicked in. Trimming can also serve as an effect; some sounds change character completely when you, for example, cut off the first few milliseconds of the initial attack.

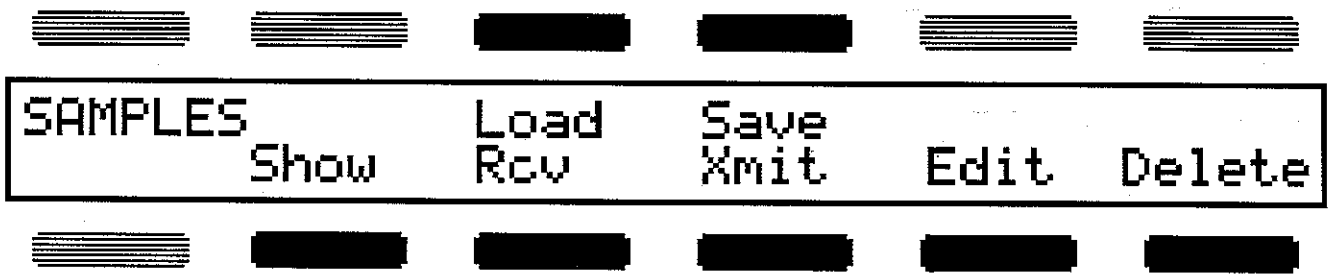
We have one remaining task: simulating the final decay of the original flute sound. This is easy to do by setting a short release time with an amplitude envelope generator. Upon releasing the key, the envelope generator will superimpose a decay on the looped signal.



6.7 ACCESSING SAMPLING FUNCTIONS

All sampling functions are located in the Sample RAM option (Master menu). To enter the land of sampling:

1. Press the **Master** system button.
2. Press the **-Sample RAM-** soft key in the lower right corner. The Samples menu, the main menu for the sampling section, appears:



Select the desired function by pressing the associated soft button. We'll next describe each menu option in detail.

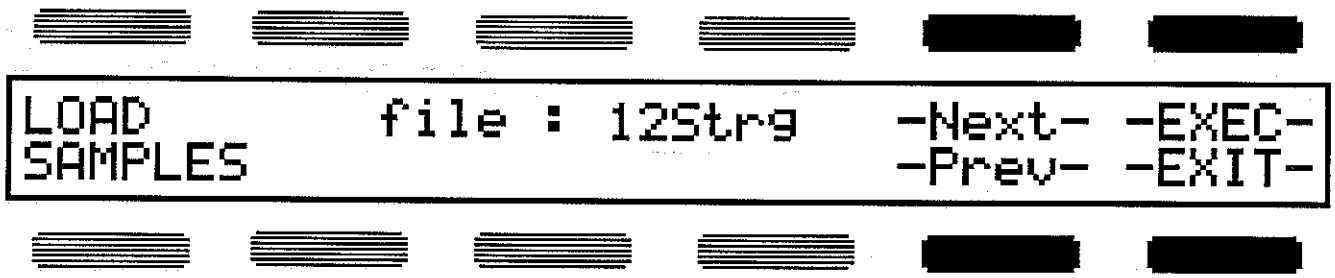
6.8 LOAD (SAMPLE FROM DISK)

To transfer samples from disk into the DPM 3 SE:

1. Place the disk containing the samples to be loaded in the drive. If you are not familiar with disk handling procedures, read section 9.7.
2. Press the **Load** soft key in the samples menu. The display says:

```
Reading directory ..
```

If the disk contains samples, the display says something like:



This is where you choose the sample to be loaded.

• **file:** shows the name of the current sample that's available for loading (or "no SAMs" if the disk contains no samples or "No format detected" if the disk is not a DPM disk).

• **-Next-** Scrolls you to the next sample in the list of available samples.

• **-Prev-** Returns you to the previous sample in the list of available samples.

• **-EXIT-** Returns operation to the main Samples menu.

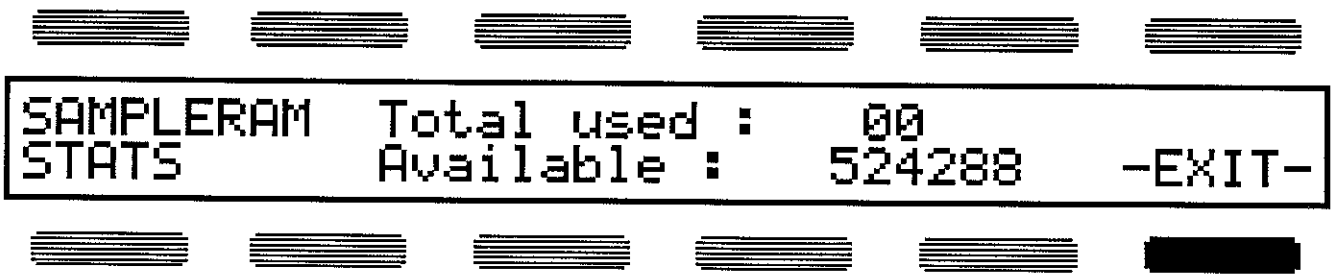
• **-EXEC-** Loads the sample into memory. The longer the sample, the longer the loading process; the display says "Loading from disk .." while loading.

Upon loading a sample, the next file name in the list of samples will appear. Therefore, you can load a series of samples by simply pressing **Exec** until all samples are loaded.

6.9 SHOW (SAMPLE MEMORY STATUS)

To check on the amount of free memory and how much memory the samples in the DPM 3 SE are using:

1. Press the **Show** soft key in the samples menu. With no samples in a fully-loaded DPM with 1 Megabyte of RAM, the display says something like the screen below.



2. This screen shows the sample RAM status. All numbers are expressed in *words*, each of which uses two *bytes* of memory. Therefore, a machine with 1,048,576 bytes of RAM (1 megabyte) has 524,288 words of RAM available.

• **Total used:** Shows the amount of memory currently taken up by the samples in RAM. The more samples you load into memory, the bigger this number will be.

• **Available:** Shows how much memory, in words, is available for loading in new samples.

• **-EXIT-** Returns operation to the main Samples menu.

6.10 RCV (RECEIVE A SAMPLE FROM AN SDS-COMPATIBLE DEVICE)

The following procedure requests a sample from an SDS-compatible device and loads it in RAM.

1. Connect a MIDI cable from the DPM 3 SE's MIDI out to the MIDI in of the computer or sampler providing the sample to be loaded.
2. Connect a MIDI cable from the DPM 3 SE's MIDI in to the MIDI out of the computer or sampler providing the sample to be loaded. These MIDI connections must be made to provide two-way communication (handshaking) between the DPM 3 SE and sampler/computer.
3. Press the **MIDI** System button. Select the base channel over which you want to transfer the sample by pressing the **Ch. IN** soft button and selecting the desired channel. Press the **Mode** soft button and select Omni or Poly mode.
4. Press the Master System button and press the **-Sample RAM-** soft button to access the main Samples menu.
5. Press the **Rcv** soft button. The display shows something like:

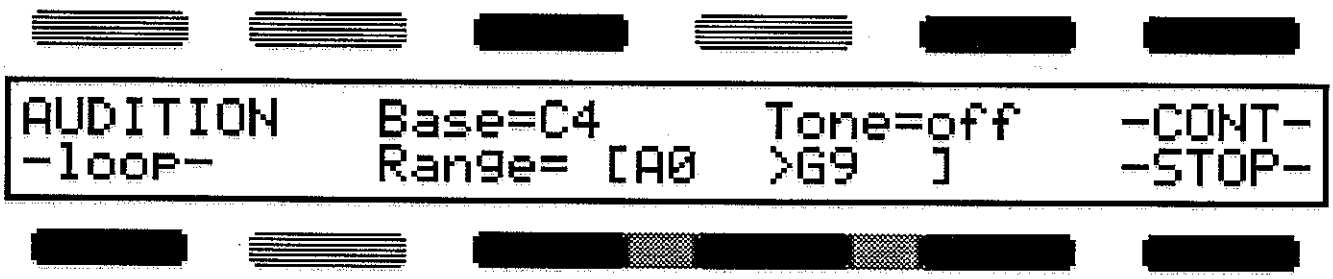
6. The default mode is **Request #01** (or the first free sample number if sample #01 already exists in memory), which lets you "grab" (request) a particular numbered sample from a computer or sampler and load it into the DPM 3 SE. Press the **Mode** soft button, then choose the desired sample number with the Data Slider (selects samples 00-254); the Inc/Dec buttons and data wheel select samples 00-16,383.

The DPM 3 SE is always ready to receive a sample from another source (unless the Trim page, section 6.12, is selected); all that's necessary is to initiate a sample send (dump) command at the remote device. This is often the easiest way to get samples into the DPM 3 SE. Scrolling below **Request #00** calls up a **Remote** data transfer

option, but it is not necessary to call this up for the DPM 3 SE to receive samples. This is included so that if you don't have the manual and scroll through the display, you'll be aware that the DPM 3 SE can receive samples from other sources.

Note: The default sample number is significant because all sample numbers lower than the default sample number correspond to an existing sample.

7. After selecting the desired data transfer mode and/or sample number, press the **-EXEC-** button. If you request a sample with the same sample number as a sample already present in DPM 3 SE RAM, that sample will be replaced with the sample being loaded.
8. If the DPM 3 SE was set to request a sample, the dump process should begin automatically. It may take a couple of seconds after sending the request for the sampler or computer to respond; this is normal. If there is no response, make sure that the sample source and DPM 3 SE are set to the same MIDI channel, that the correct sample number was specified in the request process, and that SysEx is set to **On** in the MIDI Filter page. If the DPM 3 SE was set to **Remote**, continue reading; otherwise skip to step 11.
9. After selecting **Remote** and pressing **-EXEC-** the display will usually say **Waiting for SDS dump on MIDI channel 01** (or whatever base channel you chose in step 3).
10. Initiate a sample dump (transmission) at the computer or sampler, which must be set to the same basic channel as the DPM 3 SE. If you send a sample with the same sample number as a sample already present in RAM, that sample will be replaced with the sample being loaded.
11. The display will say **Sample Dump** and show a countdown of how many bytes remain to be transferred into the DPM 3 SE. Note that MIDI sample transfers can take quite a while with long samples; be patient.
12. Shortly after the display says **Dump Complete**, the Audition screen appears:



This screen lets you set several sample parameters. Here's what the various soft buttons do.

• **Base** Selects the base note (original pitch). For example, if the sample you loaded in had an original pitch of B3, you'd probably set this to B3. Otherwise, when you played C4, you'd hear a note pitched at B3. You can also use this function to transpose a note to a different range if desired. *Example:* Choosing B4 instead of B3 will lower the sample an octave since the original pitch will be placed higher up on the keyboard.

• **Tone** When On, this provides a reference tone that tracks the keyboard. The main purpose of this tone is to let you compare the pitch of the sample with the reference pitch, and verify that the base note has been set to the proper pitch so that playing, for example, a C actually produces a C and not some other note. The reference tone also comes in handy for setting loop points, as described later.

• **Range** This sets the high note of the sample's range. The DPM 3 SE assumes that you will load in samples from the low end of the keyboard to the upper end, so the first sample will automatically default to a low note of A0 and high note of G9. If you are *not* multi-sampling and using a single sample for a wave, press **-STOP-** and skip to step 14.

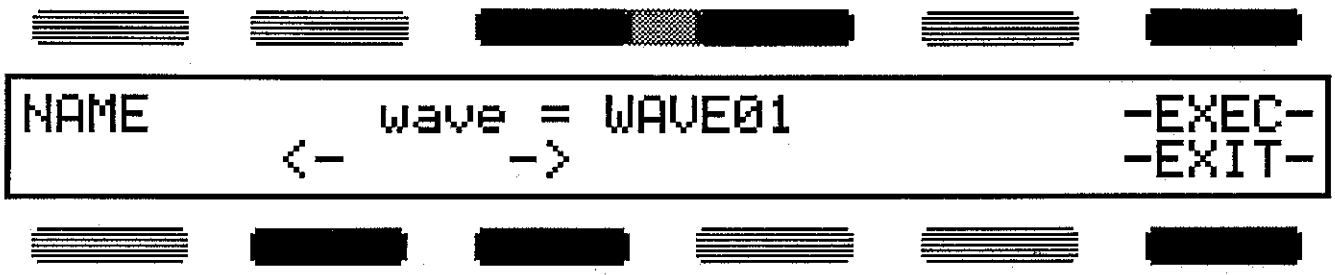
If you are multisampling, press the associated **Range** soft button and select the upper pitch limit for the sample that was just loaded. Keys above this range will not sound.

• **-loop-** This takes you to the sample edit zone so that you can create or alter loop points and/or trim off unneeded portions of the sample to save memory. These operations are described later, but note that you can perform edits while multisampling—set the edits properly for one sample before moving on to the next one.

13. After setting the upper pitch limit for the first sample of a multisample (see previous step), press **-CONT-** and the Rcv screen will appear again. Repeat steps 6-12, but note that in step 12, the range's low end will default to one semitone above the high end of the previous sample's range, and the high note will be G9. Set the high note as desired. Repeat this procedure for as many multi-samples as you need to build up a complete sound, then press the **-STOP-** soft button.

Note: Once the high note is assigned to G9, there is no more room to add samples. As a result, the DPM 3 SE will assume that if the highest sample range extends to G9 or you press **-STOP-**, you are finished transferring the multi-samples for a particular wave. *Important: When sending a sample to the DPM 3 SE, the computer program or sampler may ask you to specify a sample number. If this is the same as the one you just transferred, the previously transferred sample will be overwritten.*

14. Once sampling for a particular wave is complete as indicated by your pressing **-STOP-**, the DPM 3 SE will automatically select the Wave Name screen:



To name, press the **wave** soft button so that the = sign flashes. Use the arrow soft buttons to move the cursor under the character to be changed, then select the desired character. Press **-EXEC-** when you're done, or **-EXIT-** to use the default wave name.

6.11 XMIT (TRANSMIT A SAMPLE TO AN SDS-COMPATIBLE DEVICE)

The following procedure transmits a sample from the DPM 3 SE to an SDS-compatible device such as another sampler, or a computer-based sample editing program.

1. Connect a MIDI cable from the DPM 3 SE's MIDI out to the MIDI in of the destination computer or sampler.
2. Connect a MIDI cable from the DPM 3 SE's MIDI in to the MIDI out of the destination computer or sampler. These MIDI connections must be made to provide two-way communication (handshaking) between the DPM 3 SE and sampler/computer.
3. Press the **MIDI** System button. Select the base channel over which you want to transmit the sample by pressing the **Ch. OUT** soft button and selecting the desired channel.
4. Press the Master System button and press the **-Sample RAM-** soft button to access the main Samples menu.
5. Press the **Xmit** soft button. The display shows something like:

```
XMIT    Samp= #00          25  Kwrds -EXEC-
        Wave:(12STRG)  [A0  >B4  ] -EXIT-
```

This screen lets you select a sample for transmission, as well as provides information about the sample.

Press the **Samp** soft button then select the sample number within the DPM 3 SE to be transmitted; data in the other fields will change to reflect the selected sample's characteristics. Scrolling past the highest-numbered sample selects **All**, which means that all samples will be transmitted.

The number to the right of the sample number indicates the size of the sample in Kilowords (thousands of words). In the example above, Sample #00 has a sample size of 25 Kwords (25 Kwords = 25,000 words = 50,000 bytes = 50 Kbytes).

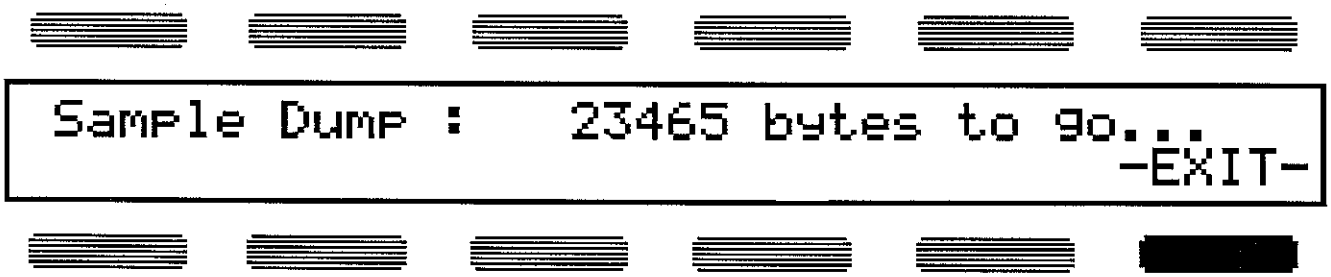
Wave: shows the name of the sample's "parent" wave. This is the name that will show up when assigning a wave to Oscillator 1 or 2; in this example, the wave name is **12STRG**.

The letters and numbers to the right of Wave: indicate the keyrange covered by the sample. In this example, Sample #00 covers the range of A0 through B4.

If the upper note for the range is lower than G9, then the sample is part of a multi-sample. Scrolling to the next higher-numbered sample will show the next higher-pitched sample of the multisample.

6. After selecting the desired sample number, make sure that the receiving device is ready to accept a sample dump from the DPM 3 SE. The procedure for doing this varies for different devices; check the device's manual.

7. Press the **-EXEC-** button to transmit the sample. A screen similar to the following appears:



In this example, the size of the sample is 23,465 bytes. As the sample is transmitted, this number will count down until it reaches 0 bytes, at which point the sample transfer is complete and the DPM 3 SE returns to the main Samples screen.

You can cancel the transfer process at any time by pressing **-EXIT-**. The DPM 3 SE then returns to the main Samples page.

6.12 EDIT (EDIT SAMPLES IN MEMORY—LOOP AND TRIM)

Several sample parameters can be edited to optimize the sample's usefulness. In the main Samples menu, press the **Edit** soft key (you can also access the Edit screen from the Audition page, as described earlier). The display shows something like:

```
EDIT    Samp= #00          13  Kwrds -EXEC-
        Wave:(12STRG)  [A0  >B4  ] -EXIT-
```

1. Choose the sample to be edited by pressing the **Samp** soft button, selecting the desired sample number, then pressing **-EXEC-** (**-EXIT-** returns you to the main Samples screen). The other fields show data about the sample being edited, as on previously-described screens (memory used, wave name, and sample key range).

2. The Audition screen now appears (possibly after a screen that says Reallocating Memory if the DPM 3 SE needs to do some RAM housekeeping). The Audition screen's functions were previously described in section 6.10. Press the **-loop-** soft button to enter the looping screen.

Note: If memory reallocation will take more than 15 seconds, you will be given an option to back out. The fewer samples in RAM during reallocation, the less time RAM housekeeping will take.

3. The Loop edit screen now appears and shows something like:

```
LOOP Edit= manual   Start=   12142
-trim-     loop=on   End=   12468   -UNDO-
```

Here's what the soft buttons do.

• **LOOP** (upper left) Press to return to the Audition page.

• **Edit** Chooses between auto and manual modes, as selected with the Data Wheel or inc/dec buttons. In auto mode, the DPM 3 SE will always place a loop point on a zero crossing *(i.e.,* where the signal crosses over from the positive to negative quadrant or vice-versa, and therefore has zero amplitude). Placing a loop point on a zero crossing often results in a smoother loop. If auto is one when adjusting one loop point (start or end), it should be on when adjusting the other loop point.

The Data Slider is always in manual mode regardless of how edit is set. This allows you to make rough adjustments then use the Data Wheel or inc/dec buttons for fine adjustments.

• **Start** Sets the loop start point, as shown by a number that indicates how many sample "words" into the sample the loop begins.

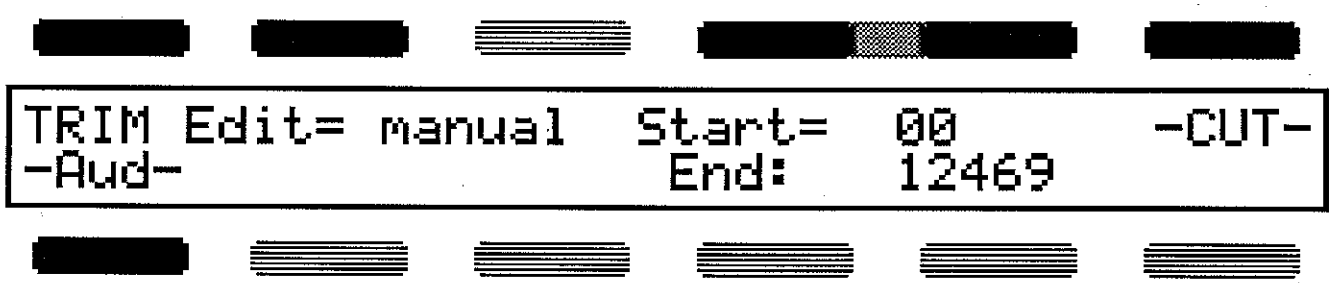
• **loop** Turns loop on or off.

• **End** Sets the loop end point, as shown by a number that indicates how many words into the sample the loop ends.

• **-trim-** Accesses the next editing page, which lets you trim sample words from the beginning or end of the sample.

• **-UNDO-** This cancels any loop point adjustments you may have made *while on this screen,* and returns the DPM 3 SE to the Audition page. If you leave this screen, the new loop points are retained and cannot be undone.

4. To trim the sample by setting a new start point and discarding all samples prior to the start point, press the **-trim-** soft button. The display shows something like:



Here's what the soft buttons do.

• **TRIM** (upper left) Press to return to the Loop page.

• **Edit** Chooses between auto and manual modes. In auto mode, the DPM 3 SE will always set the start point at a zero crossing (*i.e.*, where the signal crosses over from the positive to negative quadrant or vice-versa, and therefore has zero amplitude). This is important because a sample that doesn't start at zero, but at some particular amplitude, will usually produce a "click" at its beginning.

• **Start** Sets the new sample start point.

• **End** With unlooped samples, sets the new sample end point. With looped samples, the End is automatically set one sample after the loop end point, since any samples past the loop end are not needed.

• **-CUT-** Pressing this deletes all samples before the start point and after the end point. The display will show Reallocating Memory during the cutting process, after which the DPM 3 SE will return to the Trim screen in case you want to do more trimming.

• **-Aud-** This returns to the Audition screen, whereupon you can press **-CONT-** if you're in the process of multisampling, **-STOP-** if you've finished all operations on this particular sample, or **-loop-** if you want to cycle through the edit screens again.

Note: The only way to escape from the Trim screen is by pressing either the **TRIM** or **-Aud-** buttons. Also, this is the one screen where incoming sample dumps will not be accepted.

6.13 DELETE (DELETE SAMPLES AND WAVES FROM MEMORY)

Because samples are loaded into battery-backed RAM, if you run out of space to store samples it is necessary to delete a sample to create room for new samples.

It is possible to delete either individual samples, including those that make up a multisampled wave, or entire waves if you want to delete all multisamples in the wave with one operation.

In the main Samples menu, press the **Delete** soft key. The display shows something like:

```
DELETE Samp= #00          25  Kwrds -EXEC-
       Wave=(12STRG)  [A0  >B4  ] -EXIT-
```

This screen lets you select samples or waves for deletion, as well as provides information about the sample or wave to be deleted.

6.13A Deleting Samples

1. Press the **Samp** soft button.
2. Select the sample number within the DPM 3 SE to be deleted; data in the other fields will change to reflect the selected sample's characteristics. Scrolling past the

highest-numbered sample selects **All**, where all samples in RAM will be deleted.

The number to the right of the sample number indicates the size of the sample in Kilowords. This lets you know how much memory will be reclaimed by deleting the sample. **Wave:** shows the name of the "parent" wave containing the selected sample. In this example, the name is **12STRG**. The letters and numbers to the right of Wave indicate the keyrange covered by the sample. In this example, Sample #00 covers the range of A0 through B4.

If the upper note for the range is lower than G9, then the sample is part of a multi-sample. Scrolling to the next higher-numbered sample will show the next higher-pitched sample of the multisample.

3. After selecting the sample to be deleted, press the **-EXEC-** soft button to delete.
4. After deleting the desired samples, exit the delete function by pressing the **-EXIT-** soft button.

6.13B Deleting Waves

1. Press the **Wave** soft button on the Delete screen. The display shows something like:

```
DELETE Samp=(#00-01)                    -EXEC-
       Wave= 12STRG      25  Kwrds -EXIT-
```

This screen lets you select waves for deletion, as well as provides information about the wave to be deleted.

2. After pressing the **Wave** soft button, select the wave to be deleted; data in the other fields will change to reflect the selected wave's characteristics. Scrolling past the highest-numbered sample selects **All**, where all samples in RAM will be deleted.

Samp now indicates the sample numbers contained in the selected Wave. In the example above, 12STRG includes samples 00-01, so this is a multisample with two samples. If both numbers are the same, the wave consists of a single sample.

The number to the right of the wave name indicates the total size of all samples in the wave in Kilowords. This lets you know how much memory will be reclaimed by deleting the wave. A keyrange is not shown.

3. After selecting the wave to be deleted, press the **-EXEC-** soft button to delete.
4. After deleting the desired waves, exit the delete function by pressing the **-EXIT-** soft button.

6.14 SAMPLE MEMORY MANAGEMENT TIPS

Although loading in new samples provides a great deal of sonic freedom, with added features comes the potential for added confusion. This section will hopefully dispel some of that confusion, as well as offer tips on how to use the DPM efficiently.

6.14A Sample Time Tradeoffs

One of the tradeoffs with any sampling system is sample time vs. fidelity. Because of this tradeoff, it makes sense to implement two different strategies for using samples. For songwriting purposes, where the DPM 3 SE often serves as a multitimbral module driven by either its onboard sequencer or an external sequencer, fidelity is not as important as having a wide variety of samples available. This calls for a large collection of short samples so that as many as possible can reside in memory at the same time. Saving this set to disk (using the Save All function in the sample RAM menu) not only provides backup, but lets you reload the set when needed.

6.14B The Sample/Patch Program Relationship

You'll probably develop some special patch programs around the samples you load, but *it's vital to understand how DPM 3 SE patch programs use samples.* When you select a sample for a DPM oscillator, it finds that sample not by name, but by the position in memory. For example, suppose you clear sample memory, then load in a guitar sample followed by a marimba sample. The guitar will be the first sample loaded into memory, and the marimba, the second. Any patch programs using these samples will reference them according to their position in memory. Therefore, if you clear sample RAM but this time load in the marimba first and then the guitar, your guitar patches will now reference the first sample stored in memory (marimba), and the marimba patches will reference the guitar samples.

The easiest way to deal with this situation is to use a consistent set of samples and patch programs using those samples. One option is to keep patches based on internal ROM sounds in a cartridge, and load patches based on samples into internal memory as needed from the disk drive.

6.14C The DPM 3 SE as Sampler

The traditional difference between samplers and synthesizers is that synthesizers offer a greater number of sounds, but these are relatively inflexible. Samplers, on the other hand, tend to store a lesser number of sounds but these can be any sounds you want. The DPM 3 SE works similarly, although of course in this case, both types of operation "live" in one unit.

Although using lots of short samples works best when using the DPM 3 SE as more of a synthesizer, sometimes you'll want to opt for sound quality over quantity *(i.e.,* doing overdubs of specific instrument sounds) and treat the DPM as more of a sampler. In these instances, it makes sense to load in a smaller number of longer samples.

Since this involves working with only one basic sound at a time instead of the many different sounds typical of multitimbral operation, it's best to keep the samples and associated patches on one disk. When it's time to load that disk, clear the sample RAM and load in the samples, then load the programs and (if applicable) effects. In this situation, the DPM becomes dedicated to producing as high a quality sound as possible from a single sample or group of samples.

6.14D Additional Tips

Get into the habit of saving collections of samples and patches on disk. It only takes a few seconds to load sounds; you'll probably end up treating the DPM memory not as something sacred, but simply as a holding tank for whatever gets stuffed in from the disk drive.

RAM expansion is also an issue since just like computers, samplers can never have enough RAM. Extra RAM is not cheap, but it's worth it if you can afford it. The stock 64K of RAM that comes with a DPM is better than nothing, but you'll be limited to a very small collection of samples. Certainly no sampler on the market uses this little memory, and if you want your DPM to act like a sampler, you'll probably want to give it the memory to think like one.

6.15 SAMPLE EDITING TUTORIAL

The disk included with your DPM 3 SE contains a single nylon guitar sample, titled NYLGT5. This is a sample from the Peavey/Prosonus *12 String/Nylon Guitar disk,* which includes a variety of 12 string and nylon guitar samples and multisampled waves. NYLGT5 requires 12,736K of memory and provides a bright sound with lots of presence; its unity pitch is G2 (12,736). Even though this is not a multisample, note how the DPM 3 SE can take a single sample, stretch it across the entire keyboard, and

still have it sound pretty good at the extremes of the sample range.

We'll perform a few experiments with this sample to get a feel for the sample editing options. Do not save any of these to disk; you don't want to overwrite the original sample.

6.15A Loading

1. Press the **Master** System button.
2. Press the **-Sample RAM-** soft button. The Samples screen appears.
3. Press the **Load** soft button.
4. The directory should show that the sample NYLGT5 is available for loading. Press **-EXEC-** to load the sample.
5. The screen will show that there are no more samples in the directory for loading. Press **-EXIT-**.

6.15B Changing the Base Pitch and Keyrange

1. Press the **Edit** soft button. The Edit screen appears, and shows the wave name (NYLGT5), keyrange (A0-G9), and size (07 Kwrds).
2. Press the **-EXEC-** soft button to begin the editing process.
3. Press the **Base** soft button, which currently shows G4. Higher pitches move the sample higher up on the keyboard; lower pitches move the sample lower on the keyboard.
4. Return the Base pitch to G4. Press the **Tone** soft button and set it to On so that you can confirm that the guitar sample is set to the right pitch. When you play on the keyboard, you'll hear the reference tone along with the nylon guitar sample. Now turn the reference tone off.
5. Press the **Range** soft button then enter a new high key. Note that playing keys above this high key will not trigger the sampled sound. Set the range back to G9 before proceeding.
6. Press the **-loop-** soft button to enter the loop adjust screen.

6.15C Altering Loop Points

1. Press the **Loop** soft button and set it to Off. This is the original, unlooped sample sound. As you can hear, it is quite short, and therefore doesn't take up a lot of memory. Now return loop to On.
2. Set **Edit** to manual if it is not already.
3. Press the **Start** soft button then press the **dec** button a few times. You are now moving the loop point earlier in the sample, but the end remains fixed. This sample uses a very short loop that only loops a few cycles of sound. Therefore, as you increase the size of the loop, it becomes flatter in pitch. Lengthening the loop even more

creates a rough, buzzing sound. Shortening the loop sharpens the loop pitch (try it by pressing the **inc** button a few times).
4. Press **-UNDO-** and the original loop points return. You're now back at the audition page; press **-loop-** to return to the loop page.
5. Press the **Edit** soft button and set it to auto.
6. We will now attempt to lengthen the loop but still have it provide a smooth looping sound. Press the **Start** soft button and press the **dec** button once. Note that instead of moving the start point one sample at a time, it moves in jumps. This is because the DPM 3 SE is finding the nearest zero crossing and placing the loop start point on that zero crossing. Play a key to hear the results of this edit. The loop changes pitch, but at least there's no rough, buzzing sound.
7. Press the **dec** button again. The start point should be 5978 samples. Note that the loop is more or less the right pitch, although it is now rougher. Why? Because by looping a longer portion of the wave, the loop has more of an amplitude change—remember, a nylon guitar string produces a decaying sound. Therefore, the loop start point will be of a higher amplitude than the loop end point, creating a discontinuity. This is the cause of the roughness.
8. Let's make the loop shorter to see if we can get a better loop. Leave the start point set to 5978, but this time, press the **End** soft button.
9. Press the **dec** button once, then play a key to hear the results of your edit. Hmmm...needs some work.
10. Press the **dec** button again. The sound is much better now, but note that the loop is a tiny bit sharp compared to the rest of the sample. This can be fixed by going into manual loop adjustment and making a very small loop change.
11. Press the **Edit** soft button and select manual. Press the **End** soft button, then the **dec** button. Note how the loop goes sharper—not what we want.
12. Press the **inc** button and set the end point to 6172. Bingo! It's not quite as good as the original loop, but it's satisfactory for the purposes of this demo. We've also shortened the sample somewhat.
13. Press the **LOOP** soft button to return to the audition page, then turn the reference tone on. Note how the loop is very close to the reference tuning.
14. While on the audition page, press the **-loop-** soft button to return to the loop page.
15. Press the **End** soft button and set the end point to 6171. You can hear this is more out of tune than when the end point is set to 6172.
16. To turn off the reference tone, press the **LOOP** soft button to return to the audition screen, press the **Tone** soft button, and set it to off. Press the **-loop-** soft button to return to the loop page.

6.15D Trimming the Sample

1. While on the Loop page, press the **-trim-** soft button.
2. Press the **Edit** soft button and select manual, if it is not already.
3. Press the **Start** soft button and move the Data Slider. The higher the number, the more of the attack you cut off. Note that many settings produce clicks when you play a key.

4. Press **Edit** and select auto. Move the Data Wheel or press the **inc/dec** buttons; you'll note that fewer settings produce clicks, and those that do are much more subdued.
5. Move the start point as far up as possible while still getting a good guitar sound. To cut the sample, press **-CUT-**. The sample is now a tiny bit shorter than it was originally.

Chapter 7: The Sequencer

7.1 BASIC OPERATION

The DPM 3 SE includes a 9-track sequencer designed for efficient composing. Each track can play back polyphonically through its own internal sound, send polyphonic MIDI data out to other instruments, or both.

Even if you have a computer-based sequencer, the DPM's sequencer provides three major benefits:

- You can capture inspirations as soon as you turn on the DPM 3 SE—you don't even have to wait to boot up a computer.
- The DPM can sync to your main sequencer, thus adding up to nine more MIDI channels to your setup.
- Parts that use lots of aftertouch, pitch bend, modulation, etc. may overload your main sequencer and cause timing problems. These parts can be transferred to the DPM 3 SE sequencer and play back while synched to the main sequencer, thus relieving the main sequencer of the burden of handling this data.

Storage The sequencer memory stores up to 50 sequences, however the total number of events cannot exceed approximately 40,000.

Sequence structures An individual sequence can be treated as a complete composition. This approach is called *linear* recording since events are recorded "in a line" from beginning to end. The DPM 3 SE also allows for *modular* (or *drum-machine style)* sequencing, where individual sequences can be combined into a Song. *Example:* One sequence could be a verse, another a chorus, a third an instrumental break, and so on; a Song would play back each sequence consecutively, in the desired order. Up to 10 Songs can be stored that use any of the sequences in memory.

Resolution The resolution is 96 clocks per quarter note—as good as many computer-based software sequencers, and sufficiently accurate to reproduce your "feel."

Editing options Most operations can affect entire tracks, portions of tracks, specific ranges of notes, etc. Furthermore, a "step edit/entry" mode lets you work on an individual note level if desired—it's like putting your sequence under a microscope.

Tracks Tracks are numbered 0-8. Track 0 is assumed to be the track where a rhythm part will be recorded.

Although instruments are assigned to tracks in a manner similar to Multi mode, these functions are completely different. It is not necessary to create a Multi patch to use the sequencer.

An improvement over the original DPM 3 is that per-track program changes can now be recorded, thus allowing a track's instrument to be changed at any time.

Looping The sequencer also allows for *looping,* where any track can play continuously by jumping back to the beginning after reaching the end. However, since each track can have a separate length, loops can be independent (loop four bars of drums, eight bars of bass, etc.).

"Tape transport" Basic operation is similar to using a tape recorder, with familiar Play, Record, Erase, Fast Forward, and Rewind controls. The main difference is that sequencer editing is far more precise and detailed than using a splicing block and razor blade.

7.2 OVERVIEW OF SEQUENCER BUTTON FUNCTIONS

Pressing a sequencer button calls up a particular set of functions, as described below.

- **Select button** For choosing an individual sequence or song.
- **Edit button** Presents you with the option to edit Songs, Sequences, entire Tracks, or individual Track events (called *step editing).* After selecting the desired option, a second screen appears that displays the various editing operations.
- **Control button** This indicates general system parameters—clock source, tempo, whether loop is on or off, etc.
- **Track button** Here is where you assign instruments, MIDI channels, volume levels, fx sends, and similar track-related parameters to individual tracks.
- **Playback button** This calls up a status screen that, during sequence playback or record, informs you of the current bar and beat number, transport status (stop, play, record, record ready, etc.), the total number of bars in the sequence, and the sequence name.

When playing back a Song, the playback screen shows which sequence is playing, the number of bars in the sequence, the current bar and beat, tempo, and transport status. You cannot enter parameters on this screen; it's like a tape recorder's footage counter, only more comprehensive.

7.3 SEQUENCE/SONG SELECTION

You can select any of the 50 sequences or 10 songs. The 50 sequences are arranged as 5 Banks of 10 sequences and the songs as 1 Bank of 10 songs. First select the desired Bank, then the desired sequence or song.

1. Press the **Select** Sequencer button. The display shows something like:

```
+PAGE
[ ] [ ] [ ] [ ] [ ] [ ]
SEQ1 *empty  empty  empty  empty  empty
       empty  empty  empty  empty  empty
[ ] [ ] [ ] [ ] [ ] [ ]
-PAGE
```

...unless there are sequences in memory, in which case their names will show instead of "empty." In this example, the display's upper left corner indicates that Sequence Bank 1 is selected.

2. Press **+Page** to scroll to the Song Bank, or **-Page** to scroll through the other sequence Banks (2, 3, 4, and 5).

3. After locating the desired Bank, press the soft button associated with the sequence or song you want to play back or record into.

7.4 GETTING READY TO RECORD A SEQUENCE

Aside from a few basic setup considerations, recording a sequence does not involve any fixed procedure. You might record a track then edit it before moving on to recording another track, or record several tracks then edit them. You might prefer linear recording or building songs out of numerous short sequences.

As a result, the following sections hopefully present the available sequencing options in an order that may correspond to the way you make music, but you might find it necessary to adopt your own sequencing protocols. Here's an overview of the material presented in this chapter:

- **General system setup (Section 7.5)** This is where you set the clock source, whether the metronome is on or off, whether loop mode is enabled, [redacted]. You will generally set these parameters before recording, but you [redacted]ge them during the recording process.

- **Sequence edit functions (Section 7.6)** Before recording into a sequence, you must first create it, as described in this section. Other sequence-level operations described here include deleting and copying sequences, clearing all sequences and songs in memory, and choosing a signal processing patch for the sequence.

- **Sequence track assignments (Section 7.7)** This is like an "electronic track sheet"

where you assign sounds to tracks, determine whether a track will transmit/receive over MIDI and/or play internal sounds, set the track MIDI output channel if it transmits over MIDI, adjust the amount of effects send from each track to effects 2 of the chosen signal processing patch, and set track volume (including automated mixdown).

• **Recording a sequence (Section 7.8)** After setting up system parameters, creating a sequence (or copying a sequence from another location), and doing track assignments, it's time to record. This covers basic recording operations such as how to interpret the sequencer status screen and how to use the "transport" controls (play, record, rewind, etc.)

• **Track edit functions (Section 7.9)** You've recorded one or more tracks, so maybe you want to do some editing. This section includes information on erasing, copying, transposing, scaling velocity, quantizing, inserting, deleting, merging, and time-shifting; most of these operations can affect just a portion of a track, such as only a certain range of notes, events that occur over a certain range of measures, only certain controllers, etc.

• **Step recording/editing (section 7.10)** If you need even more detailed than is possible with the standard track edit functions, step editing lets you edit down to individual notes if desired. Step editing can also be integrated with the recording process at any time, so you can alternate between step recording/editing and conventional recording/editing.

• **Constructing a song (Section 7.11)** Now that you've perfected some sequences, here's how to string them together into songs. Options include naming, clearing, building a song, and editing song steps.

7.5 Sequencer System Setup (Control Screen)

The Control screen allows for general system setup, either before recording a sequence or if you want to change a parameter (such as the metronome's rhythm) during the recording process.

Tempo

The range extends from 40 to 250 BPM (beats per minute). This parameter is saved with a sequence or song. If clock is set to EXT, the tempo will be provided by the external MIDI clock source, not the internal tempo value.

Clock

Choose between INT (the DPM responds to its own clock at the specified tempo) or EXT (the DPM follows an external MIDI timing source if such signals are present at the DPM MIDI in).

Metronome

When On, the DPM provides an audible click during sequence recording. The first beat of each bar is accepted.

```
CONTROL  Tempo= 120 Clock= INT Met= ON
64K Free  Loop= ON  XSysR= OFF Res= 1/4
```

Memory Status

Shows the amount of memory available for recording. This cannot be adjusted and is a status display only.

Loop

When On, tracks will jump back to their beginnings after playing through their designated lengths. Each track can loop independently. With loop Off, tracks play through to their ends, then stop.

XSysR

If Clock= Int and XSysR= On, the DPM will respond to MIDI stop, start, and continue commands present at the MIDI in port but follow its internal clock. If Clock= Ext and XSysR= On, the DPM will respond to the above commands *and* external MIDI timing clocks. If XSysR= Off, the DPM will not respond to Stop, Start, or Continue commands, but if Clock= Ext, the DPM will respond to MIDI timing clocks.

Res

Selects either quarter (1/4), eighth (1/8), or sixteenth (1/16) notes as the metronome's rhythmic value.

7.6 SEQUENCE EDIT FUNCTIONS

1. Select the sequence as described in section 7.3; this is the sequence to be edited.

2. Press the **Edit** Sequencer button, then press the **Seqs** soft button. The display shows:

```
EDIT  SEQ: empty      00     bytes
-exit- Create Delete Copy  Effect ClrAll
```

3. This is the main edit menu. The top line shows the sequence name (or empty if the sequence contains no data), and also the amount of memory used by the sequence, in bytes. If the sequence is empty, the number of bytes will be 00.

4. Press the desired editing function soft button: **Create, Delete, Copy, Effect,** or **Clear All.** The following sections describe the screens and options that appear when you select one of the these soft buttons. Whatever operation you select will affect whatever sequence you selected.

7.6A Create a Sequence

Returns to the main edit menu

Press to name the sequence

Use these buttons to choose the character in the name to be changed, then select the desired character.

Select the number of bars for the first track. This can be changed later if desired.

```
CREATE Name= AAAAAA     <-   -> Bars= 01
-EXEC- -exit-             Time Sig= 04 /4
```

After setting up parameters, press to create the sequence

Returns to the main edit menu

Select a time signature between 1/4 and 32/4

After pressing **-EXEC-**, select the bank to contain the sequence with the **-Page** and **+Page** buttons, then press the desired bank sequence soft button.

7.6B Delete a Sequence

Deleting a sequence removes all data from the sequence and renames it as empty.

Returns to the main edit menu

```
DELETE Sequence: Rocket
                    -EXEC-          -Exit-
```

Press to delete the sequence

Returns to the main edit menu

7.6C Copy a Sequence

Copying a sequence duplicates the contents of the currently selected sequence and places this duplicate data in a destination sequence you select. The source sequence is unaltered. This is very handy if you have a basic rhythm track and want to generate variations; copy the basic track to other sequences, then overdub additional parts.

Returns to the main edit menu

Shows the currently selected source sequence that will be copied to the destination sequence.

Select the destination sequence to which the source sequence will be copied.

```
COPY Current Seq: Rocket to Seq= empty
                    -EXEC-          -exit-
```

Press to copy the sequence

Returns to the main edit menu

7.6D Choose a Sequence Effect

You can assign any of the effects used with individual patch programs to the current sequence; all tracks will be processed by this effect, providing that FX select in the master menu is set to either Sequence or Auto. Each sequencer track also has an effects send parameter similar to the one found on the voice edit output page. This option is described in section 7.7D.

Returns to the main edit menu

Press any of the these buttons, then select the desired effect. The display shows the program number and effect named.

```
SEQ     Effect Setup= 48 :PwrCrd
-Exit-                          -SELECT-
```

Returns to the main edit menu

As soon as you change the previously-assigned effects program, **-SELECT-** appears in lower right of the display, with an associated soft button. Press, and the effect is assigned to the sequence.

7.6E Clear All Sequences

This deletes all Sequences and Songs from memory. *Caution!* This operation cannot be undone.

Press to delete all sequences and songs in memory

Press to retain all sequences and songs in memory

```
CLEAR All Sequences/Songs?  -YES-  -NO-
```

7.7 SEQUENCE TRACK ASSIGNMENTS

1. Make sure the current sequence is selected.

2. Press the **Track** button. There are five track assignment screens:

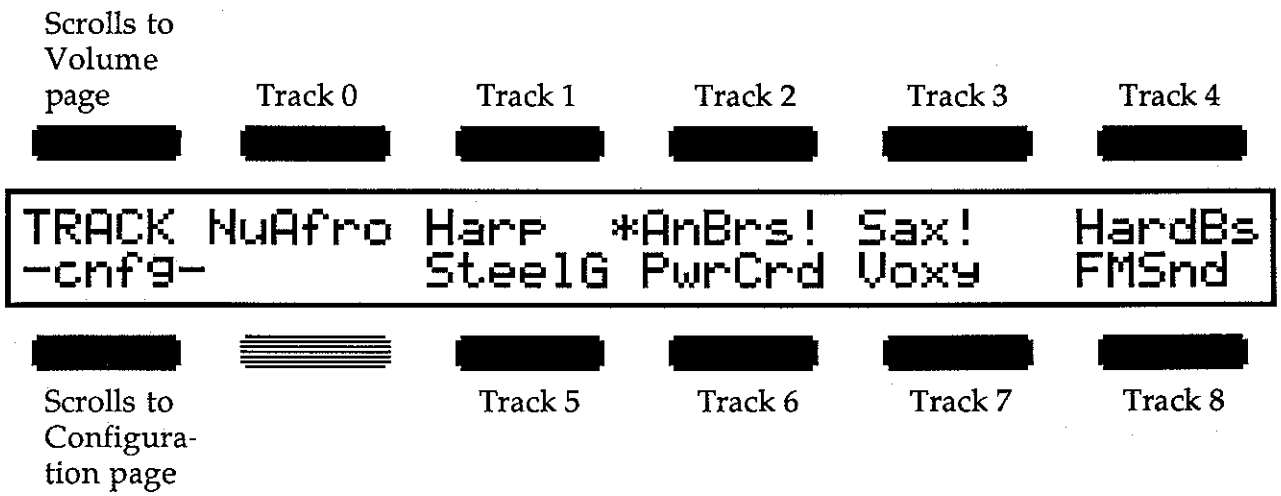
- **Track** Assigns programs to tracks and selects the current track.
- **Configuration** Chooses how data is transmitted and received over MIDI, as well as whether the sequencer plays the internal programs or not.
- **MIDI out** Selects the channel over which a track will transmit data to other MIDI devices.
- **FX2 send** Determines the amount of track signal sent to the effects 2 effects bus (see Chapter 4 on signal processing).
- **Volume** Determines volume of internal programs, and also sends volume (controller 7 data) out over MIDI.

The following describes each screen's operation. All assignments are retained when the sequence is saved.

7.7A Assign Program to Track

The Track program assignment page shows which programs are assigned to which tracks. In the example below, all tracks have instruments assigned to them. An asterisk indicates the currently selected track (AnBrs! in this case). The currently selected track can be played from the DPM keyboard; it is also the track into which recording will occur, or which will be initially selected for editing.

To assign a program, and select the current track, press the associated soft button then select the desired program.

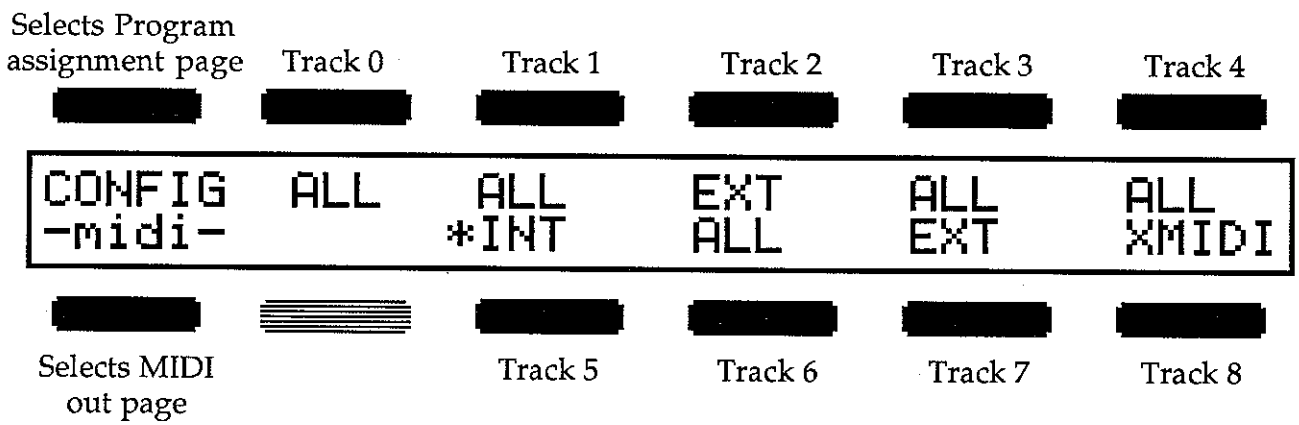


7.7B Track Configuration

Configuration determines whether a track will:
- Play the assigned internal programs only (INT)
- Transmit track data to MIDI out but doesn't play the internal program (EXT)
- Play the assigned internal programs and transmit data to MIDI out (ALL)
- Transmit track data to MIDI out but doesn't play the internal program, and receives MIDI data from the MIDI in port (XMIDI).

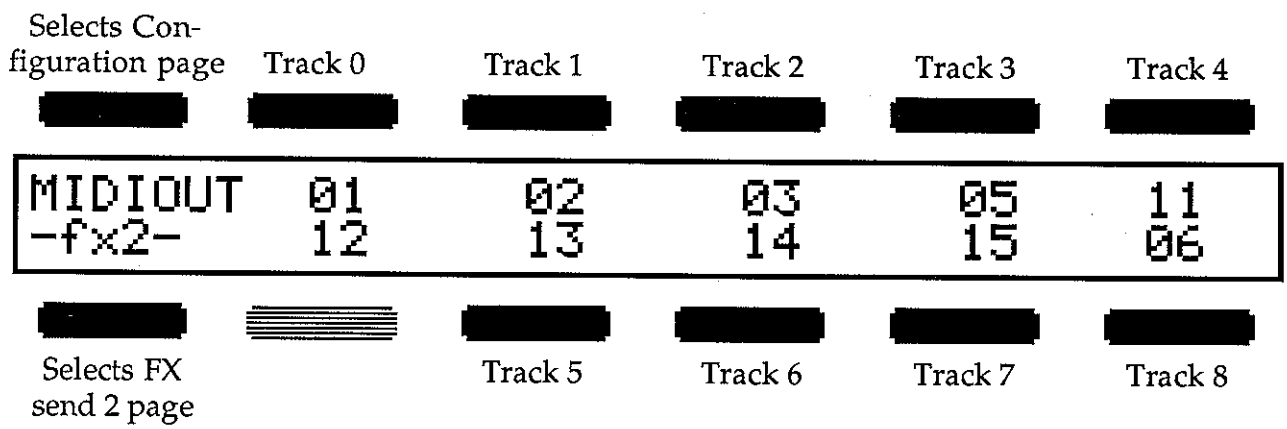
The data an XMIDI track receives depends on the MIDI menu mode assignment. If Omni, the track will receive data on any MIDI channel. If Poly, the track will receive data only on the DPM 3 SE's assigned base channel. If Multi, the Multi assignment overrides the sequencer track program assignments and configuration.

Note: If a selected track doesn't seem to play, make sure that INT or ALL is selected.



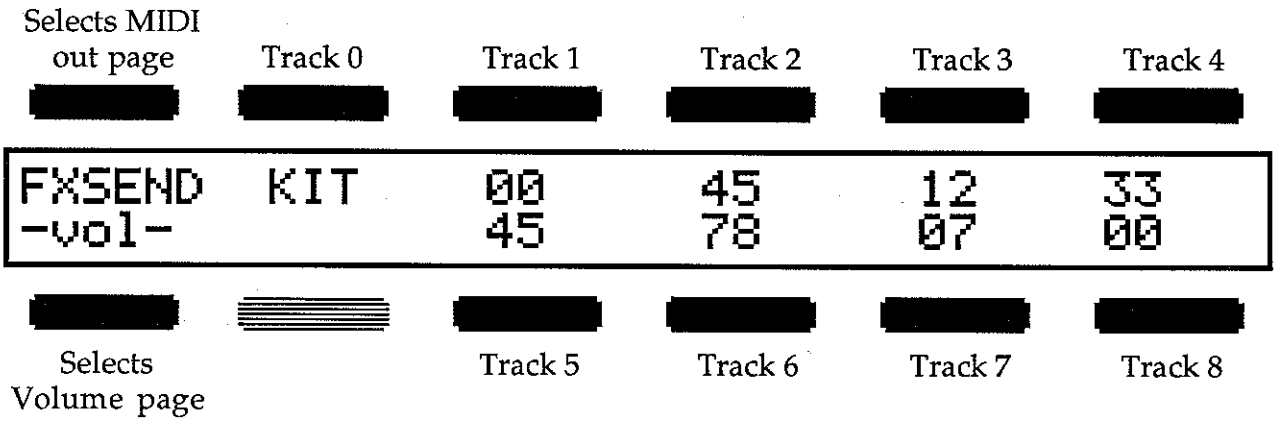
7.7C Track MIDI Output Assignment

This sets the output MIDI channel over which a track will transmit data in the EXT, ALL, and XMIDI configurations. Press the soft button associated with the desired track, then select the desired MIDI output channel.



7.7D FX2 Send Assign

Just as each program can send a portion of its signal to the effects 2 send bus, so can each sequencer track (see Chapter 4 on signal processing for more information). Drum kits will use the kit's FX2 send amount; the display shows KIT for that track. For other tracks, press the associated soft button and select the desired amount of effects send.

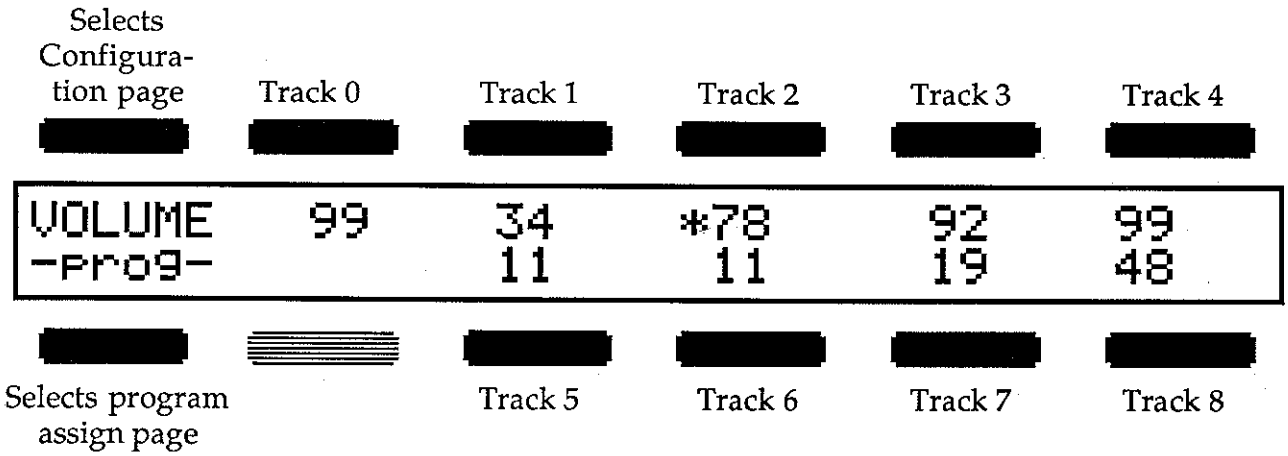


7.7E Set Track Volume /Automated Mixdown

This function sets the value of volume data transmitted over MIDI and the relative mix of the internal programs. The currently selected track is indicated with an asterisk. To change the track volume or transmit volume data over MIDI, press the track's associated soft button and select the volume data.

Clicking a selected track's soft button mutes the output; the track display shows MUTE.

For automated mixdown, adjust volume while the track is recording. Your fader movements will be recorded into the sequence.



7.8 RECORDING A SEQUENCE

Once you've created/selected a sequence and assigned track parameters, it's time to record.

1. Press the **Track** Sequencer button and check the program assignment to make sure you've selected the proper track for recording (as indicated by * to the left of the track program).

2. Press the transport **Record** button. If the track is empty, the display says:

```
TRACK is empty.  Enter Length= 01    bars
                                -continue-
```

3. Press one of the **Length** soft buttons and select a length from 01 to 996 bars, then press **-Continue-**.

4. The sequencer immedidately jumps to the status screen, which you can also access at any time by pressing the **Playback** button. The display shows something like:

Sequence name is shown here

Track length is shown here

Tempo is shown here

```
STATUS Seq: TruLuv   Bars: 04   Tempo: 134
       *RCRDY*STOP*   Bar: 01    Beat: 01
```

Transport status is shown here

Current bar number is shown here

Current beat number is shown here

This is the screen that you will most likely want to watch while recording, playing back, or erasing. The transport status indicates whether the sequence is recording, playing back, ready to record, ready to erase, etc. The bar and beat numbers increment as the sequence plays to show exactly where you are in the song.

The following pages summarize the available transport options, and how to "navigate" through a sequence.

7.8A Transport Controls: Rewind, Play, Fast Forward, Stop, Pause

The lower row of Sequencer buttons simulate a standard tape transport and are active when playing back, recording, or erasing. Their icons represent these functions:

• **Erase** This will be discussed later under sequence recording.

o **Record** This will be discussed later under sequence recording.

<< **Rewind** Press once to back up one measure, or press and hold to back up one measure at a time for as long as the button is held down. The sequencer mutes during Rewind.

> **Play** Plays back recorded data. In Record Ready or Erase Ready mode, pressing play also changes Record Ready to Record and Erase Ready to Erase.

>> **Fast Forward** Press once to go forward one measure, or press and hold to go forward one measure at a time for as long as the button is held down. The sequencer is muted during Fast Forward.

❑ **Stop** Stops the sequencer.

I I **Pause** Pauses the sequencer. You must press Pause again to exit the paused state. Pause is also used in step editing, described in section 7.10.

Note: Rewind, play, fast forward, stop, and pause all function whether a song or sequence is selected. Erase and record pertain only to sequences.

What happens when you release the Fast Forward or Rewind button depends on which mode was selected prior to pushing Fast Forward or Rewind.

Sequencer Mode	*Upon releasing Fast Forward or Rewind:*
Playback	Playback resumes
Recording	Recording resumes
Paused	Sequencer remains paused
Erase	Playback resumes, but Erase went into Erase Ready mode as soon as you pressed Fast Forward or Rewind
Erase/Record	Playback resumes, but Erase went into Erase Ready mode and Record went into Record Ready mode as soon as you pressed Fast Forward or Rewind

7.8B Recording, Erasing, and Overdubbing Functions

o **Record**

This enables and disables the recording process. To record:

1. Make sure you have selected the correct Track to be recorded (section 7.8).
2. If the status screen is not showing, press the **Playback** button to select the status screen.
3. Press the **Record** button. If the track is empty, you will be asked to specify a track length (section 7.8).
4. The transport status shows *RCRDY* (record ready).
5. Press the **Play** button. The sequencer provides a 4-beat countoff and the transport status changes to *RECRD*, indicating the DPM is ready to record.
6. Recording will continue until you press the **Stop** button. If Loop is On (control screen, section 7.5), the sequence will jump back to the beginning after reaching the end. This allows you to record multiple passes. *Example:* Suppose you're recording a drum part. You could record the kick drum on the first pass, snare on the second, and so on.

You can return to record ready mode at any time by pressing the **Record** button. This lets you practice a part without recording it. When you're ready to record again, press **Record**, and the transport status changes from *RCRDY* to *RECRD*.

Note: Recording is always in an overdub, sound-on-sound mode where new data is recorded without erasing old data. The next section describes how to record over unwanted data.

• **Erase**

This is used mainly for "spot erasure" of bad notes. The Edit Track menu offers general erase functions, such as erasing all notes or data within a certain number of bars.

To erase data:

1. Press the **Erase** button. The transport status shows *ERRDY* (erase ready).
2. Press the **Play** button. The sequencer provides a 4-beat countoff.
3. Press **Erase** when you want to begin erasing data. The display changes from *ERRDY* to *ERASE*. If you want to erase starting from the first beat of the sequence, press Erase during the 4-beat countoff.
4. Press **Erase** again when you want to stop erasing data. The display changes from *ERASE* to *ERRDY*. You can toggle back and forth between erase ready and erase as needed.

• o **Erase + Record**

This lets you record new data over old data, and requires using both the Erase and Record buttons.

1. With the desired track selected, press the **Erase** button. The transport status shows *ERRDY* (erase ready).
2. Press the **Record** button to place the transport in the *RCRDY* (record ready) mode. The transport will show *ERRDY*RCRDY*.
3. Press the **Play** button. The sequencer provides a 4-beat countoff.
4. Press **Erase** or **Record** when you want to begin recording over the old data. The display changes from *ERRDY*RCRDY* to *ERASE*RECRD*. To record starting from the first beat of the sequence, press either **Erase** or **Record** during the 4-beat countoff. As with Erase and Record, you can toggle back and forth between Erase/Record Ready and Erase/Record as needed by pressing either the **Erase** or **Record** button.

Note: If loop is on, erase and record will revert to erase ready and record ready after the sequence has played through its entire length in order to prevent accidental erasure of data you want to keep.

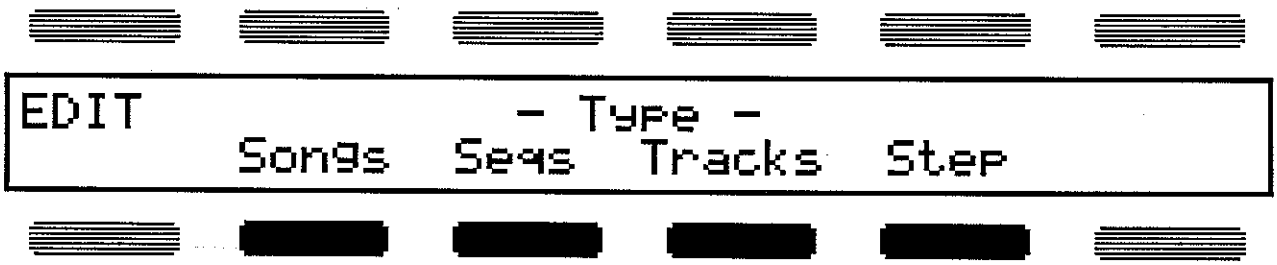
7.9 TRACK EDIT FUNCTIONS

Once a track has been recorded, there are multiple edit functions. These can affect an entire track, only certain portions of a track, only notes that fall within a certain pitch range, etc.

- Erase specified data
- Copy
- Transpose pitch
- Scale note velocities
- Quantize (correct note timing to the nearest specified rhythmic value)
- Insert data into a track
- Delete all data in a particular range of measures
- Merge data from one track to another
- Slide data forward or backward in time

1. Select the Track to be edited. If you forget to do this before entering the track edit menu, you can also select the track from this menu.

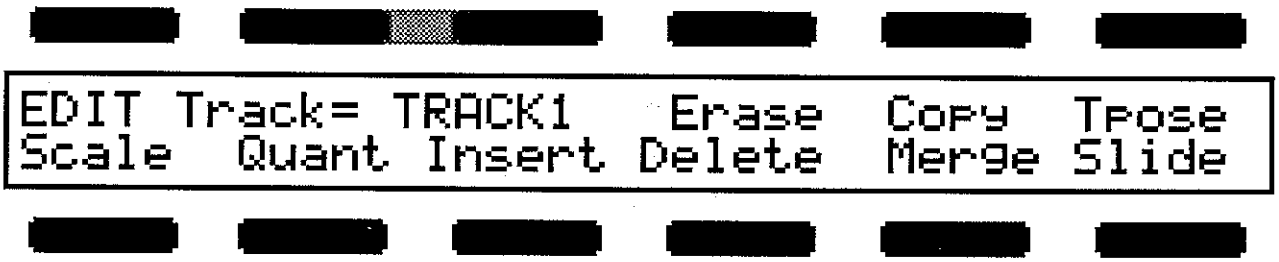
2. Press the **Edit** Sequencer button. The display shows:



3. Press the **Tracks** soft button to access the Track editing functions. The display shows something like:

Returns to main Edit menu

Press to select the track to be edited



4. This is the main Track edit menu. After selecting the track (if necessary), press the desired editing function soft button: **Erase, Copy, Transpose, Scale, Quantize, Insert, Delete, Merge,** or **Slide.** The following sections describe the screens and options that appear when you select one of the these soft buttons. Whatever operation you select will affect whatever sequence you selected.

7.9A Erase Note and/or Controller Data

This function erases all or some note and/or controller data.

1. The first screen specifies which notes or controllers are to be erased, and over what range of notes (optional).

Returns to main edit page

Select ALL to erase all notes, NONE to erase no notes, and RANGE to specify a range of notes to be erased with the Lo and Hi soft buttons

Sets the lowest pitch of the note range to be erased

Sets the highest pitch of the note range to be erased

```
ERASE     Notes= ALL    Lo= C-1    Hi= G9
-limits-  Cntrls= ALL
```

Selects limits page

Select ALL to erase all controllers, NONE to erase no controllers, or a specific controller to be erased: PITCH BEND, AFTERTOUCH, PROGRAM CHANGE, MOD WHEEL, or VOLUME.

2. Select the range of bars, beats, and clocks over which data will be erased.

Returns to first erase screen

Selects bar where erasure begins

Selects beat where erasure begins

Selects clock where erasure begins (96 clocks = 1 beat)

```
ERASE   from   Bar= 01   Beat= 01   Clk= 01
-cont-  thru   Bar= 04   Beat= 04   Clk= 96
```

Press for execute screen

Selects bar where erasure ends

Selects beat where erasure ends

Selects clock where erasure ends (96 clocks = 1 beat)

3. Press **-cont-** and the Execute screen appears. Press **-EXEC-** to confirm the erasure, or the **+Page** button (or any other non-soft button) to bail out if you change your mind.

7.9B Copy Note Data

This function copies track note data from one sequence to the same, or a different, sequence.

1. Select the *destination* sequence and track into which data will be copied.
2. Press the **Edit** button and the **Tracks** soft button.
3. Press the **Track** soft button, then select the *destination* track if not previously selected.

```
EDIT Track= TRACK2   Erase  Copy  Tpose
Scale  Quant Insert Delete  Merge Slide
```

4. Press the **Copy** soft button. The display shows something like:

Returns to main edit page

Select source sequence containing track data to be copied

```
COPY  from Sequence= BHayes
-filt-          Track= TRACK4
```

Selects filter page

Select track in the source sequence containing data to be copied

5. Press the **-filt-** soft button. The display lets you select the note range to be copied:

Returns to source sequence select page

Select ALL to copy all notes or RANGE to specify a range of notes to be copied with the Lo and Hi soft buttons

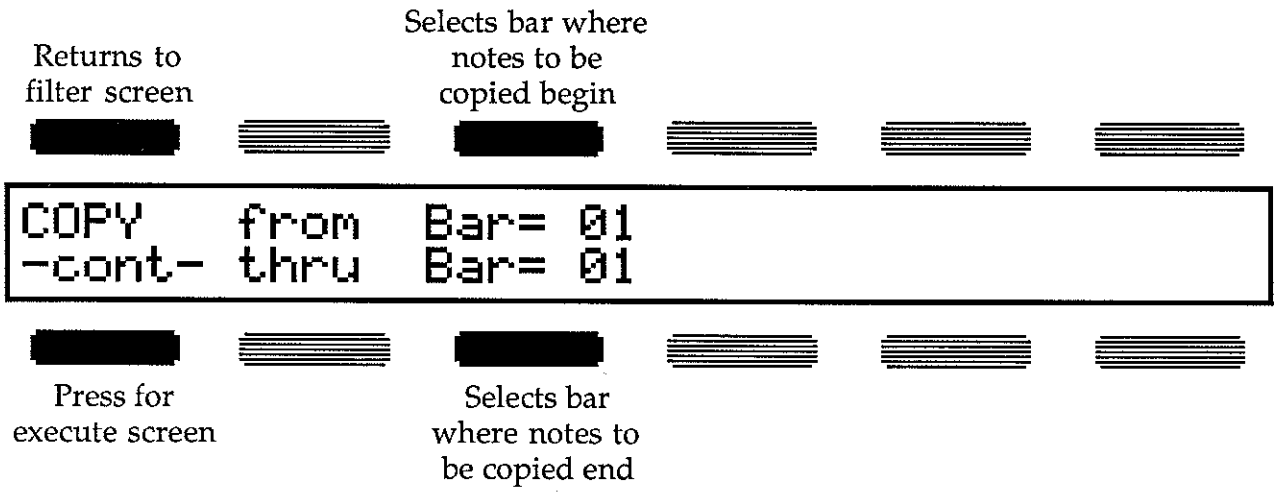
Sets the lowest pitch of the note range to be copied

Sets the highest pitch of the note range to be copied

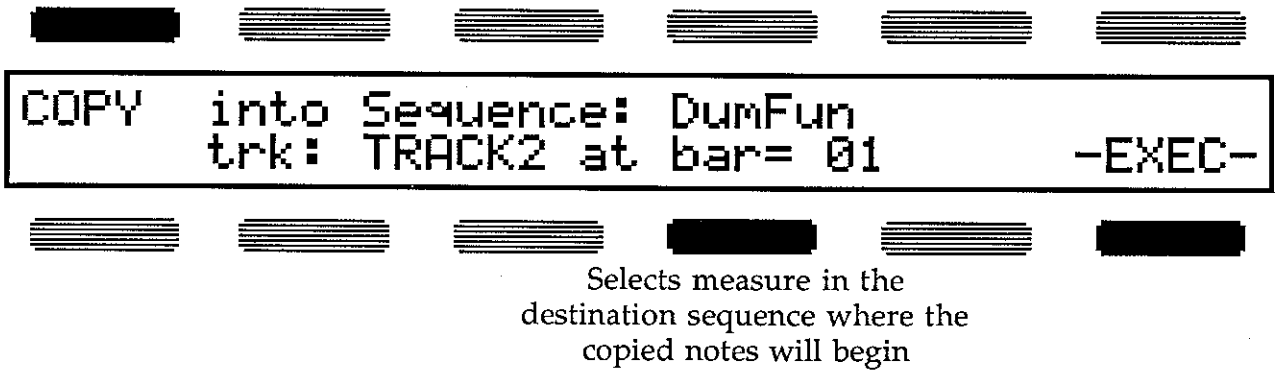
```
COPY      Notes= ALL    Lo= C-1    Hi= G9
-limits-
```

Selects limits page

6. Press the **-limits-** soft button. A display appears where you can select the range of bars to be copied from the source sequence to the destination sequence.



7. Press the **-cont-** soft button and the Execute screen appears. The display confirms the destination sequence and track, and also lets you choose the measure where the copied notes are to begin.



8. Press **-EXEC-** to confirm the erasure, or the **+Page** button (or any other non-soft button) to bail out if you change your mind. *Note:* If the destination track already contains note data, the copied data will overwrite existing destination track data.

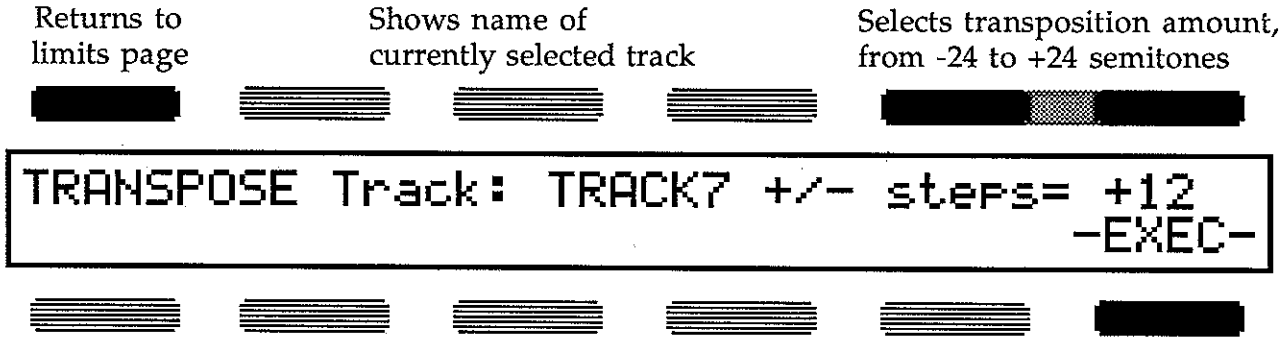
7.9C Transpose Note Data

This function transposes note data in semitone steps over a range of ±2 octaves.

1. The first Transpose screen works similarly to the filter screen described in 7.9B, step 5.

2. After filtering, press the **-limits-** soft button to select the Limits page, which works similarly to the limits screen described in section 7.9A, step 2.

3. Press **-cont-**. The display shows the transposition select screen:



3. Press **-EXEC-** to confirm the transposition, or the **+Page** button (or any other non-soft button) to bail out if you change your mind.

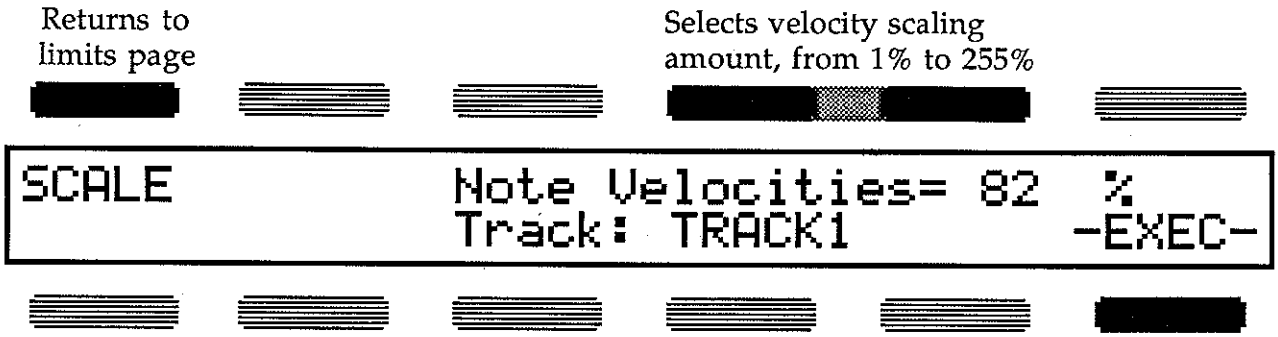
7.9D Scale Note Velocities

This function multiplies velocity values by 1% to 255%.

1. The first Scale screen works similarly to the filter screen described in 7.9B, step 5.

2. After filtering, press the **-limits-** soft button to select the Limits page, which works similarly to the limits screen described in 7.9A, step 2.

3. Press **-cont-**. The display shows the scale selection screen:



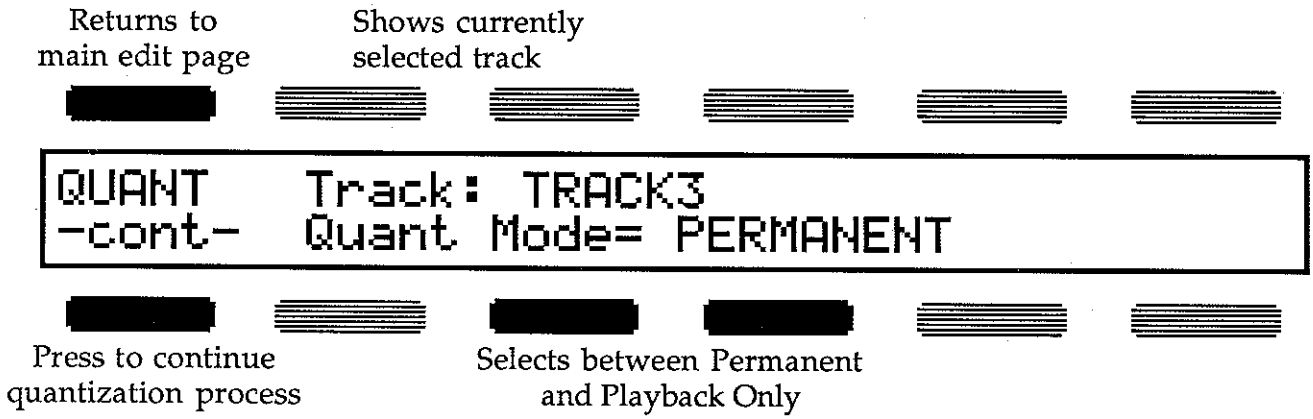
3. Press **-EXEC-** to confirm the transposition, or the **+Page** button (or any other non-soft button) to bail out if you change your mind.

7.9E Quantize Note Data

This function shifts notes to the nearest specified rhythmic value. *Example:* If you quantize to 16th notes, the start of each quantized note will be shifted to the nearest 16th note.

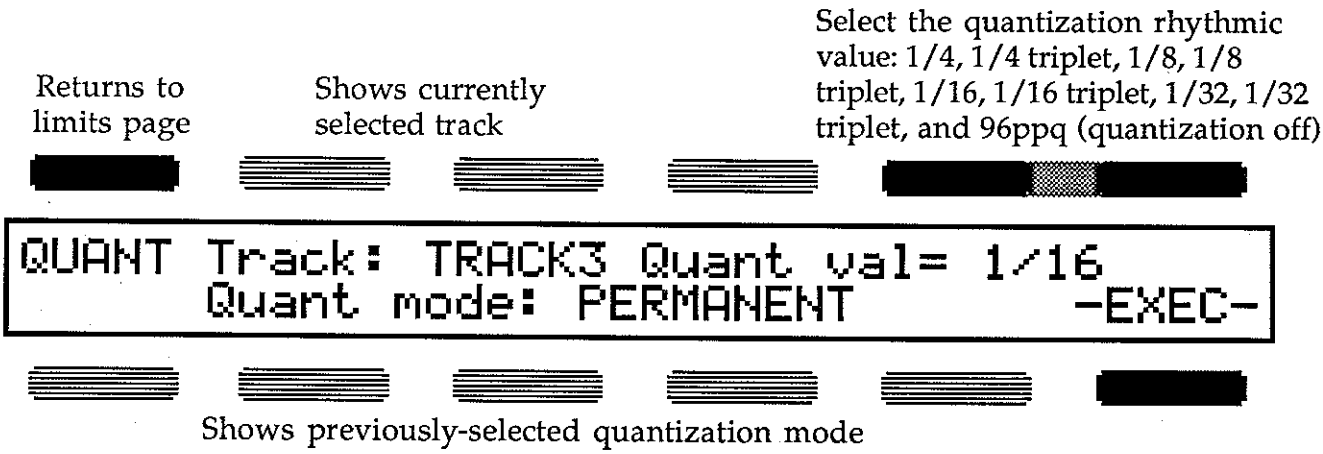
1. The DPM 3 SE offers two quantization modes, permanent (where the quantize operation cannot be undone) and playback only, where:
- The track is quantized only during playback but otherwise remains unedited, so you can audition the quantized part before committing to permanent quantization
- The quantization value remains in effect for subsequent tracks you record.

After selecting the track and pressing the **Quant** soft button, the display shows:



2. Select the desired mode then press **-cont-** to select the Limits page, which works similarly to the limits screen described in section 7.9B, step 6.

3. After specifying the measure range to be quantized, press the **-cont-** button to continue the quantization process. The display shows something like:

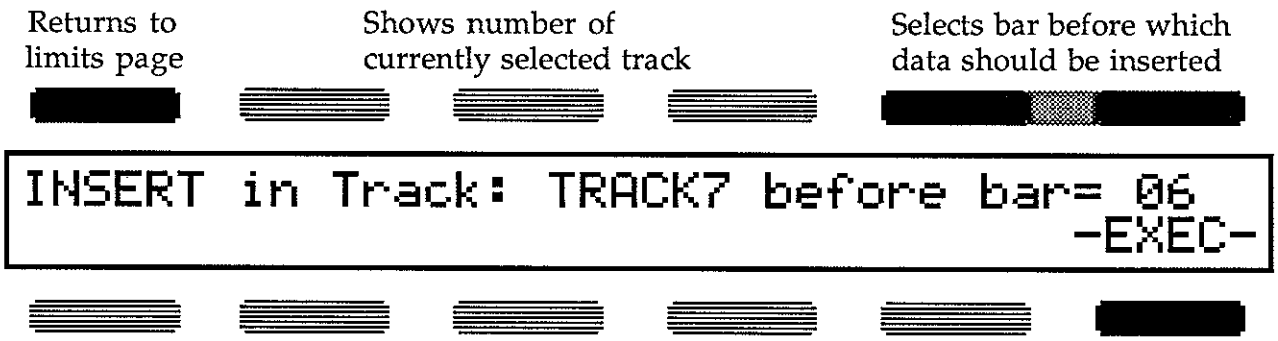


4. Press **-EXEC-** to confirm permanent quantization, **-EXIT-** to confirm playback only quantization, or the **+Page** button (or any other non-soft button) to bail out of the process.

7.9F Insert Measure Data

This function inserts note data from part of a track into the same track, starting at a designated measure. The track is extended by the length of the inserted section. *Example:* Assume four measures, A, B, C, and D. Inserting D before C creates a track that goes A, B, D, C, D.

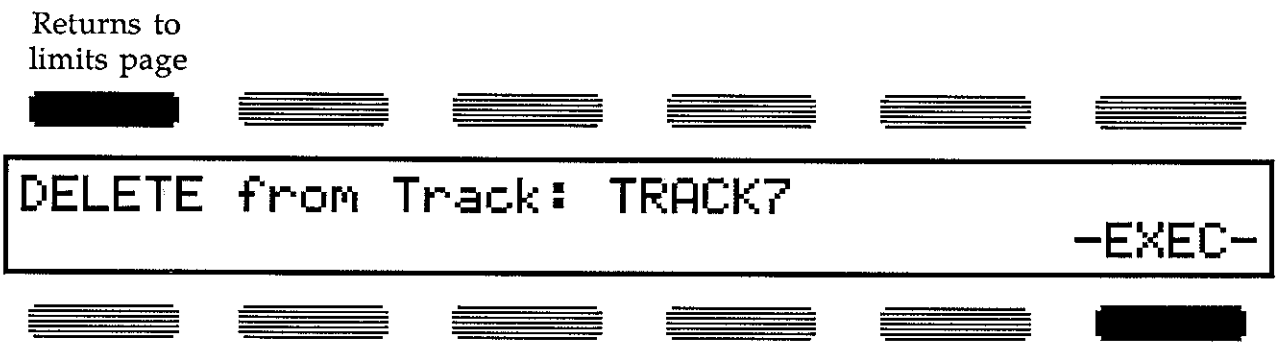
1. The first Insert screen specifies the range to be inserted, and works similarly to the limits screen described in section 7.9B, step 6. After specifying the measures to be inserted, press the **-cont-** soft button. The display shows:



2. Press **-EXEC-** to confirm the insertion, or the **+Page** button (or any other non-soft button) to bail out if you change your mind.

7.9G Delete Measure Data

1. The first Delete screen specifies the measure range to be deleted, and works similarly to the limits screen described in 7.9B, step 6. After specifying the measures to be deleted, press the **-cont-** soft button. The display shows:



2. Press **-EXEC-** to confirm the deletion, or the **+Page** button (or any other non-soft button) to bail out if you change your mind. If you delete the range of an entire track, it is returned to its unused and undefined state, with no track definition.

7.9H Merge Tracks

This function merges (mixes) all data from a specified track to the currently selected track. *Example:* Record several different solos on one track. Delete all but the best sections of each track, then merge all the tracks together into one final, combined solo track.

1. Make sure the track into which you want to merge data is selected, then press the **Merge** soft button on the main edit screen. The display shows something like:

Returns to main edit page

Selects track to be merged with currently selected track

```
MERGE   from Track= TRACK3
        onto Track: TRACK7          -EXEC-
```

Shows the currently selected track into which data will be merged

2. Press **-EXEC-** to confirm the insertion, or the **+Page** button (or any other non-soft button) to bail out if you change your mind. The merged track retains the configuration and similar data of the currently selected track.

7.9I Slide Data

This function slides all data (notes and controllers) forward or backward in time, by a specified number of clock pulses (up to ±384 clock pulses).

1. Make sure the track whose data you want to shift is selected, then press the **Shift** soft button on the main edit screen. The display shows something like:

Returns to main edit page

Select the shift in clock pulses. Negative values move events earlier in time; positive values move events later in time.

```
SLIDE Track: TRACK5 +/- clocks= -48
                          -EXEC-
```

2. Press **-EXEC-** to confirm the shift, or the **+Page** button (or any other non-soft button) to bail out if you change your mind.

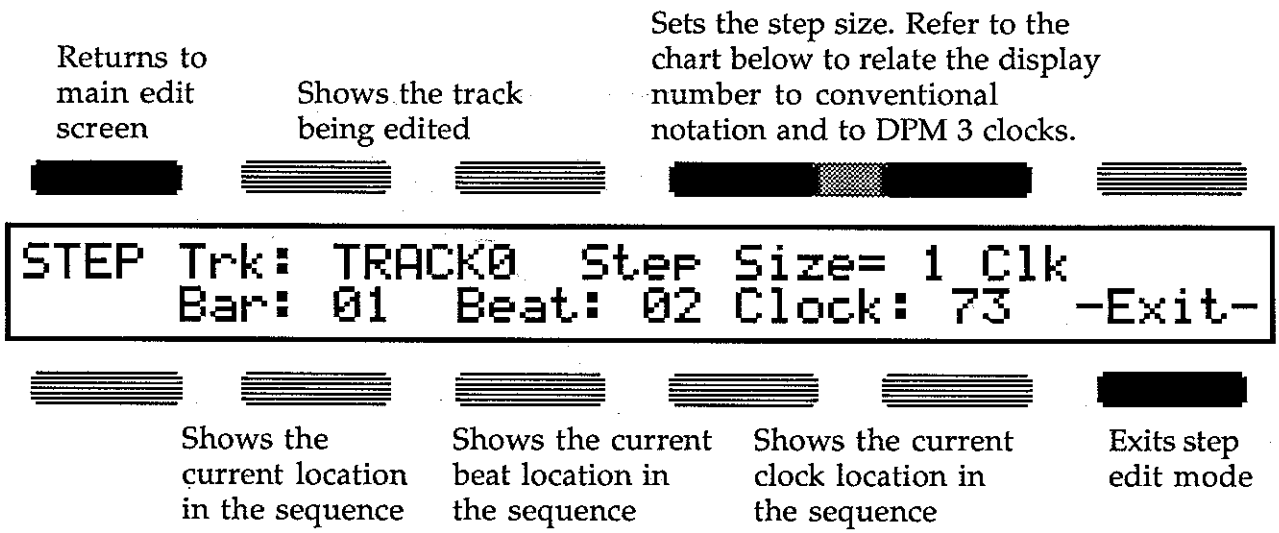
7.10 STEP EDITING

The step edit function allows you to "step" through a sequence, a single clock at a time or a specific rhythmic value at a time, by pressing the > (Play) button. Each button press advances the sequence by the specified step value. During this process you can punch in or punch out to add or delete notes.

As you step through the sequence, the step edit screen shows the current location in bars, beats, and clocks (1 clock= 1/96th of a beat).

To enter step mode:

1. Select the Track to be edited (section 7.7A).
2. Press the **Edit** Sequencer button.
3. Press the **Step** soft button. A display similar to the following appears:



Step Size Table

Display	*Note Value*	*# of Clocks*
1/4	quarter note	96
1/4T	quarter note triplet	64
1/8	eighth note	48
1/8T	eighth note triplet	32
1/16	sixteenth note	24
1/16T	sixteenth note triplet	16
1/32	thirty-second note	12
1/32T	thirty-second note triplet	8
1 Clk	1/384th note	1

4. Select the desired step value. *Example:* Setting step size to 1/8 moves through the sequence one eighth note, or 48 clocks, with each press of the > (Play) button.

7.10A Step Edit Operations

To play back a sequence in step edit mode:

1. Press the **Edit** Sequencer button.
2. Press the **Step** soft button.
3. Select the step size (section 7.10).
4. Press the I I (Pause) Sequencer button.
5. Press > (Play) to tell the sequencer you want to begin playback.
6. Press > (Play) again to position the sequencer at the first clock of the current bar.
7. Press > (Play) to step through the sequence at the selected step size. The bar/beat/clock counter will increment to show where you are in the sequence.

To enter step mode from normal playback:

1. Select the desired step size before starting normal playback.
2. Press the I I (Pause) Sequencer button.
3. Press > (Play) to step through the sequence at the selected step size. The bar/beat/clock counter will not be visible if you enter step mode from normal playback, although the Transport bar/beat counter will increment as in normal playback. To see the bar/beat/clock step edit counter, press the **Edit** Sequencer button then the **Step** soft button.

Rewinding and fast forwarding while in step mode:

1. To rewind or fast forward, press the << or >> button respectively.
2. The display reverts to the Transport, which will be in paused mode.
3. The sequencer status is now equivalent to entering step mode from normal playback. Either release pause to start normal playback or enter step mode (press **Edit** Sequencer button then press **Step** soft button).

To record in step edit mode:

1. Press the **Edit** Sequencer button.
2. Press the **Step** soft button.
3. Select the step size (section 7.10).
4. Press the I I (Pause) Sequencer button.
5. Press **o** (Record) to enter the RCRDY mode.
6. Press > (Play) to enter RECRD mode.
7. Press > (Play) again to position the sequencer at the first clock of the current bar.
8. Press > (Play) to step through the sequence at the selected step size. The bar/beat/clock counter will increment to show where you are in the sequence.
9. When you reach a bar/beat/clock where you want to record, play the note(s) to be recorded.

To erase in step edit mode:

1. Press the **Edit** Sequencer button.
2. Press the **Step** soft button.
3. Select the step size (section 7.10).
4. Press the | | (Pause) Sequencer button.
5. Press • (Erase) to enter the ERRDY mode.
6. Press > (Play) to step to the location where erasing should begin.
7. Press • (Erase) again to enter ERASE mode.
8. Press > (Play) to step through the sequence until you reach the last step where erasing is to occur.
9. Press • (Erase) again to exit ERASE mode and return to ERRDY.

To erase+record in step edit mode:

1. Press the **Edit** Sequencer button.
2. Press the **Step** soft button.
3. Select the step size (section 7.10).
4. Press the | | (Pause) Sequencer button.
5. Press • (Erase) to enter ERRDY mode and **o** (Record) to enter RCRDY mode.
6. Press > (Play) to step to the location where erasing+recording should begin.
7. Press • (Erase) again to enter ERASE mode and **o** (Record) again to enter RECRD mode.
8. Press > (Play) to step through the sequence at the selected step size. When you reach a bar/beat/clock where you want to erase+record, play the note(s) to be recorded.
9. Press • (Erase) again to exit ERASE mode and return to ERRDY and/or **o** (Record) to exit RECRD mode and return to RCRDY.

Once you get familiar with step edit options, you'll find it's easy to bounce back and forth between normal recording and step edit modes. Remember, you can enter step edit at any time during normal sequencer operation by pressing the | | (Pause) button then pressing the transport controls as appropriate (see above). To exit step edit mode at any time, simply release | | (Pause).

7.11 CONSTRUCTING A SONG

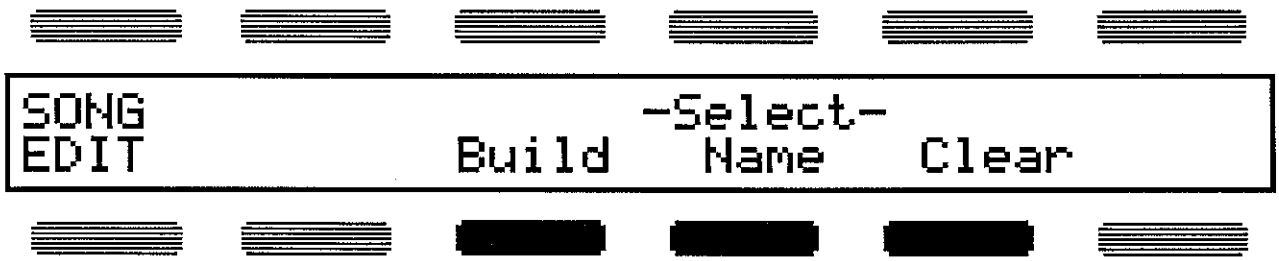
A DPM song is a playlist of sequences resident in the DPM 3 SE. This playlist specifies which sequences will play, their order, and how many times individual sequences repeat before the next sequence in the playlist begins playback.

Note that to play a song, all sequences that make up that song must be in memory. The Save All Sequences storage function saves all sequences and associated songs.

To name, clear, or build a song playlist:

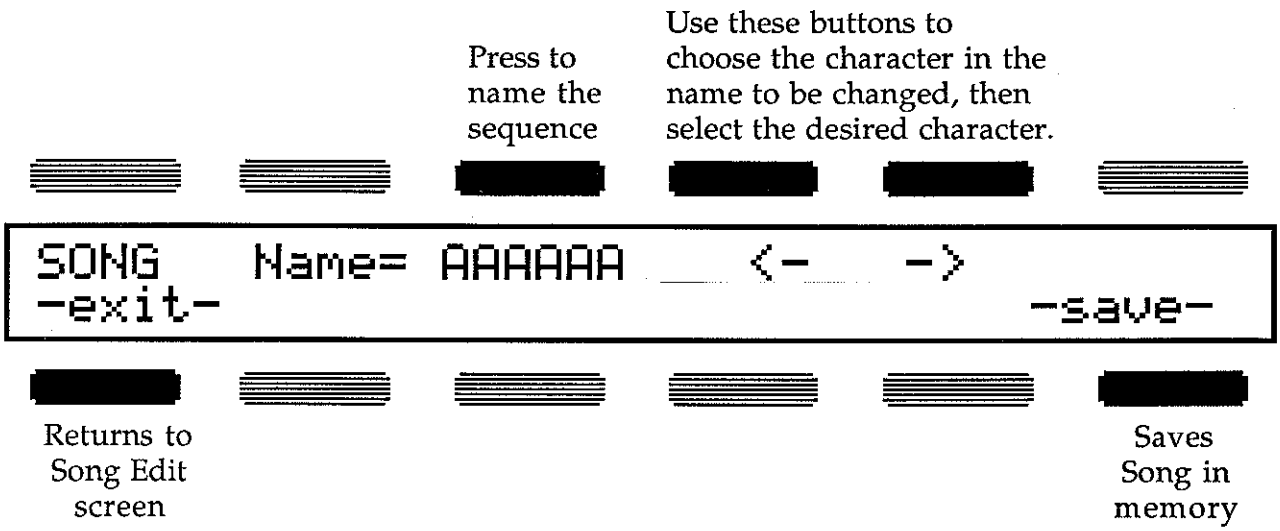
1. Select a song to be named, cleared, or created (see section 7.3).

2. Press the **Edit** Sequencer button, then press the **Songs** soft button in the Edit menu. The display shows the Song Edit screen:



7.11A Name/Save a Song

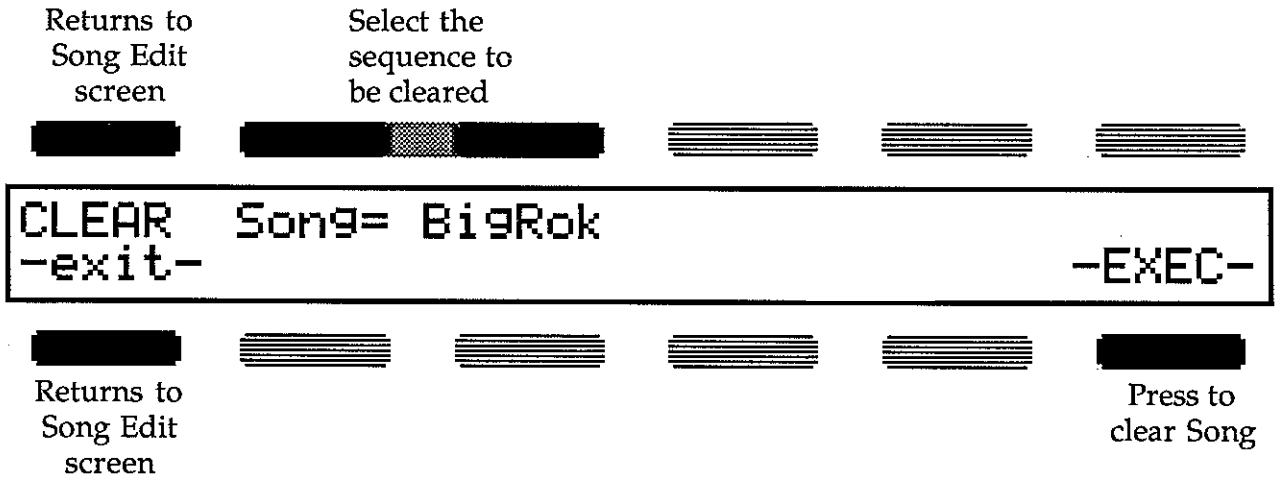
1. Press the **Name** soft button. The following display appears:



2. After pressing **-save-**, select the Song bank, then press the desired Song soft button.

7.11B Clear a Song

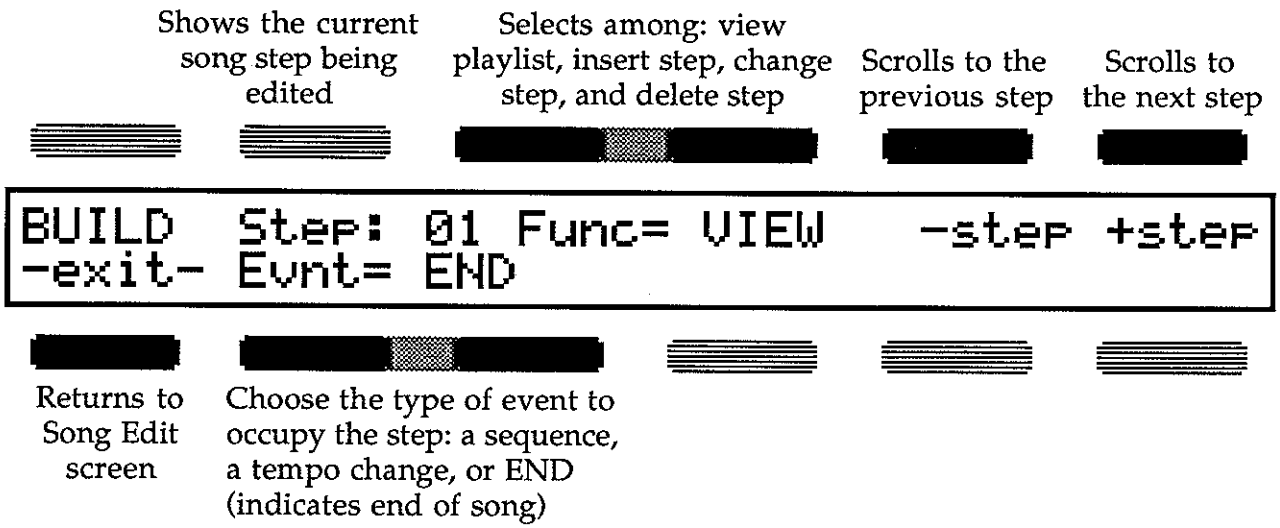
1. Press the **Clear** soft button. The following display appears:



2. Press **-EXEC-** and the Song will be cleared from memory.

7.11C Build a Song

1. Press the Build soft button. The screen shows something like:



2. The following page describes the options for these buttons in more detail.

7.11D Song Building Options

Each step can hold either:

• A Sequence and repeat information for that sequence (*e.g.*, repeat 4 times before going over to the next sequence),
• A tempo value to change tempo, or
• An End marker to indicate the end of the song.

A song can contain up to 76 steps. The display shows which song step is selected; use **-step** or **+step** to select different steps for editing. These scroll through the steps one at a time.

7.11E Building a Song

1. Choose the step to hold the data.
2. Choose the desired event for the displayed step.

• If this event is a sequence, a soft button for **Rpt** will appear under **-step**. Press the **Rpt** soft button and select the number of times the step will repeat.

• If the event is a tempo change (move the data slider all the way to the top to select End, then press the **-/Dec** button once to select Tempo), a soft button for **Tempo** will appear under **-step**. Press the **Tempo** soft button and select the tempo.

3. Press the **Func** soft button and select Insert. This registers the step in the playlist.
4. Press **+step** to move to the next step.
5. Repeat steps 1-3 until the song is complete. Enter **End** for the last step.

7.11F Editing a Song

As soon as you move off a step using the **-step** or **+step** button, the function changes to **view**. This allows you to scroll from step to step without altering the playlist. If you do want to alter the playlist, you can:

• **Change a Step**

1. Select the step with the event to be changed.
2. Select the new event for the step to be changed.
3. Press the **Function** soft button and select **Change**.

The new event will replace whatever previously occupied that step.

• **Delete a step**

1. Select the step with the event to be deleted.
2. Select the new event for the step to be changed.
3. Press the **Function** soft button and select **Delete**.

The next time you view the playlist, the deleted event will no longer be there. The events after the deleted step will close in to fill the gap created by the deleted step; therefore the step number associated with subsequent steps will be one less than it was prior to deletion.

• **Insert a Step**

1. Select the step where you want to insert a new step.
2. Select the new event for the step to be inserted.
3. Press the **Function** soft button and select **Insert**.

The next time you view the playlist, the inserted step will appear in the playlist. The events after the inserted step will be pushed ahead to make room for the inserted step; therefore the step number associated with subsequent steps will be one more than it was prior to insertion.

Chapter 8: Advanced Applications

8.1 MIDI OVERFLOW MODE

Overflow chains two DPM 3 SEs together to double the number of voices from 16 to 32 (or chain three DPM 3 SEs for 48 voices). If the first DPM 3 SE in the chain runs out of voices, it assigns any "overflow" notes to the next DPM 3 SE in the chain rather than steal its own voices. Note that the DPM V3 rack mount is ideal as a second sound generator.

To access overflow mode:

1. Load the same programs into all DPMs being used and run their outputs into a mixer. Make sure all DPMs are in Poly mode and tuned to the same MIDI channel.
2. Connect the first DPM's MIDI out to the second DPM's MIDI in.
3. If using a third DPM, connect the second DPM's MIDI out (not MIDI thru!) to the third DPM's MIDI in.
4. Press the **MIDI** System button on the first DPM. The display shows:

```
MIDI Ch.IN= 01 OUT= 01 MidC= 60 Ovf= OFF
-Filt- -Mult-     Local= ON  Mode= POLY
```

5. Press the **Ovf** soft button and select On.
6. Perform steps 4 and 5 for the second and (if present) third DPMs.

8.2 ALTERNATE TUNING TABLES

The even-tempered scale used in most western music is a comparatively recent invention; prior to that other types of tuning predominated, and non-even-tempered scales are still used in many parts of the world.

The even-tempered scale is optimized for harmonically-complex music that modulates a lot. This is because the even-tempered scale divides an octave so that multiplying any one frequency by the twelfth root of 2 gives the frequency of the next higher-pitched semitone. Since the pitch difference ratio between each semitone is constant, transposition is easy to do.

The only problem is that the twelfth root of 2 is an irrational number. Without going into a lot of complicated math, this means that the even-tempered scale contains small tuning errors compared to theoretically "perfect" scales, such as just intonation. Just intonation bases its tunings on ratios of whole numbers, with an implied preference for small number ratios such as 3:2, 5:6, etc.; this insures that all notes within a given scale are perfectly in tune with each other. However, for reasons beyond the scope of this manual, transposition into keys other than the one for which a just tuning is optimized can create intervals that are audibly out of tune.

Prior to the days of computers, cultures that used just intonation tended to stay within a particular key due to the difficulties of modulation. Considering that it is now possible to shift pitch electronically via transposition, this is no longer as much of an issue. *Example:* Suppose you set up a program in just intonation. You can play in the key of C and have perfect intonation. To modulate, copy the program to another program, and transpose it to the key to which you want to modulate. When you want to modulate, select the copied program, but *continue playing as if you were playing in the key of* C. You could use a sequencer to send out program changes that select different programs, hence different modulations, as you play.

Alternate tuning is considered one of the final frontiers of contemporary music-making. Some people feel that purer forms of tuning, such as just intonation, are more beneficial to the mind and body than even-tempered intervals, which are inherently out-of-tune and therefore grate—albeit subconsciously—on the ear/brain combination. Is this just hype? Or did we really lose an important element of music by adopting the even-tempered scale? Experiment and draw your own conclusions.

The DPM 3 SE includes three common alternate tunings and two user-defined scales.

For more information on alternate tunings, refer to the following books:

Lou Harrison's Music Primer (Harrison, Lou; C.F. Peters Corp., 1971)
On the Sensations of Tone (Helmholtz, Herman; Dover, 1954)
Genesis of a Music (Partch, Harry; Da Capo Press, 1974)

There is also a newsletter, *1/1*, published by the Just Intonation Network. For a free sample issue, write to JIN, 535 Stevenson St., San Francisco, CA 94103.

8.2A Selecting a Preset Tuning Table

1. Press the **Master** System button.
2. Press the **-Tune-** soft button. The display says:

```
TUNING Coarse= +00 Fine= +00 Feel= MEDM
-user-  Scale= EQUAL
```

3. Select the desired scale type:

- EQUAL (even-tempered)
- JUSTMaj (major scale just intonation)
- JUSTMin (minor scale just intonation)
- MEAN C (mean tone tuning, key of C)
- USER1 or USER2 (these are user-programmed scales; see next section).

To hear the difference between just and even-tempered scales, play an interval of a third or sixth with the Equal scale type. Now play the same interval using JustMaj. It will probably sound out of tune at first, but listen for a while then switch back to Equal; this scale will now sound out of tune, because its third and sixth are slightly sharp compared to their theoretically optimum value.

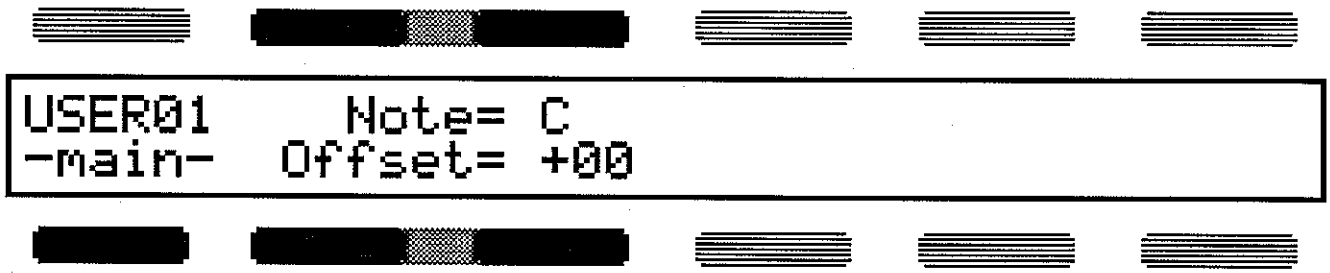
8.2B Creating Your Own Tuning Tables

You can also create two custom tuning tables for particular scales (such as Indian ragas). These scales are retained in memory, even if power is turned off.

1. Press the **Master** System button.
2. Press the **-Tune-** soft button. The display says:

```
TUNING Coarse= +00 Fine= +00 Feel= MEDM
-user-  Scale= USER01
```

3. Select the scale you want to program, USER01 or USER02.
4. Press the **-user-** soft button. The display shows:



5. Press the **Note** soft button, then select the note to be tuned (within a one octave range, C to B). The tuning specified in this octave is repeated in other octaves.
6. Press the **Offset** soft button, then select the amount of detuning (-99 to +99 cents)
7. Repeat steps 5 and 6 until all notes of the octave are tuned as desired.

8.2C Alternate Even-Tempered Tunings

In addition to the options mentioned above, it is possible to program the DPM 3 SE for alternate even-tempered tunings that include different numbers of notes per octave (*e.g.*, quarter-tone scales). These types of scales may not sound "melodic" but they are very helpful when creating sound effects—after all, car crashes and door slams are rarely equal-tempered. On the other hand, a 17-tone scale can be musically useful, assuming you find some comfortable keyboard mapping for it.

The key to this technique is to use KEYBOARD as the oscillator modulation source and scale it appropriately. Make sure that the tuning table is set to EQUAL (section 8.2A). Here are some possibilities:

1/4 Tone Tuning Set Oscillator pitch modulation to KEYBOARD and amount to -50. Set Fine pitch to +50. Setting Coarse pitch to -02, +10, or +22 puts C on the lowest key.

1/8 Tone Tuning Set Oscillator pitch modulation to KEYBOARD and amount to -75. Set Fine pitch to +75. Setting Coarse pitch to -09, +3, or +15 puts C on the lowest key.

17-Tone Tuning Set Oscillator pitch modulation to KEYBOARD and amount to -29. Set Fine pitch to +12. Setting Coarse pitch to +11 puts C on middle C; an octave spans from middle C to F above middle C.

Non-Transpose Mode In non-transpose mode, any keyboard key plays the same note. This is handy for some sound effects applications. To do this, set Oscillator pitch modulation to KEYBOARD and amount to -99. All other modulation should be OFF.

8.3 MIDI SYSTEM EXCLUSIVE STORAGE

Many MIDI devices (synthesizers, signal processors, etc.) can save their parameter settings and patches as MIDI system exclusive data. With devices that do not have on-board disk drives, system exclusive storage is often a more reliable and/or cost-effective way to save data compared to using RAM cartridges or a cassette interface.

The DPM 3 SE can store system exclusive messages (64K or less) from other MIDI devices. These are read into the DPM's memory, at which point they can then be saved to disk as a file. Later on, this file can be loaded into the DPM, then played back into devices that can accept the system exclusive data (usually this is the device that initially generated the sys ex dump).

8.3A Saving Sys Ex Data to the DPM 3 SE

This procedure sets up the DPM 3 SE to accept a system exclusive dump from another piece of gear, and either save the data to disk or send it to another piece of gear.

1. Connect the source device's MIDI out to the DPM 3 SE's MIDI in.
2. Press the **Storage** system button.
3. Press the **-Mass Storage-** soft button.
4. Press the **-Midi-** soft button.
5. Press the **SysXIn** soft button.
6. The display will indicate that the DPM is waiting for a system exclusive dump from the source device. Initiate a system exclusive dump; read the source device's manual to find out how to do this.
7. The display will count the number of bytes received. After the number stops incrementing, press the **-Stop-** soft button.
8. The sys ex message is now in the DPM's memory. You have two choices:

• To immediately resend this to another device, connect the DPM 3 SE's MIDI out to the destination device's MIDI in. Press the **SysXOut** soft button, then the **-Send-** soft button. The bytes will count down to zero; after sending the sys ex data, the DPM will return to the MIDI mass storage main screen.

• To save to disk, press the **Storage** system button, the **-Mass Storage-** soft button, the **-Disk-** soft button, the **-Save-** soft button, then the **-SysEx-** soft button. You will now have a chance to name the file before saving it to disk. After naming, press the **-EXEC-** soft button and the sys ex data will be saved to disk.

If you turn off the DPM before saving the sys ex data to disk, that data will be lost!

8.3B Reloading and Sending Sys Ex Data from the DPM 3 SE

This procedure loads a DPM 3 SE-format sys ex file from the DPM disk drive disk into memory, whereupon it can be transmitted to a device that accepts the particular type of sys ex data.

1. Connect the DPM 3 SE's MIDI out to the destination device's MIDI in.
2. Press the **Storage** system button.
3. Press the **-Mass Storage-** soft button.
4. Press the **-Disk-** soft button.
5. Press the **Load** soft button.
6. Press the **-SysEx-** soft button. The DPM will search the disk for sys ex files.
7. If sys ex files are present on the disk, you can scroll through the catalog of files with the **-Next-** and **-Prev-** soft keys. When the display shows the file you want to load, press **-EXEC-**. If you change your mind, press **-EXIT-**.
8. The sys ex file now resides in DPM memory. To send it to the destination device:
9. Press the **Storage** system button.
10. Press the **-Mass Storage-** soft button.
11. Press the **-Midi-** soft button.
12. Press the **SysXOut** soft button.
13. The display will indicate that the DPM is ready to send a system exclusive dump to the destination device. Press the **-Send-** soft button to transmit the sys ex data.
14. The bytes will count down to zero; after sending the sys ex data, the DPM will return to the MIDI mass storage main screen.

8.4 ATTENTION SOFTWARE HACKERS!

To obtain a listing of the MIDI sys ex codes used in the DPM 3 SE, send a self-addressed, stamped envelope to:

Attn. DPM 3 SE MIDI code
Peavey Electronics
711 A Street
Meridian, MS 39301

Chapter 9: Programming Tips and Background Material

9.1 SEQUENCING BASICS

The DPM 3 SE can be driven by a sequencer, or serve as a master sequencer that triggers its own sounds and/or other MIDI instruments. To understand either application, it's necessary to consider how sequencing works.

Sequencing, the computerized equivalent of tape recording, is a very common and popular MIDI application. There are three main types of sequencers: dedicated hardware units, software-based sequencer programs that run on a computer, and on-board sequencers built into keyboards. (Regarding computers, at present only the Atari ST series and Yamaha C1 computers have built-in MIDI connections, but other computers can hook up to a "black box" called a MIDI interface, which converts MIDI data into a format the computer can understand. This allows the computer to control a group of MIDI instruments.)

Sequencing takes advantage of the fact that MIDI data correlates to a performance on a MIDI instrument. The DPM 3 SE's on-board computer acts like a tape recorder, but instead of recording audio, it stores digital data that represents the notes (and controllers) you played, and the timing with which you played those events.

When driving other instruments from the DPM 3 SE, all data is transmitted over the MIDI output in a *serial* manner (*i.e.*, one right after the other). Fortunately, this happens at a very high rate so that notes played at the same time appear to occur simultaneously.

Once stored in memory, reading the data out of memory re-creates the performance. The principle is the same as a player piano, but instead of triggering keys based on holes in a roll of paper, electronic sounds within the keyboard are triggered by data contained in the computer's memory. This underscores the importance of MIDI's standardization, since any MIDI-compatible device, not just the DPM 3 SE's internal voices, can accept data from the DPM 3 SE. If the sequencer says "play middle C," any sound generator being driven will play middle C (assuming it's not programmed to transpose or otherwise alter the note data), regardless of the manufacturer. However, note that not all instruments implement all aspects of the MIDI specification. *Example:* Not all instruments send or receive keyboard pressure data.

Each of MIDI's 16 available channels can carry a unique set of MIDI data. Since all this data travels over one cable, each piece of data includes its own channel ID so that MIDI receivers can "tune in" to a particular channel and accept only that data. The

DPM 3 SE's Multi mode allows different sounds to be tuned to different channels when receiving MIDI data.

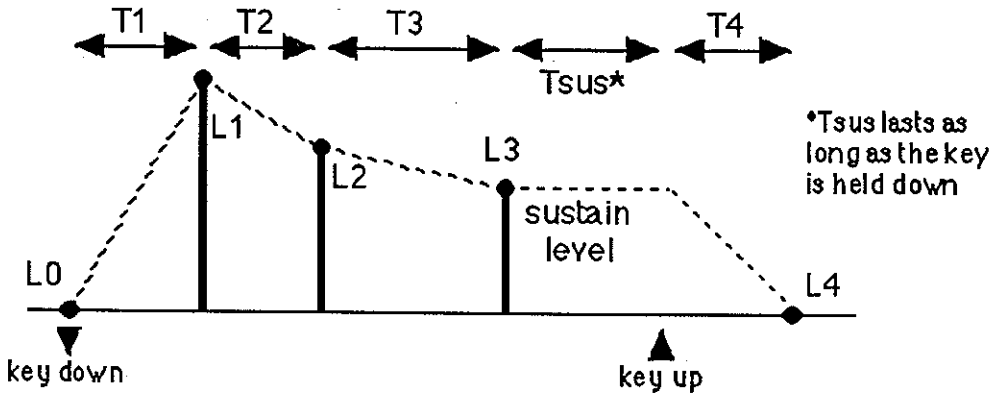
When transmitting MIDI data, each sequencer track can be assigned to transmit on a specific channel. For instance, if a track is set to channel 2, all of its data will be stamped as belonging to channel 2. This is particularly helpful, since each recorded "track" can be assigned to a unique MIDI channel, and the associated pieces of gear can tune in to a particular track. *Example:* If track 1 (set to MIDI channel 1) carries bass and track 2 (set to MIDI channel 2) contains drum data , you would set a bass sound generator to receive channel 1 data and the drum machine to receive channel 2 data.

9.2 ABOUT ENVELOPE GENERATORS

An envelope generator provides a modulation signal that varies over time. Applying it to different modulation destinations produces different results. *Example:* Sending the envelope to a DCA creates changes in level. If the amplitude decays over time, percussive effects (plucked strings, drums, etc.) will result; brass, woodwind, and some bowed instruments have amplitudes that increase over time. A note-on message triggers each envelope.

The DPM 3 SE 's envelope generators (ENV1, ENV2, ENV3, and ENV 4/AMPENV) have four pages of parameters and are virtually identical, so we only need to cover how one envelope generator works. All envelopes have five Level and four Time parameters; however, one of ENV4's levels is not variable (as explained later).

The Time parameter sets the transition time from one Level to another. Levels and Times range from 0 (minimum level or time) to 99 (maximum level or time).



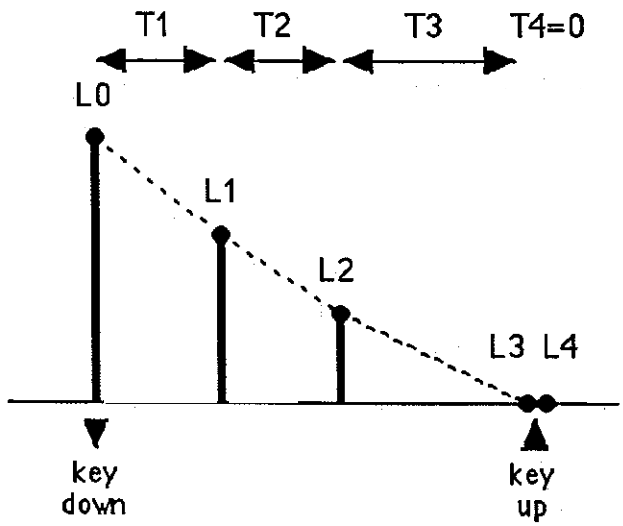
In the example above, L0 is set to 0. T1 determines how long it takes for the level to change from L0's setting to L1's setting. T2 determines how long it takes for the level

to change from L1's setting to L2's setting. T3 determines how long it takes for the level to change from L2's setting to L3's setting.

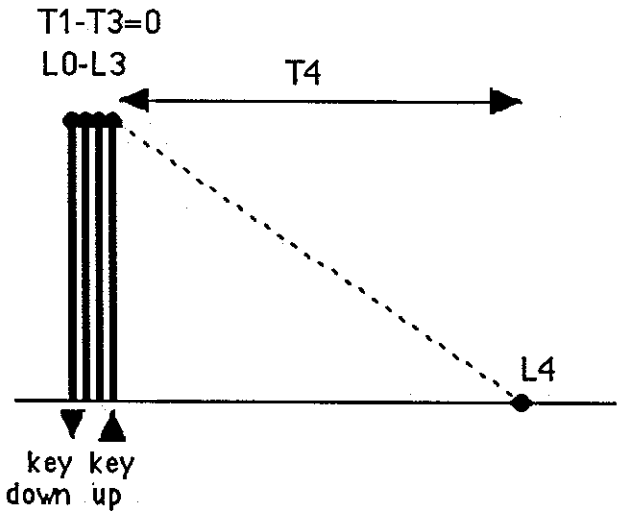
L3 sets the sustain level. This level remains as long as a key is held down.

Releasing the key kicks T4 into action. This sets the time for the sound to change from L3's setting to L4's setting. Since Env 4 determines the overall dynamics by controlling AMPENV, L4 is fixed at 0 so that a note will always eventually decay to 0 (no sound). Otherwise, it would be possible to have notes that never shut off.

Setting different levels and times produces different envelope shapes, described next.

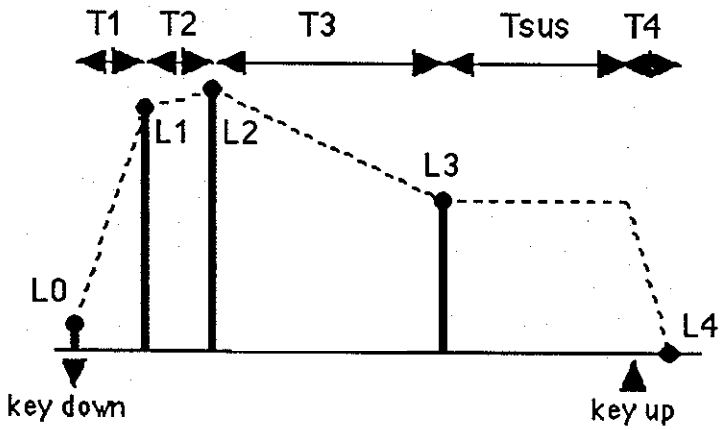


This percussive envelope decays for as long as you hold a key down. The envelope starts at the maximum, decays for time T1 to L1, decays for time T2 to L2, then decays for time T3 to L3. Because L3=0, there is no sustain time. Because T4=0, there is no release time if you lift your finger off the key before the decay has occured. For most percussive sounds, you'll want to add some release time. Typical L values (0-4): 99, 40, 20, 00, 00. Typical T values (1-4): 09, 09, 24, 00.

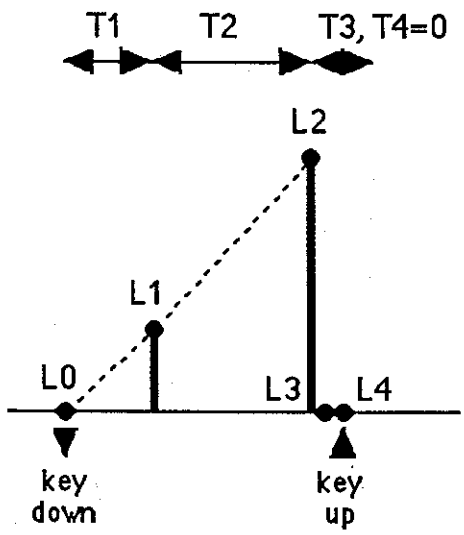


This is a different type of percussive envelope in that all you need to do is tap a key; the note will decay regardless of whether or not you keep your finger on the key. This is useful when synthesizing "struck" sounds, since with something like a marimba you hit the note once, and it decays all by itself.

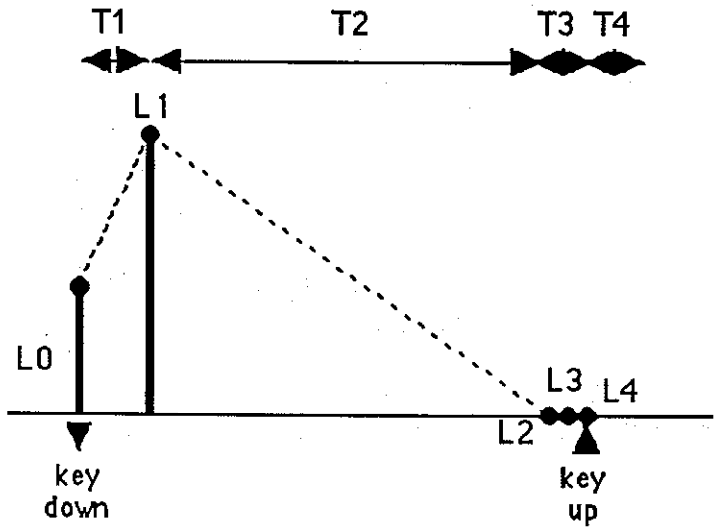
The key to this envelope is setting L0-L3 to 99 and T1-T3 to 0. When you tap a key, the envelope generator instantly jumps to L3 and since the key is also being released instantly, the release phase immediately starts and lasts for time T4.



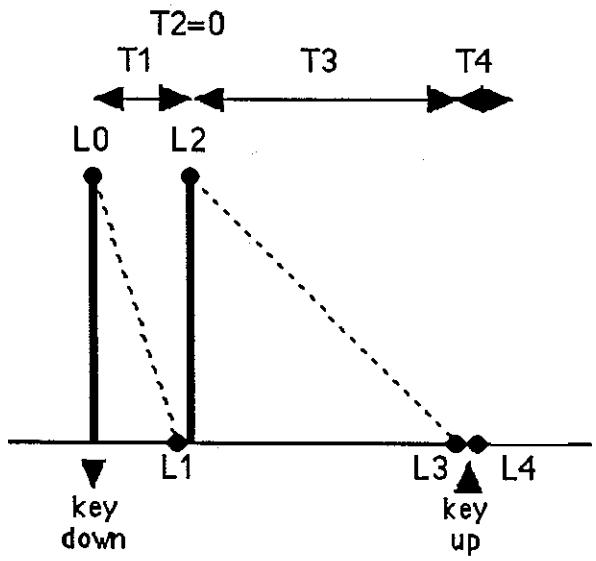
Above is a typical wind instrument envelope. It starts at a low level then rises over times T1 and T2 to a maximum level set by L2. Then there's a slight decay to L3, which sets the sustain level (sustain is needed here because a wind instrument will sustain for as long as you blow into it). Releasing the key brings in a slight release time. Typical L values (0-4): 10, 80, 99, 49, 00. Typical T values (1-4): 03, 03, 35, 03.



Here's a "backwards tape effect" envelope. As long as you hold down a key, the note will increase in level until it reaches L2. Since T3=0 and L3=0, immediately after reaching L2 the envelope will go down to 0 and stay there. Setting T4 and L4=0 insures that there won't be a release time if you release your fingers from the keys before the envelope reaches L2. Typical L values (0-4): 00, 33, 99, 00, 00. Typical T values (1-4): 15, 20, 00, 00.



This envelope is useful for bowed effects (such as cello) where you may want an attack time, yet also want to retain the initial "scrape" of the bow against the strings. Setting L0 at a value other than 0 lets the envelope start at whatever level you want; the rest of the envelope decays slowly back to 0 for as long as you hold the keys down. Typical L values (0-4): 56, 99, 00, 00, 00. Typical T values (1-4): 20, 36, 00, 03.



This final example shows an unusual "echo" envelope. The envelope decays from full down to 0, but then does another decay from full down to 0. Increasing T2 would creating more of a tremolo effect. Typical L values (0-4): 99, 00, 99, 00, 00. Typical T values (1-4): 02, 00, 15, 00.

9.3 CROSSFADE SYNTHESIS TECHNIQUES

9.3A Automatic Crossfading

Crossfade synthesis techniques create complex sounds by using envelopes to crossfade between two waves. For example, you can Oscillator 1 for an attack transient with a fast decay and Oscillator 2 for a sustained sound with a slow attack, so that the transient fades out as the sustained sound fades in. If you fade out and fade in times match, the sound will transition smoothly from one sound to another.

One common application is to use an acoustic instrument transient and synthesized sustain, such as a cello scrape crossfading with a sawtooth wave, or a flute breath transient crossfading with a triangle wave.

9.3B Manual Crossfading

To manually crossfade between two oscillators, use negative modulation with one DCA and positive modulation with the other. *Example:* Set Osc 1's level to 00, DCA1's modulation to WHEEL, and DCA1's modulation amount to +99. Set Osc 2's level to

99, DCA2's modulation to WHEEL and DCA2's modulation amount to -99. As you rotate the mod wheel away from you, Osc 1 will fade in while Osc 2 fades out.

9.3C Pressure Controlled Crossfading

Pressure is excellent for crossfading between two different sounds, such as a straight guitar sound and a "feedback" guitar sound an octave higher. Assign the same sound to both oscillators; on DCA1, use PRESS as a modulator with amount equal to -99 and level equal to 99. On DCA2, again use PRESS as a modulator but set the amount equal to +99 and level equal to 0. Increasing pressure will fade out DCA1 and fade in DCA2.

9.4 PROGRAMMING/EDITING TIPS

Here are some techniques that may help spice up your patches. Programming a synthesizer can be lots of fun; go for it! You'll learn much about sound in the process, and your programs will reflect your own unique "sonic signature."

Pressure-controlled pitch Use pressure to modulate the oscillators in guitar patches when you want to press on the keys and get pitch bending. Also use this with acoustic bass patches to give more of a "fretless" feel.

Envelope-controlled pitch effects Adding a slight amount of upward oscillator pitch bend to wind instrument or vocal patches, either manually with the pitch bend wheel or automatically with a pitch envelope, can increase a sound's realism.

Using velocity with amplitude and filtering It is often not sufficient to use just volume changes to vary a sound's dynamics since the *timbre* of "real-world" instruments usually changes as well with different dynamics. Programming a sound so that higher velocity values raise the filter cutoff slightly can create more realistic dynamics.

The advantages of dual LFOs When creating orchestral string patches, remember that in a real orchestra each player's vibrato will be at a slightly different rate. Therefore, modulate one oscillator with LFO1 set to a particular frequency, and modulate the other oscillator with LFO2 set to a slightly different frequency. This helps create a more randomized effect.

Volume balancing As you develop a set of patches, you'll probably want them to have similar overall volume levels. Usually the easiest way to adjust this is with the signal processor L parameters.

Creative use of the modulation wheel Just because everyone normally assigns the modulation wheel to LFO amount (for vibrato) doesn't mean you have to be normal. Here are some suggestions on creative mod wheel applications.

- Bring in suboctaves. This is the ticket for monster bass sounds. Assign Oscillator 1 to your primary bass sound and Oscillator 2 to the octave-lower bass sound (you'll probably need to transpose Oscillator 2 down an octave). Set DCA2 to 00 level, modulator to WHEEL, and amount to +99. Rotating the mod wheel away from you will bring in the suboctave but not affect the primary bass sound.
- Tone control. Use the mod wheel to modulate filter cutoff.
- "Ganged" parameters. Remember that you can modulate lots of different things at once—alter filter cutoff, vibrato rate, tremolo amount, or whatever turns you on by moving the mod wheel.
- Note that any of the above applications will also work with footpedal modulation.

Oscillator "chorusing" Choose the same wavesample for both oscillators, and detune them slightly to create a thick "wash" or sound.

Combi "chorusing" Slight detuning between identical programs assigned to different layers adds chorusing and flanging effects (onboard signal processing can also create these kinds of effects). For a super-thick chorus sound, detune the oscillators within a program, and assign the program to two or more detuned Combi layers.

Combi delays In addition to creating echo effects, the Combi link delay function can create sounds with multiple attacks.

Unusual oscillator combinations Combining different wavesamples can produce novel effects. *Example:* Suppose you want a really deep piano sound; try adding a bass sample, tuned up an octave and at a much lower volume, behind the piano.

Tremolo effects Modulating the DCAs with a triangle wave LFO signal varies the amplitude cyclically, creating tremolo effects.

Filter keyboard tracking Modulating the filter with the keyboard correlates the cutoff frequency to the note being played on the keyboard. With 0 modulation amount, the filter cutoff tracks the keyboard pitch. Thus, if you have a certain harmonic structure when you play one key, playing a different key will shift the filter frequency to maintain the same harmonic structure.

With negative tracking, the cutoff will change at a less than normal rate as you play higher on the keyboard. This is ideal for bass patches since higher notes will be more muted than lower notes.

With positive tracking, the filter cutoff will increase at a faster rate than pitch as you play higher up on the keyboard. This works well when you want the lower notes to be muted and the higher notes to really "cut."

Super Stereo Effects Combis preserve the stereo panning of the patches within the Combi, which allows for some hot stereo effects. To check this out:

1. Create two different single patches that play the right and left versions of a sound (*e.g.*, Strings L and Strings R, with each panned appropriately).
2. Call up Strings L and make it a Combi patch, with Strings R another patch in the Combi. You now have a patch with separate signals in the left and right channels.
3. Try turning on the delay line for one of the sounds, set for 20 to 40 ms. This should spread the stereo even further.

If you don't want to use two separate programs in the Combi, call up a Single program and set it to Combi. Now enter the same program for the second program of the Combi. If you select the output page panning parameter, this will affect only the foundation program (*i.e.*, the first "link" of the Combi) and not the second program. You can make any other modifications you want to the foundation program (set delays, change LFO, etc.). The only catch is that if you save the program, the second program of the Combi will immediately adopt whatever changes you made to the foundation program.

Many of the signal processors can also create stereo effects. With the stereo delay line, try setting each channel to a time that falls in with the beat of the music (*e.g.*, a quarter-note delay and an eighth-note triplet). The sound will bounce back and forth rhythmically, in stereo.

9.5 BLANK "TEMPLATE" PATCHES

When creating programs from scratch, you can save time by reserving some programs as *template* patches—"generic" wind, plucked, percussion, and string patches which provide a point of departure for related programs. *Example:* A generic wind patch can provide a good foundation for sax, trumpet, and similar sounds.

9.6 ABOUT LEVELS AND DISTORTION

Level can be altered at numerous points within the DPM 3 SE. Each DCA has a level parameter; the envelopes driving the DCA and final amp have variable levels (which also influence the overall volume); and the signal processing section offers several level-setting options to choose the right blend of processed and straight signals.

As with any audio system, carelessly turning up levels may produce overload conditions that result in distortion. If you encounter distortion:

• Lower the overall level with the master volume slider, or lower the output of individual programs. Also make sure you're not overloading your mixer or amp; the DPM 3 SE puts out a pretty hefty signal.
• Lower the signal processing output level parameters (the L parameter, discussed in Chapter 4 on signal processing).
• If distortion still occurs, the final amp may be overloaded. Try lowering the ENV4 (AMPENV) level parameters as these affect the final amp levels.
• High filter resonance settings can cause distortion. To solve this, reduce the levels of the two oscillator DCAs to feed a softer signal into the filter, or reduce the amount of resonance.

Unintentional distortion will probably not occur often but when it does, try some combination of the above remedies. As you become more familiar with the programming process, you will learn how to balance levels to minimize distortion.

9.7 CARE OF FLOPPY DISKS

A floppy disk is a relatively fragile device. Its operation is based on the same principles as standard magnetic audio tape (*i.e.*, signals are recorded as changes in the disk or tape's magnetic field), except that the disk stores digital data instead of audio.

A disk consists of a thin circular sheet of plastic coated with magnetic material, enclosed in a plastic jacket. The 3.5" disk types used in the DPM 3 SE feature a durable plastic case, and a "shutter" that protects the magnetic material when not in use (to see the magnetic material, slide the shutter back—but be careful not to touch or damage what you see when you do this!!).

Inserting disks Insert a disk into the DPM 3 SE drive shutter side first, label side up. Push the disk gently into the drive until it clicks in place, and the small eject button in the disk drive's lower right hand corner pops out.

Ejecting disks To eject the disk, press firmly but gently on the eject button. The disk will come partway out of the drive; pull it out the rest of the way manually.

Write-protecting disks Write-protecting a disk makes it impossible to record new data for as long as the disk is write-protected. Locate the small write-protect "slide switch" in the corner of the disk. Open it to write-protect, close to allow for recording.

Protecting the drive During transport, insert a plastic or cardboard dummy disk (available at computer stores) into the DPM 3 SE disk drive. This prevents unwanted drive movement and protects from excessive vibration. Remember—the disk drive is generally considered the least reliable element in computer-based gear. Treat it gently and avoid sharp blows, drops, or environmental extremes.

Use double-sided disks only Single-sided disks are not tested for double-sided applications (the DPM drive uses both sides of the disk). Do not use high density (HD) floppies, as they are optimized for use in an entirely different type of drive.

Proper care of disks Because diskettes are similar to audio tape, the same "dos and don'ts" concerning care and usage of audio tape also apply to floppy disks.

- Don't subject the disk to stray magnetic fields. Placing a disk on or near a speaker, television, transfomer, magnet, or other source of magnetic fields may scramble the disk's data.
- Don't subject the disk to temperature extremes, especially heat. If a disk gets left out in the sun, the jacket that holds the disk may become warped or deformed. If a disk becomes warped, immediately load it into the DPM 3 SE and try to make a copy. Crossing your fingers may help...
- Don't sit on a disk.
- Label your disks. Keeping track of which programs and samples are on which disks can be a hassle, but the only way to get the maximum use out of a disk library is to be able to find the disk you need, when you need it. Note that two different types of labels, permanent and removable, are available at office supply stores. Use the removable types—you'll find that over time, some disks will get re-used, and you'll want to change the labels.
- Store your disks in a safe place. You can use standard office supply disk holders, or save yourself a bunch of bucks by buying 4" X 6" file card boxes. However, make sure that your disk will fit in the holder before you buy it; some types have a sloping bottom that will not allow disks to fit properly. Another tip is to put a thin sheet of foam on the bottom, as this will hold the disks more securely.

Chapter 10: MIDI Supplement

(This chapter is adapted with permission from *Power Sequencing with Master Tracks Pro/Pro 4* and *The Complete Guide to the Alesis HR-16 and MMT-8,* copyright 1990 and 1989 respectively by AMSCO Publications.)

10.1 MIDI BASICS

Most current electronic instruments, including the DPM 3 SE, contain an internal computer. Computers and music get along very well, which is not surprising considering music's mathematical basis (consider frequencies, harmonics, vibrato rates, tunings, etc.). In the mid-70s, microcomputers became inexpensive enough to be built into consumer-priced musical instruments. They were used for everything from sound generation to storing parameters in memory for later recall.

In 1983, the MIDI (Musical Instrument Digital Interface) specification was introduced to better exploit the computers inside these new musical instruments, primarily to insure compatibility with equipment from other manufacturers. MIDI expresses musical events (notes played, vibrato, dynamics, tempo, etc.) as a common "language" consisting of standardized digital data. This data can be understood by MIDI-compatible computers and computer-based musical instruments.

Before electronics, music was expressed exclusively as written symbols. By translating musical parameters into digital data, MIDI can express not only the types of musical events written into sheet music, but other parameters as well (such as amount of pitch bend or degree of vibrato).

10.2 MIDI HARDWARE

MIDI-compatible devices usually include both MIDI in and MIDI out jacks, which terminate in 5-pin "DIN" connectors. The MIDI out jack transmits MIDI data to another MIDI device. As you play a MIDI controller such as the DPM 3 SE, data corresponding to what you play exits the MIDI out jack. *Example:* If you play middle C, the MIDI out transmits a piece of data that says "middle C is down." If you release that key, the MIDI out transmits another piece of data that says "middle C has been released." If the keyboard responds to the dynamics of your playing, the note data will include dynamics information too. Moving the modulation wheels and pedals attached to many synthesizers will also generate data associated with the wheel or pedal being used.

The MIDI in jack receives data from another MIDI device. In addition to the type of performance data described above, rhythmically-oriented MIDI devices (*e.g.*, drum machines) can often transmit and/or receive additional MIDI timing messages that keep other rhythmically-oriented units in a system synchronized with each other.

An optional MIDI thru jack provides a duplicate of the signal at the MIDI in jack. This is handy if you want to route MIDI data appearing at one device to another device as well.

Example: Suppose the DPM 3 SE's MIDI out feeds the DPM V3 rack mount's MIDI in. Patching the V3's MIDI thru to a second V3 sends the signal present at the V3's input "thru" to the second V3. Thus, playing on the DPM-3 will trigger both V3s.

10.3 MIDI MESSAGE BASICS

The are two main types of MIDI messages. *Channel* messages, which are channel-specific, consist of Voice and Mode messages. *System* messages, which do not have a channel number and are received by all units in a system, include Common, Real Time, and Exclusive messages.

10.4 CHANNEL MESSAGES

10.4A Voice messages

A synthesizer's voice is the most basic unit of sound generation. Usually, each voice plays one note at a time (although a DPM 3 SE voice can consist of two oscillators), so the number of notes you can play at one time will be limited by the available number of voices. MIDI messages that affect voices include:

Note On Corresponds to a key being pressed down; values range from 000 (lowest note) to 127 (highest note). Middle C is 60.

Note Off Corresponds to a key being released; values are the same as note on.

Velocity Corresponds to dynamics; values range from 001 (minimum velocity) to 127 (maximum velocity). A velocity of 000 is equivalent to a note-off message.

Pressure Indicates the pressure applied to a keyboard after pressing a key; typically

used to introduce vibrato, open a filter, etc. There are two kinds of pressure. Mono (or channel) pressure represents the average pressure of all keys held down, whereas polyphonic pressure sends out data for each individual key being pressed down. The DPM 3 SE responds to Mono pressure only. Values range from 000 to 1210.

Program Change Sending a program change command from a sequencer or other MIDI keyboard can change synth patches automatically. There are 128 program change command numbers.

Pitch Bend This "bends" a note from its standard pitch, which is excellent for creating lead guitar effects. The degree of response to pitch bend sensitivity is adjustable for each DPM 3 SE program, but to prevent confusion you might want to set them all to the same value.

Continuous Controller Footpedals, breath controllers, and modulation wheels can vary sounds as you play, thus adding expressiveness. MIDI allows for 64 continuous controllers (these act like potentiometers in that you can choose one of many different values) and 58 continuous/switch controllers (these can act like continuous controllers but some are assumed to choose between two possible states, such as on/off).

Each type of controller is stamped with its own controller identification number. Not all controller numbers have been standardized for specific functions, but the following indicates the current list of assigned controllers. Numbers in parenthesis indicate the controller range.

1 Modulation Wheel (0-127)
2 Breath Controller (0-127)
3 Early DX7 Aftertouch (0-127)
4 Foot Controller (0-127)
5 Portamento Time (0-127)
6 Data Slider (0-127)
7 Main Volume (0-127)
8 Balance (0-127)
10 Pan (0-127)
11 Expression (0-127)
16 General Purpose #1 (0-127)
17 General Purpose #2 (0-127)
18 General Purpose #3 (0-127)
19 General Purpose #4 (0-127)
32-63 Least Significant Bits, Controllers 0-31 (0-127)
64 Sustain Pedal (0 or 127)
65 Portamento On/Off (0 or 127)

66 Sustenuto Pedal (0 or 127)
67 Soft Pedal (0 or 127)
69 Hold 2 (0 or 127)
80 General Purpose #5 (0 or 127)
81 General Purpose #6 (0 or 127)
82 General Purpose #7 (0 or 127)
83 General Purpose #8 (0 or 127)
92 Tremolo Depth (0-127)
93 Chorus Depth (0-127)
94 Celeste Depth (0-127)
95 Phase Depth (0-127)
96 Data Increment (0 or 127)
97 Data Decrement (0 or 127)
98 Non-Registered Parameter MSB (0-127)
99 Non-Registered Parameter LSB (0-127)
100 Registered Parameter MSB (0-127)
101 Registered Parameter LSB (0-127)
121 Reset All Controllers (0)
122 Local Control On/Off (0 or 127)
123 All Notes Off (0)
124 Omni Off (0)
125 Omni On (0)
126 Mono On (0-16; 0=Omni Off)
127 Poly On (0)

10.4B Mode messages

There are two messages that determine the MIDI mode (*i.e.*, how the DPM 3 SE will receive MIDI data). The "omni" message determines how many channels will be recognized. Omni on means that data from all channels will be received; Omni off limits the number of channels, usually to one.

The "mono/poly" message deals with voice assignment within the synthesizer. In Mono mode, only one note at a time plays in response to voice messages; in Poly mode, as many voices can play notes as are available to play notes.

Combining these two messages in various ways produces the following mode messages.

Omni On/Poly (Mode 1) The DPM 3 SE's voices respond to voice messages occuring on any channel.

Omni On/Mono (Mode 2) This mode is seldom implemented because playing one note out of the data occuring on all 16 channels is not real useful.

Omni Off/Poly (Mode 3) In this extremely common mode, the DPM 3 SE is tuned to a single channel; any incoming messages are assigned to synth voices, up to the maximum number of 16 voices.

Omni Off/Mono (Mode 4) Voice messages are received over several channels, but each channel plays monophonically. In other words, you could play one voice on channel 1, one voice on channel 2, etc. The DPM 3 SE implements an improved version of Mono mode called Dynamically Allocated Multi Mode, which lets the synth receive *polyphonic* data over each channel.

10.4C Other messages

Local Control On/Off With Local Control on, playing the DPM 3 SE keyboard triggers the internal voices and sends data out the MIDI out jack. With Local Control off, the keyboard does not trigger the internal voices but does send data over MIDI out. The main use for Local Off is to play an expander module from a master keyboard, but not trigger the internal sounds.

10.5 SYSTEM COMMON MESSAGES

Intended for all units in a system, some of these messages are:

Song Position Pointer This indicates how many "MIDI beats" (normally a 16th note) have elapsed since a piece started (up to 16,384 total beats). It is primarily used to allow different sequencers and drum machines to auto-locate to each other so that if you start one sequencer, the other device will automatically jump to the same place in the song, whereupon both continue on together.

System Exclusive This message (called sys ex for short) is considered "exclusive" because different manufacturers send and receive data over MIDI which is intended only for that manufacturer's equipment. *Example:* Sending a Peavey DPM 3 SE message to an Ensoniq EPS won't do anything but will be understood by other DPM 3 SEs. This data often contains information about individual instrument patches.

Timing Clock The master tempo source (such as a sequencer) emits 24 timing messages (clocks) per quarter note. Each device synchronized to the sequencer advances by 1/24th of a quarter note when it receives the clock message, thus keeping

units in sync after they've both started at the same time. In the case of the DPM 3 SE, this clock is subdivided internally to a rate of 96 clocks per quarter note to increase the timing resolution.

Start Signals all rhythmically-based units when to start playing.

Stop Signals all rhythmically-based units when to stop playing.

Continue Unlike a Start command, which re-starts a sequencer or drum machine from the beginning of a song each time it occurs, sending a continue message after stop will re-start units from where they were stopped.

10.6 BOOKS ON MIDI

The preceding does not substitute for reading a good book on the subject of MIDI. For further information, refer to the following:

MIDI For Musicians and *The Electronic Musician's Dictionary* by Craig Anderton; AMSCO Publications. The former was written specifically for musicians with no background in MIDI, and the latter defines terms related to musical electronics.

Music Through MIDI by Michael Boom; Microsoft Press. An excellent text for those just getting started with MIDI, synthesis, and related topics.

The Murphy's Law MIDI Book by Jeff Burger; Alexander Publishing. Emphasizes applications and problem-solving.

Using MIDI by Helen Casabona and David Frederick; Alfred Publishing. A general guide to MIDI with an emphasis on applications.

Understanding MIDI and *Understanding MIDI 2* by various authors; Amordian Press. A collection of MIDI-oriented articles from *Musician* magazine.

These are available from many music and book stores; a mail order source is Mix Bookshelf (800/233-9604).