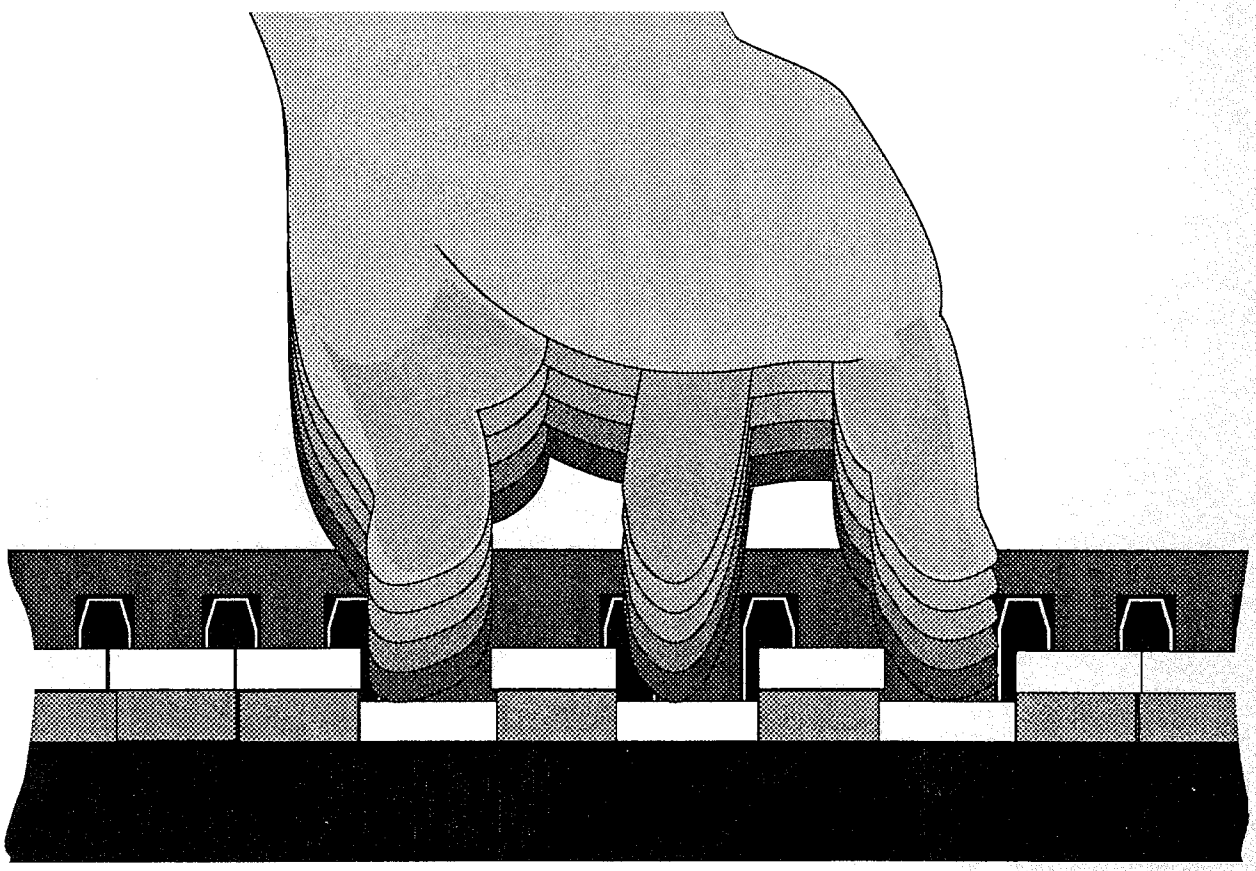
Part 3: CONTROLLER PERFORMANCE



Part 3: CONTROLLER PERFORMANCE

Controller Techniques

About the Mod Wheel, Breath Controller, and MIDI Controllers...

The DX7 II has several performance controllers that you may use besides the keyboard and pitch bender:

- **After Touch** (key pressure)
- **Foot Controllers** (FC1 and FC2)
- **Mod Wheel**
- **Breath Controller**
- **MIDI In Controllers** (1 and 2)

Each of these controllers can be assigned to control some combination of the following parameters:

- **PMod** (vibrato)
- **Amod** (loudness tremolo, timbre tremolo)
- **EGbias** (loudness crescendo, timbre crescendo)
- **Pbias** (pitch bend)

Essentially, each controller does the same thing. The main difference between them is how you "play" them (with your hands, feet, or mouth). In this section of the book we'll explore after touch, and the foot controllers in detail. As you are reading and trying out the examples, always keep in mind that the techniques I describe here also apply to the mod wheel, breath controller and MIDI In controllers as well. There are no differences in the way these controllers effect the sound of FM voices. (If you're not watching the player, you can't tell what controller he or she uses to get an effect.) There are also no differences in they way the various articulations for the controllers are notated. In fact, you can (and should) think of bends, vibratos, tremolos, and crescendos (etc.) as being independent of any particular controller. The DX7 II gives you the freedom to decide if you want to execute a bend with the wheel, pressure, a pedal, after touch, or your breath. The decision should be based on what you are most comfortable with, and which controller(s) will give you the most performance flexibility. For instance, if you want to play spills with a two handed chord part, you won't have a free hand to play the pitch bender. In this case, you could use the breath controller, or even a foot pedal, to articulate the spills, leaving both hands free to play the voicings.

As you read on, remember that the performance and patching techniques described below can be use with all of the controller options. If you haven't taken the time to try each of the different controllers, by all means take the time to do so. You may find that the breath controller (or one or more of the other controllers) is a perfect fit for your own performance needs.

After Touch Techniques

About After Touch...

The keyboard of the DX7 II is pressure sensitive. Once a key is pushed all the way down, further pressure will produce a control signal called after touch. The strength of this signal varies with how hard you press the key(s). The more pressure you apply, the stronger the signal. After touch can be routed to control modulation depth (Pmod, Amod), timbre and loudness (EGbias) or pitch (Pbias). After touch is also transmitted over the DX7 II's MIDI port as *Channel Pressure* messages. After touch (or Channel Pressure from an external MIDI source) affect all DX7 II voices uniformly. If you play an eight note chord, but only add pressure to a single key, all eight notes will change in the same manner. If you apply different amounts of pressure to different keys, all voices will respond to the total amount of key pressure. The pressure on individual keys will not affect individual notes, but all notes held down.

After touch control of modulation depth, timbre, and loudness have become almost standard on today's synths. After touch control of pitch is less common and a new feature on the DX7 II. This addition is significant since it allows you to control pitch bend directly from the keyboard. You can get bend, vibrato, and even flanging effects without taking either hand from the keyboard.

Calibrating After Touch on the DX7 II

After touch sensitivity is initially calibrated at the factory. As it comes out of the box, I've found most DX7 IIs to be too sensitive for precise pressure bending of pitch (although the sensitivity is just fine for pressure modulation and EG bias effects). If you want to get the most from the DX7 II's pressure sensitive keyboard, you may want to recalibrate the pressure sensitivity (or you may want a qualified service center to do it for you).

To determine if you need the pressure sensitivity adjusted, select a voice with a quick attack. Set the after touch Pbias to +10 (**Button 25**). Play a series of loud (maximum velocity) staccato notes and chords. (Don't hold the notes down after they're struck.) Does the pitch jump or wobble as you play? If it does you'll probably want to readjust the keyboard's pressure response. If you don't make the adjustment, you'll find it hard to control after touch bending techniques, since normal (no pressure) playing will cause notes to bend when you don't want them to.

The DX7 II's keyboard can be calibrated so that playing with dynamics won't trigger after touch. That way, you'll only hear pressure effects when you play them. The procedure is a simple one, but to do it, the DX7 must be opened and the internal circuits exposed. **If you do this on your own, you will void your warranty.** Furthermore, unless your are qualified to work on electronic equipment, **you may seriously damage your DX.** I am including the calibration procedure here as a guide to service centers and to DX7 II owners who are qualified to work on DX7 IIs. If you want the calibration done, but don't feel you're capable of nosing around inside your valuable instrument, take it to a service center and have them do it for you.

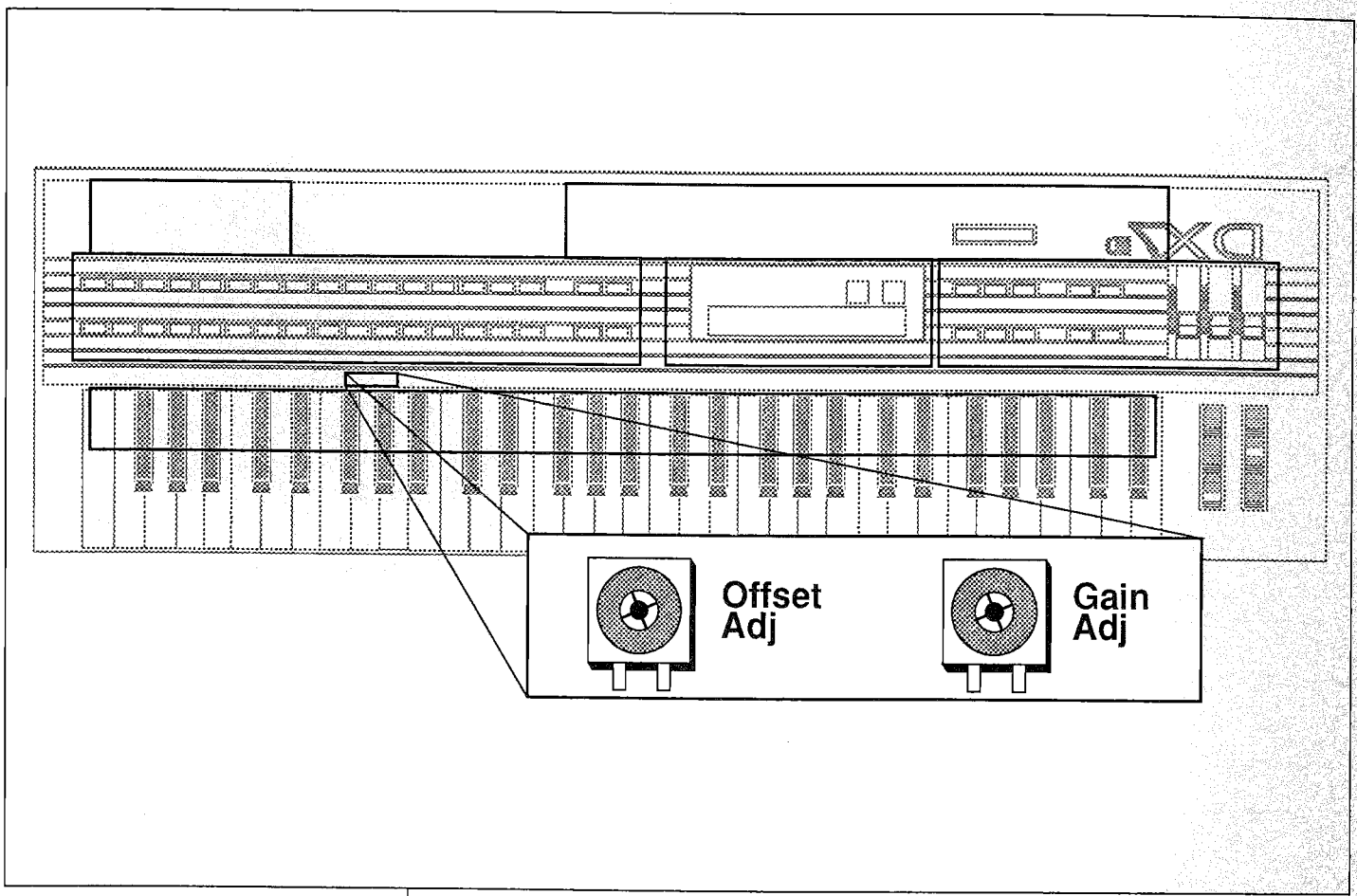


Figure 17: Location of the circuit board containing the after touch OFFSET ADJ and GAIN ADJ trim pots. (The view is from underneath the keys with the bottom panel removed.)

With that said, here's the procedure:

Pressure Calibration Procedure

- Select a preset sound with a quick attack and sustain. Set its after touch Pbias value to +10 and store the sound.
- Following standard service procedures. Turn off the power, and remove the bottom panel, exposing the **PC** circuit board (*Figure 17*).
- Note the location of the **OFFSET ADJ** and **GAIN ADJ** trim pots on the **PC** circuit board. These will be adjusted for the calibration.
- Mark the initial positions of each trim pot, so you can reset the original calibration if you need to.
- **OFFSET ADJ** is the offset trim. It determines the pressure threshold (the amount of pressure needed to trigger the effect). **GAIN ADJ** is the sensitivity trim (relative strength of the signal for a given pressure).
- Rotate the offset trim 1/4 turn clockwise. Following standard service procedures, power up the unit and recall the sound you stored in the first step of this procedure. Have whoever will be playing the keyboard play staccato notes and chords. If the pitch jumps on the attacks, readjust the offset trim until no pitch jumps are heard when the player plays loud dynamics on the keys.

- Once the offset trim is adjusted so that playing with high velocities doesn't trigger Pbias, check the pressure sensitivity. Hold a note and add pressure to bend its pitch. If necessary, increase or decrease the sensitivity trim setting so that maximum pressure on the keys produces a pitch change of a whole step with Pbias still set at +10.

  The particular settings for this adjustment are a matter of player preference, but I've found a whole step at +10 to be quite effective. Not only does this "feel" right to most players, but it allows precise pitch control from alternative MIDI sources. Whatever settings are used, a specified Pbias parameter value should equal a specific pitch change interval. In this example, if the Pbias is set for ±10, then an external MIDI source will bend the DX7 II's pitch up (or down) a whole step when it is moved to its maximum value. (This will prove to be quite convenient if the player uses a MIDI mapping device to control Pbias with the foot controller or other device,)

- Once the calibration is complete, turn off the power and replace the bottom panel.

How to Play With Pressure

Traditionally, keyboard players have had no reason to apply pressure to the keys after they are struck. On a piano or organ, once the key is down, that's it. Pressing any harder will not affect the tone in any way. If you're coming from a piano or organ background (or you've never used after touch on your synth before) this is a new technique to add to your repertoire. Use it to phrase vibrato, tremolo, loudness and timbre crescendos, and even pitch bends without taking either hand from the keys. Remember, after touch on the DX7 II is monophonic. Pressure effects are applied equally to all keys held down, no matter what the pressure on any individual key may be. This means that all pressure from both sets of arms, hands, and fingers is summed together as one source of expression.

Proper orientation of the keyboard to your arms and hands is essential to developing good pressure technique (see ***Positioning the Keyboard and Hands Effectively***). There are two basic actions useful for pressure playing. One utilizes the muscles of the individual fingers. These are the same muscles that you've developed as a keyboardist to push the keys up and down. Although they are already quite strong and flexible. You are probably not accustomed to using them to exert sustained pressure. As you work on this ability, concentrate on isolating each finger. Try not to use the muscles in your upper arm. Keep them relaxed. I use this technique mostly to add modulation effects to single notes. It will also prepare you to play controllers that have polyphonic after touch (individual pressure control for each key).

The other basic pressure motion uses the muscles of the upper arm and back to apply pressure to the entire hand. This motion is similar to the one you would make to push yourself away from the dinner table after a great meal. This technique is a good way to apply pressure effects to one or two handed chords. It is also possible to change pressure very rapidly (and repeatedly) using your arms. This makes it an ideal way to produce vibrato and other pitch bending techniques with pressure.

Performances for After Touch Articulation Examples

The following performances use after touch to control pitch, timbre and loudness effects:

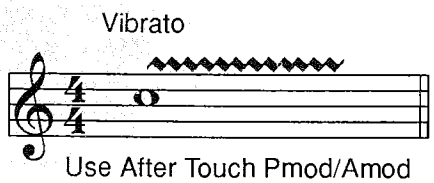
4: Jazz Pressure Flange, 7: Verb Fanfare Split, 8: Bowed Strings, 10: Fiddle Split, 15: Hi Key Pedal Steel, 21: Brass/Vibes Harmony, 23: Jazz Tremolo Pedal, 25: Jazz Tremolo Split, 29: Feedback Gtr Split, 30 Fretless Split, 31:Heavy Feedback Split, and 32:Dual Sitars

After Touch Articulations

As with the bender, there are no standardized ways of notating pressure. There are however, many commonly used ways of notating the typical pitch bender effects: vibrato, tremolo, crescendo, decrescendo, etc. Here is a description of how to play the various after touch articulations and how they are notated throughout the book. You'll see that some of after touch articulations are similar to, and notated the same way as, some pitch bender articulations. Learn how to perform them either way. This will give you alternatives when you're playing. Having alternatives is one of the keys to creative expression.

LFO Vibrato/Tremolo

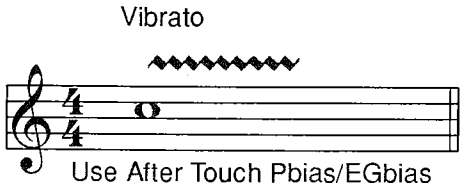
Example 61



For a voice with after touch controlling Pmod (vibrato) or Amod (tremolo), vibrato is indicated with a wavy line. The part may also be marked "pressure" or "after touch." The amount of after touch applied to the keys controls only the depth of the effect. The greater the pressure, the greater the modulation depth. The rate of the vibrato/tremolo is set with the LFO rate parameter (**Button 12**). (*Example 61*)

Pressure Vibrato/Tremolo

Example 62

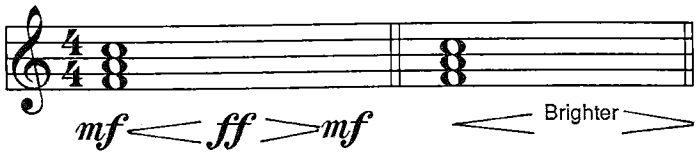


For a voice with after touch controlling Pbias (vibrato) or EGbias (tremolo), pressure is indicated with a triangular wavy line. Like pitch wheel vibrato, the rate and depth of the effect is completely controlled by the player's actions. The vibrato is determined by how much pressure is applied to the keys (depth) and how quickly it is varied (depth). I've found that by rocking my wrist rapidly up and down over a small distance I can get very controlled and expressive pressure vibrato. (*Example 62*)

Pressure Swells (Crescendo/Decrescendo)

Example 63

Use After Touch EGbias

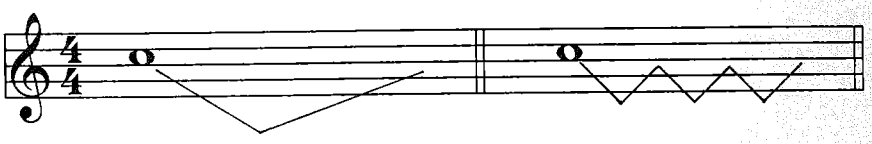


Crescendo/decrescendo effects can also be performed with voices that have after touch controlling EGbias. If the operators controlled are FM carriers, a loudness swell can be performed with after touch. If the operators controlled are FM modulators, a timbre swell can be performed with after touch. Both types of swell can be used in the same voice. The type of swell, loudness and/or tremolo, will be up to you. On the part, the swell will be shown with standard crescendo/decrescendo markings. The swell is performed by gradually increasing and decreasing pressure to the key(s). (*Example 63*)

Pressure Scooping (Dive Bombing)

Example 64

Use After Touch Pbias



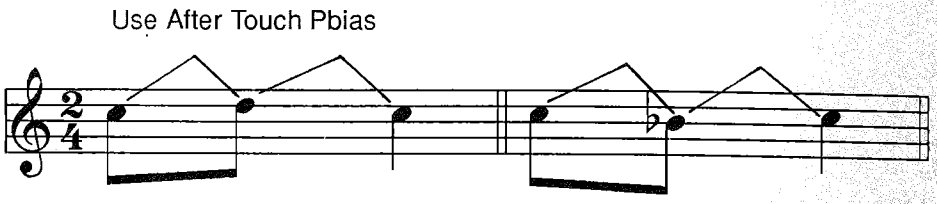
Many interesting pitch bend variations can be performed when after touch is controlling Pbias (**Button 25**). Most are some type of bend and release, since the act of releasing the key will also return the pressure (and therefore, the pitch) back to normal. You can do spills if the voice you're playing has no sustain and you hold the keys down (maintaining the pressure) until the sound fades away. The decay rate(s) (Rate 3 of all FM carriers) will determine how long you'll have to keep the keys down before the note fades out. You can also do spills if the voice's release rate is extremely short, and you release the note very quickly from the maximum pressure position.

I like to use pressure to perform scoops with many of my favorite guitar sounds. This can be as subtle as the effect produced by gently putting pressure on a guitar's head-piece to bend the neck slightly, or as blatant as the effect produced by jamming the whang-bar right into the pick guard. It's up to you.

The notation used is the same as used for the electric guitar and the pitch wheel. An angular line indicates the general shape of the scoop. The bend interval and timing of the bend and release (fast/slow, slow/fast) is determined by the player. (*Example 64*)

Interval Bending with Pressure

Example 65



Standard pitch bend and release articulations can also be performed with after touch. They are indicated in the same way as pitch wheel bend and release articulations. You'll find that it's quite difficult to articulate precisely pitched pressure bends. Also, its not possible to change the pitch as quickly as you can with the wheel. (After touch doesn't "snap back" as quickly as the spring loaded wheel.) I don't generally use pressure for interval bending in a very active one handed melody or solo. Quite frequently, however, I do use pressure for interval bending of accented notes in brass or wind parts, and to bend notes and chords within a two handed part.

As an example for after touch pitch bend articulations, I've given you a short jazz piece to try. (*Example 65*) Play it with performance 4: Jazz Pressure Flange.

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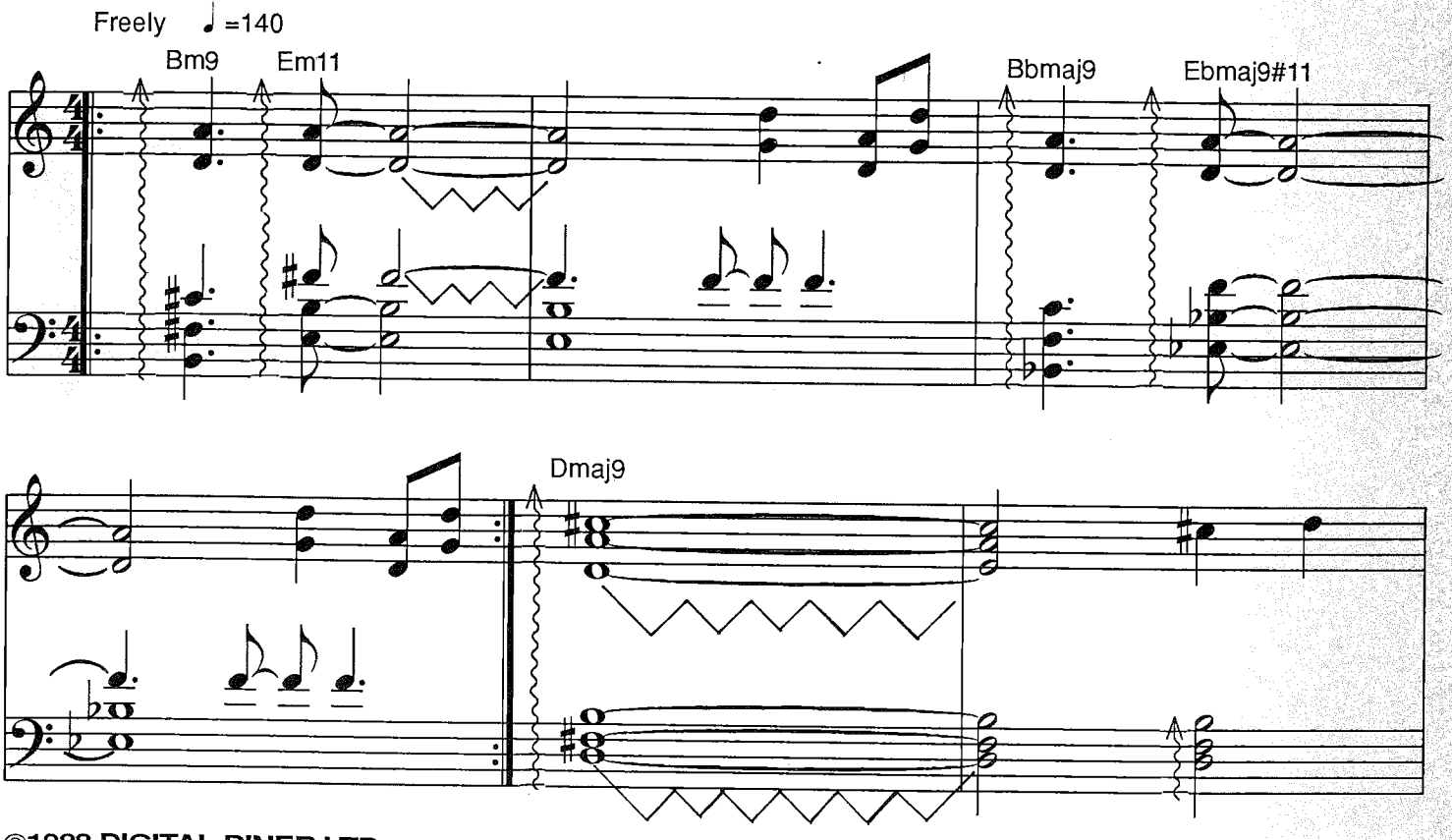
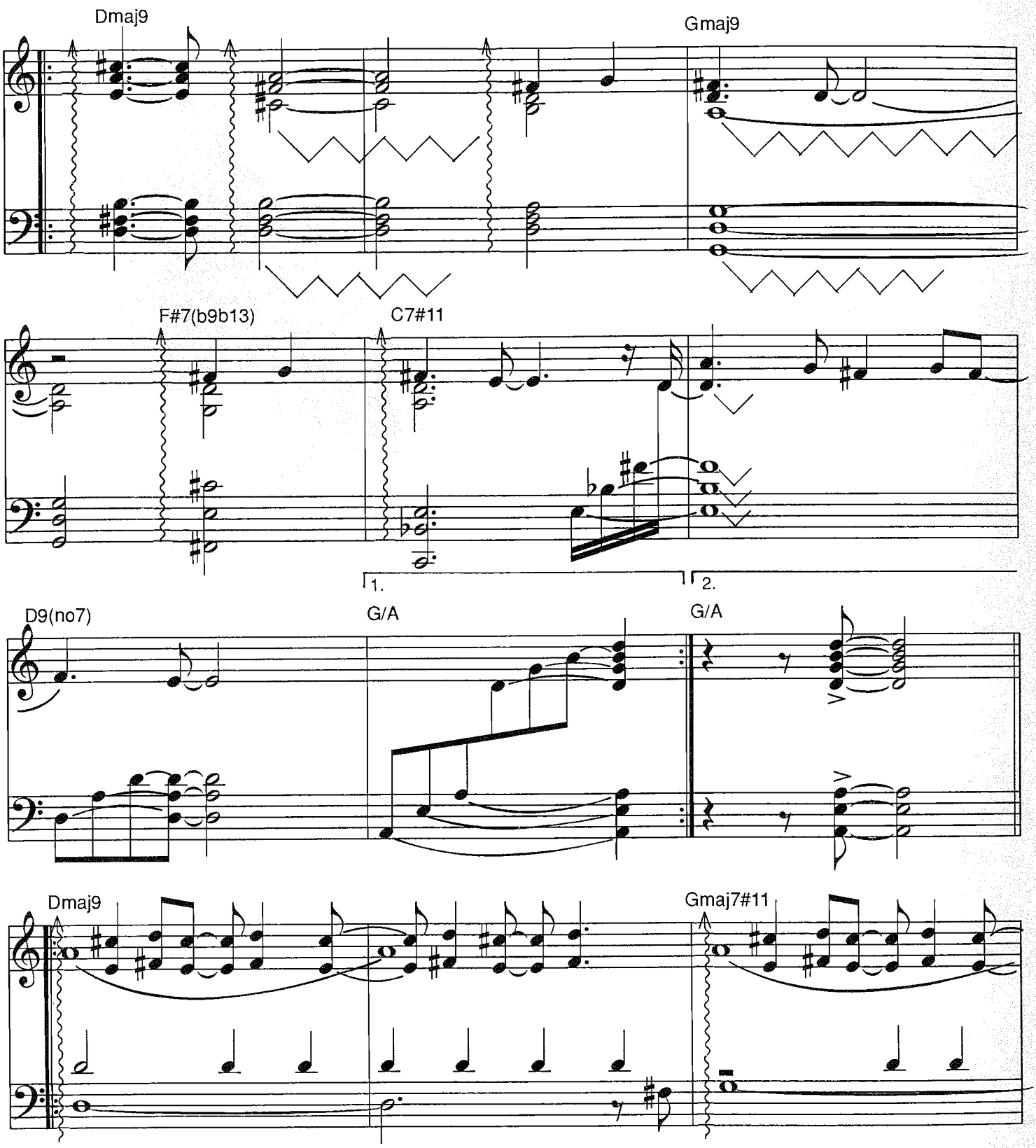
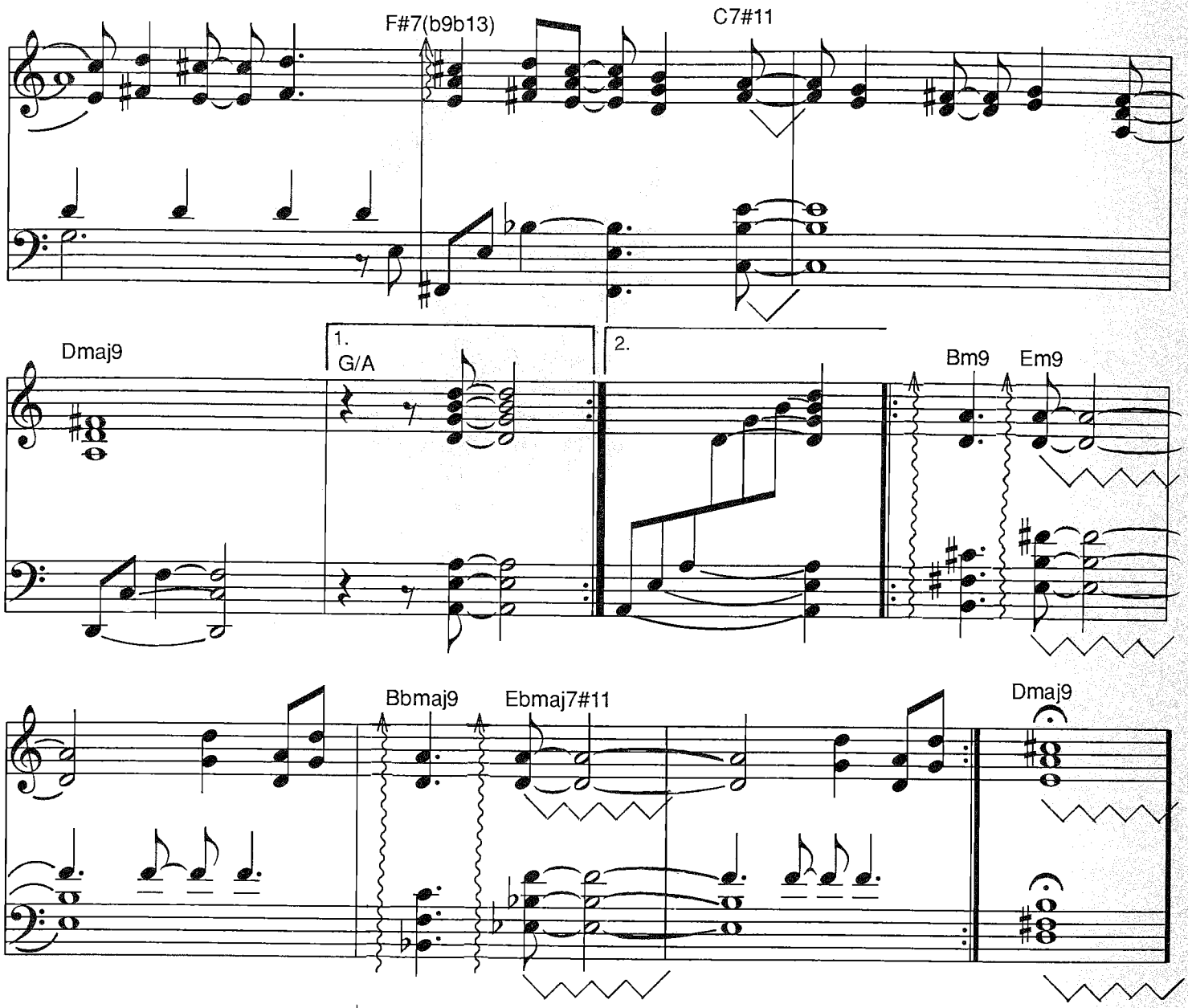






After Touch Patching

About After Touch Patching...

You can use after touch to control up to four different sets of FM voice parameters on the DX7 II. Depending on which parameter(s) you assign to after touch, you can perform dynamic changes in any voice's pitch, timbre or loudness with pressure on the keys.

This book is not meant to be a course in FM sound design. If you want to learn more about creating FM sounds from scratch, check out my book (and video) ***Secrets of Analog and Digital Synthesis*** . You might also want to look into the ***Music Technology Series*** from Ferro Technologies. It covers all you need to know about MIDI, Sampling and more. They're available from Hal Leonard Books.

Although virtually all FM voices can be more expressive when their parameters are controlled in this way, most presets don't have after touch patched into the sound. I want to show you how to edit voices from your existing collection to make them more musically expressive by adding after touch effects. It's simple enough to do as long as you understand that the after touch parameters (located under **Button 25**) interact with other FM voice parameters. The four main after touch parameters are:

Pmod: Pitch Modulation

Amod: Amplitude Modulation

EGbias: Envelope Generator Bias

Pbias: Pitch Bias

I've listed the other parameters related to each of these below, along with a brief description of how they will effect the sound. I've also given you the button number for each parameter to help you find it on the DX7 II when you start editing your favorite voices to add after touch. Use this section as a guide for how to edit any voice to add after touch effects. Many of the voices in the last section of this book incorporate after touch into the voice. Take the time to set them up and play them on your DX7 II. They'll give you some good ideas on how to incorporate after touch into your own voices.

Pitch Modulation

After touch control of pitch modulation let's you control the depth (strength) of LFO vibrato effects with keyboard pressure. This is one of the most common uses of after touch. It allows you to phrase vibrato by simply pressing down on the keys as you hold notes.

Button	Parameter	Description
25	Pmod	This sets how much LFO effect will be produced when you apply pressure to the keys. It must be above zero for you to hear LFO effects.
11	Pms	Determines the voice's overall sensitivity to LFO pitch control. Its value must be above zero for any LFO effects.
12	Wave	Sets the vibrato shape
12	Speed	Sets the vibrato speed

Amplitude Modulation

You can also use pressure to phrase tremolo as you're holding down keys. After touch control of amplitude modulation let's you control the depth of LFO tremolo effects with pressure. Timbre tremolo (brightness changes) is produced by controlling FM modulators. Loudness tremolo (volume changes) is produced by controlling FM carriers. You may control any combination of the six operators in each voice.

Button	Parameter	Description
25	Amod	This sets how much LFO effect will be produced when you apply pressure to the keys. It must be above zero for you to hear LFO effects.
11	Ams(1-6)	Each operator has its own Ams parameter. It determines the operator's overall sensitivity to LFO and EGbias effects. An operator's Ams value must be above zero for you to hear LFO effects. If the operator is a carrier, a loudness change will result. If it is a modulator a timbre change will result.
12	Wave	Sets the tremolo shape
12	Speed	Sets the tremolo speed

Envelope Generator Bias

After touch control of envelope generator bias allows you to articulate swells (crescendo/decrescendo) and tremolos with keyboard pressure. You may change loudness and/or timbre by controlling the envelopes of carriers and/or modulators.

Button	Parameter	Description
25	EGbias	This sets how loud/bright the voice will be come as you add pressure to the keys. It must be set above zero for you to hear any effect.
11	Ams(1-6)	Each operator has its own Ams parameter. It determines the operator's overall sensitivity to LFO and EGbias effects. An operator's Ams value must be above zero for you to hear LFO effects. If the operator is a carrier, a loudness change will result. If it is a modulator a timbre change will result.

Pitch Bias

You can control a voice's pitch directly with the pressure you apply to the keys to articulate bending and vibrato effects. (I use pressure for pitch bending about as frequently as I use the wheel.) Be sure to read ***Calibrating After Touch on the DX7 II***

Button	Parameter	Description
25	Pbias	This parameter is used to set the maximum amount of pitch change produced when you exert the maximum amount of pressure on the keyboard. Positive values will bend the pitch sharp. Negative values will bend the pitch flat.

Foot Controller Techniques

About the Foot Controllers...

You can connect two independent foot controller pedals to the DX7 II–FC1 and FC2. FC2 can be patched to control Pmod, Amod, EGBias, and Volume for a variety of straight and modulated pitch, timbre, and modulation effects. FC1 gives you the same set of options and also the ability to control whatever real time FM parameter is assigned control slider 1.

Proper Placement of the Foot Controllers

You may use one or two foot controllers along with one or two foot switches(FS1 and FS2). How you place them will be determined by your own performance needs and style (*Figure 18*). If you play while seated, you may want to arrange the pedals so you can play them with both feet. For example, you may want the switches under your right foot and the controllers under your left. You might set them up the opposite way, controllers on the right, switches on the left. Or, you may want one of each for either foot. If you prefer to play standing, you will probably want to arrange them so that you can play any switch or controller with either your right or left foot. Most players seem to prefer always keeping their weight on the same foot and use the other one to play all of the switches and pedals.

However you set them up, the important thing is to find a placement that works and stick with it. Keeping the placement consistent, will let you find the appropriate pedal(s) when you need to. You should be able to place your foot onto any pedal without having to look for it, or think about where it is.

You've probably noticed that your foot pedals tend to creep as you play them. Once you've decided where they should go, work out a way to anchor them in place. You can mount them to a piece of plywood (velcro works well), or make a "back stop" of some kind. If you are using two foot controllers, you'll find a convenient mounting plate attached to the bottom of the pedals. You can use it to attach both pedals together making a single side-by-side unit (*Figure 19*).

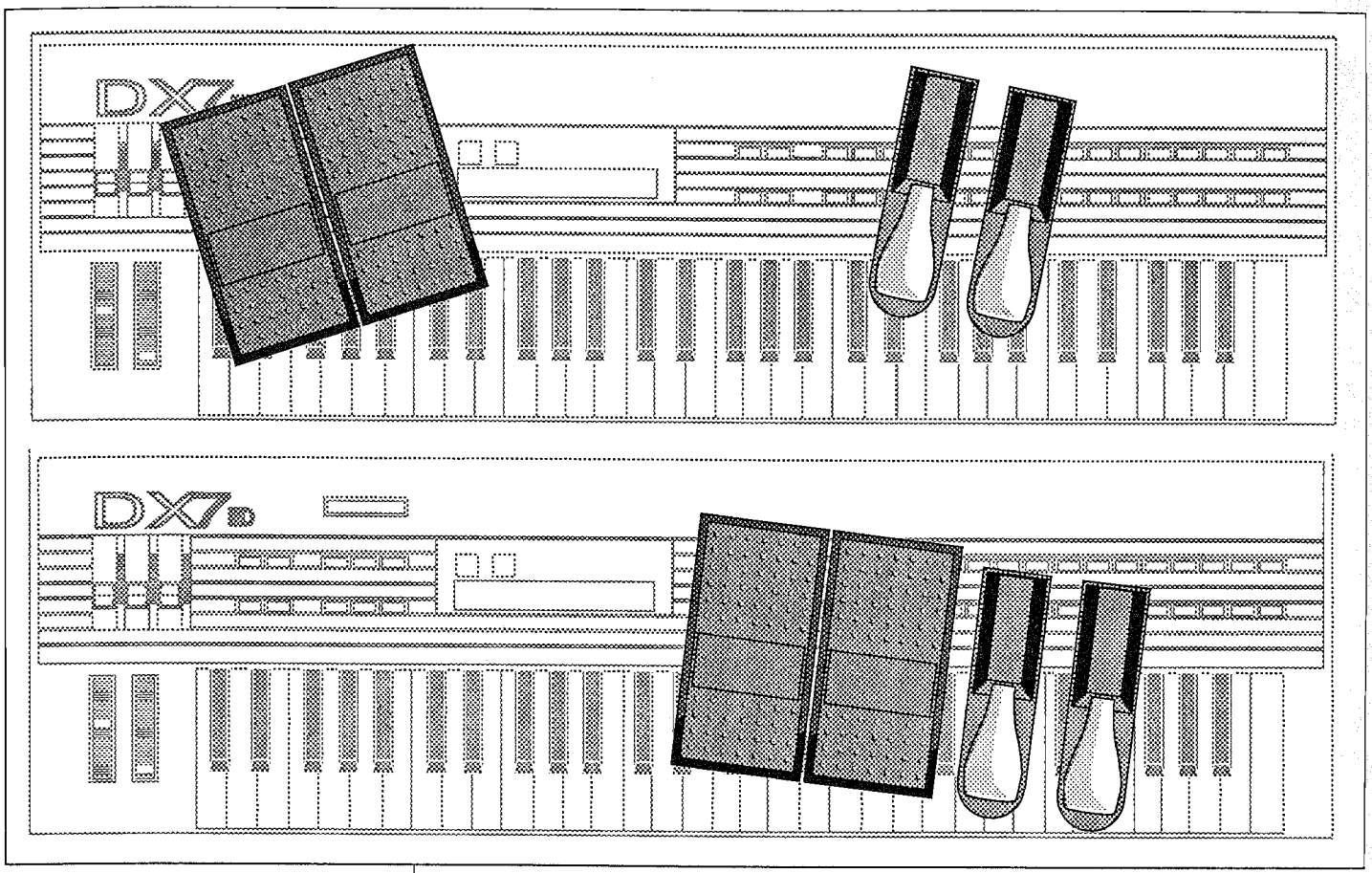


Figure 18: Here are two possible arrangements of the DX7 II's foot pedals. The upper set-up is good if you play seated and can use both feet on the pedals. If you play standing, the lower set-up is an example of how to reach any of the four pedals with one foot.

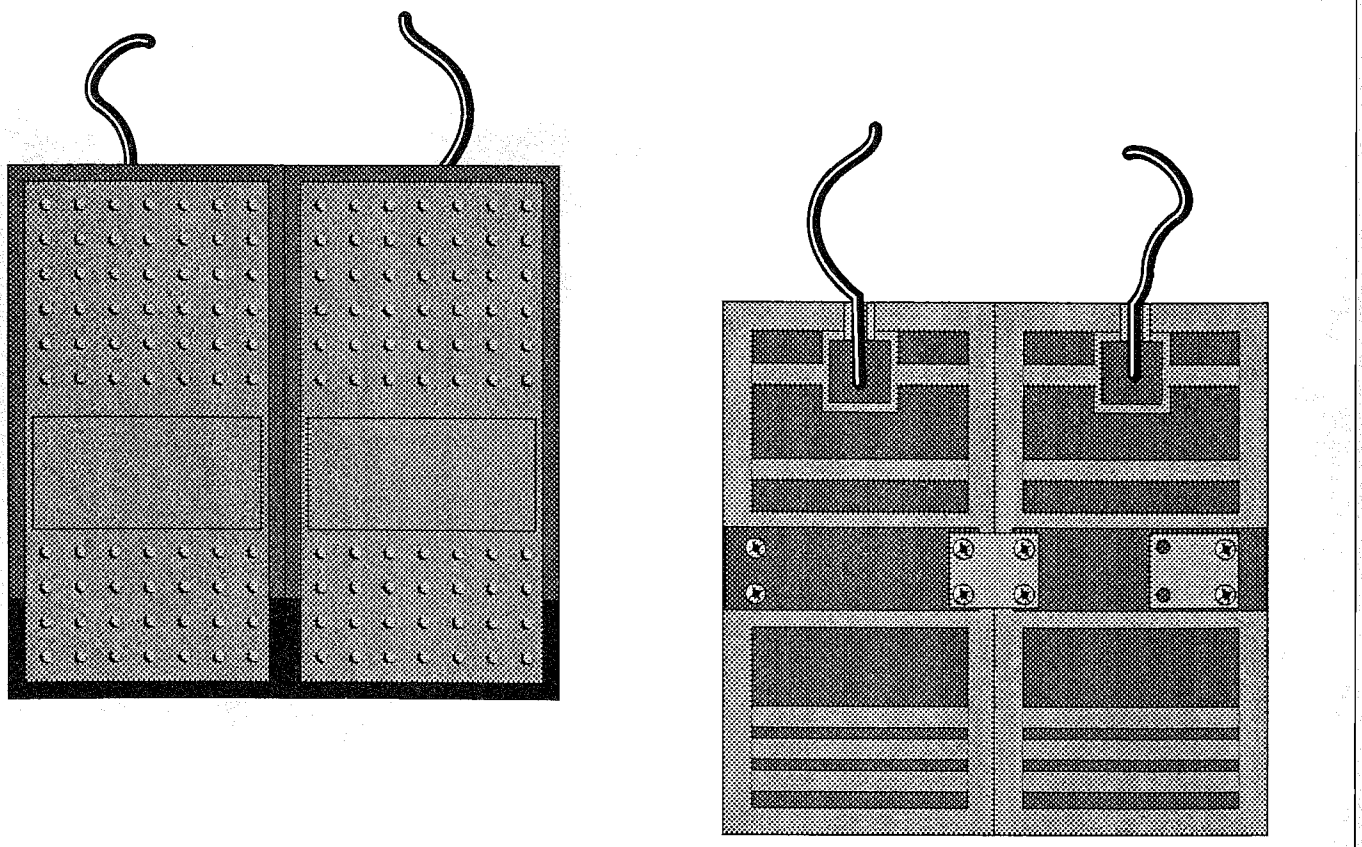


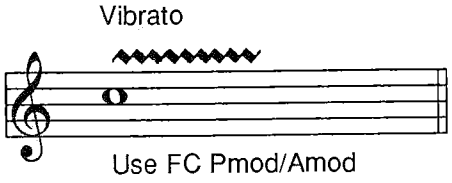
Figure 19: The small square plate attached to the underside of the DX7 II's foot pedal is used to hold two pedals together as a single unit.

Foot Controller Articulations

The foot controllers can be used to perform the same types of articulations as the mod wheel and after touch. You can also use the foot controllers to articulate pitch bends as well. (I've given you some pedal bending voices in the last section of the book.) There are no differences in the way the articulations are notated for the foot controllers.

FC LFO Vibrato/Tremolo

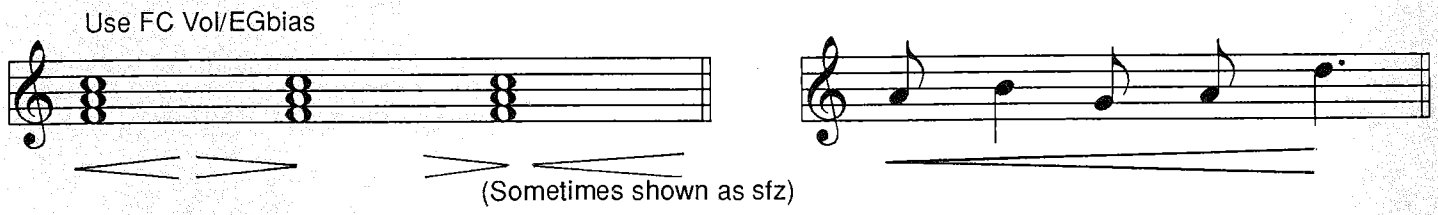
Example 66



For a voice with FC1 or FC2 controlling Pmod (vibrato) or Amod (tremolo), vibrato and tremolo are indicated with a wavy line. How far the pedal is depressed controls only the depth of the effect. The further the pedal is pushed down, the greater the modulation depth. The rate of the vibrato/tremolo is set with the LFO rate parameter. (*Example 66*)

FC Swells (Crescendo/Decrescendo)

Example 67



Performances for Foot Controller Articulation Examples

The following performances use the foot pedal to control pitch, timbre and loudness effects:

6 Fanfare Key On/Pedal, 8: Bowed Strings, 9: Strings/Verb Split. 10: Fiddle Split, 13: String Verb Choir, 15: Hi Key Pedal Steel, 18: Bones Key On Bend, 20: Blues Harp, 21: Brass Vibes Harmony, 22: Cajun Squeeze Box, 23: Jazz Tremolo Pedal, 24: Wind & Duke Harmony, 25: Jazz Tremolo Split, 26 Strings Verb, 27: Percussion Split, 30: Fretless

Crescendo/decrescendo effects can also be performed with voices that have FC1 or FC2 controlling EGbias or Vol. If the operators controlled by EGbias are FM carriers, or the pedal is set for Vol, a loudness swell can be performed with the pedal. If the operators controlled with EGbias are FM modulators, a timbre swell can be performed with the pedal. Both types of swell can be used in the same voice. The type of swell, loudness and/or timbre, will be up to you. On the part, the swell will be shown with standard crescendo/decrescendo markings. The swell is performed by gradually moving the pedal up or down. For a crescendo, the pedal is pulled up before the note is played and moved downwards while the note is held. The crescendo may last the length of an entire phrase. Here, the pedal is pulled up before the phrase is played and pushed steadily downwards during the length of the phrase. Decrescendos are played in the opposite manner. The pedal is depressed before the note or phrase begins and gradually pulled upwards as the note or phrase is played. Of course, both motions may be used with the same note or phrase to create soft/loud/soft or loud/soft/loud articulations as well. The loud/soft/loud articulation is commonly referred to as a sforzando and notated "***sfz***." (*Example 67*)

FC Pitch Bend Articulations

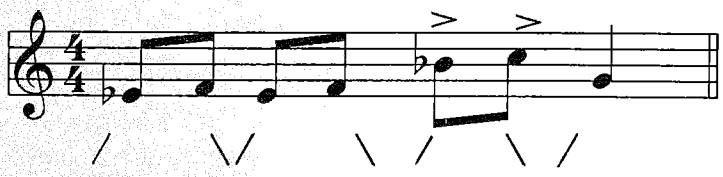
It is possible to use the foot controllers to do interval pitch bending. It requires some voice editing to set it up. (I'll show you how in ***Foot Controller Patching***.) The pedal bending differs somewhat from wheel bending in that there is no center position like on the wheel. You can only bend in one direction, sharp or flat, from the original pitch. Also, since the pedal isn't spring loaded, it won't return to the starting pitch by itself. You can bend to a new pitch, remove your foot from the pedal, and the note (as well as all subsequent notes) will remain at the new bend interval.

Once setup up for pitch bending with a foot controller, you can perform all of the same types of bend articulations that you can with the wheel–bend, ghost bend, spill, bend and release, hammer-on, pull off, slide, scoop, and unison bend. These are notated the same way for foot controllers as they are for the wheel. (See ***Bender Articulations***.)

FC Rhythmic Sweeps

Example 68

Use FC Vol/EGbias



The foot controllers can also be used to articulate rhythmic changes in timbre in much the same way a brass player uses a cup mute, or a guitarist uses a wah wah pedal. Typically, the pedal is moved down and up through some, or all, of its range over the duration of each note in a phrase. Very often the sweep occurs along with a wheel pitch bend. Rhythmic sweeps are indicated on the part with the same kind of angular line used for pitch bends. The line is general indicator of the pedal motion—up/down, down/up, up only, down only; as well as the amount of sweep to use—sharp angle for a lot, shallow angle for a little. (*Example 68*) (The coice, Duke Synth, is perfect for rhythmic sweeps.)

Foot Controller Patching

About Foot Controller Patching...

You can use the two foot controllers to perform dynamic changes in the pitch, timbre, and loudness of any FM voice. As with after touch and the other controllers, you can make any FM voice more musically expressive by patching the foot controllers. Most preset voices don't have the foot controllers patched in. You can edit any existing voice to add foot controller effects. The foot controller parameters are:

Pmod: Pitch Modulation

Amod: Amplitude Modulation

EGbias: Envelope Generator Bias

Vol: Volume

CS1: Control Slider 1 (Foot Controller 1 only)

These parameters interact with other FM voice parameters the same way after touch (and other controller) parameters do. In most cases the only difference is that you will be changing the sound with your foot instead of key pressure (or breath pressure, etc.). Here's a listing of the parameters that work in conjunction with the foot controllers.

Pitch Modulation (FC1 and FC2)

The foot controller control of pitch modulation let's you control the depth (strength) of LFO vibrato effects with pedal motion.

Button	Parameter	Description
25	Pmod	This sets how much LFO effect will be produced when you move the pedal. It must be above zero for you to hear LFO effects.
11	Pms	Determines the voice's overall sensitivity to LFO pitch control. Its value must be above zero for any LFO effects.
12	Wave	Sets the vibrato shape
12	Speed	Sets the vibrato speed

One really neat trick with Pmod is to set the wave parameter to "SQUARE" and the speed parameter to "0." Now, instead of bringing vibrato in and out, the pedal will bend the voice's pitch. The Pms and Pmod parameters both effect the amount of pitch bend. I've given you some example voices that use this technique. You can, of course, setup up the same effect with after touch or the other controllers, but the ones with Pbias can do pitch bend already. (The mod wheel doesn't have a Pbias parameter, but I don't use this trick with it either. If I want a wheel for bending, then I use the pitch bender.)

Amplitude Modulation (FC1 and FC2)

The foot controller control of amplitude modulation let's you control the depth of LFO tremolo effects with pedal motion. Timbre tremolo (brightness changes) is produced by controlling FM modulators. Loudness tremolo (volume changes) is produced by controlling FM carriers. You may control any combination of the six operators in each voice.

Button	Parameter	Description
25	Amod	This sets how much LFO effect will be produced when you move the pedal. It must be above zero for you to hear LFO effects.

11	Ams(1-6)	Each operator has its own Ams parameter. It determines the operator's overall sensitivity to LFO and EGbias effects. An operator's Ams value must be above zero for you to hear LFO effects. If the operator is a carrier, a loudness change will result. If it is a modulator a timbre change will result.
12	Wave	Sets the tremolo shape
12	Speed	Sets the tremolo speed

Envelope Generator Bias (FC1 and FC2)

The foot controller control of envelope generator bias allows you to articulate swells (crescendo/decrescendo) and tremolos by moving the pedal. You may change loudness and/or timbre by controlling the envelopes of carriers and/or modulators.

Button	Parameter	Description
25	EGbias	This sets how loud/bright the voice will be come as push the pedal down. It must be set above zero for you to hear any effect.
11	Ams(1-6)	Each operator has its own Ams parameter. It determines the operator's overall sensitivity to LFO and EGbias effects. An operator's Ams value must be above zero for you to hear LFO effects. If the operator is a carrier, a loudness change will result. If it is a modulator a timbre change will result.

Volume (FC1 and FC2)

The volume parameter is independent of any other FM voice parameters. It controls the overall volume of the FM voice. When the pedal is all the way down, the voice will always be at its normal loudness. With the pedal all the way up, the loudness of the voice is set with the Vol parameter. When the value is set to 99, the controller acts like an ordinary volume pedal. All the way up is off, and all the way down is full volume. When the volume parameter's value is zero, the pedal will have no effect (on volume). At intermediate settings, the voice will be softer, but still audible, when the pedal is all the way up. I frequently set this parameter to a value between 20 and 35 or so to built some additional dynamics into a voice. I don't often want to use the pedal to completely silence a sound. Instead I like to use it to articulate crescendos from *mf* to *ff*, or to kick in a little something extra for a screaming lead.

Control Slider 1 (FC1 Only)

Foot controller 1 can also be used to control whatever parameter is currently assigned to control slider 1. *Figure 20* list the parameters that can be controlled by control slider 1 and FC1.

Button	Parameter	Description
25	CS1	When this parameter is set to "on," moving the pedal will change the sound in the same way as moving the CS1 slider would. If the parameter is "off," the pedal will have no effect on the CS1 parameter.
27	CS1	You can select any parameter from the following chart to be controlled by moving CS1, FC1, or an external MIDI controller. Global parameters effect both voices. Selectable parameters can be switched on or off for either voice A or B.
31	MIDI In CS1	This sets the control number ID (5-31) for an external MIDI controller.

DX7 II Real Time Parameters

The following parameters can be controlled in real time by either CS1 and/or CS2 as well as the MIDI controllers assigned to them (5-31).

Global (Effects both voices)

NO EFFECT
TOTAL VOLUME
OUTPUT BALANCE
PAN CONTROL
DUAL DETUNE

Selectable (On/Off for voice A and B)

ALGORITHIM
FEED BACK LEVEL
LFO WAVE
LFO SPEED
LFO DELAY TIME
LFO PMOD SENSITIVIY
LFO PMOD DEPTH
LFO AMOD DEPTH
PITCH EG
PORTAMENTO TIME
OSCILLATOR FREQUENCY (COARSE) (Op1-Op6)
OSCILLATOR FREQUENCY (FINE) (Op1-Op6)
OSCILLATOR DETUNE (Op1-Op6)
OPERATOR EG (R1) (Op1-Op6)
OPERATOR EG (R2) (Op1-Op6)
OPERATOR EG (R3) (Op1-Op6)
OPERATOR EG (R4) (Op1-Op6)
OPERATOR EG (L1) (Op1-Op6)
OPERATOR EG (L2) (Op1-Op6)
OPERATOR EG (L3) (Op1-Op6)
OPERATOR EG (L4) (Op1-Op6)
KEY VELOCITY SENSITIVITY (Op1-Op6)
AMOD SENSITIVITY (Op1-Op6)
TOTAL LEVEL (Op1-Op6)

Figure 20: Real time parameters.