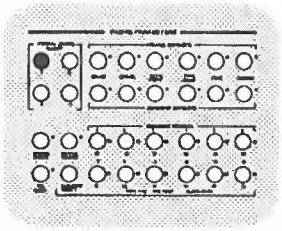
# Programming partial timbres

## Selecting partial timbres



***partial timbre select button 1***
*panel 1*

### *Partial timbres of the keyboard timbre*

In order to make any changes in the keyboard timbre, one or more of the partial timbres of the keyboard timbre must be selected. A partial timbre is selected when its **partial timbre select** button is either lit or blinking.

If the keyboard timbre is a raw sound file that has just been recorded or recalled to the keyboard, it is usually placed on the first partial timbre. The first **partial timbre select** button is lit, indicating that it is already selected and ready for programming.

If the keyboard timbre is a synthesis or resynthesis timbre, it may have up to four partial timbres already programmed. One or more of them may be selected.

If the partial timbre you want to work on is not already selected, you select it by pressing its corresponding **partial timbre select** button to make it light or blink. Timbre modifications apply only to the partial timbres with lit or blinking buttons.

## *Selecting a single partial timbre for programming*

You can select a partial timbre and program it while listening to all the partial timbres in the timbre.

1. Press the desired numbered button under **partial timbre select.**

   The button lights up. When you play a note, you hear all the partial timbres.

2. Press one of the **timbre parameter** buttons.

   The button lights up and the current setting appears in the display window.

3. Turn the control knob to dial in a new setting.

   The settings are changed in the display window and on the terminal displays (see the section "Timbre displays"). When you play a note, you hear the change in the selected partial timbre. You also hear the other partial timbres, but they remain unchanged.

## Selecting partial timbres (con't)

### *Selecting a single partial timbre for programming (con't)*

You can also select a partial timbre and program it while listening to its sound alone.

1. Press the desired numbered button under **partial timbre select** twice.

   The button blinks. When you play a note you hear only that partial timbre.

2. Press the button for the parameter you want to change.

   The button lights up.

3. Turn the control knob to dial in a new setting.

   The setting changes are displayed in the display window. When you play a note, you hear only the selected partial timbre with the changes you have made.

## *Selecting two or more partial timbres for programming*

You can program two or more partial timbres simultaneously.

1. Select or solo two or more **partial timbre select buttons** by pressing them once or twice so that they are lit or blinking.

2. Press the button for the parameter you want to change.

   The button lights up.

3. Turn the control knob to dial in the new settings.

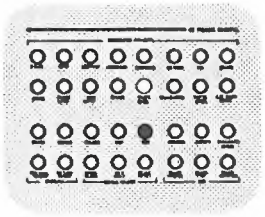
   The new setting is appliedto both partial timbres.

If the previously programmed settings are the same, all the changes are the same.

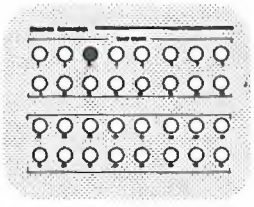
If the settings are different, the numerical values are locked together and all are changed by the same amount.

If any of the changing numbers reaches maximum or minimum value for the parameter, it remains the same while the others continue to change.

## Selecting partial timbres (con't)



*skt*
*panel 2*



***track select numbered buttons***
*panel 3*

## *Erasing partial timbres*

You can erase any or all of the existing partial timbres in the following way:

1. Press **skt.**
2. Press and hold down the selected **partial timbre select** button.
3. Press a **track select** button for an empty track.

*figure 2.1*
*The partial timbre select buttons*

- When you press a lit **partial timbre select** button, it starts blinking. When you play a note on the keyboard, you hear only the selected partial timbre.
- When you press a blinking **partial timbre select** button, it stops blinking and becomes lit. When you play a note on the keyboard, you hear all the partial timbres, whether their buttons are lit or unlit.
- When you press an unlit **partial timbre select** button, it becomes lit or blinking, depending on the state of the previously pressed button. The previously pressed button becomes unlit.
- Any programming done is applied only to partial timbres with lit or blinking buttons.

## The steady-state waveform

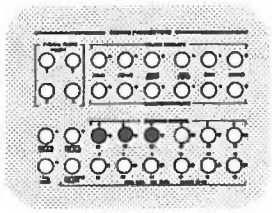
### *Additive synthesis*

The quality of sound of any periodic wave is determined by the number of its harmonics, their frequencies and their relative volumes and phases. Since these can be analyzed through Fourier analysis, the same principles applied in reverse can be used to construct a sound wave. Adding together sine waves of different frequencies, volumes and phases is called **additive synthesis.**

## *Harmonic coefficients*

You create a steady-state waveform by dialing in the relative volume of up to 24 harmonics on a scale of 0.0 to 100.0. A coefficient of 0.0 for a selected harmonic means that the harmonic is not present in the waveform. A coefficient of 100.0 means that the harmonic is present at full volume.

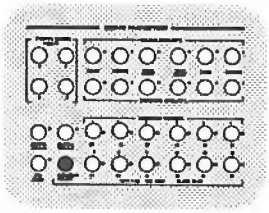
The first harmonic, accessed by **button 1** under **harmonic control,** is the fundamental frequency of the waveform. In the sine wave it is set at 100. If you press A above middle C, a sine wave with a frequency of 440 hertz is generated at 100 percent volume.



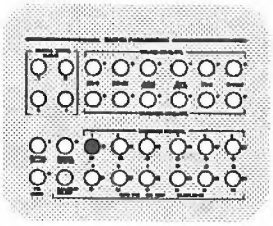
***harmonic control buttons 1, 2, 3***

The second harmonic, accessed by **button 2,** is twice the fundamental frequency. If you set it at 50, for example, with the fundamental set as above, pressing A above middle C causes a complex waveform to be generated. This waveform consists of two superimposed sine waves, one with a 440 hertz frequency sounding at 100 percent volume and one with an 880 hertz frequency sounding at 50 percent volume.

The third harmonic, accessed by **button 3,** is three times the fundamental frequency. And so on. As each harmonic is entered, the Synclavier computes the waveform by means of Fourier synthesis and places it in a wavetable memory in the digital synthesizer.



*harmonic select panel 1*



*harmonic control numbered buttons panel 1*

## *Programming harmonic coefficients*

1. Select the group of harmonics that contains the harmonic you want to program by pressing **harmonic select** on the keyboard. If a timbre display is on the terminal screen, you can select the harmonic group by pressing the **<spacebar>.**

   When the **harmonic select** button is unlit, harmonics 1–12 are available for selection. When **harmonic select** is lit, harmonics 13–24 are available for selection.

2. Select the specific harmonic or harmonics by pressing one or more of the numbered buttons under **harmonic control.**

   The selected button(s) light up. If a button is blinking, the button is controlling the phase, not the harmonic coefficient, as explained below.

   In the display window, the current relative volume of the lowest selected harmonic is shown along with the number of the harmonic.

3. Turn the control knob.

   Changing the value of any harmonic causes the computer to recompute the waveform. If you hold down the **harmonic control** button while you dial the relative volume, the computing of the waveform is delayed until you release the button.

Harmonics can also be programmed using the **numeric display** on the terminal. See the section "Timbre displays."

As you make changes, the display window and terminal displays reflect each new setting. When you play the keyboard, the modifications are heard on every note you play.

| harmonic | ramp | triangle | square | pulse* |
|---|---|---|---|---|
| 1 | 100.0 | 100.0 | 100.0 | 100.0 |
| 2 | 50.0 | – | – | 100.0 |
| 3 | 33.3 | 11.1 | 33.3 | 100.0 |
| 4 | 25.0 | – | – | 100.0 |
| 5 | 20.0 | 4.0 | 20.0 | 100.0 |
| 6 | 16.7 | – | – | 100.0 |
| 7 | 14.3 | 2.0 | 14.3 | 100.0 |
| 8 | 12.5 | – | – | 100.0 |
| 9 | 11.1 | 1.2 | 11.1 | 100.0 |
| 10 | 10.0 | – | – | 100.0 |
| 11 | 9.1 | 0.8 | 9.1 | 100.0 |
| 12 | 8.3 | – | – | 100.0 |
| 13 | 7.7 | 0.6 | 7.7 | 100.0 |
| 14 | 7.1 | – | – | 100.0 |
| 15 | 6.7 | 0.4 | 6.7 | 100.0 |
| 16 | 6.3 | – | – | 100.0 |
| 17 | 5.9 | 0.3 | 5.9 | 100.0 |
| 18 | 5.6 | – | – | 100.0 |
| 19 | 5.3 | 0.3 | 5.3 | 100.0 |
| 20 | 5.0 | – | – | 100.0 |
| 21 | 4.8 | 0.2 | 4.8 | 100.0 |
| 22 | 4.6 | – | – | 100.0 |
| 23 | 4.4 | 0.2 | 4.4 | 100.0 |
| 24 | 4.2 | – | – | 100.0 |

*figure 2.2*
*Harmonic coefficients for selected waveforms*

* An easier way to create a pulse wave is to set the first harmonic at 0.1 or 0.2. A variety of different pulse waves can be created by adding the second and third harmonics at settings of 0.1 or 0.2.

## *Harmonic phase control*

Each harmonic of a sound has a **phase.** The two sine waves shown in the figure opposite have the same frequency and amplitude, but have different phases because they reach their amplitude peaks and cross the horizontal axis at different times.

The phases of all harmonics except the first can be programmed by activating the blinking mode for the **harmonic control** buttons.

1. Press and hold one or more **harmonic control** buttons.

2. Press **harmonic select.**

   The button or buttons blink and

   0 PHASE # [number of harmonic]

   appears in the display window.

3. Turn the control knob and set the phase to a value between 0 and 63.

   These numbers correspond to mathematical values between 0 and 2 pi (0 and 360 degrees).

To return to the harmonic coefficient setting, repeat steps 1 and 2.

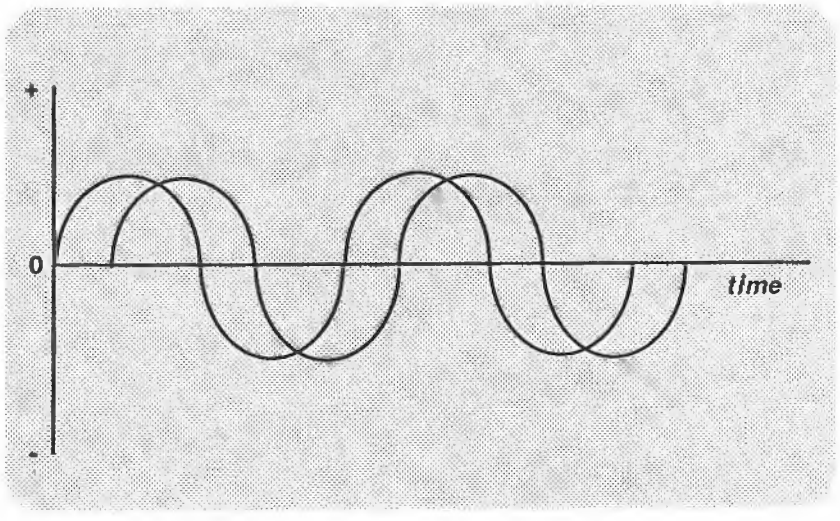



*figure 2.3*
*Sine waves with different phases*

## The volume envelope

A sound, whether a musical tone, sound effect or a piece of dialog, has a beginning, middle and end that is called its **volume envelope** (ve).

### *Creating a volume envelope*

You create the volume envelope by setting four time intervals and two volume levels.

*Time intervals*

| | |
|---|---|
| **delay** | time from key depression to beginning of sound |
| **attack** | time from beginning of sound to peak volume level |
| **initial decay** | time from peak volume level to sustain volume level |
| **final decay** | time from key release to end of sound |

*Volume levels*

| | |
|---|---|
| **peak** | relative volume of sound at the instant attack changes to initial decay |
| **sustain** | relative volume of sound from the end of initial decay to key release |

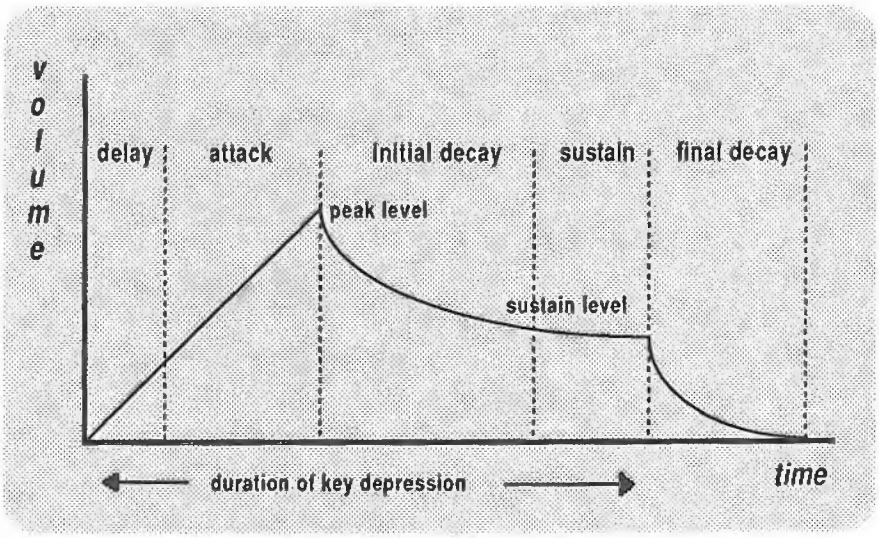
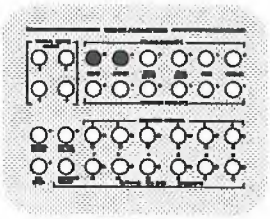
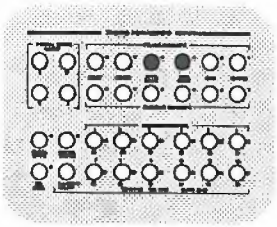



*figure 2.4*
*Typical volume envelope*

## The volume envelope (con't)



*delay, attack*
*panel 1*



*initial decay,*
*final decay*
*panel 1*

### *Setting the volume envelope time intervals*

1. Select the partial timbre you want to change by pressing the appropriate **partial timbre select** button.

2. Press the **delay** button, if you want the sound to start after the key is depressed.

   The button lights.

3. Turn the control knob to select a delay time between 0 and 30,000 milliseconds.

   The value appears in the display window.

4. Press the **attack** button to set the time interval between the beginning of the sound and the peak of the volume envelope.

   The button lights.

5. Turn the control knob and select an attack time interval between 0 and 15,000 milliseconds.

   The value appears in the display window.

6. Press **initial decay** and turn the control knob to select an initial decay time interval between 0 and 30,000 milliseconds.

7. Press **final decay** and turn the control knob to select a final decay time interval between 0 and 30,000 milliseconds.

## *Setting the volume envelope volume levels*

Once the time intervals are programmed, set the volume levels.

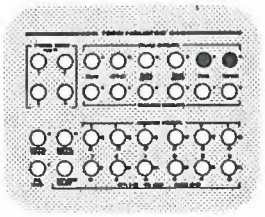
1. Press **peak** and turn the control knob to select a peak volume level between 0 and 100.0. A setting of zero gives no peak volume; a setting of 100.0 gives maximum peak volume.

   The value selected appears in the display window.

2. Press **sustain** and turn the control knob to select a sustain volume level between 0 and 100.0. A setting of zero gives no sound at all; a setting of 100.0 gives maximum sustain volume.

   The value selected appears in the display window.

Although a typical waveform rises to a peak volume and falls off to the sustain level, you can set the peak equal to or less than the sustain level. You can even set the peak at zero.



***peak, sustain***
*panel 1*

## The volume envelope (con't)

### *Different kinds of attacks*

Normally the attack of a note starts with zero volume. But if, when you strike a key, the preceding note of the same pitch and timbre is in final decay, the attack of the new note begins at the current volume level.

With the ability to set the peak volume level at zero, you can assure an initial decrease in volume when the same key is pressed a second time during the final decay of the first note.

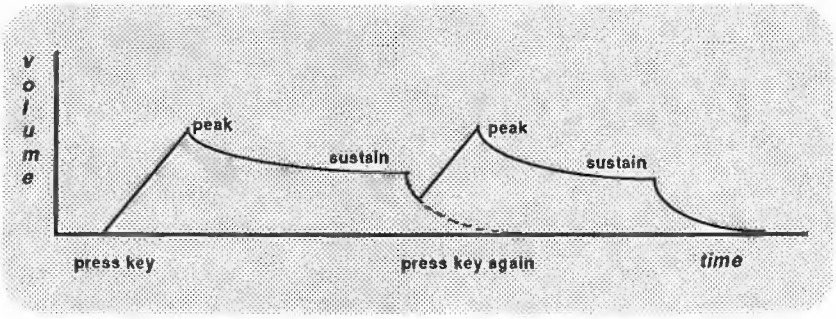



*figure 2.5*
*A repeated note with peak volume greater than sustain volume*

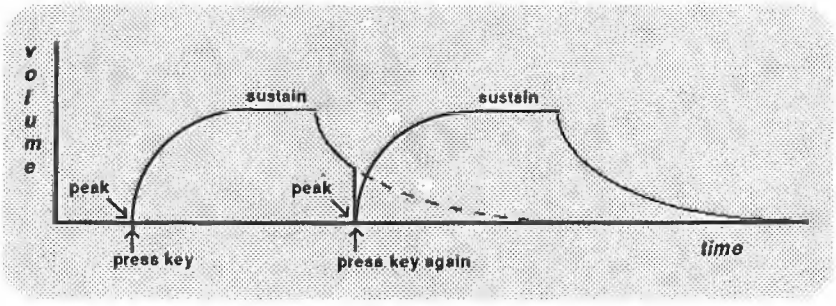



*figure 2.6*
*A repeated note with the peak volume set to zero*

## The volume envelope (con't)

### *Programming a sustaining timbre*

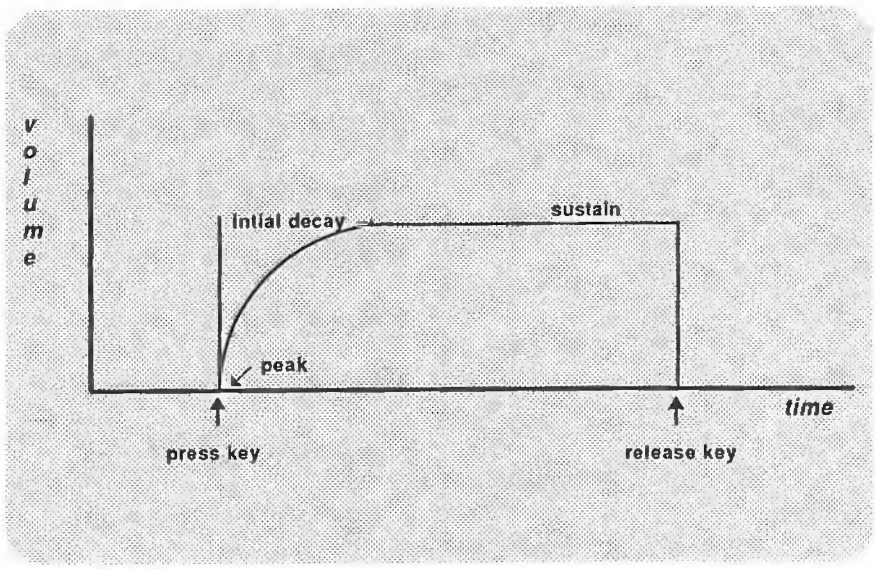
A low peak level and a high sustain level with a long initial decay creates a timbre that rises gradually from zero to a maximum volume without peaking. This makes an effective timbre for notes that seem to swell as you hold them down.

For example, with these settings,

| | |
|---|---|
| **initial decay** | 4000 |
| **peak** | 0 |
| **sustain** | 100 |

a volume envelope like the one on the opposite page is produced. The sound takes four seconds to rise from zero volume to maximum.

*figure 2.7*
*Sustaining timbre*



## The volume envelope (con't)

### *Programming a non-sustaining timbre*

Any sound with a 0.0 sustain volume level is a non-sustaining timbre. Interesting percussion sounds can be created by setting the peak level of a partial timbre to a high level and the sustain level to zero with no attack time and different length initial decay segments.

For example, with volume envelope settings of

| | |
|---|---|
| **delay** | 0 |
| **attack** | 0 |
| **initial decay** | 500 |
| **peak** | 100 |
| **sustain** | 0 |

a waveform like that shown opposite would be produced.

With no attack segment, the volume rises instantly as you press the key to maximum volume. It fades rapidly, no matter how long you hold the key down, since the sustain level is set to zero.

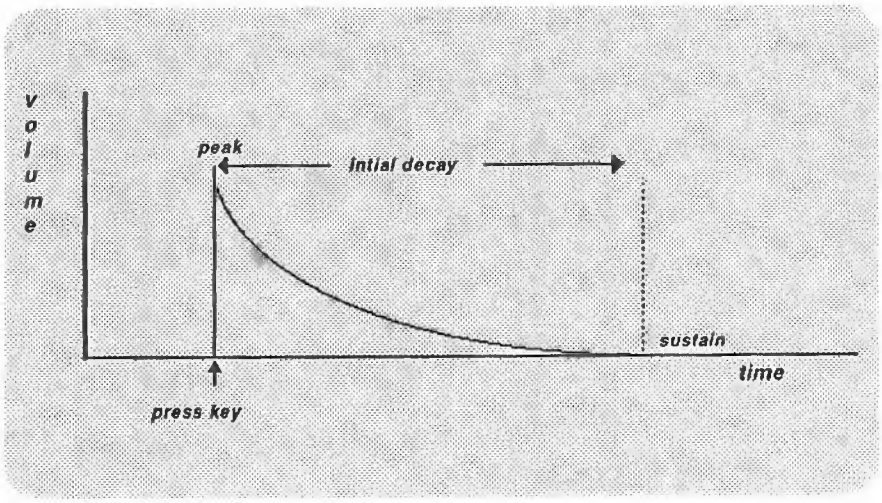



*figure 2.8*
*Non-sustaining timbre*

## The volume envelope (con't)

### *Final decay on non-sustaining timbres*

If you add a final decay to the previously described percussion timbre, you can change the sound as you play by holding the keys down more or less time. That is, when you hold the key down, the sound fades to zero at the end of the initial decay. However, if you release the key **before** the end of the initial decay segment, the long final decay begins while the note is still sounding and decays as programmed for that level. The sustain level of zero is bypassed.

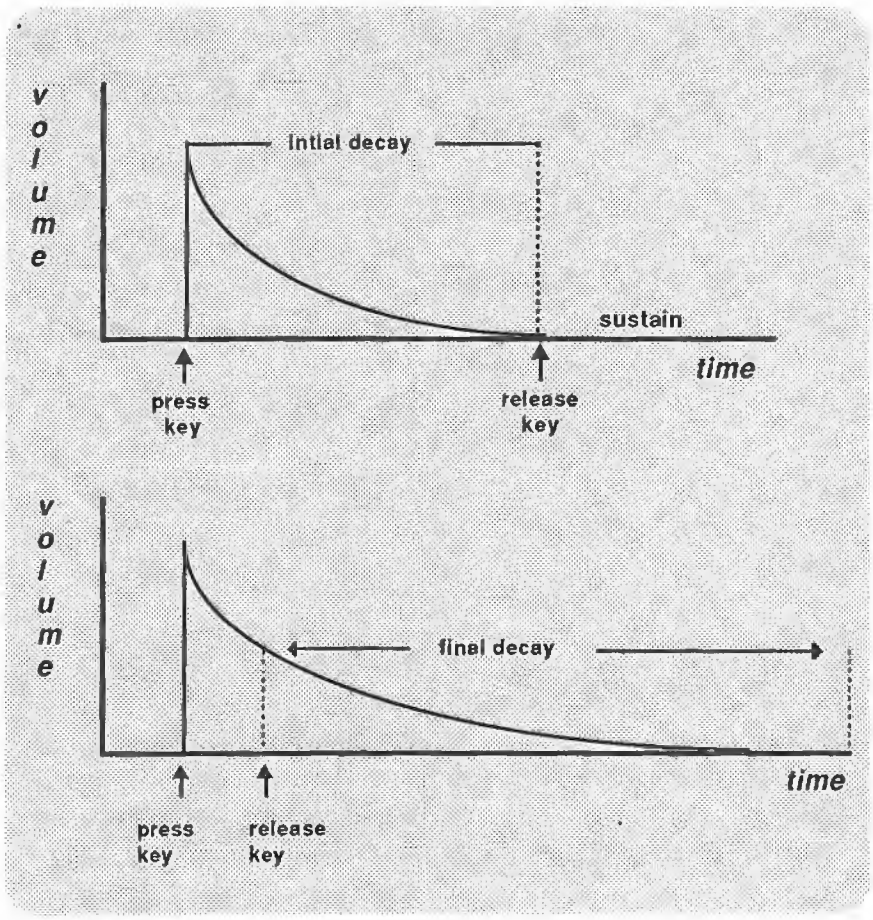
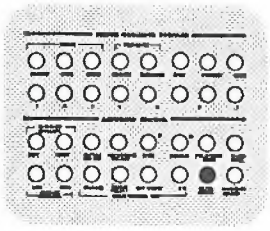



*figure 2.9*
*Non-sustaining timbre with final decay*

## The volume envelope (con't)



*decay adjust panel 4*

### *Adjusting the final decay*

The decay adjust function allows you to program longer final decays for notes with lower pitches. This feature can be used to enhance the realistic quality of certain sounds.

To program a timbre with decay adjust:

1. Press the **decay adjust** button in the fourth panel.

2. Turn the control knob to change the decay adjustment factor from 0.000 to 1.000.

A setting of 0.000 causes all keys on the keyboard to trigger notes with the final decay programmed in the volume and harmonic envelopes.

The sound triggered by the rightmost key on the keyboard always retains the original final decay. As you increase the setting, the final decays gradually increase for all the other keys. A setting of 0.500 doubles the length of the final decays every two octaves to the left of this key. A setting of 1.000, the maximum, doubles the length of the final decays every octave.

1. Select a partial timbre to program.

2. Set the length of the four volume envelope time segments.

   **delay** 0 to 30,000 milliseconds
   **attack** 0 to 15,000 milliseconds
   **initial decay** 0 to 30,000 milliseconds
   **final decay** 0 to 30,000 milliseconds

3. Set the two volume levels.

   **peak** 0 to 100
   **sustain** 0 to 100

4. Use **decay adjust** to adjust final decay from 0.000 to 1.000 if desired.

*figure 2.10*
*Volume envelope summary*