SYNERGY

OWNER'S MANUAL

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Chapter 1.   Introduction

The Synergy is a 74-note all-digital keyboard synthesizer, the first in its price class to include so many voices and features in one console. The console includes two FootSwitches, a two-way Pitch Bend, and a variety of knobs and switches. The 24 voices provided with the Synergy can be patched under user control to the stereo outputs. There is a socket for an External Cartridge which holds more voices, allowing the Synergy to include new, improved voices as they are developed. For the most part, the Synergy handles just like a well-built analog synthesizer. However, it has been designed so that even keyboard players without any analog experience can start making music with it very quickly.

The Synergy is a *polyphonic* synthesizer, which means that the Synergy keyboard can control more than one note playing at a time. More than one *voice* can be played at once, which makes the Synergy a *polytimbral* synthesizer as well. The Synergy keyboard even offers touch-sensitive control of both amplitude *and* timbre, so that you can control changes in the voicing from your fingertips as you play.

Inside the Synergy, there is a small computer, some computer memory, and the digital equivalent of 32 voltage-controlled oscillators. Each oscillator contains the digital equivalent of a voltage-controlled amplifier, with envelope generators (triggered and gated automatically from the keyboard) for both amplitude and frequency. These 32 oscillators are assigned to the 24 voices, depending on which voices are playing. There is also the digital equivalent of a 24-in, 3-out mixer for routing the voices to the stereo outputs.

Playing the Synergy does not require any computer programming. But there are several major advantages to including a computer inside the Synergy. A digital synthesizer will not need to be retuned on stage every time the temperature changes. A digital synthesizer can change patches very quickly, and remember settings for all of its knobs and other controls, even when the power suddenly goes out. The computer in the Synergy can also be

coaxed into being helpful in performance, such as "following" the hands on the keyboard to allow for what will be called the "Floating Split Keyboard."

This manual has been written as a guide for beginning and experienced keyboard players. The Synergy manual can be read chapter by chapter. Musical examples and diagrams are included where needed to make things clearer. There are a few sections that deal with complicated or obscure items; these can be skipped on a first reading. An index is provided, to make the Synergy manual useful as a reference.

But don't just *read* this manual. Stop, when you've finished a section, and try out what's been discussed. Only by making music with these knobs and switches will you really learn what the Synergy can do for you!

Chapter 2.   Single-Voice Mode

This chapter will cover the 24 individual voices provided with the Synergy, played one voice on the keyboard at a time. This is called playing the Synergy in "Single-Voice Mode." It is possible, of course, to play more than one voice on the keyboard at the same time, using "Multi-Voice Mode," which will be introduced in Chapter 9.

Voice Switches

On the front panel of the Synergy there are two rows of 12 switches each. These will be called the **Voice** Switches. In Single-Voice Mode, each **Voice** Switch chooses one of these 24 voices to be played from the keyboard. What could be simpler? Before reading any further, try pressing a **Voice** Switch and playing the keyboard. (The volume controls on the Synergy are the two knobs on the far left of the console; Chapter 7 gives more details).

Voice Lights

Whenever a voice has been selected, the red light in the switch for that voice will turn on. This light will stay on as long as the voice is on, except when you are playing on the keyboard. When the voice has been selected and is currently playing, the light in the switch for that voice will momentarily turn off.

Turning a Voice on and off

When you press a **Voice** Switch once, the corresponding voice is turned on. If you press the same switch again, that voice (and its light) will be turned off. Many of the switches on the Synergy work the same way.

Earlier in this chapter, it says that for Single-Voice Mode, only one voice can be played from the keyboard, and a voice can be turned on and off by pressing the switch for that voice. There is another way for turning on and off voices in Single-Voice Mode. If a voice is turned on, and you press the Voice Switch for another voice, then the first voice will be turned off automatically.

Switching between Voices

If you select another voice while a chord is still sounding, it is important to keep in mind what will happen. There are two possibilities.

Suppose that Voice No. 3 has been selected. You press a Voice Switch to select a new voice (say, Voice No. 7) while you are holding down a chord. All of the notes of the chord will continue to sound in the original voice (in this case, Voice No. 3) until the keys are released. When you lift your hands from the keyboard, the notes will continue to die out in the original voice (Voice No. 3). After all of the notes in this chord have died out, the new voice (Voice No. 7) will be turned on. If you play any notes while the original chord is still sounding, those notes will not be heard.

There is another possible effect of switching between voices. Suppose you play a chord, release the keys for the chord, and then switch to a new voice while the chord is still dying out. In this case the notes of the chord will be cut off as soon as you select the new voice.

In other words, you can control how the Synergy will react when you press a **Voice** Switch in Single-Voice Mode, simply by holding down or releasing keys before the new **Voice** Switch is pressed. This kind of control is one of the many advantages of having a computer included in a digital synthesizer. The computer can sense whether any keys are down when the Voice Switch is pressed, and keep or cut off the remaining notes accordingly.

Chapter 3. General Keyboard Controls:

FootSwitches, Tuning, Pitch Bend (Joystick)

This chapter discusses the FootSwitches, the Joystick (Pitch Bend), and the Tuning Knob. Together, these three controls will be called the General Keyboard Controls, because they affect all of the voices being played from the keyboard.

FootSwitches

There are two FootSwitches provided with the Synergy (see Appendix A for information on connecting them). Both FootSwitches are mounted on one base. The Sustain FootSwitch (on the right) functions like the "sustain" pedal on the piano. If you press this FootSwitch while holding down a key, the note played by the key keeps sounding until the FootSwitch is released. If other keys are played, they will also be sustained. This FootSwitch also controls Portamento, which will be explained in Chapter 4.

The FootSwitch on the left functions like the "middle pedal" on a grand piano. If you press down this FootSwitch while holding a key, that key is sustained; but other keys which are played later are NOT sustained. This is useful, for example, in playing a bass chord which is sustained by the action of this pedal, followed by staccato notes in a higher range.

The Synergy, like all digital synthesizers, can play only so many notes before it starts to run out of oscillators. If you are playing several voices from the keyboard, and you use the FootSwitches extensively, then sometimes complications will occur — for example, a note might be cut off before you release a key. These cases will be explained in more detail in Chapter 13.

Tuning Knob

When the Synergy is turned on, the keyboard is tuned so that the A above middle C is set to be 440 cycles per second, which is the international tuning standard.

The overall tuning of the Synergy can be moved up or down as much as one half step by turning the **Tuning Knob**. Once the knob has been activated (this will be explained in the next paragraph), then the red light above the knob will stay on as long as the knob is moved from a central position. When the knob is set so that the tuning corresponds to A = 440 cycles per second, then the light above the knob will go out again. This knob affects all voices which are currently being played from the keyboard or the **Sequencer**.

Activating a digital knob

The knobs on the Synergy are not exactly like the knobs on analog synthesizers or other keyboard instruments.

When you first unpack and turn on the Synergy, all of the lights next to the knobs should be off. In general, there are times when a knob on the Synergy is "active," and times when it is "inactive." As long as the knob is *inactive,* its light is off and it can be moved to almost any part of its range without having any effect on the parameter which it controls. Before a knob on the Synergy can be used, it must be *activated*.

With the knobs on the Synergy, it is important to remember that there is a difference between the *setting* of a parameter and the *position* of the knob controlling that parameter. The *setting* is the actual value of the parameter, as stored in the computer inside the Synergy. Even though the **Tuning Knob** is moved to the far right, for example, this does not necessarily mean that the keyboard tuning (the *parameter* controlled by the knob) has been moved up from its original setting.

In order to activate one of the digital knobs (in this case, the **Tuning Knob**), turn the knob completely to the left, then completely to the right. When the position of the knob corresponds to the current setting of the parameter which the knob controls, then the red light above the knob will turn on, and the knob will be activated. In general, as long as the red light above the knob is on, the knob is active, and should function like a normal knob. There are many instances in which the knobs on the Synergy are automatically de-activated. It is also possible in some cases to manually de-activate a knob. These cases will be specifically mentioned as the other knobs are introduced in this manual.

Pitch Bend (Joystick)

The **Pitch Bend**, located on the far left of the Synergy, works like the pitch bend on an analog synthesizer. Try playing a chord on the Synergy keyboard; if you move the **Joystick** to the left, the pitch goes down; move it to the right, and the pitch goes up. The **Pitch Bend** affects all of the voices currently being played from the keyboard (but not the voices already recorded in the **Sequencer**). The **Pitch Bend** lever also moves up and down to control "Modulation," which will be explained in Chapter 6.

Restore Switch — Setting the Pitch Bend Throw

The **Pitch Bend Throw** is the maximum change in pitch when the **Joystick** is moved clear to the left or the right of its range. When the Synergy is delivered from the factory, the **Pitch Bend** is set so it will move the note on the keyboard up or down a major second (the distance from C–natural to D–natural). A wider range of **Pitch Bend Throw** is available.

The **Restore Switch** is used to extend the Throw of the **Pitch Bend**. Press the **Restore Switch** once — the light in the switch will come on. Then move the **Joystick** horizontally. The light in the **Restore Switch** will go out, and the **Pitch Bend Throw** will be set to a perfect fifth — the distance from C–natural to the G–natural above. (The **Restore Switch** has other uses, which will be covered in Chapter 5).

Making the **Pitch Bend Throw** smaller than a perfect fifth follows a similar process. Play a note on the keyboard, then "pedal" it using the Sustain **FootSwitch**. With the left hand, move the **Pitch Bend** horizontally until you hear the maximum Throw that you want the **Pitch Bend** to have. Then press the **Set Switch** once. (The **Set Switch** also has other uses, which will be explained in Chapters 10 and 13).

Chapter 4. Voice Controls: Portamento

Voice Controls

Chapter 3 discussed the General Keyboard Controls which affect all of the voices. There is another set of knobs and switches, known as the Voice Controls, which affect only one voice at a time:

Portamento Quantization Switch
Portamento Rate Knob
Vibrato Depth Knob
Vibrato Delay Knob
Vibrato Rate Knob
Transpose Switch
Timbre Center Knob
Timbre Sensitivity Knob
Amplitude Center Knob
Amplitude Sensitivity Knob
Channel Assign Switch

Of these, the Portamento controls will be discussed in this chapter; discussing the other Voice Controls will take up Chapters 6 through 8.

It is important to remember that the Voice Controls will affect only the voice which was most recently selected, no matter whether the Synergy is in Single-Voice Mode or Multi-Voice Mode.

Portamento

"Portamento" is a kind of slide or glide between two pitches (see Figure 4.1a). There are two controls for Portamento: the **Portamento Rate Knob**, and the **Portamento Quantization Switch**. They will be explained below. For now, press the **Portamento Quantization Switch** once, so that the light in the switch comes on. This light must be on in order for Portamento to work. Also, the **Sustain FootSwitch** must be connected (see Chapter 3 and Appendix A).

Turn on a voice, and hold down a key on the keyboard. Press down and hold the **Sustain FootSwitch**. Now press another key on the keyboard, and release the first key. The original note should slowly glide to the pitch of the second key (Figure 4.1a). Release the **FootSwitch** and the second key; the second note will die out.
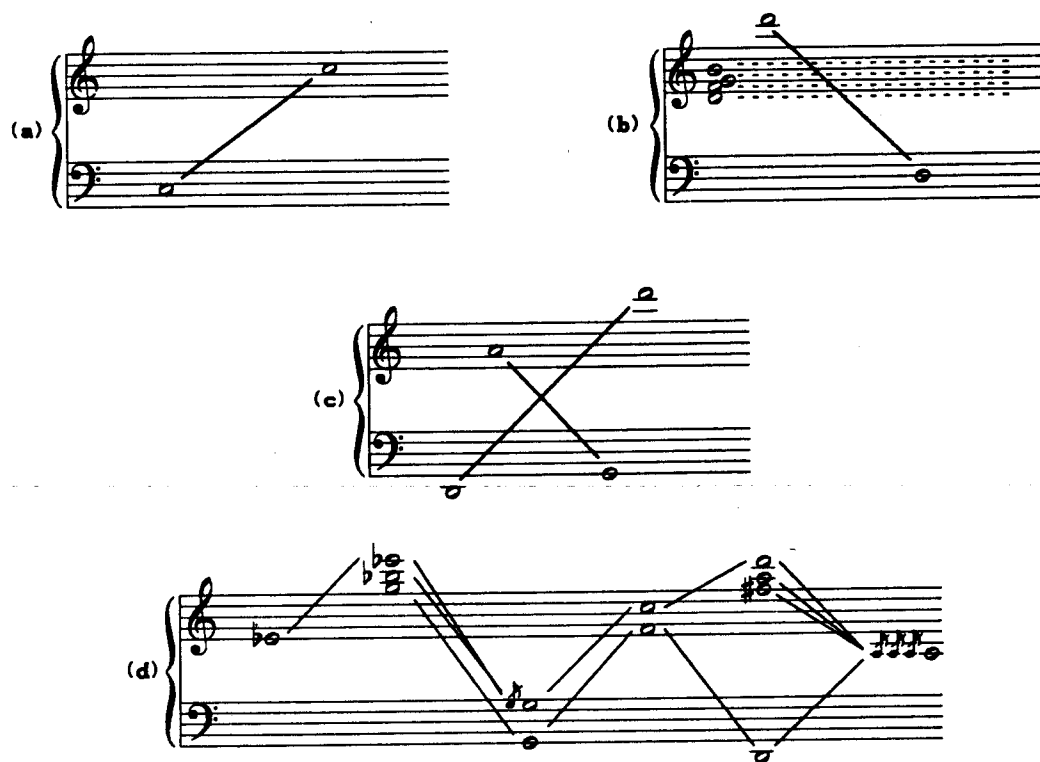
Figure 4.1. Portamento on the Synergy. Portamento can cross through a chord (b), or cross another portamento (c). Portamento can even be used to give the impression of expanding and contracting chords (d) sliding around the keyboard.

Computer-Controlled Portamento

One advantage of having a computer included in a digital synthesizer is that the computer can keep track of complicated portamentos, which is very difficult to do on an analog synthesizer.

For example, play a chord on the keyboard with the left hand, holding down the **Sustain FootSwitch**, and play a note higher than the chord with the right hand. Now lift the right hand and play a note lower than the left-hand chord (but hang onto the chord in the left hand — see Figure 4.1b). The portamento will slide *through* the chord without affecting any of the notes in the chord.

Another possibility involves having two separate portamentos cross each other in opposite directions (Figure 4.1c). If more than one portamento is sounding at one time, remember that the portamentos occur in the order in which the keys were released.

Still another possibility is to have a portamento start on one pitch and end in a chord. Alternatively, you can collapse a thick chord into a smaller chord (Figure 4.1d). To collapse two notes into one, you must play the "target" note twice, as shown by the small notes in Figure 4.1d. In exploring these kinds of portamento, remember that the portamento can only occur if a key is released while the **Sustain FootSwitch** is held down.

Portamento Rate Knob

The **Portamento Rate** Knob functions as its name implies. When the knob is turned to the right, the portamento happens quickly; with the knob in a far-left position, the portamento is quite slow. (Before this knob can have any effect, it must be "activated;" see Chapter 3).

The actual effect of the **Portamento Rate** Knob is actually a little more complicated; if you are not interested in the details now, skip the rest of this paragraph. Suppose that you play a portamento from a C–natural to the C–natural an octave higher. If you now play the portamento from the first C–natural to a note *two* octaves higher, on the Synergy the portamento will take *the same amount of time*. This means that the time needed to get from one note to any other note on the keyboard is held constant, assuming that the **Portamento Rate** Knob is not moved. In other words, when the **Portamento Rate** Knob is changed, then the *time* between notes is affected. There is a musical reason for requiring the time to stay the same. Suppose that two different portamentos start from one note, but landing on different pitches. Since the time for the portamento is constant, both portamentos will land on the destination pitches at the same time, which means that the "target" chords will always play together.

Portamento Quantization Switch

When the Synergy is set up at the factory, Portamento is completely turned off; in this case, the light inside the **Portamento Quantization Switch** is off.

When you press the **Portamento Quantization Switch** once, portamento is turned on, and the portamento from one note to the next is completely smooth.

If you press the **Portamento Quantization Switch** again, the light in the switch will start flashing slowly. The portamento from one note to the next will still be smooth, but only the first note will trigger a new envelope. When the portamento lands on a new note, it will continue using the amplitude and frequency envelopes from the old note, instead of starting up a new set. The section "Portamento effects with one-note voices" in Chapter 13 discusses a special use of this feature.

There is one more setting for the **Portamento Quantization Switch**. Press the **Portamento Quantization Switch** again, and the light in the switch will flash quickly. Now the portamento will occur in half-step steps, with re-triggering of the envelopes. This means that portamento will stop very briefly at each white and black key on the keyboard.

By pressing the **Portamento Quantization Switch** several times, you can select one of the possible Portamento *settings*. After you have stepped through each of these settings, and then you press the **Portamento Quantization Switch** once again, the Portamento is turned off (and the light in the switch goes out), so that the whole cycle can be repeated.

Chapter 5.   The Restore Switch

It will probably happen at some time that the settings for a voice will be so far removed from the original settings that you will decide to do away with all of those changes and start over. The Restore Switch on the Synergy console can be used to erase all of the changes which you have made to a given voice. Press the Restore Switch once. The light for this switch will come on and stay lit. If you decide that you do not want to change a voice after all, then press the Restore Switch again. The light will go off, and no voices will be changed by this switch until you press it again.

To restore a voice to its factory-delivered settings, use the following sequence: press the Restore Switch once, then press the Voice Switch for the particular voice which you want to restore. After you press the Voice Switch, the light in the Restore Switch will be turned off, and the voice will be reset.

The Restore Switch will reset a voice to its original factory settings no matter whether the voice is currently turned on or off. When the voice is turned on and you restore its settings, the voice stays on. If the voice is off, then the voice will stay off. (This works in both Single-Voice Mode and Multi-Voice Mode, which will be explained in Chapter 9.)

Restoring all of the Voices at once

The Restore Switch will normally restore only one voice at a time. If you want to reset several different voices, you must press the Restore Switch every time that you want to restore a new voice.

However, there is a way to reset the *all* of the voices at once to their original factory state. The process is very simple: press the Restore Switch, then press the Cartridge Switch (this switch will be covered in more detail in Chapter 14). When you do this, all of the voice controls (listed above)

for all 24 voices supplied with the Synergy will be reset to their original, factory-delivered values.

Restoring the entire Synergy

Finally, there is a way to reset the *entire* Synergy to its original factory state. The process is again very simple: press the **Restore Switch**, then press the **Save Switch**. In less than 1 second, *all* of the Synergy's settings will be returned to their factory settings.

For the sake of completeness, this includes the following items, some of which will be covered later in this manual:

Turn off all switches
De-activate all knobs
Reset all voices to their factory settings
Clear all four program memories (see Chapter 11)
Clear all Sequencer memory
Set the Cartridge Switch to "internal"
Reset Pitch Bend Throw
Reset Tuning to A = 440 cycles per second

Reset RS-232 interface to "No Parity"
Reset SeqOut to Momentary, Normally Opn.
and Loop Off.
Reset RecOut to Momentary, Normally Open.
Reset Midi to Channel #1, Omni Mode
Disable Midi Input record
Reset Midi output transpose + split.

This will probably not be used very often, because it will erase all of the settings which you have changed for all of the voices.

It is possible, however, that the Synergy (like all digital equipment) will in some cases get "stuck" in some way that is not corrected even by turning the Synergy on and off again. In such a case, if there aren't any repair facilities nearby, you might try performing this kind of overall restore before giving up completely.

~~Other uses for the Restore Switch~~ DELETE

~~The Restore Switch is used in conjunction with the Pitch Bend, see Chapter 3 for further details. The Restore Switch can also be used to clear the Stored Programs, which will be discussed in Chapter 11. Chapter 14 discusses the use of~~ the Restore Switch with the External Cartridge.

Other uses for the RESTORE Switch:

A) When used with the Pitch Bend, the bend range may be expanded.
   See chapter 3 for further details.

B) When used with the Program Switches. the test software is accessed.
   See chapter 11 for further details.

C) Sequencer playback transpositions may be cleared when used with the
   Transpose Switch. For this see chapter 12.

D) When the Restore Switch is pressed twice. the setup display is
   accessed.

   MIDI Input Channel:
        The Midi interface allows the Synergy to respond to
        messages assigned to a Midi channel. If the Synergy
        is not in "omni" mode. the data received will be checked
        for the proper channel number and if the number matches
        the assigned input channel. the Midi command will be
        execiuted. Voice switches #1 through #16 will select
        the corresponding Midi input channel.

   MIDI Poly Mode:
        Voice switch #17. when on. will enable Midi poly mode.
        In this mode. only Midi messages for the selected
        channel will be processed by the Synergy. When off,
        any Midi message will be processed.

   MIDI Local Control Disable:
        Voice switch #18 will disconnect the Synergy keyboard
        from the Synergy sound generation. This allows the
        Synergy to be split into a controller and slave on
        the Midi bus.

   SEQOUT Control:
        This section allows for the programming of the signal
        format used by the "SEQOUT" jack on the back of the
        Synergy. This signal may be used for the control of
        a drum machine or any device requiring syncronous control
        associated with the sequencer start. stop. and optionally
        the loop point.

        Switch #19 off = Select momentary mode.
        Switch #19 on = Select latched mode.
        Switch #20 off = Select normally open.
        Switch #20 on = Select normally closed.
        Switch #21 off = Disabe loop period output
        Switch #21 on = Enable loop period output.

RECOUT Control:
        The record out is a signal generated by pressing
        the record switch while the sequencer is running.
        This signal may be recorded into the sequencer for
        playback at a later time. The output was intended
        to be used as either an external trigger for drum
        machine accents or as a control signal. An example
        would be to control the switching on/off of a
        flanger. DDL. reverb, etc.

        Switch #22 off = Select momentary mode.
        Switch #22 on = Select latched mode.
        Switch #23 off = Select normally open.
        Switch #23 on = Select normally closed.

MASTER-MODE:
        The Synergy may be placed in a state where all keys
        and the pitchbend. modulation. pedals, transpose switch.
        and the sequencer on/off switch will be transmitted to
        another Synergy as well as being used internally. This
        feature allows for a primitive slaving of 2 machines.
        Both machines may be placed in this mode so that the
        the controls listed above will be common to both.
        NOTE: Do not enable this mode when interconnection
        is not implemented. Doing so will freeze the Synergy.

        A special RS-232 cable is required to reverse the
        transmit and receive signals. No handshake signals
        are required. This same cable is used between the
        Kaypro computer and the Synergy.

                SYNERGY #1   SYNERGY #2
                    Pin 2   Pin 3
                    Pin 3   Pin 2
                    Pin 7   Pin 7

        Switch #24 = master mode toggle

PARITY Control:
        The RS-232 interface is always set for a word length
        of 8 data bits. The baud rate is selected by a jumper
        on the interface card (see "Configuration" in
        "Apendix A"). Available rates are 19,200, 9600.
        4800. 2400. 1200. and 600 bits per second. There is
        always one start and one stop bit transmitted.
        Therefore. a minimum of 10 bits are transmitted for each
        byte. An additional parity bit may be programmed using
        the channel assign switch.

        Channel switch off   = NO INTERFACE PRESENT
        Channel switch left = odd parity
        Channel switch right = even parity
        Channel switch both = no parity

Refer to the operating manual for the serial interface
Implemented on the computer you intend to use for the
details concerning necessary handshake and data pattern
requirements.

MIDI Input Record Enable:
When enabled, the data inputed from the Midi channel
is only recorded in the sequencer and is not used by
the Synergy. When the sequencer is played back, the
same data is then transmitted out the Midi output.
This allows an alternate keyboard with no sequencer
to be played in parallel with the Synergy and its
actions to be recorded and played back. The Cartridge
switch controls this function.

E) Keyboard Response Curve Adjustment

The response of the keyboard may be adjusted for the
playing characteristics of a particular musician.
This procedure is intended to be used only if the
Synergy is being played by a person different from
the person who last ran this function. To make the
adjustment, a voice with smooth velocity changes
should be selected and restored. Voice #11 on the
internal voices is a good choice. Be sure the voice
is restored. Now activate the restore switch to the
steady light state and turn the Amplitude Center
control while playing. Adjust the control so that the
Synergy response becomes predictable ie. so that
when you play a key you get the amplitude and timbre
you were trying to get. Now return the restore switch
to off. Some fine tuning of this value may be necessary
when you get used to the touch of the keyboard.
NOTE: This value will be destroyed by either a full
system restore or test program #1.

One further note: the actual weighting of the keys
may be adjusted by a service center for a lighter
or heavier action. This may aid you in adapting to
this uniquely controlled instrument.

Chapter 6.   Voice Controls: Vibrato, Random, Transpose

This chapter will cover how to add vibrato (or random variations) to a voice, and how to transpose a voice up or down by an octave or more.

Vibrato

Vibrato is a more or less slow change in the *frequency* (pitch) of a note. You can add or modify vibrato in the voices provided in the Synergy.

Vibrato Depth Knob

The amount of change which vibrato causes will be called "depth." When you move the Vibrato Depth Knob clear to the right and play a note on the keyboard, the pitch of the note is noticeably changed by the vibrato. As the knob is moved toward the center of its range, the changes in the pitch of the note get smaller and smaller, perhaps so small that they cannot easily be heard. (For this knob to work, it must be activated — see Chapter 3).

When the Vibrato Depth Knob is at the center of its range, then the changes controlled by this knob are completely turned off, and the light above the knob will go out.

When the Vibrato Depth Knob is moved to the left part of its range, the pitch of the note is affected, but not in the same way as with vibrato: the pitch of the notes on the keyboard is affected in a *random* way. Again, the *amount* of the change is controlled by this Vibrato Depth Knob. When the knob is very close to the center of its range, the changes in the pitch of the note are quite small. As the knob is moved further and further to the left, the random changes become more noticeable.

Only the Vibrato Depth Knob makes the selection between *random variations* or *vibrato*. The Vibrato Rate and Vibrato Delay Knobs, introduced in the following sections, will affect vibrato or random variations, whichever has been chosen by the setting of the Vibrato Depth Knob.

Vibrato Rate Knob

As its name implies, this knob controls the speed of the vibrato (or of the random variations). This knob must be activated in order to have any effect. With the knob turned clear to the left, the pitch of the note will be changed slowly; the speed of the changes is increased as the knob is moved to the right.

Vibrato Delay Knob

It is possible to introduce a delay between the time when the key is pressed and the time when the vibrato or random changes take effect. This amount of time is controlled by the Vibrato Delay Knob. Again, this knob must be activated in order to have any effect.

Periodic and Aperiodic Vibrato

There are actually two kinds of vibrato used in some of the voices on the Synergy. For some voices, such as a vibraphone, it is natural for all of the notes to have synchronized vibrato. Other voices, like the flute, have a vibrato which changes from note to note.

The best way to hear this difference is to select some voice supplied with vibrato at the factory. Turn the Vibrato Depth Knob clear to the right, and the Vibrato Rate Knob clear to the left. If any aperiodic vibrato is included, you should heard the slow, random-sounding variations in the voice.

If the voice uses only periodic vibrato and you play a chord, the vibratos for all of the notes will stay together. If there is any aperiodic vibrato in the voice, then the vibratos will wander apart.

What happens if the vibrato on a note has started and you play another note? If the voice contains only periodic vibrato, then the vibrato for the second note will immediately start tracking the vibrato for the first note. Otherwise, the vibrato for both notes will stay independent.

Finally, it's important to remember that the three Vibrato Knobs affect only the voice that was most recently selected with the Voice Switches. This applies even in Multi-Voice Mode, which will be introduced in Chapter 9.

Pitch Bend Modulation

The Pitch Bend was introduced in Chapter 3. This section will cover the vertical motion of the Joystick.

When you move the Joystick up or down, vibrato *depth* is added to all of the voices currently selected on the keyboard. This is known as Modulation, and is simply another way to change temporarily the setting of the Vibrato Depth Knob. Modulation does not change the *rate* or *delay* of vibrato, only the *depth*. In particular, as soon as you move the Joystick from its middle position in the up/down direction, vibrato *depth* is turned off in the appropriate voice(s) for the notes being played on the keyboard, and Modulation takes over. When the Joystick finally returns to the middle of its vertical range, then the note(s) will still have the vibrato completely turned off. If you play a new note in the same voice(s), the new note will have vibrato set according to the Vibrato Depth Knob *until* the Joystick is moved vertically again. In other words, Modulation overrides the setting for the Vibrato Depth Knob only temporarily.

Finally, Modulation does not duplicate all of the functions of the Vibrato Depth Knob: Modulation cannot choose *between* vibrato or random changes. If vibrato has been chosen using the Vibrato Depth Knob, then Modulation will simply change the vibrato depth. If random changes have been chosen with the Vibrato Depth Knob, then Modulation will not affect those notes.

Transpose

The Tuning Knob was already covered in Chapter 3; remember that the Tuning Knob affects all of the voices on the Synergy at once. There is also a switch on the Synergy labelled Transpose. With this switch, it is possible to transpose *one* voice at a time, up or down one or more half steps, and the voice will stay transposed until you reset it. As with the other Voice Controls, the Transpose Switch will affect only the voice which was most recently selected with the Voice Switches.

Starting at middle C, the bottom two octaves of the keyboard (and a few notes besides) are involved in transposing a voice. If you press the Transpose Switch once, then none of the keys in the lower half of the keyboard will sound. Instead, these keys will determine how the voice will be transposed. If you press a key above middle C, then the voice will play in its (transposed) setting.

The second C–natural from the bottom of the keyboard is like a center mark for setting transposition. If you turn on the Transpose Switch and then play a key below this center mark, the entire voice will be transposed down. The amount of transposition can be determined by counting the number of white and black keys (half steps) from the key you pressed, up to the center mark. For example, if you turn on the Transpose Switch and

then press the second B–natural from the bottom of the keyboard, the voice will be moved down one half-step. If you turn on the Transpose Switch and then press the first A–flat from the bottom of the keyboard, the voice will be moved down an octave and a major third.

If you turn on the Transpose Switch and then play a note in the octave directly below middle C, the entire voice will be moved up.

When you are satisfied with the transposition setting, then simply turn off the Transpose Switch, and the transposition for that voice will be remembered as you set it.

If you turn on the Transpose Switch, and then decide not to set the transposition for a voice, simply press the Transpose Switch again. The light above the Transpose Switch and the switch itself will be turned off.

After you have read about Multi-Voice Mode (Chapter 9), experiment with different combinations of transposed and untransposed voices. Some examples will be given in Chapter 10. The use of the Transpose Switch with the Sequencer will be covered in Chapter 12.

MIDI Output Transpose

　　　The Midi output of the Synergy may be transposed seperately.
This allows the play range of a slave keyboard to be superimposed
on the Synergy keyboard at a different base pitch. Press the
"Transpose" switch three times so that the lamp is now flashing
quickly. Use the same key proceedure explained above to change
the Midi output base pitch.

Chapter 7.   Voice Controls: Channel Assign

The Synergy has stereo outputs. Each of the output channels has its own Volume knob, located on the left side of the Synergy. This chapter will cover how to assign each of the voices independently to the output channels.

Channel Assign Switch

The Channel Assign Switch has two lights. When the Synergy is set up at the factory, this switch and both lights are turned off. As long as these lights are off, all of the voices will be sent to both of the Synergy's stereo outputs.

The Channel Assign Switch is one of the Voice Controls. This means that the Channel Assign Switch will affect only one voice at a time — the voice most recently selected with the Voice Switches.

When you press the Channel Assign Switch once, the left-hand light in the switch will be turned on. This means that the voice will be sent only to the left channel. When you press the Channel Assign Switch again, the right-hand light comes on, and the voice goes only to the right channel.

If you press the Channel Assign Switch one more time, both lights will alternate flashing slowly. In this setting, the successive notes played by that voice will alternate between the two channels. When several voices or notes are sounding, the Synergy is set up to keep things interesting by changing the order in which each note will come out of the two channels.

Finally, if you press the Channel Assign Switch again, both lights will be turned off, and the voice will once again be sent to both output channels.

Chapter 12 covers the effects of the Channel Assign Switch setting on recording and playback with the Sequencer.

Chapter 8.   Voice Controls: The Touch-Sensitive Keyboard

While you are playing, you can change the sounds produced by the Synergy simply by striking the keys faster or slower. This chapter will show how to add some of the touch-sensitive features to the voices which do not already have them, and how to adjust the keyboard's touch sensitivity to suit your own playing style.

There are two independent ways of setting up the touch-sensitive keyboard: control of *amplitude* and control of *timbre*, which on the Synergy can include tone color, tremolo speed, and many other aspects of sound. The amplitude part of the touch-sensitive keyboard will be covered first.

Introduction to Keyboard Amplitude Control

The knobs labelled **Amplitude Sensitivity** and **Amplitude Center** will control how the amplitude of the voice reacts to your playing style. Both of these knobs must be activated (see Chapter 3) to have any effect. Remember that these knobs will affect only the voice most recently selected using the Voice Switches.

Amplitude Sensitivity

Move the Amplitude Sensitivity Knob to the far left, and place the Amplitude Center Knob in the middle of its range. When the **Amplitude Sensitivity** Knob is turned to the far left, no matter how fast or how slowly you play the keyboard, all of the notes will have the same loudness. This means that when you turn the Amplitude Sensitivity Knob clear to the left, you will not be able to control the amplitude of the voice *from the keyboard*.

New turn the Amplitude Sensitivity Knob to the right (leave the Center Knob in the middle of its range). The note which is produced for a slow playing speed will be softer than before, and the note produced by a fast playing speed will be louder. With these settings, the amplitude of the voice can be changed somewhat by pressing the keys quickly or slowly.

Move the Amplitude Sensitivity Knob to the far right of its range. When you play a key very slowly, the softest possible note will sound. A very fast playing speed will produce the loudest possible note for that voice. With this setting of the Amplitude Sensitivity Knob, there is a maximum range of amplitudes between the loudest and softest notes playable from the keyboard.

Amplitude Center

Thus far, the Amplitude Center Knob has stayed in one position while the Amplitude Sensitivity Knob was being moved.

When the Amplitude Sensitivity Knob is moved clear to the left, then the *keyboard* control of amplitude is turned off. In this case, the Amplitude Center Knob acts like a volume control for the individual voice. Moving the Amplitude Center Knob to the left makes the voice softer; moving the knob to the right makes the voice louder.

As the Amplitude Sensitivity Knob is moved to the right, the range of keyboard control for amplitude is expanded. The Amplitude Center Knob then controls the relative position of the entire amplitude *range*. Move the Amplitude Center Knob to the left, and the entire range of amplitudes available under keyboard control is moved toward softer notes; move the Amplitude Center Knob to the right, and the entire range is made louder.

Adding Touch Sensitivity to Voices

Many of the voices are set up at the factory to include touch-sensitive control of amplitude. By activating and adjusting the Amplitude Center and Amplitude Sensitivity Knobs, you can modify the touch-sensitive control of amplitude for any of the voices supplied with the Synergy.

In the same way, it is possible to *add* amplitude control to any of the voices that don't already have it. Simply activate the Amplitude Center and Amplitude Sensitivity Knobs, and adjust them to get the touch-sensitive control of amplitude that you want.

Using the Touch-Sensitive Control of Amplitude

Chapter 9 will cover how to play several different voices on the keyboard at once. You may want to skip this section until you have read that chapter.

The Amplitude Center and Amplitude Sensitivity controls can be used to provide a kind of balancing control. Here's how:

A   Figure 8.1   B
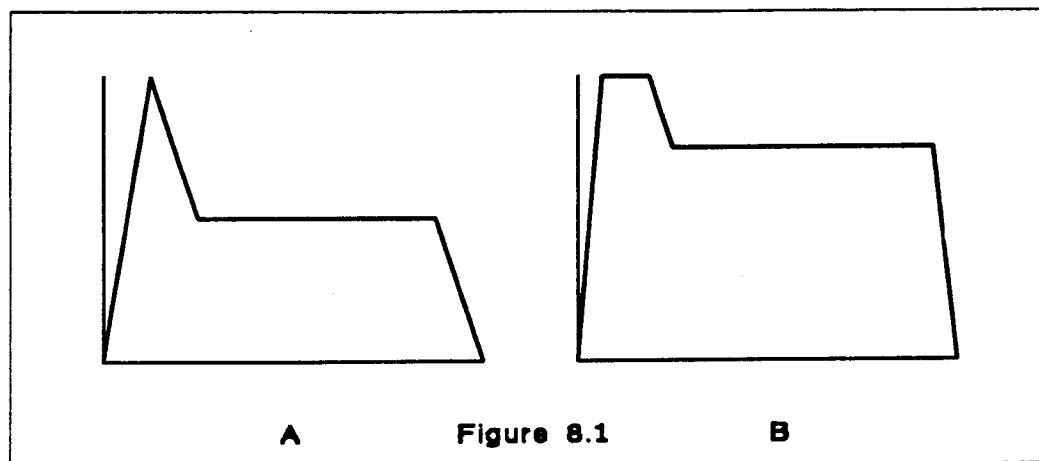
When the **Amplitude Sensitivity Knob** is turned to the far left, the touch-sensitive amplitude control is basically turned off. The **Center Knob** acts like a volume control knob in this case. If you are playing two or more voices at once, it is possible to adjust the amplitudes of the voices so that the Amplitude Center control for one voice is turned to the left, making it quite a bit softer, and the Amplitude Center setting for the other voice is turned to the right, making it louder. This will probably have a noticeable effect in balancing the voices.

There is one potential problem in using these controls for balancing. There are "amplitude envelopes" used inside the Synergy, just like envelopes on the traditional analog synthesizer (except that they can't be changed *directly* from the front panel — only indirectly, using the Center and Sensitivity controls). Many of these envelopes have an outline similar to the ADSR shape produced on many synthesizers, such as is shown in Figure 8.1a. Sometimes it can happen that the amplitude envelope(s) for a particular voice will be squashed somewhat with the **Amplitude Center Knob** turned clear to the right; the result can appear as shown in Figure 8.1b. It may even happen that the output of the Synergy will be overloaded, which would produce audible distortion in the output. For this reason it is best to avoid playing several voices together with their Amplitude Center settings all the way to the right.

Introduction to Keyboard Timbre Control

It is also possible to control the *timbre* of some of the voices supplied with the Synergy. Timbre is a property of sound (like pitch, loudness, etc.) which, among other things, allows us to tell two different instruments apart; timbre also includes qualities like "buzzy" or "reedy" or "hollow."

Some of the voices on the Synergy have been set up so that when the keys on the keyboard are played very slowly, the voice has a given timbre (called Timbre 1 in this chapter), and when the keys go down very quickly, the voice has another timbre (Timbre 2).

Before reading further, select one of the voices; activate the **Timbre Center** and **Timbre Sensitivity** Knobs (see Chapter 3 on activating a knob) and try playing the voice with various settings of the knobs.

Timbre Sensitivity

Activate the **Timbre Center** Knob and move it to the center of its range. With the **Timbre Sensitivity** Knob activated and turned clear to the left, any key speed will cause the voice to produce the same timbre; this timbre will be somewhere between Timbre 1 and Timbre 2.

As the **Timbre Sensitivity** Knob is moved to the right, toward the center of its range, each of the different key speeds will produce a different timbre. A very slow speed will produce Timbre 1, and a very quick playing speed will produce Timbre 2.

The **Timbre Sensitivity** Knob is set up slightly differently from the **Amplitude Sensitivity** Knob. The maximum difference between the two timbres is reached when the **Timbre Sensitivity** knob is set at the middle of its range. This is different from the **Amplitude Sensitivity** Knob, where the most sensitive position is with the knob turned all the way to the right.

Finally, when the **Timbre Sensitivity** Knob is turned to the right past the middle of its range (with the **Timbre Center** Knob still in the middle of its range), there are basically only two timbres which can be produced by the voice. Any slow to moderate playing speed will produce Timbre 1, and anything faster will produce Timbre 2. This is very useful for being able to select between two completely different sounds simply by varying playing speed.

Timbre Center

The **Timbre Center** Knob works just like the **Amplitude Center** Knob. When you move the **Timbre Center** Knob to one side or the other, the range of timbres for the voice is shifted accordingly. Specifically, when the **Timbre Sensitivity** Knob is moved clear to the left (turning off the keyboard control of timbre), moving the **Timbre Center** Knob to the left shifts the timbre of the voice toward Timbre 1; moving the **Timbre Center** Knob to the right shifts the voice toward Timbre 2.

As the **Timbre Sensitivity** Knob is moved to the right, the range of timbres available under keyboard control is expanded. In this case, moving the **Timbre Center** Knob to the right will shift the entire *range* of timbres toward Timbre 2.

Adding Touch-Sensitive Timbre Control to Voices

Some of the voices supplied with the Synergy are set up at the factory so that the touch-sensitive control of timbre has in effect been turned off. If you activate and move the **Timbre Center** and **Timbre Sensitivity** Knobs to modify these voices, you can set up the control of timbre to suit any playing style.

Other voices are adjusted at the factory so that some control of timbre is available from the keyboard whenever the voice is selected. For these voices, you can change the way in which the keyboard controls timbre by activating and moving the **Timbre Center** and **Timbre Sensitivity** Knobs.

There are some voices for which it is impossible to *add* touch-sensitive control of timbre. This is the one major difference between touch-sensitive control of amplitude and timbre on the Synergy. Touch-sensitive control of amplitude can be added to any voice, but touch-sensitive control of timbre will not necessarily work on all of the voices.

How are amplitude and timbre related?

There are two different sets of touch-sensitive controls on the Synergy. *The settings for amplitude control of a voice are completely independent of the settings for timbre control of the same voice.* For example, you can have the amplitude control for a single voice set up so that only loud notes are played; and the timbre can be set up so that the full range of timbres for that voice is available. Alternatively, you can have the amplitude set up for a wide range of amplitudes; and the timbre could be set so that basically only two timbres will be produced.

Setting up the Touch-Sensitive Keyboard for different Voices

Every time you select a new voice using the Voice Switches, the Center and Sensitivity Knobs for both amplitude and timbre are de-activated. When you activate any of these four knobs, the Center and Sensitivity Knobs will affect only the voice which was most recently selected. This means that you can have a different response for amplitude and/or timbre set up for each voice on the Synergy. This should make it possible for you to set up the Synergy keyboard in a variety of ways to suit your different performance needs.

Chapter 9. Multi-Voice Mode

Each voice on the Synergy can be used to play several notes at a time —
which means that the Synergy is a *polyphonic* synthesizer. It is also possible
to have up to four different voices available at any one time on the keyboard,
with the Synergy in Multi-Voice Mode. The first step will be to look at
the controls for getting the voices to play together in unison, which will be
covered in this chapter. Chapter 10 will show how to set up the keyboard so
that the different voices are played separately (for example, split keyboard).
Chapter 11 discusses how to save different groups of voices so that you can
recall them by simply touching one switch.

Save Switch

The **Save** Switch changes the Synergy from Single-Voice Mode to Multi-
Voice Mode. Press the **Save** Switch once, and the light for that switch will
be turned on. Like many other switches on the Synergy, when you press the
switch again, the light will go off.
    In Single-Voice Mode, every time you press a **Voice** Switch to select
a new voice, all of the other voices are turned off. Multi-Voice Mode is
different. When you press a **Voice** Switch in Multi-Voice Mode, the voices
which were already selected will continue to sound from the keyboard, and
the new voice will be added as well. By pressing **Voice** Switches while the
Save Switch is on, you can select up to *four* voices which will play together
when you press a key. As always, to turn a voice off, you can simply press the
switch for that particular voice again. When you are in Multi-Voice Mode,
it is easy to tell which voices are selected, because the lights in the switches
for each of the voices selected will remain lit.

Modifying Voices in Multi-Voice Mode

Sometimes it will be important to remember the order in which you selected the voices in Multi-Voice Mode. One example will be discussed here; Chapter 10 gives others. Suppose that you selected Voices No. 3, 18, 7, and 2, in that order. Now you want to add vibrato to Voice No. 2. The **Vibrato Rate Knob**, like some of the other Synergy controls, will affect the settings for only one voice at a time. When the **Vibrato Rate Knob** is activated, it will change only Voice No. 2, since that was the last voice selected. If you had selected Voices No. 8, 2, and 1, in that order, and then activated the Vibrato Rate Knob, it would affect only Voice No. 1.

Here is the rule:

> *The Voice Controls affect only one voice at a time. The voice which is changed by these controls is the voice which was most recently selected.*

And here's another example. Suppose that you had selected Voices No. 3, 17, 22, and 10, and now you want to change the settings for Voice No. 17. One way to do this, of course, would be to turn off Voices No. 17, 22, and 10, and then turn back on Voice No. 17. But there is an easier way. After you have selected Voices No. 3, 17, 22, and 10, you can turn off Voice No. 17, and then turn it back on again. Now the voice controls will affect only Voice No. 17. This agrees completely with the rule just given.

Selecting more than four Voices

The Synergy is set up so that you can choose up to 4 of the 24 voices to be played from the keyboard at any one time. What happens when you have already selected four voices, and you try to select a fifth? The Synergy simply ignores you when you push more voice switches. If you want to select some other voice after you have selected four voices, then you must turn off one or more of the four voices.

Returning to Single-Voice Mode

The Synergy stays in Multi-Voice Mode as long as the Save Switch is on. When the Save Switch is turned off, the Synergy *stays* in Multi-Voice Mode until a Voice Switch is pressed. Then the Synergy enters Single-Voice Mode, all of the old voices are turned off, and the new voice is turned on.

Chapter 10.   Voice Assignment Modes

Chapter 9 covered Multi-Voice Mode, which is turned on with the **Save** switch. When you select several voices at once, all of the voices play together in unison as you press a key. There are other ways of playing several voices from the Synergy keyboard at the same time. These will be covered in this chapter.

The computer inside the Synergy watches the keys being played on the keyboard and keeps track of which voices are on and off. An advantage of having a computer in the Synergy is that the computer can help decide which notes are to be played using which voice. There have been polyphonic analog synthesizers, but with digital technology there are many more possibilities for the player to explore.

There is a switch on the Synergy console labelled **Voice Assign**. This switch selects one of seven different Voice Assignment Modes, indicated by lights next to the switch. When you first turn on the Synergy, none of the lights should be on.

Find the **Voice Assign** Switch on the console, and press it. The light labelled **Rolling** will be turned on. This means that the "Rolling" Voice Assignment Mode has been selected. Press the switch again, and the mode will change once more. The switch steps through all seven Voice Assignment Modes, one by one. So, after you have pressed the Voice Assign Switch seven times, it will return to the Mode where it started, with none of the Voice Assignment Mode lights on.

Unison Mode

In the Unison Mode, all of the Voice Assignment Mode lights are off. When you first turn on the Synergy, the Voice Assignment Mode will be set to Unison.

In the Unison Mode, when one key is pressed, all of the voices which are available on the keyboard will play together. Suppose that you have selected Voices No. 7, 18, and 23, and you play middle C and the E above middle C. In Unison Mode, all three voices will produce a note at middle C, and all three voices will also produce a note at E above middle C. This means that the Synergy will be playing a total of six different notes, even though only two keys are pressed.

Rolling Mode

Make sure that the Voice Assignment has been switched to Rolling, by pressing the Voice Assign Switch on the Synergy until the light next to "Rolling" on the console is turned on. (Also make sure that the "Key Split" light is off — keep pressing the Voice Assign Switch as necessary until the "Key Split" light is off, and the "Rolling" light is on).

In the "Rolling" Voice Assignment Mode, each new key which is pressed is assigned a new voice, as shown in Figure 10.1a. Each voice in the figure is shown with a separate symbol. The Rolling Voice Assignment Mode can produce a fairly frantic effect, if you have selected several voices and you are playing many notes quickly in both hands.

You can set up the order for "rolling" between the voices. Suppose that you had pressed the switches for Voices No. 16, 3, and 22, in that order. The first voice which you select with the Voice Switches (Voice No. 16) will be the voice assigned to the first key played; it does not matter whether you selected a lower-*numbered* voice later. The second voice which you selected (No. 3) will be played by the second key, and so on. In other words, the order of voices played in Rolling Mode is governed by the order in which the voices were selected.
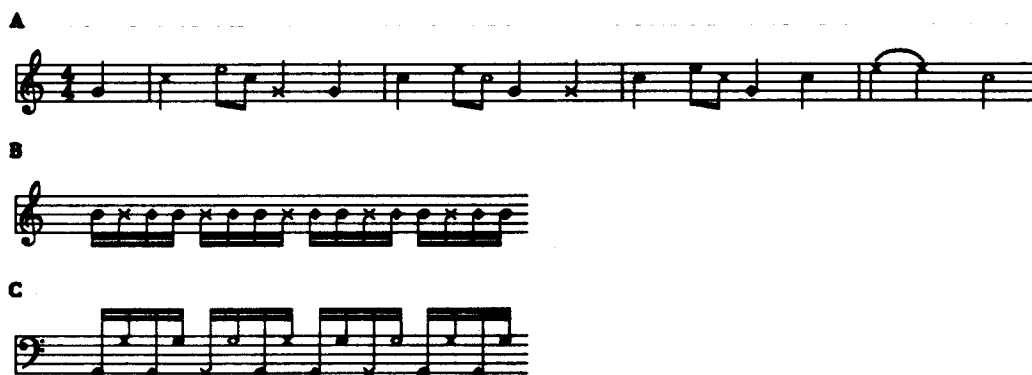

Figure 10.1. The Rolling Voice Assignment Mode.

The simplest way to get a feel for the effects produced by the Rolling Voice Assignment Mode on the Synergy is to play one key several times when several voices have been selected (see Figure 10.1b). Of course, if you play a lead line in the right hand, with chords in the left hand, the combinations of voices can become quite complicated. In this case, successive notes, even in the same melody, can be assigned to different voices!

Another interesting effect is to play a repetitive pattern on the keyboard. Suppose that you have selected four voices in Multi-Voice Mode, with the Rolling Voice Assignment Mode selected. Now play a 5-note pattern, say C–E–G–A–C. Or, with only three voices available on the keyboard, "roll" quickly between two notes an octave apart (see Figure 10.1c).

But the best way to get a feel for this is to select some of the voices on the Synergy and to play around with the Rolling Mode. Take some time off to do this before reading about the other playing modes — it will make it easier to understand the differences between the modes if you have have a feel for them in your fingers.

First Available Mode

If the Voice Assign Switch is set to the "Rolling" Voice Assignment Mode, and you press the Voice Assign Switch once, the "First Available" light on the Synergy console will turn on. (Before reading further, make sure that the "Key Split" light is off — if necessary, step through the Voice Assignment Modes with the Voice Assign Switch until the "Key Split" light is off, and the "First Available" light is on).

The First Available Mode on the Synergy is similar to the Rolling Mode in that the voices are chosen by the computer in the order in which they were turned on with the Voice Switches. But in the First Available Mode, the pattern for assigning voices to notes is more complicated and interesting. Suppose that you had chosen Voices No. 13, 2, and 18, in that order, using the Voice Switches. The first note played will be heard in Voice No. 13. If this first key is released before a second key is played, then the second key will *also* be played by Voice No. 13. (Recall that in Rolling Mode, the second key would be played by Voice No. 2.) As long as only one key is pressed at a time, Voice No. 13 will be used. However, as soon as one key is held down while a second key is played, Voice No. 2 is used for the second key while Voice No. 13 continues to sound on the first key.

If three or more keys are played, something similar to "voice-leading" will happen; as long as two keys are held down, pressing a third key will always cause the same voice to be used for the third key.

This can be exploited by changing your playing style slightly. Suppose you are playing a lead line in the right hand, with accompanying chords in the left hand. If you are careful to play the right hand continuously, then the right-hand melodic line will always be played with the same voice. But if

you let the left hand get the first voice, then the right hand may be shifted to another voice. This can be used to produce some interesting effects.

Key Split

In order to make things easier to explain, skip the "Float Split" Voice Assignment Mode for now. Press the Voice Assign Switch until all of the Voice Assignment Mode lights are off except for "Key Split."

It is possible to divide the keyboard into two halves, so that the computer in the Synergy will automatically assign a different voice to each half. When the Synergy is shipped from the factory, the lower half of the Synergy keyboard (from the bottom note to the B just below middle C) is set up to be the "lower half" of the keyboard, and from middle C on up is the upper half of the keyboard. In Key Split Mode, the first voice which was selected using the Voice Switches is assigned to the lower half of the keyboard, and the last voice selected with the switches is assigned to the upper half. If you have selected more than two voices, then the other voices will be ignored.

If only one voice is on, then it will be played from both halves of the keyboard. This is true for all of the split keyboard options described in the rest of this chapter.

Set Switch — adjusting the Key Split

It is possible to change the position at which the keyboard will be split in the various Split Keyboard Modes (Key Split has already been covered — the others will follow in the rest of this chapter).

On the Synergy console, find the switch labelled Set. Press it once. The red light above the switch should come on. Now press any key on the Synergy keyboard. By pressing this key when the Set light is on, you have changed the dividing point for the two halves of the split keyboard. The light for the Set Switch should now be off. In order to move the position of the keyboard split again, you must press the Set switch again.

When you press the Set switch and then press a key, no note will be produced by the Synergy for that key. However, the next key played will sound as usual (providing, of course, that a voice is on). So you do not have to turn all of the voices off in order to change the position of the keyboard split.

Float Split

Something like Key Split has been used on keyboard instruments (pipe organs, harpsichords) for hundreds of years. For example, Handel played on organs with this feature. This kind of split keyboard has been a common

Figure 10.2. In the Float Split Voice Assignment Mode, the computer inside the Synergy will automatically assign the notes in the right hand to one voice, and the notes in the left hand to the other voice, no matter where the hands are placed on the keyboard.

feature on analog synthesizers, home electronic organs, and other keyboard instruments.

But with a computer inside the Synergy, it is possible to make the keyboard "follow" the player's hands so that, with a few restrictions, the right hand will always play with one voice, and the left hand will always play with the left voice. This will happen even if the left hand is above the initial key split position, or if the right hand is below the initial key split. The Digital Keyboards General Development System was the first all-digital synthesizer to introduce this feature, and the Synergy has it as well.

In order to see how this works, press the Voice Assign Switch until all of the Voice Assignment Mode lights have been turned off except for the "Float Split" light.

In the Key Split Voice Assignment Mode, the first voice selected is assigned to the left hand, and the last voice selected (if there are more than two voices) is played with the right hand. This also holds true for the Float Split Mode. Likewise, the Synergy keyboard is initially set to split at middle C.

Probably the quickest way to understand how the Float Split Mode works is to stop reading this manual, set up the keyboard for Multi-Voice Mode, select two voices, and play with both hands. Depending on how you play, the two voices will track your two hands, no matter where you are on the keyboard!

The rest of this section will cover several different examples showing how the Float Split works, with some cases where the system might not work as you would expect (these are fortunately rare). If you are not interested in the details right now, skip them and come back to this section later.

Basically, the Float Split works as follows. Start with the hands playing two separated chords, such as shown in Figure 10.2. For all practical purposes, one hand can play up to a tenth, that is, an octave and a third. When the computer sees that a key has been pressed in Float Split Mode, it checks

to find the lowest key and the highest key. Suppose that you had played the left-hand chord in Figure 10.2 first. Then the computer would find that C below middle C was the lowest note played, and assign a voice to that note (not just any voice — the first voice selected). Then the computer would scan up the keyboard, looking for notes within a tenth of that lowest note. Any notes in this range (to E above middle C in the bass clef of Figure 10.2) are also assigned to the same voice. Any notes higher than that are assumed to lie in the right hand, and so they are assigned to the other voice. If the notes in the right hand are played first, then the computer will attempt to assign everything to the upper voice within a tenth from the top note. This means that if you jump around on the keyboard, then it is possible for the Float Split to track the hands.

In jumping around the keyboard, it is also possible to force the computer to move the key split. Suppose that you were playing with both hands in the bottom range of the keyboard. Then you want to move up to the area above middle C, with the voices divided between the hands. If you start by playing some notes above middle C, then these notes will be assigned to the upper voice, even if you are playing with the left hand. The way to get around this is to play a very high note first. When this high note is played, the entire keyboard split is moved up, and then the notes played in the left hand around middle C will be heard in the lower voice. You can use the same technique (but in the other direction) to artificially lower the keyboard split after you have been playing in the high part of the keyboard.

When the hands come closer than about two octaves apart, then the keyboard split is set up to lie between the two outer notes. In situations like this, sometimes the computer will get confused about which note to play with which voice. One way to get around this is to arpeggiate the chords just slightly. If you want the computer to assign more notes to the chord in the right hand, then "arpeggiate" the chords in both hands, starting with the top note in the right hand. If you want there to be more notes in the left hand, "arpeggiate" the chords in both hands, starting with the lowest note in the left hand. This arpeggiation can be very quick, in fact so quick that the ear will hear only one chord, but still the keyboard split will occur as desired.

You can explicitly reset the initial keyboard split position, using the Set Switch as discussed earlier in the chapter. Also, when you take your hands off the keyboard for a fairly long period of time, the computer will not reset the keyboard split to middle C (or wherever you have explicitly placed the initial setting). When you come back to the keyboard (after having taken a break, or after playing on some other instruments) the Float Split will be where you left it.

To a limited extent, the two voices can even be crossed. In Figure 10.3, the left hand is holding a chord (dashed lines), and the right hand plays a scale passage down toward the left hand. If the right hand plays between the notes of the chord, as shown in the figure, the computer will still keep track of which voice is supposed to be playing which notes. The right-hand scale
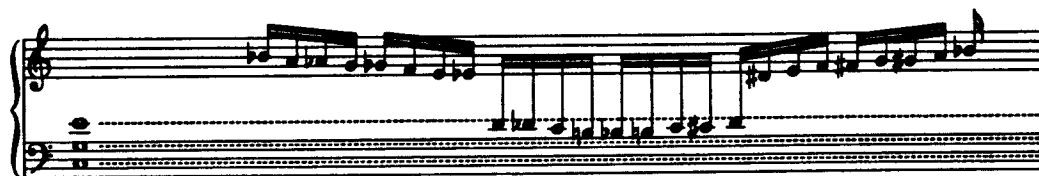
*Figure 10.9. The Float Split Voice Assignment Mode.
The right hand plays a line in one voice which crosses
over part of a chord played in the left hand on a* different
*voice. The computer inside the Synergy keeps track of
which voice is playing which notes.*

passage can then come back out of the chord, still playing with the proper
voice.

Compound Split Keyboard Modes

There are two more combinations of the lights for the Voice Assignment
Modes. In the modes discussed so far, only one of the lights is on. If the Float
Split Voice Assignment Mode is selected, and you press the **Voice Assign**
again, *two* of the lights will come on: **Key Split** and **Rolling**. With this
setup, the first voice which was selected using the **Voice Switches** is played
in the left hand; the other voices are distributed in the right hand according
to the Rolling Mode.

Press the **Voice Assign Switch** again. The **Key Split** light will stay
on, and the **First Available** will come on. In this setting, again the left
hand will play the first voice selected, but now the other voices will be played
in the right hand according to the First Available Mode.

If you press the **Voice Assign Switch** one last time, all of the Voice
Assignment Mode lights will go out, and the Voice Assignment Mode will
return to Unison.

Transposition

Here is an example of the kinds of things that you can do by combining
the Voice Assignment Modes with other features of the Synergy, in this case,
Transposition.

Select a voice and transpose it up an octave. Select another voice and
transpose it *down* an octave. With the Float Split Voice Assignment Mode,
you can play duets in the two hands, keeping the hands, on the average, two
octaves apart. The transposed voices will then sound as though they were

playing in the same range. And no matter where the hands travel on the keyboard, the Float Split will keep the voices apart.

Set Switch - adjusting the Midi Key Split

     The Midi interface output may be programmed to function in
only a specified area of the Synergy keyboard. The <u>Set Switch</u> is
~~used to define this split also.~~

     To program the Midi output to be only left of the split
position. press the Set Switch twice such that the light on the
switch is flashing slowly. Now press the key where you wish Midi
control to stop. The Set light will turn off and only the area
left of the key will send Midi data. This split mode can be used
to disable the Midi output by programming the active area to be
left of the left-most key.

     To program the Midi split to be in the right hand area of
the keyboard. press the Set Switch three times. The light on the
switch will be flashing quickly. Now press the key where you wish
Midi control to start. The Set light will turn off again and only
the area starting with the selected key and right will send Midi
data. This split mode may also be used to remove the Midi split
and allow the Midi output to cover the full range of the keyboard.
To do this. simply program the active area to be right of the left-
most key.

Other Uses of the Set Switch

          Single sequencer track transpose. (see Chapter 12)

          Pitch bend limit (see Chapter 3)

          External program load request (see SYNHCS manual)

          Monophonic voice select (see Chapter 13)

Chapter 11.   Programs

There are many musical situations in which the performer needs to change a large number of settings quickly. This was sometimes a problem on analog synthesizers; changing the settings of 10 or 20 knobs and switches between numbers (or even between sections of one number) is nearly impossible, especially if the changes have to be accurate.

To make the Synergy more flexible, and to allow for quick, accurate recall of the settings for the voices, there is a feature for storing one or more voices, complete with settings for various knobs and switches, as a Program which can be recalled simply by pressing one switch.

Stored Programs

Suppose that you have worked with Voices No. 2, 3, 5, and 8, setting them up so that they can be used in a piece which you will be recording later, or performing as part of a set on stage. You can save these voices in a Stored Program.

There is room in the Synergy for eight Stored Programs, four for the internal voice and four for the external cartridge (discussed in Chapter 14. Each Stored Program can hold up to four different voices. For each voice, the settings for the voice controls are saved:

Portamento Quantization Switch
Portamento Rate Knob
Vibrato Depth Knob
Vibrato Delay Knob
Vibrato Rate Knob
Transpose Switch
Timbre Center Knob
Timbre Sensitivity Knob
Amplitude Center Knob
Amplitude Sensitivity Knob
Channel Assign Switch

In addition, each Stored Program will contain the settings for the following:

Voice Assignment Mode, including Key Split setting
Which voice was most recently selected
Pitch Bend Throw,
Midi Output split.
Midi Output Transpose

Saving a Stored Program

In order to save this information in a Stored Program, the Save Switch (see Chapter 9) must be turned on. With the Save Switch on, simply press one of the four Program Switches on the Synergy console. Then all of the information just listed will be saved, and the light for the Program Switch will be turned on. Whenever the light for one of the Stored Programs is on, something has been stored in that Program's memory.

When you press a Program Switch with the Save Switch turned on, the Save Switch will also be turned off. This means that the keyboard will leave Multi-Voice Mode whenever the next Voice Switch is pressed (this was explained in Chapter 9). This is especially useful when you are performing, you save some voices in a Program, and continue playing until you want to change to a new configuration of voices. Since the Save Switch has been turned off, you only have to press the switch for one (new) voice, and all of the other voices which were playing will be turned off. If you want to stay in Multi-Voice Mode after storing a Program, simply press the Save Switch again.

Recalling a Stored Program

When you want to recall a Program from the Program memory, simply press the switch for the Program which you want to play. Any voices which

are currently turned on will be turned off. Then the voice(s) which you previously recorded into the Stored Program will be activated. Specifically, for each voice in the Stored Program which you recall, the voice control settings and the other information in the Stored Program will replace the current settings on the instrument. *The values active before pressing the Program Switch will be overwritten, and hence lost.*

Restore Switch — ~~erasing a Stored Program~~   see Pg 11-4 thru 11-10

If you decide for some reason to erase a Stored Program, you can do so by pressing first the Restore Switch, and then the switch for the Program to be erased. When this is done, the light for the Program will go out (meaning that the Program memory for that Program is empty), and the Restore Switch will be turned off.

It is not necessary to erase the memory for a Stored Program before storing a new Program. Whenever you store a Program, whatever was stored there before will simply be replaced by the new Program.

The Synergy will simply ignore you if you attempt to select a Stored Program which is completely cleared.

Stored Program Memory

Whatever you save as a Stored Program will be remembered until you store something else into the same Program number, or you clear the Program. In particular, if you turn off the Synergy, the Program will still be there when you turn the Synergy back on.

Restore Switch - Diagnostic Programs

        The Restore switch changes the program switches to access
the internal diagnostic programs. Pressing the restore switch
once so that the lamp is on steady will allow the access of the
first four test programs. Pressing the Restore switch a second time
so that the lamp is flashing will allow access to the second set of
diagnostic routines.

Program #1:   Processor board tests

        When initiated. all the panel lamps will be turned on thus
placing the maximum load on the power supply. The Synergy will remain
in this state for about 23 minutes. During this period.the routine
will verify the proper operation of the dynamic ram. If an error is
encountered. the entire pannel will flash at a 1Hz rate. Following
this. a lamp test is performed. Starting at the left side of the
pannel each lamp will be individually turned on and off. Now the
upper row of voice lights will display the current test number and
if an error is detected, the programmer section will flash
continuously.

        #1 (voice 12 on) is the program rom crc. test. The Synergy
program storage is tested for proper contents. Test time: 1.2 sec.

        #2 (voice 11 on) is a memory test for the internal
voice set editor memory. Test time: 1 sec.

        #3 (voice 11 & 12 on) is a memory test of the external
voice set editor memory. Test time: 1 sec.

        #4 (voice 10 on) is the select logic test for the internal
/external voice memory banks. Test time: 30 msec.

        #5 (voice 10 & 12 on) is the internal voice rom crc. test.
The rom containing the internal voices is tested for proper data
contents. Test time: 1 sec.

        #6 (voice 10 & 11 on) is the VRAM memory test. The memory
used to hold voice data loaded by the external host computer is
tested. Test time: 6 min.

        #7 (voice 10. 11. & 12 on) is the scan processor memory
test. The processor which is responsible for the monitoring of
the keys. switches. and pots is interfaced with the main processor
via a two port memory area. The access to this memory from the
main processor is tested. Test time: 4 sec.

        #8 (voice 9 on) is the oscillator interface test. Like
the scan processor. the oscillator is also interfaced to the
main processor via a two port memory area. This memory is located
on the digital oscillator circuit board. The interface to this
memory is tested. Test time: 9 sec.

Program #2:   Key. Panel. & Pedal test

        This test program uses the upper row of voice lamps to
display the binary identity of each device and the lower row to
display the current value of each device. In the case of a key
the stereo assignment switch will display the key position.
When a key goes down. the left channel lamp will be lighted.
When a key goes up. the right channel lamp will light. If the
latest incoming device is not a key. both channel lamps will
be turned off.

                    DEVICE # (voice switches #6 - #12)

```
------------------------------------------------------
 |  6  |  7  |  8  |  9  |  10  |  11  |  12  |
------------------------------------------------------
    -     -     -     -      -      -      -
    -     -     -     -      -      -       ------- Bit 0
    -     -     -     -      -      ------------- Bit 1
    -     -     -     -      ----------------- Bit 2
    -     -     -      ----------------------- Bit 3
    -     -      --------------------------- Bit 4
    -      ------------------------------- Bit 5
     --------------------------------- Bit 6
```

                    VALUE (voice switches #17 - #24)

```
------------------------------------------------------
 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
------------------------------------------------------
    -    -    -    -    -    -    -    -
    -    -    -    -    -    -    -     ------ Bit 0
    -    -    -    -    -    -     ---------- Bit 1
    -    -    -    -    -     --------------- Bit 2
    -    -    -    -     --------------------- Bit 3
    -    -    -     ------------------------- Bit 4
    -    -     ----------------------------- Bit 5
    -     --------------------------------- Bit 6
     ------------------------------------- Bit 7
```

The device number for the left most key is 00H (H indicates
hex notation. See the explanation at the end of this section.).
The keys are defined sequencially up to the right most key
which has a device number of 49H (73 decimal). The value
in the lower bank of voice switches represents the velocity
of the down or up motion of the key.

Pots have a value range of 02H - 0FFH (255 decimal). The
pots usually move in steps of 2 when rotated slowly. Therefore,
if the current value is an odd number and the pot is rotated
slowly the values reported will always be odd. This is also
true for even numeric values. The reason for this is that the
pot scanning hardware has a built in filter function to prevent
value jittering from the vibration caused by playing the keyboard.

The filter works as follows: If the value change is <2 then the
movement is not reported to the main processor. If the value
change is > or = 2 then the processor is allerted to to pot
in motion. If the current value is odd and the new value is
=>2 and even then the pot will track even values. In this way
the filtering is accomplished without loosing pot resolution.

Pot #	Pot Name
21H	Pitch Bend
25H	Modulation
1DH	Speed
22H	Portamento Rate
1FH	Vibrato Delay
1EH	Vibrato Rate
1CH	Vibrato Depth
18H	Amplitude Center
1BH	Amplitude Sensitivity
19H	Timbre Center
1AH	Timbre Sensitivity
16H	Tuning

Switches are another case entirely. This is because
they are implemented on pot channels. Most of these channels
have two switches tied to them. The method used to sense one
switch from the other on the same channel is that one of the
will go to half value (0C0H > switch > 20H) and the other
will go to minimum value (>21H) when depressed. Either
switch when released will return to maximum value (ie. greater
than 0BFH).

Channel #	Half Value	Minimum Value.
0EH	Voice #13	Voice #1
0DH	Voice #14	Voice #2
08H	Voice #15	Voice #3
09H	Voice #16	Voice #4
0BH	Voice #17	Voice #5
0AH	Voice #18	Voice #6
0CH	Voice #19	Voice #7
15H	Voice #20	Voice #8
14H	Voice #21	Voice #9
13H	Voice #22	Voice #10
12H	Voice #23	Voice #11
11H	Voice #24	Voice #12
02H	Program #1	Program #2
05H	Program #3	Save
01H	Track #4	Portamento Quant.
07H	Seq. ON/OFF	Seq. Record
03H	Seq. Even	Track #1
04H	Voice Assign	Transpose
06H	Program #4	Set
00H	Track #2	Track #3
10H	Cartridge	Channel Assign

OFH	....	Restore
23H	....	Left Pedal
24H	....	Right Pedal

8 Bit Binary / Hexadecimal / Decimal Conversions:

Eight data bits can represent 256 different values.
The weight of each bit is listed below. To convert binary to
decimal, simply add the value of each bit that is set (=1,
lighted) together.

```
bit 0 = 1
bit 1 = 2
bit 2 = 4
bit 3 = 8
bit 4 = 16
bit 5 = 32
bit 6 = 64
bit 7 = 128
```

To convert binary to Hexadecimal (base 16) the binary
word must be divided into 2 digits. The least significant digit
is formed from bits 0 nhrough 3, and the most significant digit
is formed from bits 4 through 7. With 4 bits per digit, each
digit may have 16 possible values. In decimal, these values would
be represented as 0 through 15 but in order to represent the
16 values with one character per hex digit letters are used for
the last 5 values. Using the table below the binary value:
01101100 would be translated to 6C (H)ex.

Binary	Hex	Decimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

To convert Hexadecimal to decimal in 8 bits we multiply the decimal
value of the most significant digit by 16 and add the decimal value
of the least significant digit. Using the 6CH from above as an
example we:

----

    6 hex = 6 decimal so 6 * 16 = 96
    C hex = 12 decimal so 96+12 = 108 = 6CH

Program #3: D/A Converter Test

In this test, again the voice switches are used for control.
The top row of voice switches will produce eleven 16 bit sine
wave tones mapped against a 32KHz. sampling rate from the left
channel. Voice #1 is OFF and Voice #2 nhrough #12 are tones
at octave intervals. Voice switches #13 nhrough #24 do the same
for the right channel. This test is useful for testing the
D/A board for proper operation. At the factory. this test is
used with an oscilloscope. a THD distortion analyzer and a
signiture analyzer. In the field, a scope or a good set of
ears will spot gross errors.

NOTE: The output from this test is at the maximum amplitude that
the Synergy can produce and the lowest frequency is in the range
of 2.4Hz. Therefor do not operate when the unit is connected to
high power amplification equipment. Damage to such equipment may
result from doing so. (Also you would send your sound man screeming
out the back door.)

Program #4: Communications Link Test

This test is for the SIA. The top row of voice lights displays the
status of the USART (universal syncronous/asyncronous receiver
transmitter) as follows:

    Voice #5 = Clear to Send from Host (CTS)
         The host is ready to receive data from Synergy

    Voice #6 = Break Detect (not used by Synergy)

    Voice #7 = Framing error
         Last character received did not have a valid
         stop bit. This used for diagnostics only.

    Voice #8 = Overrun Error
         The host started transmitting before the Synergy
         read the last byte sent.

    Voice #9 = Parity Error
         Indicates Synergy and host do not have equal
         parity setups or data is getting scrambled.

    Voice #10 = Transmitter Enabled
         The Synergy enables the transmitter at startup.
         If this lamp is not on. the interface board is
         defective or missing and therefore the Synergy
         did not enable the interface.

          Voice #11 = Receive Data Available
                    This lamp is on when the interface has new data
                    and the Synergy has not read it yet.

          Voice #12 = Transmitter Buffer Empty
                    This lamp is on when the Synergy is not sending.

The bottom row of voice lights is the value last received by the
Synergy and echoed back to the host. See the value section under
test program #2 for the interpretation of this display.

        Any data terminal or terminal simulator (Kaypro "Term"
program) may be used as a data source. When using a terminal,
the test is simply what ever it typed on the terminal keyboard
should be seen on the screen if all is ok. If no data is being
echoed in the voice lights or on the terminal screen. check to
be sure the data cable is wired correctly and that the terminal
is not in local mode. If incorrect data is echoed. then check
for proper baud rate and data parity settings.

> > > >   S E C O N D   S E T   D I A G N O S T I C S   < < < <

        The next four programs are accessed via the "Restore"
switch pressed a second time such that the lamp is flashing.

Program #1:   RS-232 Loop Test

        This test will check the computer interface without
the aid of a terminal or communications port. To execute.
a special connector (DB-25M) with pins 2 and 3 connected
together must be used. Place the connector in the RS-232
socket located at the rear of the Synergy prior to executing
this test. The Synergy will write and then read all 256 bit
combinations. If the test is successful. the Synergy will
return to it's power up state. If the test fails. the
programmer section of the pannel will flash continuously.

Program #2:   Cartridge Interface Test

        To check the cartridge socket. a known-good cartridge
must be inserted into the receptical prior to selecting this
test. If the cart access is ok then the Synergy will return
to power-on condition. Otherwise, the programmer section of
the pannel will flash continuously.
        The reverse of this test, ie. the receptical is known
to be operational and the cartridge is suspect, will check
for proper cartridge operation.

Program #3:   MIDI Data Path Test

        The Midi interface on the rear of the Synergy is tested
by interconnecting the Midi Out and the Midi In with a known
good Midi cable prior to selecting this test. During the test,
the upper row of voice lights will display the iteration of the
test, and the lower row of voice lights will display the test
status in the event of an error. If the test completes, the
Synergy will return to normal operation. If it fails, the
programmer section of the pannel will flash continuously and
the error code will be displayed in the lower voice lights.

                    Error Codes
                    ----

    1 (voice #24)   = Fifo will not clear.
                             The Synergy can not initialize the
                             Midi interface.

    2 (voice #23)   = Fifo full early.
                             Less than 132 bytes were written when
                             the fifo became full.

  ✓ 3 (voice #23 & 24)   = Fifo will not fill.
                             132 bytes were sent and the fifo is
                             not full.

    4 (voice #22)   = Fifo empty early.
                             While reading the data from the fifo,
                             the empty status was generated prior
                             to 132 reads.

    5 (voice #22 & 24)   = Value error.
                             The data received does not match the
                             data transmitted.

    6 (voice #22 & 23)   = Fifo will not empty.
                             132 bytes read from a full fifo and
                             the empty status is not set.

Chapter 12.   The Sequencer

The Synergy contains a flexible Sequencer which works like the sequencers on analog synthesizers, except that the Sequencer on the Synergy will do much more. Basically, you can play something on the keyboard and have it recorded into the Sequencer for playback later. Up to four different Sequencer tracks can be recorded and played back independently or together. Each track can hold as many different voices and notes as you can play with two hands on the keyboard (the restrictions on this will be covered later in this chapter). As long as the Synergy is plugged in and turned on, the Sequencer will remember whatever is recorded in its four tracks. *When the Synergy is turned off, all information in the* Sequencer *is lost.*

Recording One Track

Among the controls for the Sequencer on the Synergy console, there is a switch labelled **Record**. When you press it once, the light for this switch will come on (and some other things happen, to be discussed later). As with many switches on the Synergy, if you press the **Record** Switch again, the light will go off, and nothing else will happen.

After the light for the **Record** Switch has been turned on, the Sequencer is almost ready to Record; you must also select one of the four Sequencer tracks for recording. To do this, press one of the four Sequencer **Track** Switches while the **Record** light is on. The light for the **Record** Switch will then be turned off, and the light for the Sequencer track will start flashing very quickly.

The final step in setting up a recording is to press the **Sequencer On/Off** Switch. When you are ready to being recording, press this switch; its light will be turned on, and the Sequencer is recording.
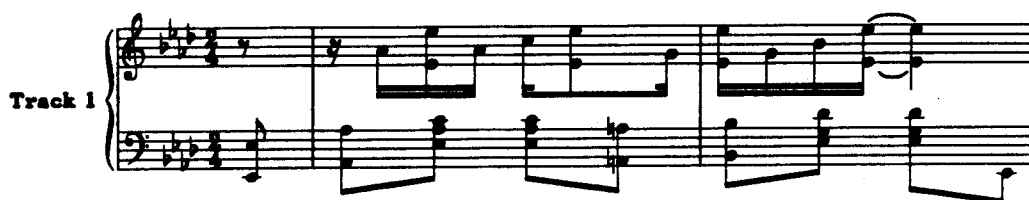
Figure 12.1. Maple Leaf Rag *by Scott Joplin.*

Now all that's missing is some music to record. The examples in this chapter will use the opening few measures of the *Maple Leaf Rag* by Scott Joplin, given in Figure 12.1. If you would rather play something else into the Sequencer, go ahead. But stop reading this manual, and play *something* into the Sequencer.

Anything which you can play on the keyboard can be recorded by the Sequencer. This means that you can use any combination of voices, with any of the Voice Assignment Modes. Portamento, Pitch Bend, Modulation, and the FootSwitches are recorded as well. When the recording is done, press the Sequencer On/Off Switch one last time; the light for that switch will be turned off, and the light for the Sequencer track will stop flashing.

Playing One Track

If everything discussed in the last section worked correctly, something has now been recorded into one of the Sequencer tracks. Playing this material back is even easier. Press the Sequencer On/Off Switch once. The track will start playing back, and Figure 12.2 shows the results. When the track is done, the light for the Sequencer On/Off Switch will be turned off.

Obviously, if you want to stop Playback before the end of the track, you can press the Sequencer On/Off Switch while the track is playing. If you press this switch twice quickly while the track is playing, the same track will start over again "from the top."

Figure 12.2.

For Playback, the light for the **Sequencer** track must be on (not flashing). This is set up automatically after recording. When you turn off the **Sequencer On/Off** Switch, any tracks set to Record are automatically reset to Playback so that you can easily check what was recorded. A **Sequencer** track can also be set up for Playback manually, by pressing the **Sequencer Track** Switch until the light for that track stays on.

Playing along with the Sequencer

While the **Sequencer** is playing back its track(s), you can play on the keyboard, using the same voice or different voices. When the track is being recorded, the **Sequencer** stores which voice was used to play which note(s). Thus, you can record a track onto the **Sequencer** using one voice; when you play back the track, you can turn off the original voice, and then turn on some other voice to play from the keyboard.

Erasing One Track

Erasing a track is very simple. Press the **Record** Switch once. Press the **Sequencer Track** Switch for the track which you want to erase. Press the **Sequencer On/Off** Switch once to turn it on. *Without playing any notes on the keyboard,* turn off the **Sequencer On/Off** Switch. The track will now be completely erased.

If you decide that you don't want to erase the track after all, then don't press the **Sequencer On/Off** Switch. Instead, press the **Record** Switch again to turn off recording, and the track will not be changed in any way.

Sequencer Memory

The **Sequencer** contains its own computer memory. When you turn off the Synergy (or when the power fails, or your roadie accidentally unplugs the Synergy just before you start your act), then the **Sequencer** memory is completely erased. This means that when you turn on the Synergy, the **Sequencer** memory will be blank.

Space Light

The Synergy can hold up to approximately 1950 ~~1750~~ different notes (a note includes key down and key up) in the **Sequencer**. There is a light labelled **Sequencer Space** near the knobs and switches for the **Sequencer** which will warn you that the **Sequencer** is nearly full. This light will start flashing slowly when there is room left in the **Sequencer** for about 100 notes. When the light starts flashing quickly, there is room left for only about 25 notes. If

the light turns on and stays on, the Sequencer is completely full. In order to record anything else, you must erase a track.

The Sequencer as event recorder

Actually, the Sequencer on the Synergy can best be thought of as an event recorder. This means that every time a key on the keyboard is played while you are recording, or when certain other things happen, an entry is made in the Sequencer's memory. For the keys on the keyboard, each entry will contain the following information:

which key was played
which voice(s) were played by the key
velocity of the key
duration (how long the key stayed down)

Every time the Joystick or one of the FootSwitches is moved, an entry is made in the Sequencer's memory as well. The Joystick can be used to record either Pitch Bend or Modulation. It is important to remember that the Joystick can eat up Sequencer space by itself, depending on the Pitch Bend Throw and how fast the Joystick is moved.

Finally, if you press a Sequencer Track Switch while the Sequencer is recording, an event for that switch will be stored in the Sequencer. The uses of this will be covered below, in the section "Using one track to control other tracks." In case of recorded transpositions, only the key down half of key cycle is recorded.

When you are playing back a track from the Sequencer, the information for each event is retrieved from the Sequencer memory and passed on to the synthesizer proper, just as though you yourself were playing the Synergy.

Initial rests

The computer inside the Synergy has been programmed to make the Sequencer more flexible than the sequencers on analog synthesizers. For example, suppose that you waited for a long time to start recording after you had pressed the Sequencer On/Off Switch, so that what you recorded might sound as shown in Figure 12.3. When you record this into a single track, and then play back that track, the initial rests will be chopped off, and the track will start playing immediately when you press the Sequencer On/Off Switch. (If the initial rest is longer than 8 seconds, only the first 8 seconds will be chopped off.) This means that the recording will be played back as shown in Figure 12.2.

The end of the initial rest can also be marked by moving the Joystick or one of the FootSwitches, as implied in the previous section. If nothing

*Figure 12.3. When the track is played back, the initial
rests will be omitted.*

has been recorded into the track yet, then the motion of the **Joystick** or
FootSwitch will mark the begin of the track.

This means that the **Joystick** or **FootSwitches** can be used to *force* an
initial rest into a track. If you are recording a track, and the first thing you
do is to move the **Joystick** or the **FootSwitches**, then any rests thereafter
will actually be recorded as rests.

Repeat

When you press a **Sequencer Track Switch** to select a track for
Playback, the light for that track is turned on and stays on until it is turned
off manually. If you press the **Sequencer Track Switch** again, the light
will start flashing slowly. (Remember that when the light is flashing quickly,
the track is set to Record). Now, when you press the **Sequencer On/Off**
Switch, the track will start playing. But when the end of the track is reached,
the track starts to play back from the beginning. This repeating playback
will continue (see Figure 12.4) until you turn off the **Sequencer On/Off**
Switch. If you hear that there are extra rests before each repeat, or that
some notes seem to be missing, the reasons why will be explained in the next
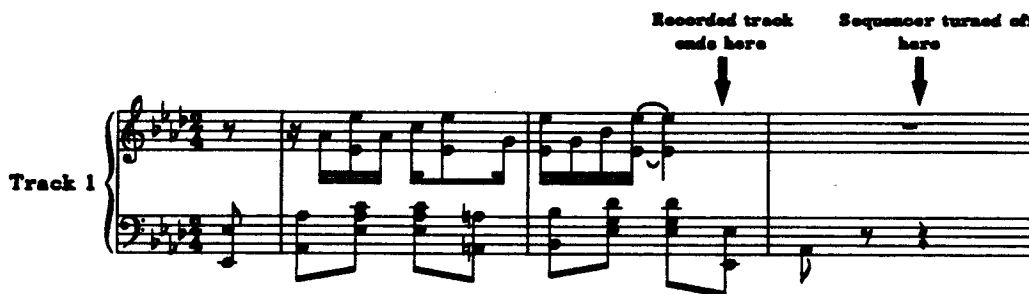section.

Figure 12.4.

Figure 12.5.

Specifying the end of the Track

Whenever you record a track on the Sequencer, the last note which you play has a very important function: it marks the end of the track. It is very important to remember this when recording a track into the Sequencer.

This chapter started with the example given in Figure 12.1. Notice that this example ends with an E–flat in the left hand. Figure 12.2 shows how this would sound when played back. This example is missing that last E–flat. If you want to make sure that the last E–flat is played, then you will have to record an *additional* note! For example, you might record Figure 12.5; When you play this back, then you will hear everything except the very last note, as shown in Figure 12.6.

Here is the rule:

> *The track being recorded cuts off the last note played.*
> *The last note played marks the end of the track, includ-*
> *ing any final rests you want to include.*

Specifying the end of Repeat Tracks

The situation gets even more interesting for a track which will be repeated. Suppose that you wait for a few beats before playing the last note of the recording, so that you end up recording something like Figure 12.7. Again, the recorded track will not end when you turn off the Sequencer On/Off Switch, but with the last note played. In Figure 12.7, the track ends
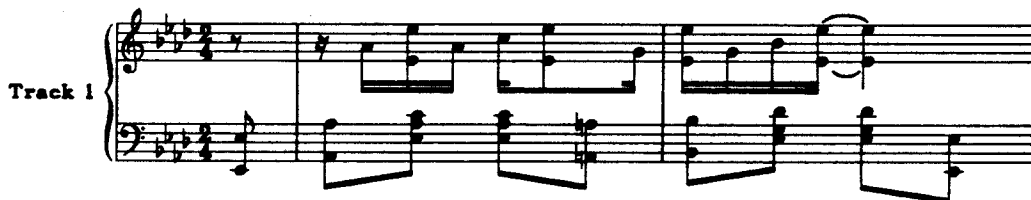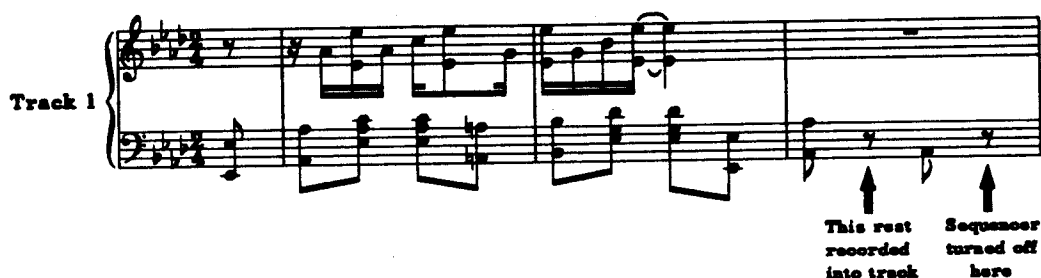

Figure 12.6.

Figure 12.7.

with the A–flat octave in the left hand, followed by a rest which is recorded as part of the track. However, the rest *after* the last note in Figure 12.7 will not be recorded. Now when you play back Figure 12.7 by having the track set to Repeat, it should sound something like the example in Figure 12.8. The syncopation can become even more pronounced, depending on what is recorded.

Sequencer Speed Knob

The Sequencer Speed Knob controls the tempo for playing back tracks from the Sequencer. As with the other knobs, it must be activated (see Chapter 3) before it will have any effect. As you turn the knob to the right, the track(s) being played from the Sequencer will get faster; turning the knob to the left will make them slower.

When the speed is returned to its normal seting, the light above the Sequencer Speed Knob will turn off. In order to make overdubbing easier, the light for the Sequencer Speed Knob will flash slowly when the Sequencer speed is exactly two times normal speed, ~~and will flash quickly when the Sequencer speed is exactly four times normal speed (this setting is all the way to the right on the knob).~~ or ½ normal speed. The overall range of the speed control is ⅓ speed to 3x speed in 127 steps.

Figure 12.8.

The Sequencer Speed Knob has no effect when you are recording into the Sequencer. To be precise, when you begin recording, the Sequencer Speed Knob is de-activated, and the Sequencer speed is returned to its normal setting.

Transposition

Chapter 6 covers how to transpose a voice up or down by one or more half-steps, using the Transpose Switch. This same switch can be used to transpose up or down when you are playing back tracks from the Sequencer.

The Sequencer transposition works like as transposition for a voice. When you press the Transpose Switch, the light for that switch will come on. Then the bottom half of the keyboard, up to middle C, is used for transposing the Sequencer. When you play a track from the Sequencer with the Transpose Switch on, you can play a note below middle C and the Sequencer will be transposed accordingly. You do not need to hold the note down; just pressing it once will cause the transposition to happen. When you want to return the Sequencer to its original setting, play the C below middle C, which is "home base" for this transposition feature.

Earlier in this chapter, it says that you can play along with the Sequencer while the Sequencer is playing back its tracks. This is also possible when the Sequencer transposition feature is turned on, except that you should not play any notes below middle C on the keyboard.

Recording more than one Track

Like the Synergy itself, the Sequencer is completely polyphonic and polytimbral. This means that for any of the four sequencer tracks, you can record more than one note at a time, using more than one voice at a time. You can also play back more than one track at a time, simply to hear the tracks together, or to use the tracks already recorded as guides in recording other tracks.

To see how this works, record the left-hand part of the Joplin *Rag* into Track No. 1 on the Sequencer (see Figure 12.9). After you have recorded this track, you can record the right-hand part into another track, such as Track No. 2. Press the Record Switch, then the Sequencer Track Switch for Track No. 2. Now when you press the Sequencer On/Off Switch, the left-hand part in Track No. 1 will be played while you record the right-hand part (see Figure 12.10 — the *x*'s show what's being played back from the Sequencer). Of course you can finish recording and turn off the Sequencer before all of Track No. 1 is played. In this case, the last note played in Track No. 2 will mark the end of Track No. 2. If you want to hear the last E–flat

Figure 12.9.

octave in the right hand, an extra note such as shown in Figure 12.10 must be included!

Playing back more than one Track

Whenever you turn on the **Sequencer On/Off** Switch, the **Sequencer** will start to play any tracks which have been set to Play or Repeat. Before reading further, listen to both tracks of the Joplin example, just to make sure that they were recorded correctly.

Initial rests

Earlier in this chapter, its says that when you play back an individual track by itself, any initial rests will be removed. When the right-hand part recorded in Track 2 of Figure 12.10 is played (with Track 1 turned off), the initial rests are stripped off. When you play two or more tracks *together*, the first note in any of the tracks will play as soon as the **Sequencer On/Off** Switch is turned on. The initial rests of the other tracks will be changed so that the other tracks will enter at the proper time. This means that if you had initially recorded the tracks as shown in Figure 12.11, then the rests shown in this figure would be omitted from both tracks when you play them back together.

The situation changes slightly when you play back one or more tracks while recording a new track. In this case, all of the initial rests originally recorded in each track set for Playback are reproduced just as they were

Figure 12.10.

This much rest
omitted from
both tracks

First note in any track

Figure 12.11.

recorded. Thus, if you decide to add another track to Figure 12.11, the initial rests will be played back while you are recording the new material.

Can you add rests to the beginning of a track after you have recorded it? No. This is why you would record the left-hand part of the Joplin piece first. When recording several tracks into the Sequencer, it is important to remember this and to plan the tracks in advance.

Sequencer Speed and Transposition

The Sequencer Speed Knob and Transposition features, described earlier in this chapter, affect the Sequencer no matter how many tracks you are playing back. All of the Sequencer tracks being played are affected together.

Repeat Track(s)

When you are playing several tracks together, you can make the Sequencer repeat, just like the Repeat setting introduced above for one voice. To do this, select all of the tracks which are supposed to be playing, using the Sequencer Track Switch, so that the light for each track to be played is on. Then select one or more tracks to Repeat, by pressing the **Sequencer Track Switch** for the appropriate tracks again; the light for any track set to Repeat will flash slowly.

How the tracks actually play and repeat depends on the length of each track. The repeat mechanism is governed by the longest track which is set to Repeat. When the end of this longest Repeat track is reached, it immediately repeats. Any Repeat track or Playback track which has already finished will wait for the repeat to begin. Extra rests will be inserted at the end of the other tracks as necessary.

The Joplin *Rag* will show how this works. Suppose that you had recorded two tracks, with rests at the end as shown in Figure 12.12. If you play this with Track No. 1 set to Repeat, and Track No. 2 set to Playback, the result will be similar to what is shown in Figure 12.4. This example

Figure 12.12.

would be played the same if you had both tracks set to Repeat, since the repeat mechanism depends on the longest track set to Repeat.

The situation is more complicated when there is a Playback track longer than the longest Repeat track. Again, the repeat mechanism is controlled by the longest track which is set to Repeat. If you have a Playback track which is longer than the longest Repeat track, then this Playback track will continue playing after the other tracks have begun to repeat. When the Playback track reaches the end of what was recorded, then rests are inserted automatically until the repeat occurs again, and then all of the tracks start over (including the Repeat track). This can mean that the Playback track which is longer than the longest Repeat track may drop out for a while. This will happen if you set Track No. 1 to Playback, and Track No. 2 to Repeat; the result will be as shown in Figure 12.13.

Figure 12.13. Track 1, recorded as in Figure 12.12, is longer than Track 2. Track 2 is set to repeat. At the end of the first repetition of Track 2, Track 1 is still playing; after it finishes, it drops out temporarily until Track 2 starts again.

Starting and stopping tracks during Playback

When you have recorded several different tracks, you can turn them on and off as the Sequencer is playing. However, the tracks may not start or stop immediately.

When you turn on a Sequencer track while other tracks are already playing back, the new track will not start playing until the longest Repeat track is restarted.

A Sequencer track will continue to play to the end when it is manually turned off.

In a few isolated cases, turning on a Sequencer track while a note played on the keyboard is sounding can cause the note to be cut off. This will be discussed in more detail in Chapter 13.

Silent Track(s)

Earlier, in the section "The Sequencer as Event Recorder," it says that the Sequencer will record events from the Joystick and FootSwitches. This means that it is possible to record a silent track using, say, only one FootSwitch: Instead of playing some notes, simply press the FootSwitch once to "start" the track, and once to "stop" it. Such a track could be useful in some instances. For example, suppose that you have a very short Repeat track, and a very long track set to Playback. A third, "silent" track is recorded with one FootSwitch to be longer than the Repeat track but shorter than the Playback track. You start playing the Sequencer with the "silent" track turned off; after a few repeats, you turn on the "silent" track. The "silent" track is now the longest Repeat track, and *it* will govern the repeat mechanism.

Using one Track to control other Tracks

In the section "The Sequencer as Event Recorder," it says that you can record changes in the settings of the Sequencer Track Switches. This means that a track can turn any track (including itself) off and on at any time. The effect is the same as if you had recorded the track, and then manually pushed the switches at the appropriate time during Playback.

This is useful for doing things like having a track repeat a fixed number of times and then shut down. You can use a Silent Track to start a track some number of times. Or, one track can turn on another track, and turn it off later.

Bear in mind that if a track is turned on, it does not start up immediately. According to the rules given earlier in this chapter, the track will start only when the longest currently playing Repeat track restarts. This means, of course, that if a track is turned on when there are no Repeat tracks playing, it will never get started. Similarly, if one Sequencer track

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Selecting the Single Transpose Track

        In order to take advantage of the single track mode
of the sequencer transpose. a track must be selected. To do
this press the Set Switch such that the lamp is on and not
flashing. Select the track to be singled out for transposition
by pressing the desired track switch. The Set light will turn
off indicating the selection has been made. This selected track
will be the same in both the record and play sequencer modes.

Transposition of Currently Sounding Sequencer Notes

        When the Synergy initializes following power up or a
full system restore. the transpose features of the sequencer
will only affect new notes from the sequencer following a change
in transposition. To enable the transpose to affect currently
sounding sequencer notes. press the Set Switch such that the
light on the switch is on and not flashing. Now press the
Transpose Switch. Repeating the procedure will toggle
the feature off again.

Clearing the Playback Transpose(s)

        The five transposition values used by the sequencer
for playback (4 individual tracks and the global) may be cleared
at any time by activating the Restore Switch followed by the
Transpose Switch. This procedure will also disable the current
sequencer note transpose feature.

Half Speed Recording

        At times it may be difficult to play a very complicated
musical passage into an existing orchestration. In order to
facillitate this. the Synergy has the ability to play back
tracks at 1/2 speed while recording. The data recorded at this
time is syncronized with the sequencer so that when the tracks
that were recorded at normal speed and the tracks recorded at
half speed are played. they sync up. To enable this feature,
press the record switch twice such that the record lamp is
flashing. Now press the track switch for the track in which you
wish to record. The track light will also start flashing. Press
the sequencer "On" switch to start. Any tracks set to play will
do so at 1/2 speed.

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turns off another track. the second track will still play to the
end of the recorded material before stopping.

Transposition During the Record Process

        The transposition of the current playback tracks or
a single playback track may be recorded into the sequencer.
The transposition switch is a four way toggle that may be
changed at any time during the recording process. The four
modes are: Off (light out). all playing tracks (light steady),
single selected track (light flashing slowly), and Midi output
transpose (light flashing quickly).
        In the "all playing tracks" mode. transpositions will
be recorded for all the tracks currently playing while recording.
Other tracks with data that are turned off and the recording
track will be uneffected.
        In the "single selected track" mode, the track selected
via the Set Switch. described later in this chapter, will have
transpositions recorded for it. Track selects may be made at
any time. Note: Since the Synergy initializes at power on to
no track selected, this feature is disabled until a track is
selected. Under this mode. tracks that are off or even empty
may have transpositions recorded for them. One tricky item is
that transpositions may also be recorded for the current record
track but since the keys recorded do not yet belong to the
sequencer, the transpose will not be heard until the track is
played.
        The Midi output transpose is not recorded in the sequencer
but is available at all times.

Transposition During Playback

As in the section above. the transpose switch is a four way
toggle that may be changed at any time during the sequencer
playback.
        In "single selected track" mode the track identified
with the aid of the Set Switch will be transposed. If this
track is being transposed by the recorded data in another
track. then the playback transpose will be added to the
one comming from the other track. As an example. if the
recorded track instructed the selected track to go up a 5th
and the playback transpose is down a 5th then the track
would play at it's recorded pitch.
        In "all playing tracks" mode (light steady), all
tracks will be transposed. This final transposition will
compound all other recorded and playback transpositions.
This is the global transpose.

~~turns off another track, the second track will still play to the end of the recorded material before stopping.~~

Summary of Repeat and Playback Modes

If you are playing back *one* track (whether set to Repeat or Playback Mode), the initial rest (up to 8 seconds) is omitted; rests at the end of the track are retained.

If you are playing *several* tracks in Playback or Repeat Mode, the first note across all of the tracks (see Figure 12.11) is played as soon as the Sequencer On/Off Switch is pressed. The initial rests of the other tracks are shortened accordingly.

If there are any Repeat tracks, the longest Repeat track governs the repeat. Rests are inserted after the end of Playback tracks and other (shorter) Repeat tracks until the longest Repeat track is finished. Then all of the tracks repeat together. Initial rests are omitted in repeats, just like at the beginning of Playback with one track.

If there is a Playback track longer than the longest Repeat track, then it continues playing even though the other tracks have started to repeat. Rests are inserted at the end of this longer Playback track until the other tracks repeat again.

"Even" Feature for Track No. 1

Suppose that you had recorded the left-hand part for the *Maple Leaf Rag* into Track No. 1. Then you decide that it needs to be smoothed out so that the time between notes is exactly the same. The Sequencer Even Switch will do exactly that for whatever is recorded in Track No. 1. When you press the Sequencer Even Switch, the light for this switch will stay on. When you play back Track No. 1, all of the notes in this track, including the initial rests, are evened out so that the notes are evenly spaced. With the Sequencer Speed Knob at its normal setting, this works out to 1/4 second per note. Since the left-hand part of Figure 12.1 contains only eighth notes, this might help smooth out any inconsistencies in the recording. Obviously, doing this to the right-hand part will distort it!

There is a built-in chord detector which looks for chords in the track. A "chord" in this case is any group of notes which have start times very close to each other. When the Even feature finds a "chord" in Track 1, it plays the entire chord on one beat, and plays the next note (or chord) on the following beat.

Re-Orchestrating the Sequencer

To a certain extent, it is possible to change the recording when you are playing it back. In explaining this, it will be helpful to remember that the Voice Controls on the Synergy affect only one individual voice, but other controls affect the Synergy as a whole.

Suppose that you have used Voice No. 3 for recording something into Track No. 2. If you change the Voice Control settings for Voice No. 3 while the track is playing back, then the notes recorded in the track will be affected. Another way of saying this is that the Sequencer "goes through" the Voice Controls rather than recording the Voice Control settings as part of a track. If the settings for Portamento or the stereo outputs are changed, the difference will be especially noticeable.

In order to change the settings of the Voice Controls, recall that you must select the voice using the Voice Switches, and then activate the appropriate knob or press the appropriate switch. You can do this even while the Sequencer is playing. For the Transpose Switch, remember that if any sequencer track is playing, transposition will affect the Sequencer only, not the individual voices.

Selecting a Program may or may not have an effect on the sequencer. Remember that when you select some Program, the settings for as many as four voices can be changed. If the Transposition of a voice is changed by selecting a Program, for example, then selecting a Program will alter the recorded track being played back.

The Voice Controls affect individual voices. There are other features of the Synergy which affect the entire instrument, such as the Tuning Knob, the selection of the external cartridge (to be explained in Chapter 14), and the Volume Knobs for the right and left channels. Any change in these will affect the recorded tracks in the Sequencer. (If you select voices from the external cartridge, in effect you will change the entire orchestration for what is recorded in the Sequencer, which will be explained in more detail in Chapter 14).

During Playback from the Sequencer, you can change the following without having any effect on what is played from the Sequencer:

    Joystick — both Modulation and Pitch Bend
    Voice Assignment Modes
    Single/Multi-Voice Mode
    FootSwitches

For example, this means that if you are pedalling using the Sustain FootSwitch, nothing in the Sequencer will be affected.

Chapter 13. Resources

The Synergy is a polyphonic instrument, which means that you can play more than one note at a time on the keyboard or from the Sequencer. It is also polytimbral, which means that more than one voice can be played together. There are certain limitations, which hold for all digital synthesizers, governing how many notes can be played on how many voices at once. Normally, these limitations will not affect your playing. But it is important to be aware of the nature of the problem, in case the Synergy seems to be doing something that doesn't seem to make sense at first.

In addition to the computer and memory introduced in earlier chapters, the Synergy contains a printed circuit board with 32 digital oscillators. There are 24 voices provided with the Synergy. The 32 oscillators are not permanently assigned to the 24 voices. When you press a key, the computer decides which voice(s) are supposed to play, sets up the envelopes for the oscillators, finds some oscillators which are not in use yet, and starts the note; all of this happens within a fraction of a second. When the note has finished playing, then the computer can use these oscillators for another note. This flexibility in patching the 32 available oscillators is one of the great advantages of digital synthesizers.

Single-Voice Mode

Different voices may require different numbers of oscillators for each note. Suppose that a voice is playing which takes four oscillators to make one note. How many notes can play at once? The math is easy:

32 oscillators divided by 4 oscillators per note = 8 notes.

For a voice which requires five oscillators to produce one note, a maximum of six notes will play at once. In this case, two oscillators will be left over. As a final example, a voice which requires only two oscillators per note will play as many as sixteen notes at once.

Multi-Voice Mode: Unison Voice Assignment

When more than one voice is being played from the keyboard at once, the computer attempts to divide up the oscillators among the voices so that the greatest number of notes can be played by the greatest number of voices. At the same time, the computer tries to minimize the number of oscillators left unused.

Suppose that a voice which requires three oscillators per note is playing along with another voice which takes four oscillators to make one note. Obviously, there can be at least four notes in both voices, since

4 notes × 3 oscillators per note for the first voice

+ 4 notes × 4 oscillators per note for the second voice

= 28 oscillators,

which is less than 32. How about 5 notes? Not quite, since

5 notes × 3 oscillators per note

+ 5 notes × 4 oscillators per note

= 35 oscillators,

which is more than the Synergy contains.

This process operates in a similar manner, no matter how many voices are selected. If you add a second voice which requires four oscillators per note, then only *three* notes can be played on the keyboard at once:

3 notes × 3 oscillators per note

+ 3 notes × 3 oscillators per note

+ 3 notes × 4 oscillators per note (in the other voice)

= 30 oscillators.

Obviously, in Unison mode, the more voices selected at once, the fewer notes which can be played on the keyboard at a time.

Split Keyboard

When a split keyboard Voice Assignment Mode is selected, the situation is changed just slightly. Remember that in the split keyboard modes, only two voices can be played at one time: one in the left hand, and one in the right. If three or more voices are selected, then some of the voices are effectively being wasted. And the notes which belong to those voices are also being wasted. When selecting split keyboard modes, it makes sense to turn off the voices that aren't being used.

Rolling, First Available

These two Voice Assignment Modes are slightly different from Unison and the split keyboard modes when it comes to assigning oscillators to voices. In these Voice Assignment Modes, only one voice is played for each key pressed on the keyboard.

This will change the example presented earlier, where there was a voice with four oscillators per note and another voice with three oscillators per note. With Rolling or First Available Modes, a total of at least eight notes can be played at once:

4 notes × 3 oscillators per note for the first voice

+ 4 notes × 4 oscillators per note for the second voice

= 28 oscillators,

This would leave four oscillators unused. These four oscillators *could* be used to play another note with the three-oscillator voice, making a total of nine notes requiring 31 oscillators. But in general it would make more sense to use the last four oscillators for the four-oscillator voice, for a total of nine notes with 32 oscillators. In other words, *all of the oscillators are used up whenever possible.*

What happens when you play too many notes

Returning to Single-Voice Mode, if one voice is selected which requires four oscillators to produce one note, then as many as eight notes can be played. Suppose that the chord shown in Figure 13.1 is being held. Now the A above middle C is played, as shown in Figure 13.2. On some digital synthesizers, the new note simply will not play until you release some other note. But on the Synergy, and on some other digital synthesizers, one of the notes being played is stopped to make room for the new note.

On the Synergy, it is easy for you the player to know which note will be sacrificed. Here is the rule:
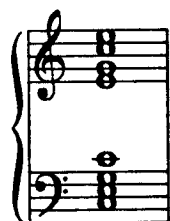
Figure 13.1.   *Figure 13.2.*

When all of the available notes have been used up, and a new note is played, then one of the old notes is released by the computer in the Synergy. The lowest note being held is never released in this way. Instead, the computer automatically finishes the oldest note above the lowest note, and then plays the new note.

Suppose that the chord in Figure 13.1 is arpeggiated, as shown in Figure 13.3, and then the "extra" note at A above middle C is added. As Figure 13.3 shows, the lowest E will be released, because it is the oldest note in the chord, and it is not the lowest note.

If the chord is arpeggiated from the top, as shown in Figure 13.4, then the oldest note (the E at the *top* of the chord) will be automatically finished by the computer inside the Synergy, making room for a new note to be played. In this way, the Synergy attempts to provide a musically "reasonable" solution to the problem of running out of oscillators when "too many" notes are played.

This E♮ will be released

Figure 13.3.

This E♮ will be released

Figure 13.4.