CRUMAR®

STRATUS

OWNER'S MANUAL

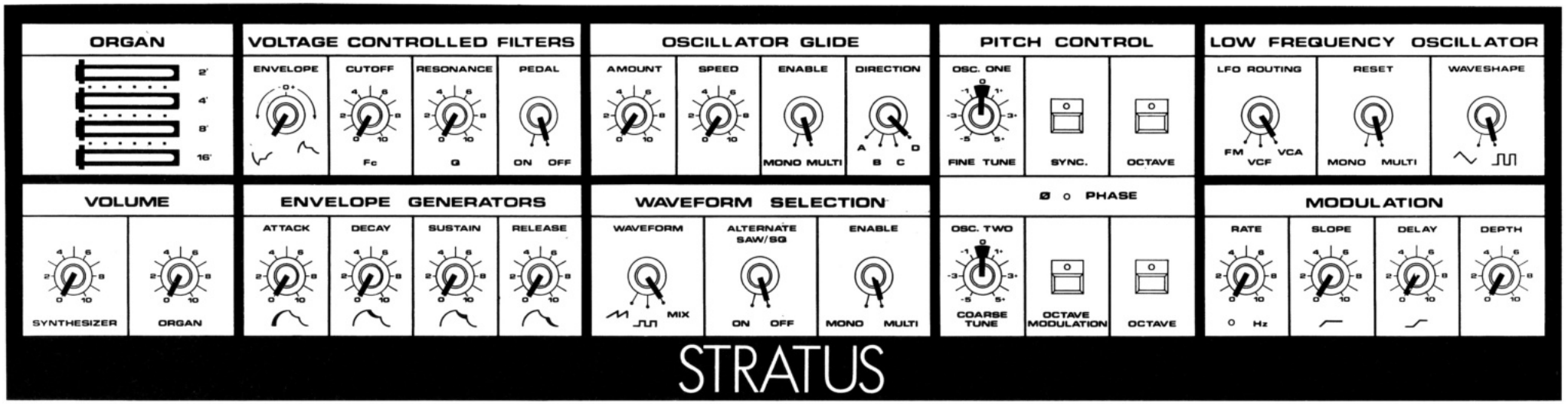
by: TOM RHEA

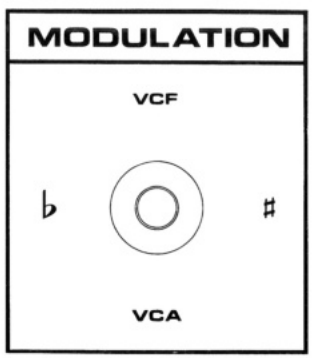
INTRODUCTION

Welcome to the **dual** *sound worlds of the Crumar STRATUS.*
Your STRATUS is literally two instruments in one: an organ with extensive tuning and footage mixture capability, and a flexible voltage-controlled polyphonic synthesizer.
This manual introduces you to both. First we have a brief introduction to the two instruments in the STRATUS, including an easy-to-remember sound check and tuning procedure.
Following this are several instructive sound charts that demonstrate a small portion of versatility of the STRATUS; each sound chart demonstrates a different facet of STRATUS capabilities **in sound** *- with brief commentary.*
Then we go on a musical tour of the STRATUS that explains the function of every front panel knob, switch, and slider; this section is organized in terms of **musical** *topics such as* **vibrato, delayed vibrato, tremolo,** *etc. rather than engineering jargon. Next we have a section that explains "STRATUS Polyphony".*
The manual ends with some comments on the use of rear panel jacks that enhances musicality.
Before getting started, a few suggestions. Unpack the STRATUS and keep the box if you anticipate needing to ship your instrument in the future.
BEFORE YOU CONNECT THE STRATUS TO ELECTRICAL POWER check the small plate on the back of the instrument to confirm that you are using the appropriate voltage (117 volts in the United States).
To start exploration, connect the POLYSYNTH output jack on the rear to the **audio input** *of your amplifier, keeping amp volume low until the sound check/tuning procedure is done.*

PREPARATORY PATTERN

In time you will become familiar with every feature of the STRATUS. Until then it is handy to have a starting point and a tuning procedure that is easy to remember. When starting, set all front panel controls to the PREPARATORY PATTERN as shown:



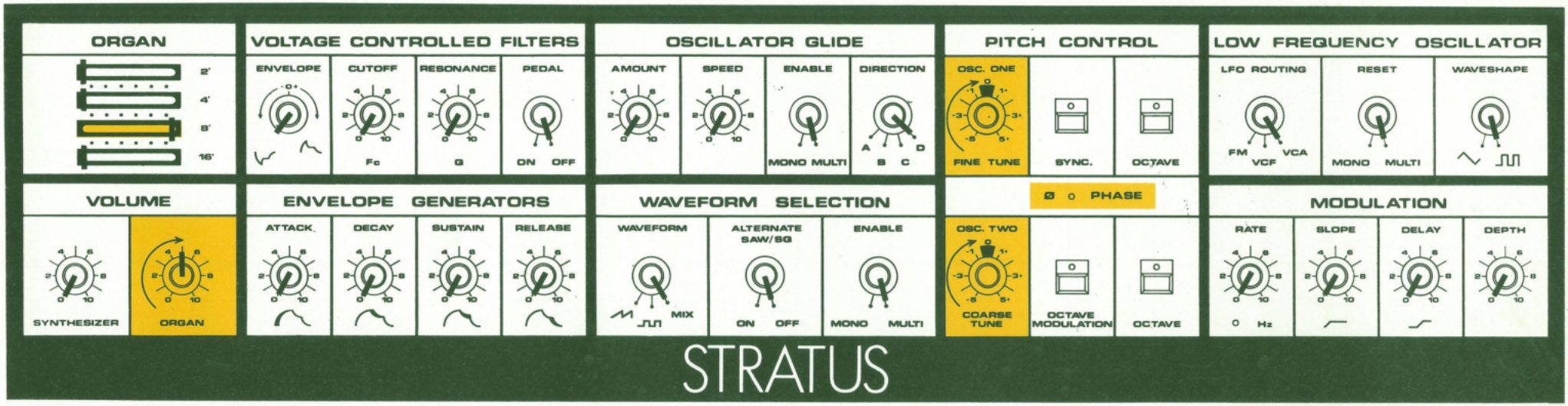


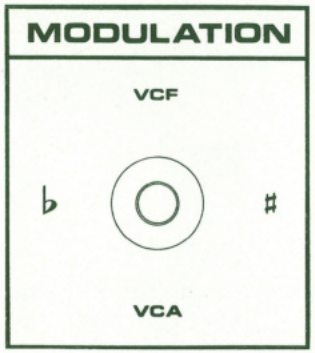
1) Turn all knobs and rotary switches fully **counterclockwise.**
2) Place all slidepots to the **left.**
3) Place all push switches **off** (lights out).

You may have noticed that the rotary switches have different-colored caps to help you distinguish them from the other knobs.

TUNING: LISTEN TO THE ORGAN

The synthesizer and the organ within the STRATUS **share** the same tone generators, or **audio oscillators.** When you tune, **both** instruments are tuned simultaneously. Since the organ is less complicated than the synthesizer, listen to the organ when tuning. Do the following:





1. - Start by placing front panel controls to the PREPARATORY PATTERN (controls counterclockwise, left, or off).

2. - Slide the 8' slider in the ORGAN section completely to the right.

3. - Hold a key down and turn the ORGAN knob in the VOLUME section clockwise to a high setting; adjust amp volume if necessary.

4. - Turn the OSC. TWO COARSE TUNE knob in the PITCH CONTROL section to its midpoint (zero) position; you may feel it "click" into place.

5. - Turn the OSC. ONE FINE TUNE knob in the PITCH CONTROL section to its mid point position (also zero).

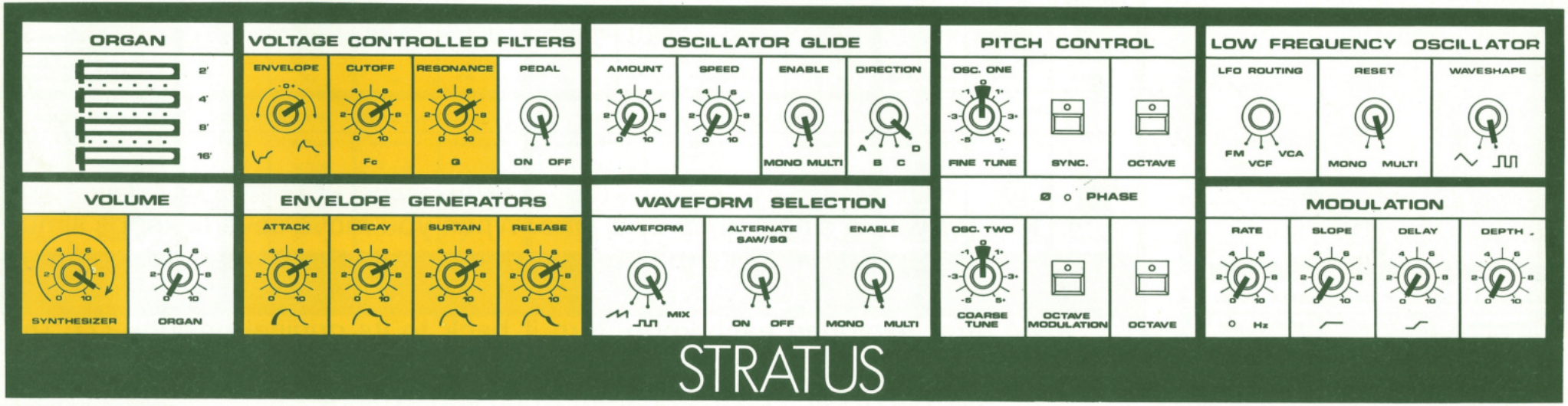
6. - Adjust the OSC. ONE FINE TUNE knob until the two oscillators agree in pitch. Watch the PHASE lamp to gauge their agreement; when the PHASE lamp stops blinking, the oscillators are exactly in tune. (A slight mistuning gives a movement to the tone and is desirable).

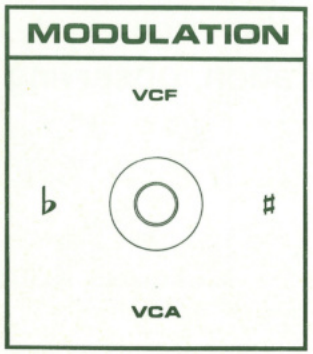
Now that the STRATUS is tuned, you can explore the ORGAN sliders, which are **footage** controls. The term footage is borrowed from pipe organ terminology; it literally represents the lengths of pipes. The longer "pipes" on the STRATUS are represented with larger numbers — the "pipes" are longer — just as they are on the pipe organ. Mixtures of the four footages using different ORGAN slider patterns produces different organ tone colors.

Notice that the STRATUS organ has the typical organ keying response: a tone starts and stops almost instantly on depression and release of a key; the tone sustains at full volume as long as a key is held. But the STRATUS organ offers some unusual features (glide, delayed vibrato, etc.) that distinguish it from more traditional instruments — as we shall see during the Musical Tour of the instrument.

SYNTH SOUND CHECK

What does a polyphonic synthesizer offer that an organ doesn't? Greater capability to color and articulate sound. For a brief introduction to this aspect of the STRATUS synthesizer do the following:





1. - Set up the PREPARATORY PATTERN

2. - Perform the TUNING procedure; this tunes the synthesizer as well as the organ.

3. - Set up the LUCKY 7 SYNTH sound chart as shown by turning the seven controls in the VOLTAGE CONTROLLED FILTERS and ENVELOPE GENERATORS sections to 7. "Turn seven to 7".

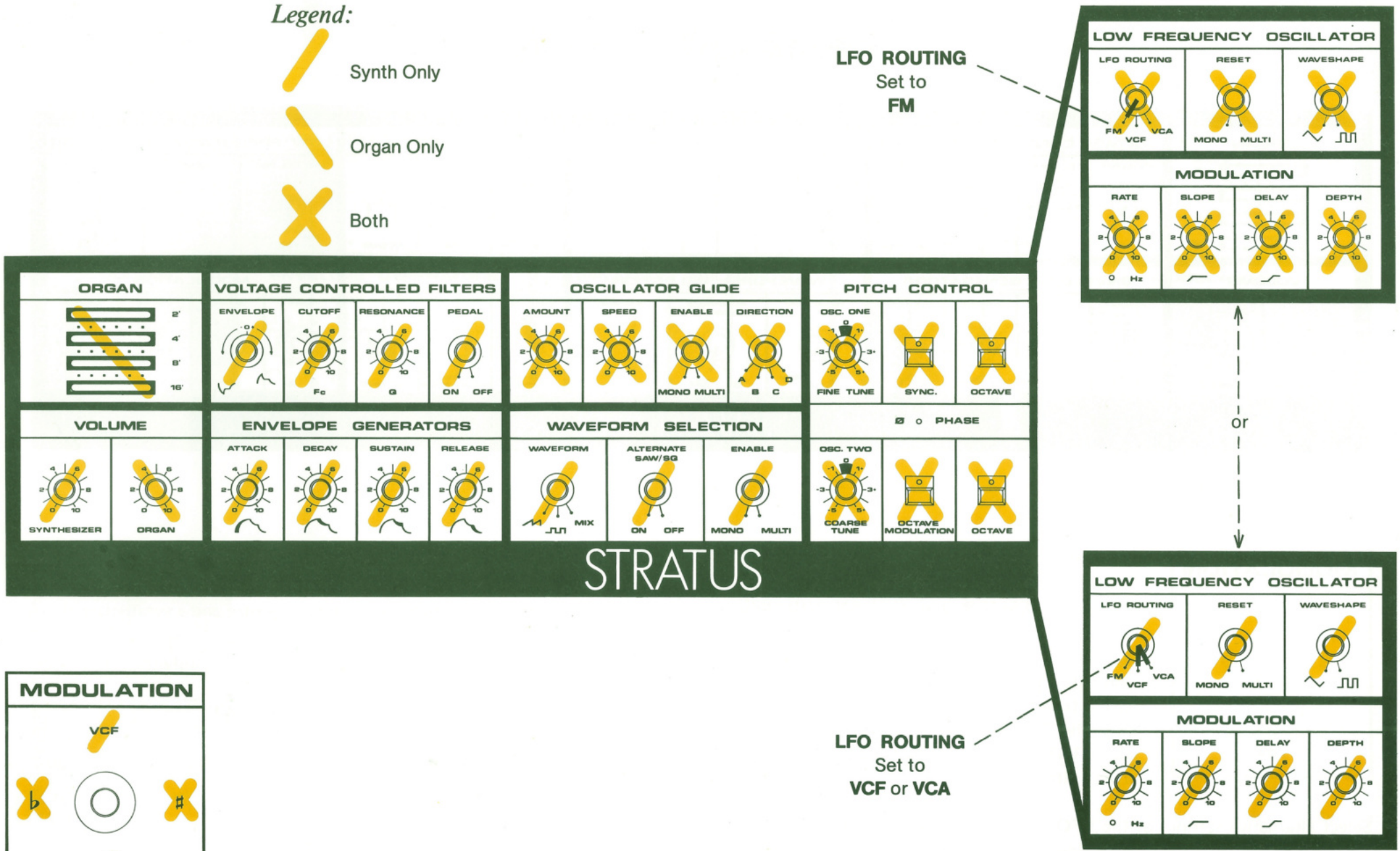
4. - Turn the SYNTHESIZER knob in the VOLUME section clockwise to a high setting. Adjust amp volume if necessary.

Since the STRATUS is two instruments in one, it is particularly important to know **which** instrument is contributing what sound to the sound mix. The VOLUME section knobs govern the final mix when the POLYSYNTH jack on the rear of the instrument is connected to your amp. To listen to only one instrument or the other requires turning one of the VOLUME knobs to zero. For now, turn the ORGAN knob off (to zero) so you can hear the sound of the synthesizer alone. Explore the seven knobs indicated. Here are some suggestion to help you learn when you explore:

1. - Play with a single knob at a time. When you move several knobs simultaneously it is difficult to determine the contribution of an individual knob.

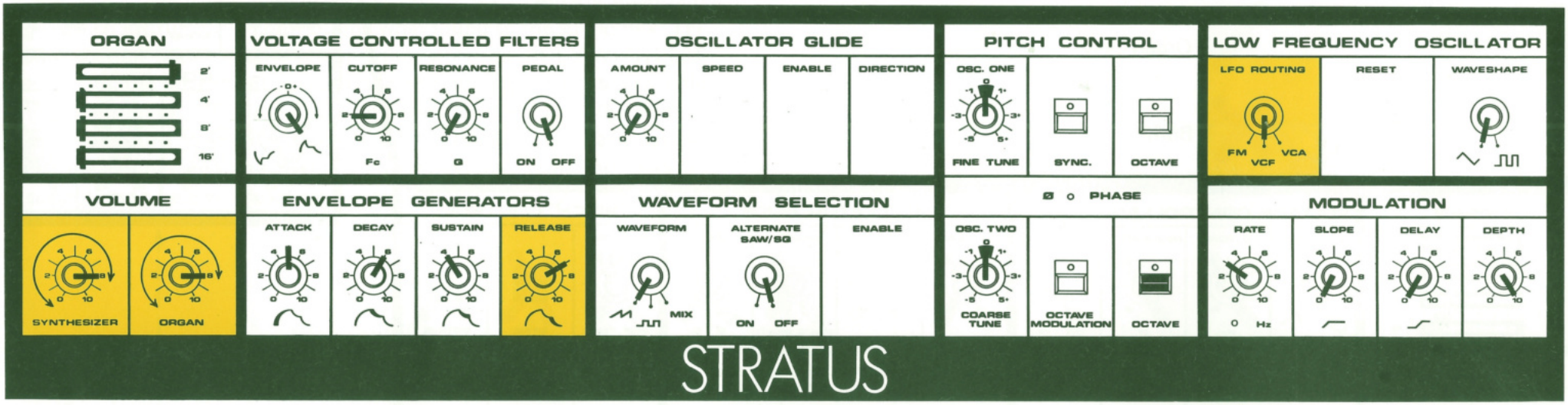
2. - After exploring each knob, turn it back to its original position (7). The LUCKY 7 SYNTH sound chart knob settings were chosen to help make the role of each knob apparent when you explore.

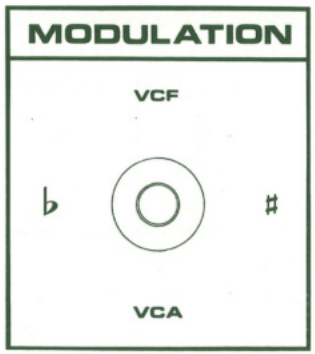
Look at the figure to understand which knobs relate to the organ only, synthesizer only, or both instruments. Continue the exploration, observing these suggestions.



The sound Charts that follow don't have to be explored in their order of presentation. Each sound chart will teach you about order of presentation. Each sound Chart will teach you about some feature of the STRATUS if you set it accurately, and stick to the two rules for exploration given above. Enjoy!

Elephant + Flea





Play with a staccato (detached) style. Listen to only the synthesizer, then only the organ — use the SYNTHESIZER and ORGAN VOLUME knobs.

Only the synthesizer can have an extended release time. Organ release is always immediate. Vary the RELEASE knob in the ENVELOPE GENERATORS section; listen alternately, the organ — then the synthesizer.

Select alternative settings of the LFO ROUTING rotary switch in the LOW FREQUENCY OSCILLATOR section, listening alternately to the organ and the synthesizer.

CONCLUSIONS:

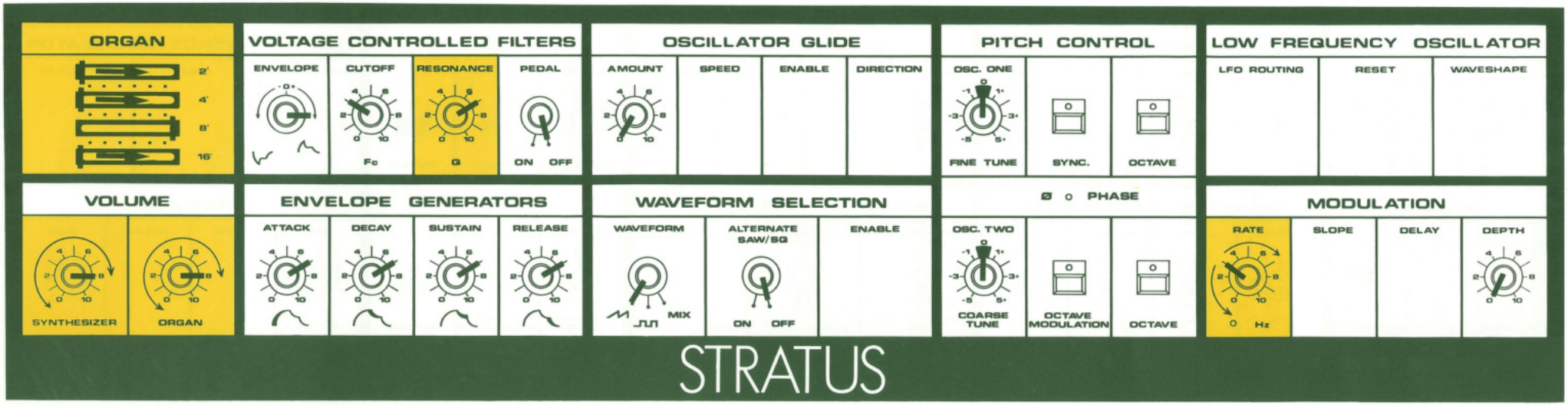
1) The STRATUS has **two** instruments: an organ and a synthesizer.

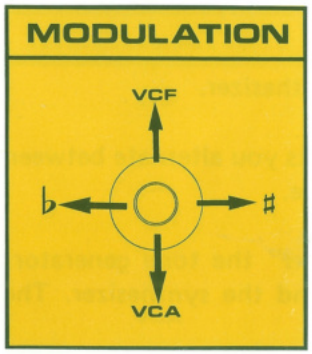
2) The ENVELOPE GENERATORS section affects **only** the synthesizer.

3) "FM" affects **both** the organ and the synthesizer.

4) "VCF" and "VCA" affect **only** the synthesizer.

Layered Sound





Listen alternately to only the organ, then only the synthesizer by using the VOLUME knobs.

Repeat this procedure and manipulate the ORGAN sliders.

Repeat this procedure and experiment with the MODULATION joystick, moving it in all directions.

Repeat the procedure; vary the RATE knob and **then** vary the MODULATION joystick.

Repeat procedure and vary the RESONANCE knob in the VOLTAGE CONTROLLED FILTERS section.

CONCLUSIONS:

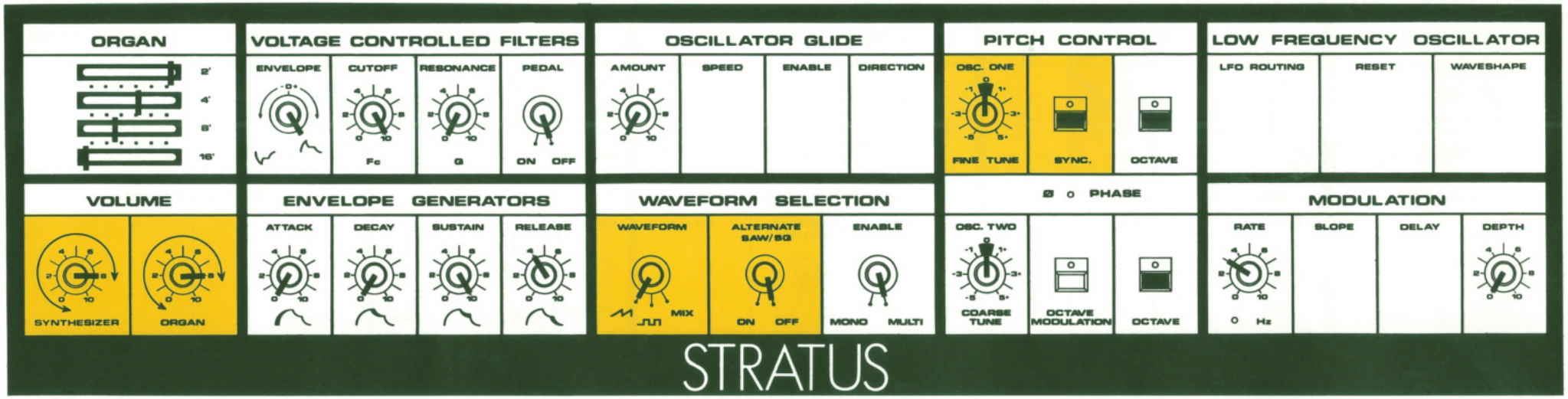
1) The ORGAN sliders affect **only** the organ.

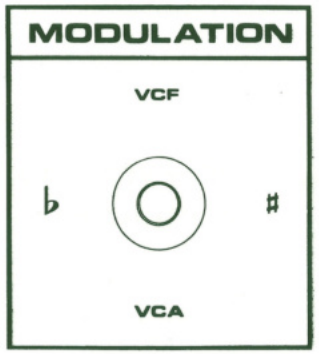
2) Movement of the MODULATION joystick toward VCF or VCA affects **only** the synthesizer. Use of the joystick to bend pitch affects **both** the synthesizer and the organ.

3) The RATE knob controls the speed of modulation

4) The VOLTAGE CONTROLLED FILTERS section affects only the synthesizer.

Straight Organ





Listen alternately to the organ, then the synthesizer, using the VOLUME knobs.

Depress and **hold** a single key low on the keyboard. Use the WAVEFORM selector in the WAVEFORM SELECTION section as you listen — first to the organ, then to the Synthesizer.

Listen only to the synthesizer (turn ORGAN VOLUME to zero). Place ALTERNATE SAW/SQ rotary switch to ON position. Play single note repeatedly and listen to **waveform alternation**. Repeat this procedure while listening only to the organ.

Place SYNC push switch in PITCH CONTROL section off (lamp out). Adjust beat rate using FINE TUNE knob. Repeat procedure listening first to the synthesizer, then to the organ.

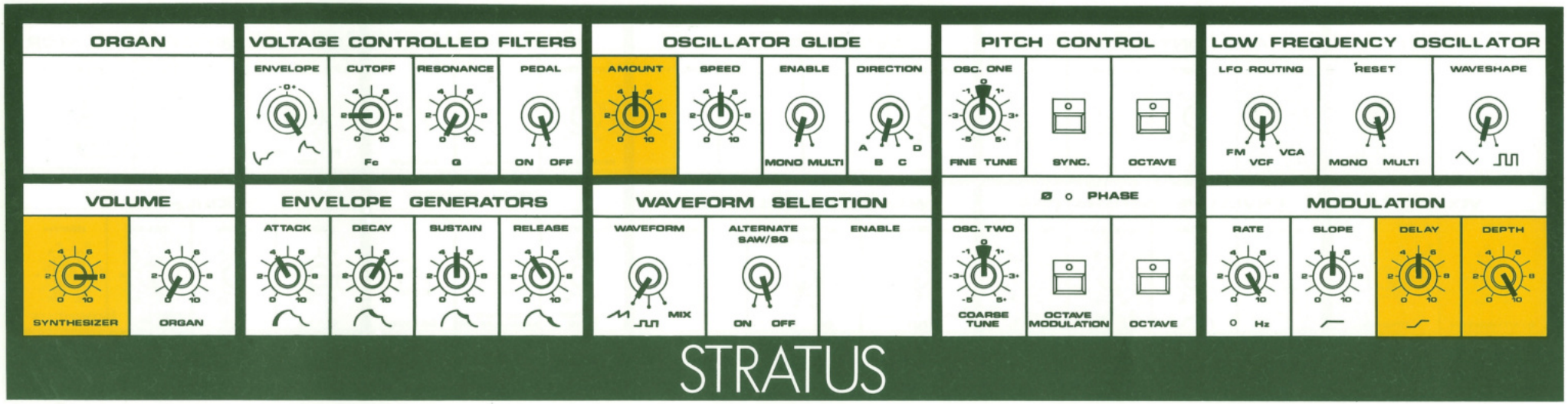
CONCLUSIONS:

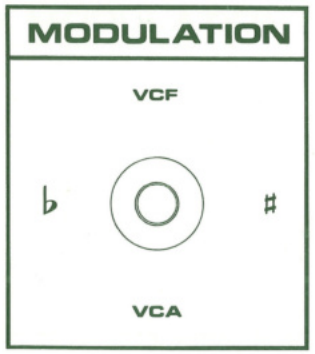
1) WAVEFORM SELECTION affects **only** the synthesizer.

2) The ALTERNATED SAW/SQ rotary switch lets you alternate between synthesizer waveforms using keyboard technique.

3) The SYNC push switch "locks" and "unlocks" the tone generators within the STRATUS, both for the organ **and** the synthesizer. The FINE TUNE knob controls **beat rate.**

Flutter Brass





Hold chord and listen for "flutter", or VCF modulation. Vary DELAY knob in MODULATION section. Return to 5.

Hold chord and slowly move DEPTH knob to zero. Leave at zero and continue.

Play single note repeatedly (slowly) and listen to "glide". Vary AMOUNT knob in OSCILLATOR GLIDE section and repeat procedure. Turn AMOUNT knob to zero and play.

CONCLUSIONS:

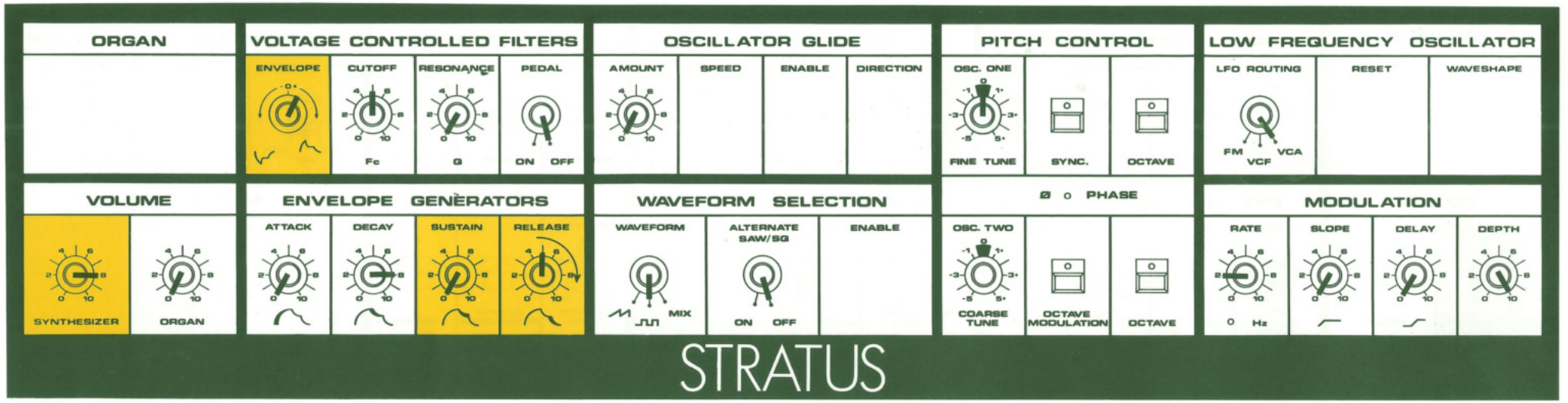
1) Modulations such as "flutter can be **delayed** on the STRATUS.

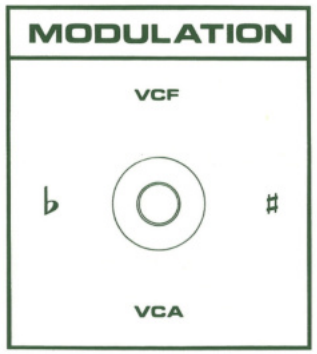
2) The DEPTH knob is the key to modulation **amount,** (if joystick is not touched).

3) The AMOUNT knob is the key to **glide**; if it is set to zero, the other knobs/switches in the OSCILLATOR GLIDE section are inoperable.

QUESTION: Does the OSCILLATOR GLIDE section affect the organ?

Chord Piano





Play in a block chordal style.

Play and hold a chord until it dies away. Play and hold a chord, but release **before** it dies away. Adjust RELEASE knob to 8, and repeat procedure. Return RELEASE to 5.

Play and hold a chord until dies away. Repeat procedure, but adjust the SUSTAIN knob to 6. (Chord will sustain as long as you hold it when SUSTAIN is up).

Vary the ENVELOPE knob clockwise and listen to difference in "brightness shape of sound". Turn ENVELOPE to zero and play.

CONCLUSIONS:

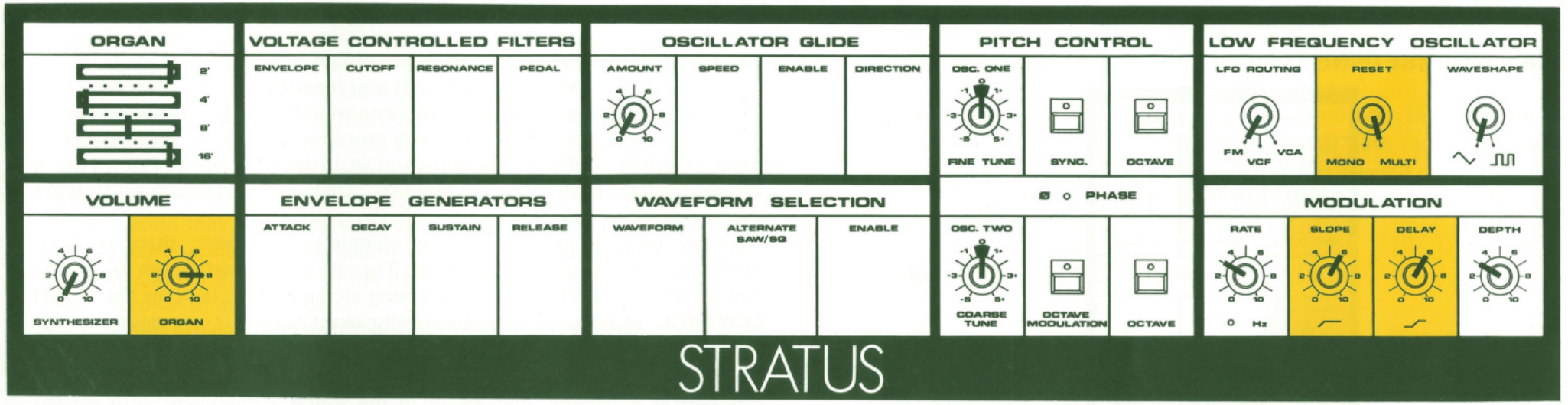
1) The RELEASE knob relates to what happens when your hands leave the keyboard.

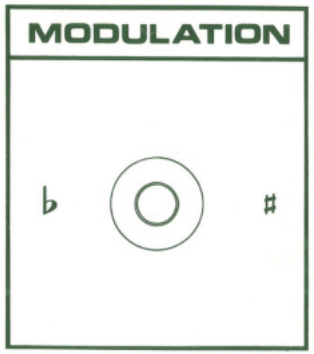
2) When SUSTAIN knob is at zero, the sound will **not** sustain indefinitely (on the synthesizer).

3) The ENVELOPE knob affects the "brightness shape" amount.

QUESTION: When the SUSTAIN knob is set to zero, is the organ affected? (Try it).

Delayed Vibrato





Play and hold a note until you hear vibrato appear. While holding that note, depress new keys and then wait until you hear vibrato.

Repeat the procedure, but switch the RESET rotary switch to the MONO position.

Place the SLOPE and DELAY knobs to zero. Repeat the previous procedure, trying the RESET positions MONO and MULTI.

CONCLUSIONS:

1) When the SLOPE and DELAY knobs are **not** at zero, vibrato may be delayed and shaped.

2) When RESET is set to MONO only the first key depressed has delayed vibrato. In the MULTI position, every new key depressed **resets** the delay time, delaying vibrato anew.

3) When SLOPE and DELAY are both set to zero, the setting of the RESET switch determines the **keyboard priority** for delayed vibrato.

A MUSICAL TOUR
– PITCH –

Tuning: COARSE/FINE TUNE

The STRATUS is an electronic musical instrument; it deals with electrical signals. The devices that generate signals that become sounds we call **oscillators.** When you pluck a guitar string you can **see** it **oscillate** to and fro. If you could see the air around an organ pipe you would see that it also is in motion — like the guitar string. A single oscillator on the STRATUS acts like an entire **rank** of organ pipes — a rank that we can tune with a single knob. (e.g. FINE or COARSE TUNE).

When tuning the STRATUS you probably noticed that the **temperament** of the keyboard — the distance between halfsteps — doesn't require your adjustment. It's fixed at the factory and can't go out of tune. You can, however, affect the pitch **level** of all the "pipes" of the STRATUS simultaneously with a single knob. It's as though you had a piano where all the strings were hooked into a single string and you had one giant tuning pin that would raise or lower all strings simultaneosly.

There are two oscillator ranks in the STRATUS. During the tuning procedure you tuned them using the COARSE TUNE and FINE TUNE knobs. The OSC. TWO COARSE TUNE knob tunes only the second oscillator — Throughout a pitch span of approximately one octave. The COARSE TUNE knob has a "detent" at its mid-position where you will feel a definite "click". When placed there, the STRATUS second oscillator rank agrees with standard international tuning, where the note A = 440.

The OSC. ONE FINE TUNE knob lets you tune the first oscillator rank over a smaller pitch span — approximately one whole tone above or below center pitch. When you performed the tuning procedure you first brought the OSC. TWO COARSE TUNE to its mid-point in order to bring oscillator two to standard pitch. Then you used the OSC. ONE FINE TUNE knob to make the two oscillators **agree** in pitch.

Anytime two pitches are not in complete agreement, there is a natural "beating" or loudness pulsation. The rate of this beating can be visually monitored on the STRATUS by looking at the PHASE lamp in the PITCH CONTROL section. Usually, fanatically exact tuning is not desirable musically — such a sound tends to be rather lifeless. Usually the FINE TUNE knob is set to produce a small pitch difference between the two oscillators — this creates a "rolling" movement in the sound. Experiment with various beat rates using the FINE TUNE knob. This beat rate can play a powerful role in overall sound quality and should be thoroughly explored.

Parallel Intervals: COARSE TUNE

The COARSE TUNE knob may be set over a wide pitch span; therefore it is possible to produce a musical **interval** or pitch ratio between the two oscillators. When this is done, that **same** interval will sound on every key. When you play up and down the keyboard there will be a succession of **parallel intervals.** In most cases parallel intervals are best restricted to solo playing (monophony), or limited polyphony (a few notes). After all, when parallel intervals are played you are quite literally playing in two keys simultaneously; the possible harmony clashes when even simple chords are played may not be desirable.

Hold down a single key on the STRATUS keyboard to sound a tone continuously. Turn the OSC. TWO COARSE TUNE knob in either direction to create an interval (for example, a minor third — three halfsteps) between the two oscillators. Notice that every key now sounds that interval — the **entire** oscillator "rank of pipes" has been tuned simultaneously. Play to create parallel intervals.

Beatless Tuning: SYNC

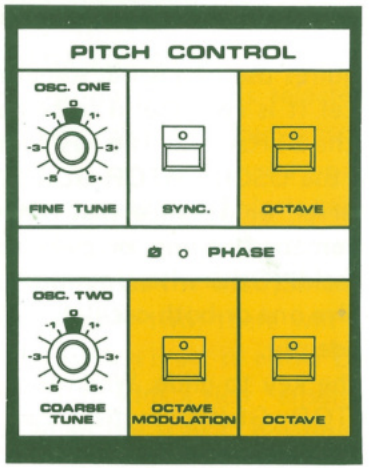
It is virtually impossible to achieve fanatically accurate tuning with acoustic instruments — therein lies part of their charm. In the case of the piano, some keys strike two or three strings that are purposely mistuned to produce the rich "chorus" effect typical of the instrument. A totally beat-free tuning is possible on the STRATUS, however, and can be exploited because of the uniqueness of such a sound. Depress the SYNC push switch; (when any push switch on the STRATUS is on, its light is on).

When the SYNC switch is on, both oscillators will be **locked** to the pitch of oscillator **one** (the COARSE TUNE control no longer operates). Even if you have tuned oscillator two to create a wide interval, oscillator two pitch will **duplicate** that of oscillator one exactly when sync is on. This produces a very straight sound that may fatique the ear if used too much; (ear fatigue causes nothing more serious than boredom). You will still hear **some** beating when you play chords; this is due to the discrepancies of standard equal temperament — typical of any keyboard.

Try different tunings using the FINE and COARSE TUNE knobs.

Switch SYNC on and off to confirm what you have read. Use the STRATUS footswitch; place its plug into the SYNC jack on the back of the instrument. Notice that the footswitch operates **only** when the SYNC push switch on the front panel is **off** (Lamp out).

Octavation: OCTAVE



When men and women sing together, they often sing in different **octaves,** even when they are said to sing in **unison** ("same note"). This is due to obvious physical reasons. Most musical instruments have octave **control;** otherwise they would have an extremely limited pitch span. The most obvious manifestation of this on a keyboard instrument is the layout of the keyboard to span several octaves. Unlike some acoustic keyboards, the pitch span of the STRATUS is **not** limited to the size of the keyboard.

On the **STRATUS,** each oscillator has an OCTAVE push switch that can **lower** oscillator pitch one octave (try it).

Normally these OCTAVE switches work independently; but when the SYNC switch is on, **either** OCTAVE switch will control **both** oscillators; that is, if either OCTAVE switch is on, both oscillators are lowered one octave.

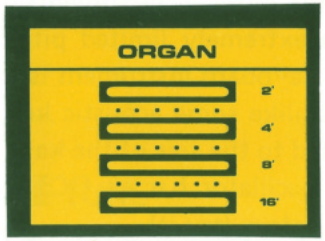
Broken Octaves: OCTAVE MODULATION

Some piano music requires a technique that calls for "rocking"the hand to produce "broken octaves". The two notes of a broken octave are sounded **melodically** — one after the other.

On the STRATUS this effect can be introduced automatically; that is, you can produce broken octaves by holding a single key down. When the OCTAVE MODULATION push switch in oscillator two is **on**, oscillator two sounds the octave melodically. The rate of this **modulation** — or repeating change — is governed by the RATE knob in the MODULATION section. The OCTAVE MODULATION effect does **not** depend on the setting of the OCTAVE push switch in the second oscillator — its setting makes no difference. When the SYNC switch is on, **both** oscillators will be modulated. In this case, **neither** OCTAVE switch has any relevance to the effect created. Experiment with various combinations of the OCTAVE switches, the SYNC switch, and the OCTAVE MODULATION switch to confirm their interaction.

As mentioned, the rate of modulation is controlled by the RATE knob in the MODULATION section. In fact, the rate of all modulations produced by the STRATUS are governed by this knob. In the case of OCTAVE MODULATION, notice that the lamp adjacent to the RATE control and the lamp on the OCTAVE switch in oscillator two blink synchronously, or together. This gives visual indication that the octave modulation is taking place; it's as though an invisible finger pushes the OCTAVE switch off and on. When SYNC is on, the lamps in **both** OCTAVE switches blink in time with the RATE lamp (both oscillators are modulated).

Footage Pitch: ORGAN Sliders



In pipe organ terminology, **footage** relates to the relative lengths of organ pipes. For pipes of the same type, a short pipe makes a higher sound than a long one. So, it's not surprising that the 2' (literally, "two foot") slider on the STRATUS ORGAN sliders produces a higher sound that the 16' slider. Each ORGAN footage slider governs the loudness of a "rank within a rank". That is, for the organ within the STRATUS, **each** of the two oscillators has four footage ranks — 16', 8' 4', and 2'. Any rank is exactly one octave higher or lower than an adjacent rank.

If all the ORGAN sliders are placed to the left, the organ in the STRATUS cannot be heard. Quite literally, the loudness output of all ranks would have been reduced to nothing. Also, the organ cannot be heard if the final gain (ORGAN VOLUME) knob is placed to zero. Both cases are true, whether you are using the POLYSYNTH or the separate ORGAN output jack on the rear of the STRATUS. The VOLUME knob and the ORGAN sliders always work in **conjunction** to control the loudness of the organ.

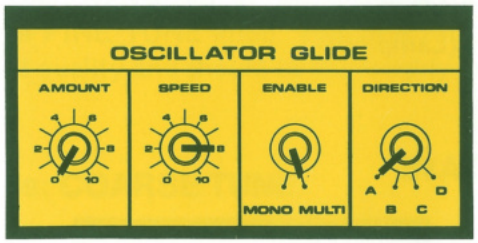
Pitch Bending: MODULATION Joystick

To the left of the keyboard is a **joystick** that lets you introduce several effects during performance. This is an "X-Y" joystick capable of movement in two planes (directions X and Y). Lateral movement of the joystick, in the "East-West" direction of the keyboard introduces a pitch deviatio; pushing the joystick to the **right** "sharps", or **raises** pitch; pushing it to the **left** "flats", or **lowers** pitch. The maximum possible pitch bend in either direction is approximately a whole step (two chromatic halfsteps). Pitch bend is a momentary effect that lasts only as long as you **hold** the joystick. On release, the joystick returns to center pitch; (it is "spring loaded").

It is possible to move the joystick to either side **before** any key is depressed. In this case, release of the joystick **after** a key is depressed results in a pitch bend that moves **toward** the pitch of the key depressed. But the easiest and most intuitive joystick use is a bend **away** from the note(s) depressed. Although whole chords can be bent (all keys depressed will bend), pitch bending is particularly effective when you play a solo line. Solo (monophonic) instruments do not have the fixed tuning of a keyboard, and greatly depend on pitch bending to maintain musical interest.

Pitch bending, and all joystick effects, are always available. That is, front panel settings never negate use of the MODULATION joystick. (More on its use later).

Automatic pitch Bend: OSCILLATOR GLIDE



Manual pitch bending requires use of a hand; sometimes a hand just can't be spared during performance! It is very useful to be able to bend automatically, and you can do so on the STRATUS. The **key** to automatic pitch bending is the AMOUNT knob in the OSCILLATOR GLIDE section. The AMOUNT knob determines the interval, or distance that pitch bend will travel when key(s) are depressed. Automatic bending, or **glide** is necessarily restricted to bends **toward** the key(s) held. (Otherwise, you might bend to another key as you play). Glide can involve one or both oscillators. Glide interval and speed can be controlled independently.

The AMOUNT knob is the key to glide. When this knob is set to zero, no knob in the OSCILLATOR GLIDE section can affect sound. As the AMOUNT knob is advanced towards "10" (maximum), the **interval,** or distance that glide covers increases. That is, pitch wil start **further** from the "home" pitch of the key depressed. Set the OSCILLATOR GLIDE section

as shown; strike a single key repetitively (slowly), and gradually turn the AMOUNT knob from zero to 10. Note the increase in glide interval. Try the same thing, playing a chord (all keys glide when glide is introduced).

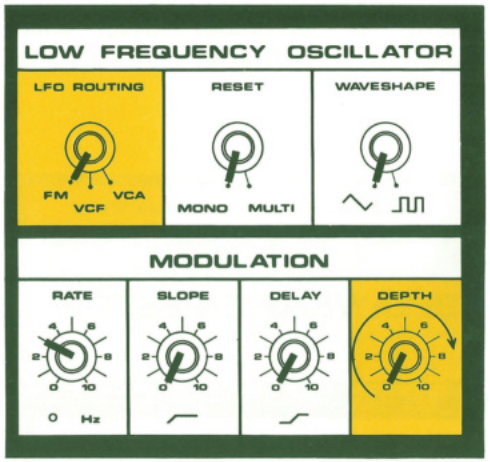
The SPEED knob determines how much time it takes pitch to settle at the final or home pitch (the pitch of the key(s) depressed). Leave the AMOUNT knob at 10, and try different SPEED settings. as the SPEED knob is moved to higher settings it takes more time for glide to finish-glide "slows down".

The ENABLE rotary switch lets you introduce glide **selectively,** according to haw you play the keyboard. In the MULTI position all keys held will glide every time **any** key is depressed; glide is "retriggered" (and will restart) **unconditionally** upon any and each key closure. In the MONO position, glide is introduced when the first key is depressed, but further glides are **supressed** until the next "keyboard clear" condition (no keys down). That is, as long as **any** key is being held, glide will not be retriggered with each successive key closure. However, as soon as **all** keys are released, the glide circuit is "rearmed" and will introduce glide on the next key closure. If you play with a connected **legato** style — making sure that at least one key is down at all times — glide would be introduced at the **beginning** of each new phrase (**following** the "all clear" no-key-down keyboard condition) On the other hand, if you play with a separated **staccato** style it might be possible to introduce glide at the beginning of each note. A mix of styles lets you introduce glide when you want to. (this capability to mix styles matters only in the conditional MONO mode).

The DIRECTION rotary switch offers four alternatives. Positions A and B provide glide that starts **below** the pitch of the key(s) depressed. Positions C and D provide a glide that starts **above** the pitch of the key(s) depressed. **Both** oscillators on the STRATUS glide in positions A or D. Only oscillator two glides when either position B or C is selected. Set AMOUNT to 10; SPEED to 5, and experiment with the four position of the DIRECTION rotary switch. Put the SYNC switch on, and you will discover that only positions A and D now introduce glide. (This is because the **first** oscillator is the "master" oscillator in the sync mode; the second oscillator is the "slave" and **must** stay at the same pitch as the first. Since positions B and C do **not** cause oscillator one to glide (only two) there will be no glide if SYNC is on and the DIRECTION rotary switch is set to either B or C).

If used in small amounts, glide adds a rich "ensemble" effect to the beginning of a note or chord when the B or C position is selected and SYNC is **off**. One oscillator glides and the other doesn't, suggesting two players struggling to match pitch — the "ensemble" effect.

Vibrato: FM MODULATION



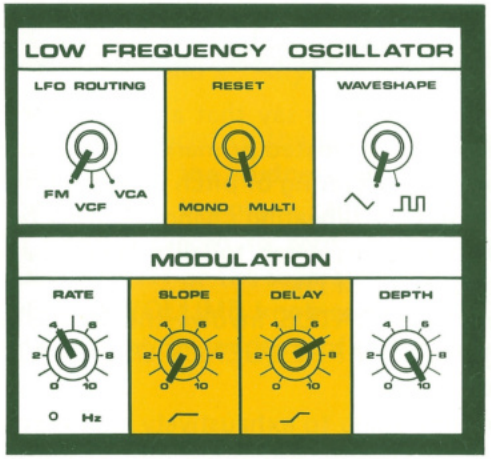
Perhaps you have heard someone say that a good singer has a "well-modulated" voice. This perception is created primarily by the singer's use of **vibrato,** the smooth and repetitive quavering of pitch produced by virtually all singers. Vibrato is a **modulation,** or repeating change (not to be confused with the modulation of key that occurs when **tonality** is shifted. E.g., a **modulation** from the key of C to the key of D).

All modulations on the STRATUS involve the MODULATION section (as you might suspect!), the LOW FREQUENCY OSCILLATOR, and sometimes the MODULATION joystick.

At this point we are not going to exhaustively explore modulation possibilities, but introduce the concept and show how vibrato may be produced. Vibrato is a repetitive change of pitch, or **frequency;** it is a technically known as "frequency modulation", or FM for short. The key to vibrato production on the STRATUS is the DEPTH knob in the MODULATION section, and the LFO ROUTING rotary switch in the LOW FREQUENCY OSCILLATOR section. To create vibrato on either the synthesizer or the organ, the LFO ROUTING switch **must** be placed to the FM position. Also there can be no vibrato on the STRATUS unless the DEPTH knob is placed higher than zero. Set the STRATUS sections as shown and slowly advance the DEPTH knob clockwise toward 10. Note that the depth of vibrato increases as the DEPTH knob is advanced. Adjust the RATE knob to confirm that the rate of vibrato may be varied. Select the alternative (square) waveshape with the WAVESHAPE rotary switch in the LOW FREQUENCY OSCILLATOR section to produce **trill** — another variety of FM, or frequency modulation.

When the oscillators are not synched — when SYNC IS off — only the **first** oscillator is affected by frequency modulations such as vibrato and trill. This adds to the "chorus" or "ensemble" effect. When SYNC is on, **both** oscillators will be modulated.

Delayed Vibrato: DELAY/SLOPE/RESET



On an acoustic instrument the most fundamental thing about vibrato is that its depth **varies.** The instrumentalist usually halts vibrato production for a moment as he changes pitch — for physical reasons. For instance, a violinist must move his left hand and fingers to different fingerboard positions to change pitch; vibrato is also produced by a rocking motion of the left hand. Pitch selection and Vibrato production tend to be pitted against each other; it's hard to do one while you are doing the other. Typically, instrumental vibrato features a **delay** between selection of pitch and the start of vibrato (see DELAY knob on STRATUS) and its depth is increased gradually the longer the tone is held (see SLOPE knob on STRATUS).

Delayed and shaped vibrato is very musical, and the STRATUS is designed to produce such a vibrato. In the portion of the manual preceding this section, the basics of vibrato production were explained. All the knobs discussed in that section are also important in the production of delayed vibrato. But, **delayed** vibrato depends on DELAY, SLOPE, and RESET settings. Set the knobs on the STRATUS as shown. Depress a single key and wait until you hear vibrato appear. The onset of vibrato is delayed by a time set with the DELAY knob; try various DELAY settings, key and hold a note. (Return the DELAY knob to 7). The higher the DELAY setting, the longer vibrato is delayed. When the SLOPE knob is set to zero, the **onset** of vibrato is immediate. Since vibrato is usually introduced gradually, more slope (higher SLOPE setting) is usually desireable. The SLOPE knob **shapes** the onset of vibrato. Experiment with the SLOPE knob until its setting creates a natural and gradually increasing vibrato.

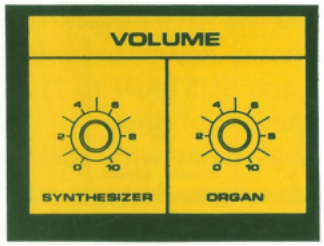
All vibrato is controlled in rate by the RATE knob, and in depth by the DEPTH knob. Delayed vibrato is no exception. The DEPTH knob controls the **ultimate** depth that will be reached after the delay time set by the DELAY knob and the shaping by the SLOPE knob have run their course. To summarize delayed vibrato, the DELAY knob determines the time interval between key closure and vibrato onset. The SLOPE knob determines the way vibrato is introduced once it starts.

Now lets explore the RESET rotary switch. Set SLOPE and DELAY knobs to 6. Hold a key down with either hand and slowly play a series of keys with the other hand, waiting each time until vibrato is heard. In the MULTI mode, the delay time is unconditionally **reset**, or started over **each** time any key is depressed. In this mode you could play so rapidly that vibrato would be delayed indefinitely; only when you hold keys and stop making new key closures would the delay circuit have time to run its course and allow introduction of vibrato.

In the MONO mode of the RESET rotary switch, the STRATUS ignores all but the "first" key closure — defined as the first key closure **following** the "all clear" condition of **no keys down.** In this mode it is possible to introduce new notes without resetting vibrato; you can "play through" the vibrato — a typical organ characteristic. In this case, vibrato is delayed only when you lift both hands prior to the desired delay. Once again, we see a design feature on the STRATUS that allows control that depends on your keyboard technique. Set the DEPTH control fully to 10 (maximum) and experiment with all of the knobs and switches on the LOW FREQUENCY OSCILLATOR and MODULATION sections. Mastery of these sections helps add musicality to your performance.

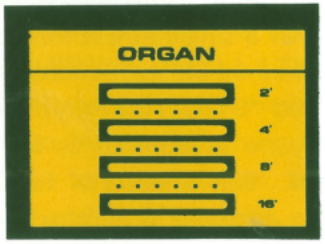
LOUDNESS

Dynamics: VOLUME



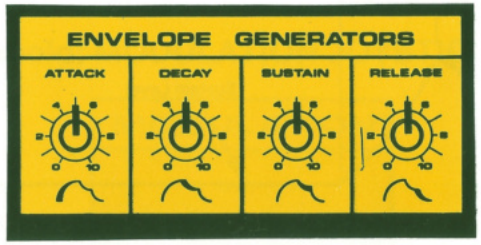
The VOLUME section governs the final output of the STRATUS; no sound can be heard if the SYNTHESIZER and ORGAN VOLUME knobs are set to zero. For best signal-to-noise ratio set at least one of these knobs high (above 5) and set the other in relationship to it. The **mixture** of the synthesizer and the organ will appear at the POLYSYNTH output jack on the back of the STRATUS. In addition a separate output jack (ORGAN) for the organ is provided should you wish to treat the organ signal separately external to the STRATUS. The strength of the organ signal at either the POLYSYNTH or ORGAN jack is determined by the ORGAN volume knob (and the ORGAN sliders, which we discuss later).

Footage Mix: ORGAN Sliders



The sliders in the ORGAN section govern the loudnesses of the various footages" that are analogous to pipe organ pipe lengths. The ORGAN sliders increase loudness as they are moved to the right. They work in conjunction with the ORGAN VOLUME knob; that is, both must be set properly to provide output at either the POLYSYNTH or ORGAN output jack on the rear of the STRATUS. Turn the ORGAN VOLUME knob to 10 and experiment with different mixes of the 16', 8', 4', and 2' ORGAN sliders.

Articulation: ENVELOPE GENERATORS

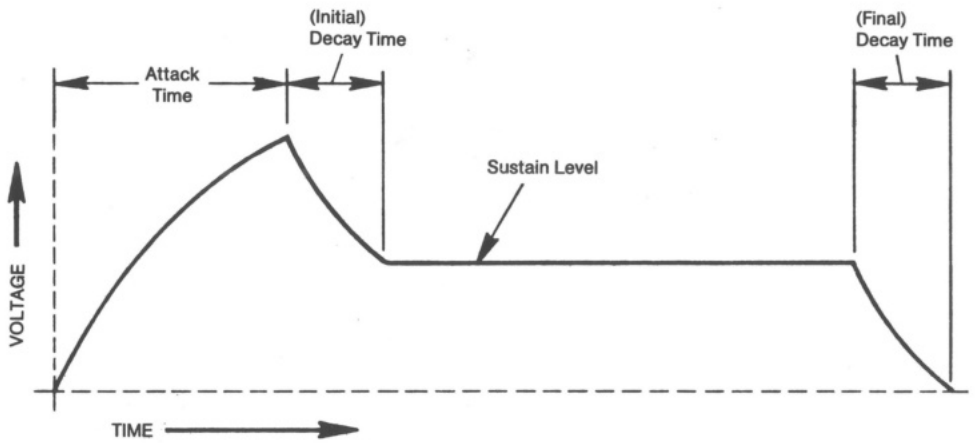


Traditionally, the organ features a "rectangular" articulation shape; the attack (beginning) begins quickly, the sound sustains at a stable loudness, and the release is also nearly immediate. One of the things that distinguishes a synthesizer from an organ is the synthesizer's capability of varying the **articulation** of a sound — not just **when** the sound appears, but **how** it is shaped when it appears. The loudness shape of a sound is called its **envelope;** the sound envelope may be varied widely on the polyphonic synthesizer of the STRATUS using the knobs in the ENVELOPE GENERATORS section. Unlike the fixed attack and release of the organ, the attack and release **times** on the synthesizer may be varied widely using the ATTACK and RELEASE knobs. Set all the knobs in the ENVELOPE GENERATORS section to 5 and experiment with each knob (one at a time!) and return it to 5. Make sure you are listening to the synthesizer— the SYNTHESIZER VOLUME knob must be up.

Listen first to the synthesizer; then to the organ by using the VOLUME knobs. Notice that the ENVELOPE GENERATORS section has no effect on the organ; its envelope characteristics are fixed— as is traditional with the organ.

If you play long enough you will discover that the ENVELOPE GENERA—TORS section that creates synthesizer articulations has three **timing** knobs and one **level** knob. Tke ATTACK, DECAY, and RELEASE knobs determine **how long** it takes sound to rise or fall from silence to maximum level, maximum level to the SUSTAIN level, and finally from the SUSTAIN level back to silence. The SUSTAIN knob alters the loudness **level** at which a sound may be sustained as long as a key is depressed.

The diagram depicts the general form of the signal produced by the ENVELOPE GENERATORS section.



Each envelope comprises four parts: the initial rise **time** or attack— set by the ATTACK knob; the initial decay **time** or subsiding from maximum to the sustain level— set by the DECAY knob; the **level** at which the tone may be held indefinitely by holding a key down— set by the SUSTAIN knob; and the final release **time** which determines the **time** it takes the tone to fall to silence— set by the RELEASE knob.

After experimentation and some thought, it becomes apparent that a long ATTACK time may make it difficult to play rapidly, since your fingers move over the keys before the tone has time to rise and be heard. A very long DECAY time will tend to make the sound more "rectangular," therefore organ-like, since sound world take so long to fall to a sustain level. A very high SUSTAIN level tends to "mask" or obscure the effect of the DECAY knob, since the signal cannot "fall" **up** to a high sustain level. A long RELEASE time may "muddy" the sound. The general observation can be made that setting any knob in the ENVELOPE GENERATORS section much higher than its midpoint (5) calls for careful consideration, for extreme settings often create special playing conditions very much **unlike** familiar organ on/off enveloping.

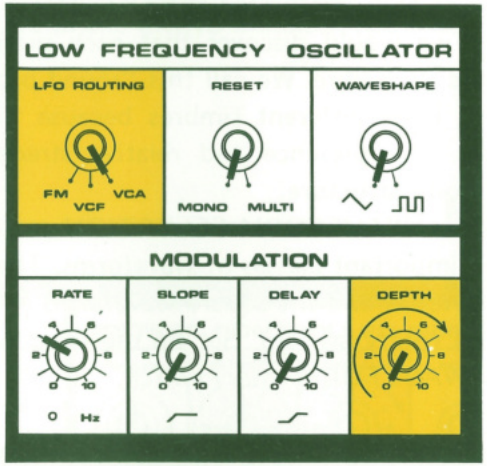
To gain mastery of the envelope generator concept it is necessary to know more about how the individual segments **interact.** For instance, the attack produced is related to the RELEASE setting: when you first depress a key the attack cycle starts from silence; when you release, the sound dies at a rate set by the release knob; if you depress the **same** key before the sound dies completely, the attack cycle begins again— but **not from silence.** The attack cycle starts from the point on the downward decay or release path you are at when you restrike the key. Attack is **not** unconditinally reset to silence upon restriking the same key. To confirm this, set ATTACK and RELEASE to 10; (DECAY and SUSTAIN to 7). Strike and restrike a single key; hold it down different lengths of time.

Repeat the procedure several times with successively shorter RELEASE times, until RELEASE is set to zero. At some point the release of the sound will fall to silence so quickly you don't have time to restrike the key before silence occurs. When **both** ATTACK and RELEASE are set long, it is possible to "pump" the sound by restriking the key irregularly and make it swell or die. When RELEASE is short and ATTACK is very long, a new attack will sound like it restarts from absolute silence. These are two very different modes of **playing;** experiment until you get an intuitive understanding of their musical use.

The final release of sounds on the STRATUS is achieved only when the "all clear" no-key-down keyboard condition is sensed, or when the footswitch is plugged into RELEASE and depressed. Set ATTACK to 1 (short) and RELEASE to 8 (long); (leave DECAY and SUSTAIN at 7). Play and hold a key; now play other keys and release them while holding the first key. Notice that release time is **not** long for the notes not held (unless the footswitch is on). Try the same procedure, but release **all** keys at some point. Notice that the RELEASE time is enabled only when you release **all** keys. Also, all the keys that are released **together** will die away together. (You may have noticed that when a single key is held and others are depressed, some keys cause the held key to be rearticulated. This is explained in the section of the manual entitled "STRATUS Polyphony".

An envelope generator may be thought of as the handle of a faucet that controls the flow of water. But instead of turning the handle by hand, you can program— with an envelope generator—how the handle is opened and closed. From an electrical standpoint the faucet is an amplifier (called a VCA) that is sensitive to the shape of the signal generated by the envelope generator when you depress a key. The STRATUS is polyphonic; it has more than one envelope generator and more than one "faucet", or VCA. For a complete discussion, see the section of this manual entitled "STRATUS Polyphony".

Tremolo: VCA MODULATION

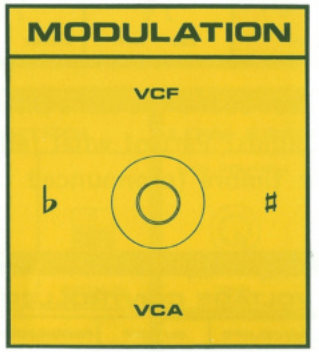


In the previous part of the manual, the analogy between sound flowing through an amplifier and water flowing through a faucet was made. The amplifier within the STRATUS referred to is a particular kind of amplifier; it is a **voltage controlled** amplifier (abbreviated VCA). This means that its amplification factor, or **gain** can be controlled by application of a voltage. If the voltage level controlling gain goes up — the sound gets louder; if the voltage level goes down — the sound gets quieter. **Tremolo** is a loudness modulation, or repeating change. Tremolo is a regular, repeating loudness fluctuation that would be produced on the STRATUS if we could find a smoothly rising and falling voltage to connect to the VCA (control input). We can. The LOW FREQUENCY OSCILLATOR on the STRATUS produces such a fluctuating voltage called a **waveshape.** Set up the sections as shown and discover tremolo by slowly raising the DEPTH control in the MODULATION section. Like **any** modulation, tremolo may be delayed and shaped by using the DELAY and SLOPE knobs.

Notice that the LFO ROUTING rotary switch must be set to the VCA position to produce a tremolo (loudness modulation). The amount of tremolo is governed by the DEPTH control which is the key knob in the MODULATION section. You probably noticed that the DEPTH control must be set to a higher number for tremolo than vibrato. That's because the ear is less sensitive to loudness than to pitch; higher DEPTH settings are more appropriate for tremolo — a modulation of the VCA —, that produces a loudness change.

The speed of tremolo is controlled by the RATE knob; at very fast rates, tremolo takes on a rough characteristic that could be called a "growl". Notice that the change of the WAVESHAPE rotary switch makes no difference when LFO ROUTING is set to the VCA position.

Momentary Tremolo: MODULATION JOYSTICK

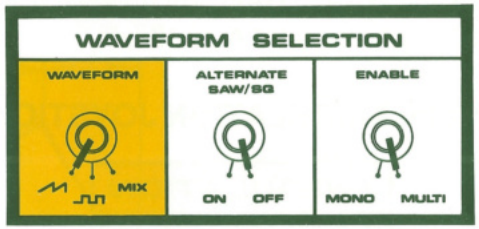


If you want tremolo to appear automatically when you play the keyboard, the DEPTH control must be advanced to a high setting, and LFO ROUTING must be set to VCA. If you would like to inject tremolo momentarily during performance, simply pull the joystick back toward you. Tremolo will occur regardless of front panel settings. In fact, you could have the front panel set to automatically produce a delayed vibrato, and **add** tremolo to the effect by pulling the MODULATION joystick back. Of course, both modulations would occur at the same rate, for the RATE knob governs the rate of all modulations. The DEPTH knob has no bearing on the amount of tremolo introduced by the joystick; the extent to which you pull the joystick back determines the amount of modulation introduced.

If you go back and review the modulations we have discussed you will find that any FM modulation affects both the organ and the synthesizer of the STRATUS. That's because the organ and synthesizer **share** the same oscillators that can be frequency modulated. On the other hand, the VCA (and the VCF) belong strictly to the synthesizer; VCA or VCF modulations will not be heard at the ORGAN output jack — or the POLYSYNTH output jack unless you are listening to the synthesizer. In general one can conclude that anything involving a **pitch** change involves both the organ and the synthesizer. If it's not a pitch change, you're dealing with the synthesizer unless the front panel specifically tells you otherwise.

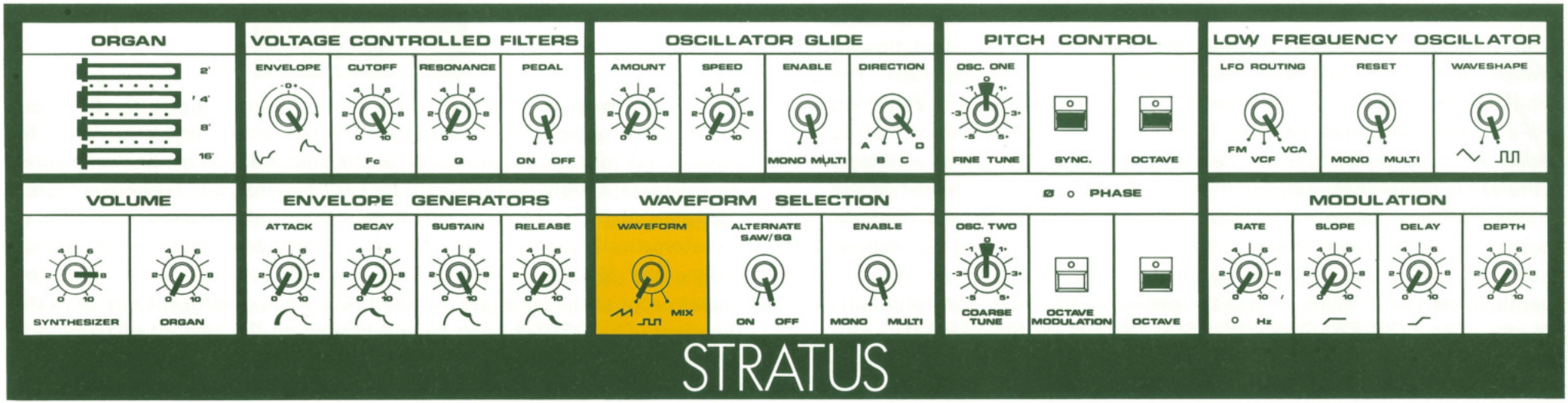
TIMBRE

Basic Tone Color: WAVEFORM SELECTION



If a trumpet, violin, and oboe sound the same pitch one after the other, how do we distinguish their sounds? Part of what tells us which instrument we hear is its tone color, or **timbre** (pronounced tam-ber in English). If we looked at the sound of each instrument on an oscilloscope (instrument with a television screen) we would discover that each produces a distinctive picture that describes its timbre. We call this "sound picture" a **waveform.** Different waveforms have different timbres because they have different harmonic structures. The presence and relative strengths of harmonics constitutes that harmonic structure.

On the STRATUS, the WAVEFORM SELECTION section lets us choose between or mix **two** important classes of waveforms. They are named after their shapes: the sawtooth and the square waveforms (look at the graphics for the WAVEFORM rotary switch). Set up the front panel as shown and experiment with the WAVEFORM rotary switch.



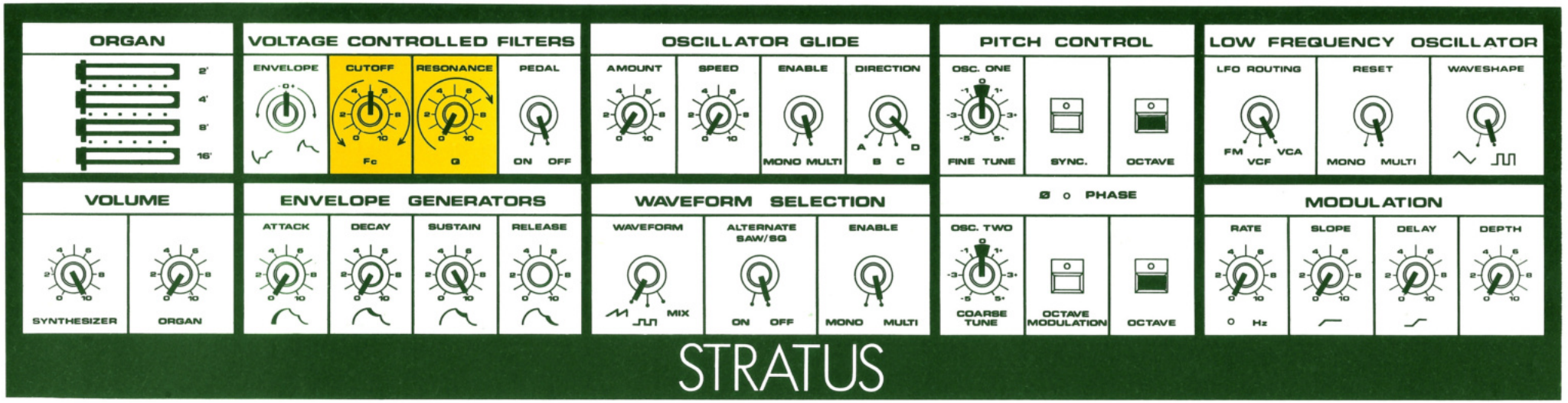
As you hear, the sawtooth tends toward the brass family and the square waveform sounds somewhat like a member of the woodwind family. The WAVEFORM rotary switch allows manual selection of the sawtooth, square, or a mixture (MIX) of the available waveforms. You may have noticed that the square waveform sounds one octave higher than the sawtooth; this further extends the "size" of the STRATUS keyboard. When you select a waveform, you do so for **both** oscillators simultaneously. The WAVEFORM SELECTION section affects only the synthesizer portion of the STRATUS; organ timbre is not affected by WAVEFORM selection.

The ALTERNATE SAW/SQ rotary switch allows automatic switching between the sawtooth and square waveforms from the **keyboard,** when it is switched ON. When this switch is on, the sawtooth and then the square waveform will be selected alternately regardless of the setting of the WAVEFORM switch. The ENABLE rotary switch determines the rules for switching. The ENABLE rotary switch lets you use keyboard technique to effect a switch between waveforms. In the MULTI mode, a change of waveform coincides with **any** and every new key closure. In the MONO position, the waveform alternation occurs only **after** a "clear keyboard" condition; that

is, **following** a condition where no keys are depressed. In this case (MONO) you can play entire passages with the same waveform if you take care to always have at least one key depressed at all times. For example, hold a chord with the left hand and play a run with the right and the waveform will not alternate if you're in the MONO mode. In this mode, when **you** want to change waveform, simply lift **both** hands from the keyboards for the slightest moment and the waveform will alternate on the very **next** closure.

A waveform is the **raw** material out of which sound may be shaped on a synthesizer. The most important thing to remember when making music is to make the sound **move,** as we see in the next parts of the manual.

Modifying Timbre: CUTOFF/RESONANCE

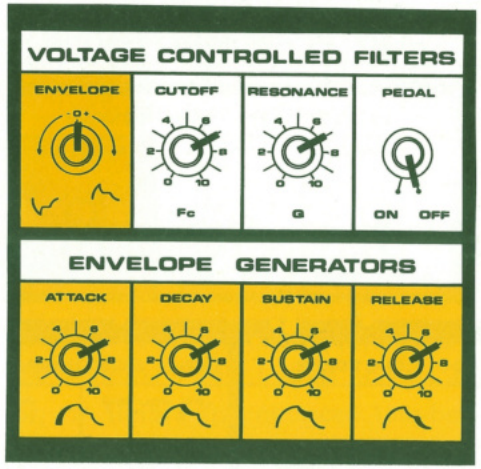


If you cup your hands and put them over your mouth while speaking, your hands **filter** the sound of your voice. They reduce, or attenuate the "highs" and produce a muffled, mellower sound. Any filter **removes** something. For instance, the porous piece of paper in a coffee maker removes the solid particles and lets the dissolved particles pass. Any filter removes something, but it also **passes** something. The filter(s) within the STRATUS remove highs and pass lows in the sound. That is, this type of filter removes high harmonics within a given waveform and passes low harmonics. The filter starts this "cutting off" of highs at an adjustable **cutoff frequency**. Set up the sound chart shown above, hold a chord and turn the CUTOFF knob through its settings. Then turn the RESONANCE knob to 7; repeat the procedure with the CUTOFF knob.

The CUTOFF knob acts like the curtain on a stage that can be raised and lowered. As it is raised you can see progressively more "highs" on the people on stage until you can see all of them. As the curtain is lowered, fewer highs are seen; eventually nothing of the people may be seen. The analogy to sound is similar.

The RESONANCE knob funnels, or "feeds back" energy around the cutoff frequency (the bottom of the curtain) and emphasizes the presence of harmonics found in the waveform. The use of very high RESONANCE knob settings results in the "wow" filter sound that has become a synthesizer cliche. The highly resonant filter sound is only one of **many sounds that the STRATUS filters can produce.**

Dynamic Timbre: ENVELOPE KNOB



Musical interest is enhanced when something about the sound **moves**. Most musical instruments have moving timbral characteristics that are integrated with their loudness characteristics. For instance, loud sounds on a trumpet tend to be brilliant, and soft sounds mellow. This **change** of tone color, or **dynamic timbre** is an important element of what we perceive as the "characteristic" sound of an instrument.

Although a large number of **fixed** timbres might be created using different CUTOFF and RESONANCE knob settings, musical interest would be enhanced if the cutoff frequency of the filter(s) in the STRATUS could be **moved** while the keyboard is played. Of course this could be done by hand, but it can be done more easily, accurately, and quickly using **voltage control**. Each filter in the STRATUS has a control input; application of a **high** voltage to that input **raises** the cutoff frequency of the filter and brightens the sound. Application of a **low** voltage **lowers** the cutoff frequency, which causes more highs to be cut off; the sound is made more mellow-muted.

The rest of this portion of the manual deals with **where** we can find suitable voltages that move in interesting ways, and **how** we can route those voltages to the filter control inputs of the synthesizer in the STRATUS in order to move the cutoff frequency. When the cutoff frequency moves, timbre is **dynamic,** or changing.

As previously mentioned, the most fundamental example of dynamic timbre is the tone color change that accompanies the loudness change of the instrument. We have already seen that the articulation, or loudness envelope of a tone can be varied using the ENVELOPE GENERATORS section. That same four-part rising and falling voltage pattern produced by the ENVELOPE GENERATORS may be applied to the filters in the STRATUS to provide a **timbral** change that accompanies the loudness change. How do we get this signal from the ENVELOPE GENERATORS to the control input of the filter? By moving the ENVELOPE knob in the VOLTAGE CONTROLLED FILTERS away from its zero (midpoint) position. When the ENVELOPE knob is moved off its zero position, the rising and falling voltage pattern generated by the ENVELOPE GENERATORS section can move the cutoff frequency internally and automatically. Once again, its as though "invisible" fingers move the CUTOFF knob for you.

The ENVELOPE knob acts as an **attenuator;** it attenuates, or reduces the amount of the signal routed into the filter control input. As the ENVELOPE knob is moved toward zero (from either the negative or positive side, as panel graphics show), less and less of the envelope signal is allowed to pass through to the filter. When the ENVELOPE knob is at zero, the ENVELOPE GENERATORS section does not affect filter cutoff frequency.

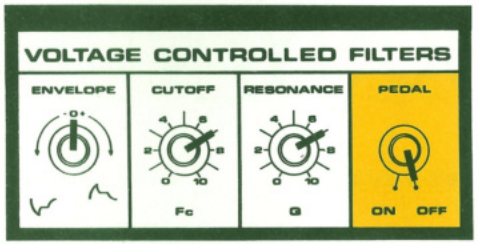
All ENVELOPE knob settings clockwise past the zero point — on the "positive" side, produce a "normal" movement of the cutoff frequency of the filter. That is, the cutoff is moved first **up** and then **down**, following the directionality of the signal coming from the ENVELOPE GENERATORS section. All settings counterclockwise of the zero point of the ENVELOPE knob cause the signal coming from the ENVELOPE GENERATORS section to be **inverted,** or turned upside down. Look at the graphics that accompany the ENVELOPE knob; they demonstrate visually what is happening internally.

Demonstrate normal and inverted cutoff frequency movement, or "enveloping" by setting the control panel as shown above and trying various positions of the ENVELOPE knob. (Listen to the Synthesizer only!) You will notice that extreme settings — far from zero — produce large excursions of the cutoff frequency and inverted settings sound just the opposite of normal settings.

Since positive ENVELOPE knob settings cause the filter cutoff to be raised when you depress a key, the sound will progress from "dark" to "bright". If the sound seems **too** bright at the maximum excursion you can do one of two things: (1) reduce (attenuate) the signal passing to the filter by moving the ENVELOPE knob setting back toward zero. (2) Set the **initial** cutoff frequency lower manually by turning the CUTOFF knob to a lower setting. (If you start with a lower cutoff frequency, your maximum excursion is reduced commensurately).

Extreme **inverted** settings may **lower** the cutoff frequency so much when you strike a key (remember, everything is upside down!) that all sound may be "cut off" and silence will result. You have the same options as with normal filter enveloping: (1) reduce the signal size going into the filter by moving the ENVELOPE knob back toward zero. (2) Adjust the CUTOFF knob; **upward in this case, since cutoff frequency is being driven too low.** The STRATUS is a polyphonic instrument; there is more than one filter within it. For a discussion of the musical implications, see the "STRATUS Polyphony" section of this manual.

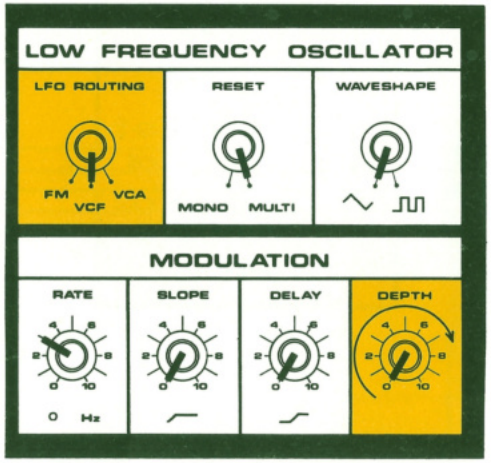
Wah Wah Pedal: PEDAL



The voltage controlled filters in the STRATUS are sensitive to voltage from **any** source. You can control the cutoff frequency of the filters with the STRATUS **footpedal** if you wish. Connect the footpedal to the VCF jack on the rear of the instrument. The pedal is operative only when the PEDAL rotary switch in the VOLTAGE CONTROLLED FILTERS section is switched ON. (This action forces the cutoff very high; **other** means of controlling the cutoff may be obscured, but they are still operative. For instance enveloping is still possible; but the cutoff is forced so high that only **inverted** settings may have an audible effect).

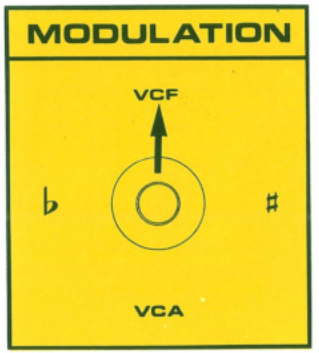
Pedal movement **replaces** CUTOFF knob movement when the PEDAL rotary switch is ON. That is, the CUTOFF knob is no longer operable, but filter cutoff frequency may be set using the footpedal. All other filter controls work as usual; for instance, if RESONANCE is set high (7 or above), the resonant "wah" effect will be achieved when the footpedal is moved.

Auto Wah Wah: VCF MODULATION



Since the filters in the STRATUS are voltage controlled, and sensitive to fluctuating voltages from any source, let's try another possibility. From previous experience you know that the LOW FREQUENCY OSCILLATOR produces repeating voltage patterns that rise and fall. The shape of the pattern is determined by the WAVESHAPE rotary switch. Go to the LOW FREQUENCY OSCILLATOR section and select VCF (the filters) with the LFO ROUTING rotary switch. This action connects the LFO to the necessary voltage control inputs of the filters. When the DEPTH knob is turned up, a filter modulation will be heard — **if** you are listening to the synthesizer. (Only the synthesizer has filters (VCF). All LOW FREQUENCY OSCILLATOR and MODULATION knobs and switches behave as you have previously learned. The end result of any filter modulation (or enveloping) is movement of the cutoff frequency — those little "invisible fingers" that move the CUTOFF knob for you.

Momentary VCF Modulation: MODULATION Joystick



VCF modulation may be introduced at any time, regardless of MODULATION section and LFO ROUTING settings. Simply push the joystick away from you (toward the Volume section) And modulation will occur at the rate set by the RATE knob. Modulation depth depends on the distance you push the joystick. If you have already set the LFO ROUTING rotary switch to VCF and have the DEPTH knob up to produce a continuous filter modulation, use of the MODULATION joystick will **add** (more depth) to the continuous modulation.

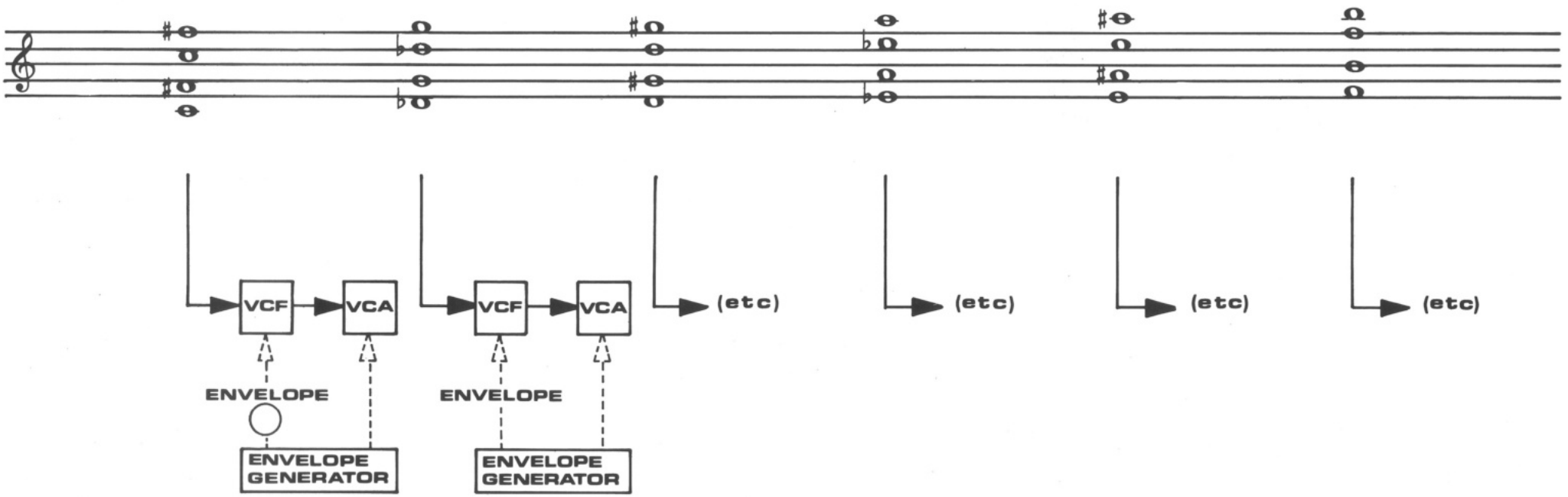
STRATUS POLYPHONY

The word **polyphony** means "many voices". In the design of electronic musical keyboards "polyphony" calls for the **independent** articulation, or "keying" of several different musical lines, or voices. This implies providing independent keying circuitry for each key on the keyboard. The organ of the STRATUS does have completely independent keyers; the depression or release of any key is not affectea by the depression or release of any other key. This complete independence is possible, in part, because organ keyers are simple, and the use of one for each key on the STRATUS is not prohibitively expensive.

The synthesizer within the STRATUS utilizes the more-complicated, **variable** voltage-control system of keying that allows a wider range of sound coloring and shaping. Each keying "channel" must have a voltage-controlled filter (VCF), a voltage-controlled amplifier (VCA), and an envelope generator (EG). To duplicate this circuitry for **each** key of an instrument the size of the STRATUS would make the instrument unaffordable. Some designers have tried to circumvent this situation by **limiting** the number of keys that can be played at any one time — the "two voice", "four voice", "six voice" approach. When **more** than the allowable number of keys is depressed, some notes being held may cease sounding; a newly-depressed key may refuse to play, or other problems **foreign to the keyboard player's experience** may arise.

Another compromise to circumvent the problem has been to retain complete polyphony, but provide only a **single channel** for articulation (only one VCF, VCA, EG "sound chain"). With this design, block chords may be articulated, but the single channel approach effectively rules out **polyphony** — several independently articulated voices.

At Crumar, our approach with the STRATUS is to **retain** full polyphony — all keys will sound at once if you press all of them — and still provide **multiple** articulation channels. We feel that this approach provides the most intuitive and least-limited design. We have provided not one, but **six** channels comprising a VCF, VCA, and EG **each.** Certain notes on the keyboard then **share** an articulation channel; notes chosen to maximize true polyphonic capability.



As the diagram shows, any note throughout its various octaves passes through the same channel; in addition, the note at the interval of the **tritone** (augmented fourth) also passes through that same channel. When this scheme is replicated chromatically — six times — all notes are accounted for. Most of the time you will be unaware of the keying scheme. Sometimes you may notice that a key you are holding will be **rearticulated** when you strike another specific key. For example, if you are holding a C and strike and F#, **both** tones will be articulated on striking the F#. (C and F# share a channel). The effect will be most pronounced when you are heavily enveloping the filter; that is when the ENVELOPE knob is in an extreme position. A revoicing of the chord held may cause the effect to be inaudible; more likely, you will discover new musical uses for the restrike capability and incorporate it into your playing technique.

EXTERNAL ARTICULATION AND VIBRATO CONTROL

The ENVELOPE GENERATORS section of the STRATUS offers powerful, variable control over articulation — the shaping of loudness and brightness of a tone in time. That **variability** exiss **before** you start playing — when you set the knobs in the ENVELOPE GENERATORS section; once set, the envelope produced each time a key is struck will be the **same**. We have made it possible for you to change the envelope shape **as you play** and also perform a vibrato that you can change in rate and depth according to your hand movements. The STRATUS has two jacks on the rear that are specifically designed to be connected to the STEINER MASTER'S TOUCH, a wind accessory for keyboards.

The MASTER'S TOUCH has a VCF and VCA that can act in lieu of those within the STRAUS (or other keyboard). When a special breath tube is blown, any signal passing through the MASTER'S TOUCH will be articulated (and filtered). Your breath acts like an envelope generator that is varied as you blow; the signal produced by blowing the breath tube controls the cutoff/gain of the VCF and VCA in the MASTER's TOUCH.

Ideally, the MASTER'S TOUCH requires an **unprocessed** audio signal — that is, one that is unfiltered and not heavily articulated. We have provided such a signal directly from both oscillators of the STRATUS at the SIGNAL OUT jack. Connect this output to your amplifier and play. At first, it seems that any note depressed will drone on forever. This is not quite true; any note played merely has a very long release time and will eventually die out. This is ideal for use with the MASTER'S TOUCH, for you want a "continuous" sound that you can articulate with your breath. Notice that notes continue to sound even after your hands leave the keyboard. You can even build **tone clusters** by **quickly** striking new keys; each new key will add to those struck previously. However, if you first remove your hands from the keyboard — while notes are sounding — and then depress and **hold** any key for a moment, all previously sounding keys will be canceled. (Only the one being **held** will sound).

In the specific case of using the SIGNAL OUT jack with the MASTER'S TOUCH. This allows the signal from the STRATUS to pass **through** the MASTER'S TOUCH to be articulated by your breath. In the more general case, use the signal from the SIGNAL OUT jack in any situation where you would like to process the **raw** oscillator waveforms — MIX is provided — signal from the STRATUS. Use of the SIGNAL OUT jack does not interfere with use of the other OUTPUT jacks. However, take note that the signal appearing at the SIGNAL OUT jack is **not** affected by knobs in the VOLTAGE CONTROLLED FILTERS, ENVELOPE GENERATORS, WAVEFORM SELECTION sections; don't be surprised if they have no effect — they shouldn't Most of their functions will have been superseded by external instruments such as the MASTER'S TOUCH.

The MASTER'S TOUCH also has a TM, or "touch modulator" that allows sensitive and direct control over vibrato. The performer places his finger on the TM pad and shakes from side to side, producing a fluctuating voltage that may be used to control any voltage controlled device. Specifically, we have provided the TM INPUT jack so that the pitch of the STRATUS oscillators may be controlled from an external device — the MASTER'S TOUCH, in this case. The TM INPUT jack is the **control** input to the first oscillator only, and only its pitch will be affected — unless the SYNC switch is on. In this latter case, **both** oscillators will be affected.

When the TM input jack is in use, normal FM connections on the STRATUS front panel are disabled. You create vibrato **either** externally, **or** by using the STRATUS front panel knobs — both are not possible simultaneously. Other modulations — VCF and VCA — function normally. This makes it possible to have both a VCF or VCA modulation under control of the STRATUS circuitry, and a vibrato produced externally. Specifically, connect the TM TRANSDUCERS OUT jack on the MASTER'S TOUCH to the TM INPUT on the STRATUS in order to produce vibrato using the MASTER'S TOUCH TM pad.

Either or both the TM INPUT and SIGNAL OUT jacks may be used; the use of one does not require the use of the other. For instance, you might use the SIGNAL OUT jack in order to provide external articulation and **not** use the TM INPUT jack, thereby preserving normal use of STRATUS FM (vibrato) capabilities.

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