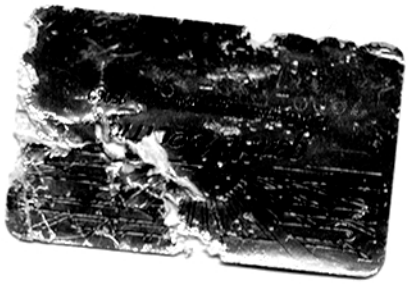
GENTLE ELECTRIC

MODEL 101

PITCH AND ENVELOPE FOLLOWER

OWNER'S MANUAL



CONTENTS

INTRODUCTION

Congratulations on your purchase of the Gentle Electric Model 101 Pitch and Envelope Follower. This piece of electronic equipment can give you many years of satisfying service.

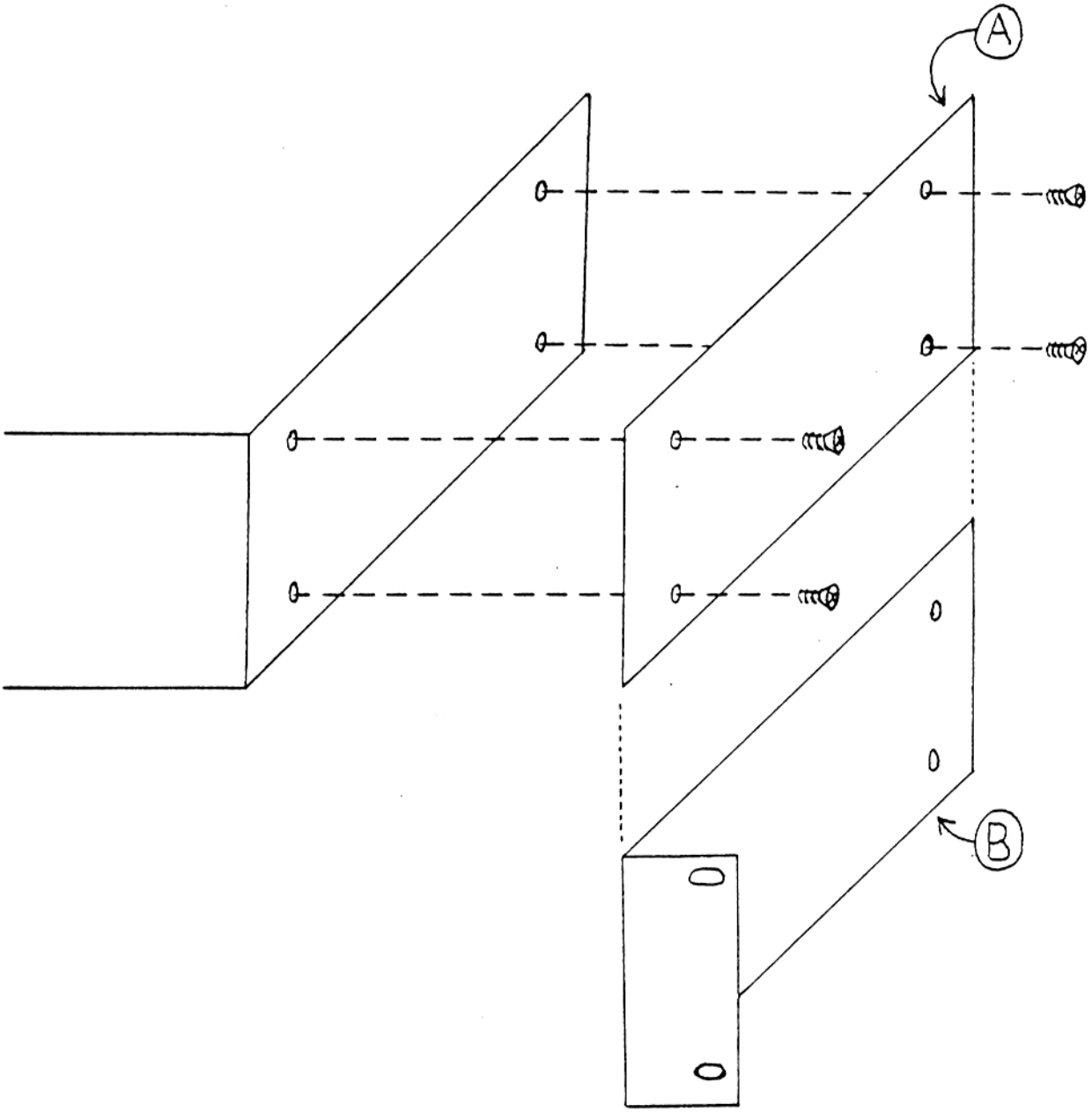
To get the best results from this sophisticated interface you should read this manual carefully to become familiar with the numerous features of the PEF. As you read through this manual you will find a number of patch diagrams which show particular ways the PEF can be used. Take the time to set these patches up and try them out, but don't stop there. These diagrams show just a few of the many ways the PEF can be used.

INSTALLATION

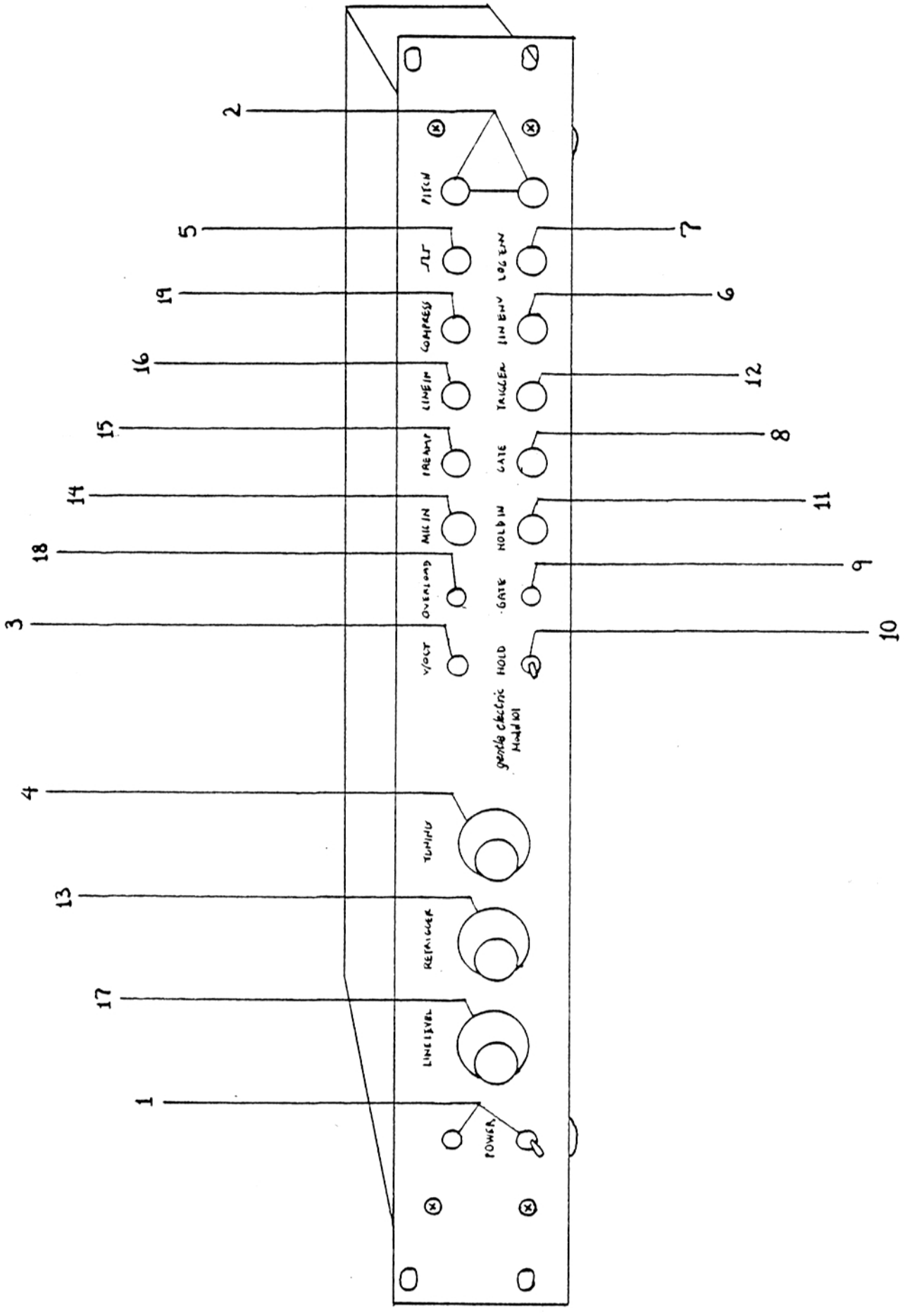
The PEF requires AC 117V 50-60 cycles. It should be located near the synthesizer to which it will be connected, and where the controls on the front panel will be within easy reach. The PEF may be rack mounted by changing the plain end panels on the cabinet to the rack mount style end panels, as shown in the diagram on the next page. Rack mount end panels can be ordered through your dealer.

The PEF will operate accurately over normal temperatures. It should be kept away from extreme temperatures or humidity, and direct sunlight or intense heat should be avoided.

SIDE-PANEL INSTALLATION



Method of attachment of the plain side-panel (A),
or the rack-mount side-panel (B).



FUNCTION DESCRIPTION

FUNCTION DESCRIPTION (also see Block Diagram)

1) Power Switch and Indicator

If the indicator doesn't light when you flip the switch up, check that the power cord is plugged in and that the fuse is good. The unit will operate immediately, but for the best pitch tracking, allow it to warm up for a few minutes.

2) Pitch

The pitch output is a 1 volt/octave DC control voltage normally used to control the frequency of a voltage controlled oscillator. For convenience, there are two pitch outputs. Both are the same.

3) V/oct.

This volts/octave trim is set at the factory for 1volt/octave to be compatible with most synthesizers. If your oscillator isn't tracking accurately and you don't wish to change the v/oct. trim on it, you can easily adjust the v/oct. trim on the model 101 by following the directions in the initial setup procedure.

4) Tuning

The tuning control changes the pitch output by 2½ octaves up or down. The tuning control has no affect on the pulse wave output.

5) Pulse Wave (⎍)

This is a 10 volt peak-to-peak pulse wave output at the fundamental frequency of the input signal. The pulse width is determined by the input signal waveshape.

6) Linear Envelope

The linear envelope output is a DC voltage proportional to the amplitude or loudness of the input signal. It can be used to vary the gain of a linear voltage controlled amplifier (VCA) and/or the cutoff frequency of a voltage controlled filter (VCF).

7) Log Envelope

The log envelope output is a DC voltage which follows the logarithm of the amplitude of the input signal. It is more sensitive to changes at low amplitudes than at high amplitudes. It can be used in the same instances as the linear envelope, although with different results, and for other applications, such as reversed dynamics. (see patch diagram #10)

8) Gate

The gate output is a high DC voltage (12 volts) when "on" and 0 volts when "off". The gate turns on for medium to loud signals and off for soft signals or silence. The gate can be used to control an envelope generator in your synthesizer, which can then be used in the same way as the linear envelope output described on the last page. It can also be used with various digital gating inputs, such as track and hold, oscillator gates, sequencers, etc..,.

9) Gate Indicator

The gate indicator light is on when the gate is high, and off when it is low.

10) Hold

The hold switch, when activated, will hold the last pitch (and the gate will stay on) until the switch is disengaged. The switch is momentarily on (as long as someone is holding it) in the down position but will remain locked on in the up position. The switch is off in the center position. The hold function can also be controlled externally using the hold in jack.

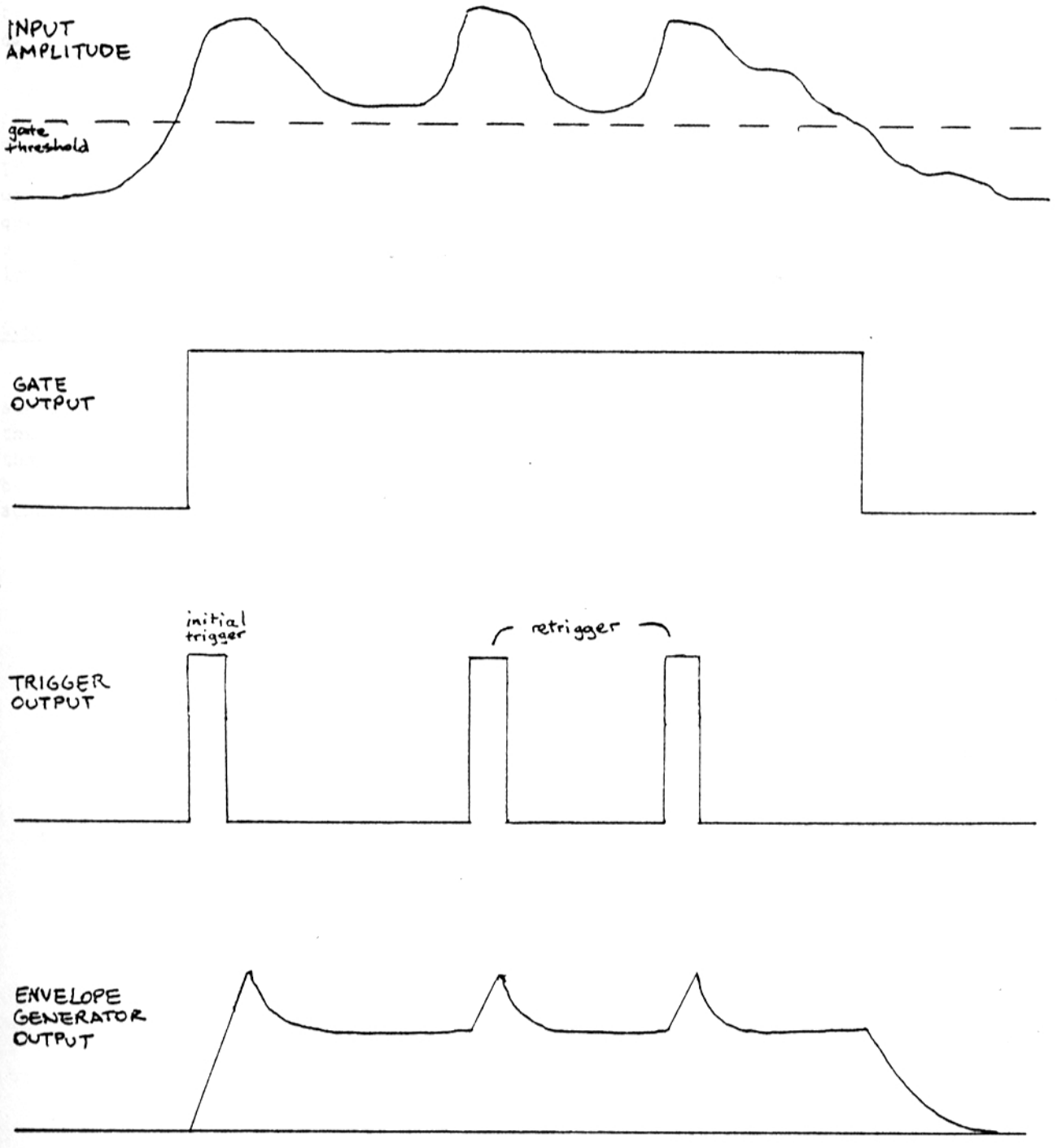
11) Hold In

The hold function can be operated by a remote source, such as a footswitch or other external switch or with a synthesizer voltage (such as a clock output from a sequencer). A footswitch is available as an accessory. The hold function is activated when this input is shorted to ground by a footswitch or when a control voltage below 1 volt is applied.

12) Trigger

This output, which is normally at 0 volts, produces a 10 volt, 3 msec. pulse. There are two types of conditions that can produce trigger outputs from the model 101: an initial trigger and a retrigger (see diagram on next page). The initial trigger will occur whenever the gate comes on (i.e. at the beginning of a sound). The retrigger occurs when a gate is already present and there is a sudden increase in the amplitude of the input signal. The retrigger can be made more or less sensitive to different amplitude changes by adjusting the retrigger control. Retriggering allows your synthesizer to respond to subtle articulation accents. The trigger output can be used along with the gate to control an envelope generator with both gate and trigger inputs, or to trigger a sample and hold, sync a low frequency oscillator, or step a sequencer.

TRIGGERING DIAGRAM



13) Retrigger

The retrigger control adjusts the sensitivity of the retriggering circuit to amplitude increases in the input signal. Retriggering will occur at smaller increases in signal amplitude as the retrigger control knob is turned clockwise. When the retrigger control knob is turned all the way counter clockwise, there will be no retriggering. In this instance only the initial trigger will occur (when the gate first comes on). The gate must be on and the retrigger sensitivity turned up to produce retriggering.

14) Mic In

This input accepts signals from microphones or instrument pickups, which then go into a low noise, high gain preamp. This input is high impedance, unbalanced. However, it will work fine with low impedence and/or balanced signals.

15) Preamp

This is the output of the preamp. This output is also patched internally to the "normal" connection of the line in jack, so that the preamp output is normally connected to the line input unless a patchcord is inserted into line in, in which case the normalled connection is broken. (The preamp output is then disconnected from the line in jack.) This allows for seperate use of the mic preamp from the rest of the PEF. The line in signal may be pitch followed while using the mic preamp for something else.

Note: The mic preamp is quite sensitive. It is possible to distort the preamp by using too hot of a signal in which case it may be necessary to attenuate the input signal, or apply it to the line input. (see overload)

16) Line In

Line level signals, such as those from tape decks, or synthesizers, etc., should be connected to the line input. Also, some instrument pickups are capable of putting out fairly high level signals in which case they should be connected to line in rather than mic in unless attenuated first.

17) Line Level

The line level control is an attenuator on the signal patched into the line input, or the preamp output if nothing is connected to line in. When turned all the way clockwise all of the input signal is passed through. When turned all the way counter clockwise, no signal will pass through. The line level control should be set so that the input signal causes the overload light to flicker occasionally on the very loudest passages.

Note: The line level control will also affect both envelope outputs, gate and trigger thresholds, and the compressor output.

18) Overload

The overload indicator will turn on whenever the line input signal is too loud, which would result in clipping distortion in the compressor and degraded pitch following. Retriggering will not occur when the overload light is on. It is possible to overload the mic preamp without the overload indicator turning on if the line level control is turned too far down. (The mic preamp may be distorted but if the line level control is turned down low, not enough of the distorted signal will get through to turn on the indicator.) If the line level control is set at about 2 o'clock then the overload indicator will also show preamp overload. If you are finding that your signal frequently overloads the mic preamp, try going directly into the line input, or attenuate your mic output before connecting it to mic in, or use an external, lower gain preamp.

19) Compress

A compressor output is included in the model 101. The amplitude of the signal is 10 volts peak-to-peak. The compressor removes the dynamics from the input signal by boosting low amplitudes and limiting high amplitudes so that the output signal is always at the same amplitude. The compressor can be used in many ways, including wide dynamic range signal processing, controlled acoustic feedback, and dynamic reversal. (see patch diagrams 7,8,9,10)

OPTIMUM PITCH EXTRACTION

To achieve the best results from the pitch and envelope follower, it is necessary to understand some essential points about how to obtain good signals and what kinds of signals the pitch follower needs to track pitch reliably. Of course, pitch following is only one of the many features of this interface. All the other features can be used with any type of signal, whether it contains pitch information or not. For example, the envelope follower, gate, and trigger outputs can be used as a percussion interface.

In order to be affordable and compact, and operate in real time, the PEF was designed to analyze a restricted class of signals: those that are clearly pitched, monophonic, and low noise. To understand why this was necessary you must appreciate that at the present time there is no universal procedure for detecting the pitch (or pitches) present in all possible types of signals, even with the largest and fastest computers (or your ear), let alone in real time. So you must take care that those signals which you wish to pitch follow reliably have the following qualities:

1) THE SOUNDS MUST BE PITCHED. For example, the PEF will follow vocal vowel sounds extremely well. But what is the pitch of an "s" or a "t"? There is no particular pitch, but the PEF will try anyway, and will respond to the high frequencies of these sounds, and give rapidly changing sequence of high pitches which will sound pretty random. (Of course some people like to make use of this effect.) With woodwinds, one must take care not to make sounds with the fingers or keys that might get into the PEF. Very strong articulations will also produce brief unpitched noises.

2) THE SIGNAL MUST BE MONOPHONIC. This pitch follower is monophonic, in that it generates a single pitch-related control voltage--this control voltage cannot make an oscillator produce more than one pitch. When two or more tones are mixed together, the resulting composite may be more or less "periodic" as a whole. Certain intervals, for example a perfectly-tuned fifth, have a highly periodic nature that the PEF will detect as a single pitch, interpreting the individual tones as harmonics of some lower frequency. In the case of a perfect fifth, the PEF will treat these as 2nd and 3rd harmonics of a frequency an octave below the lower tone. However, most signals with more than one tone will cause the PEF to give an apparently random sequence of outputs, as it detects changing periodicity in the composite signal.

3) LOW BACKROUND NOISE. In any real situation there will be some amount of extraneous signal present in addition to the pitched signal of interest. What is important is to keep this at a very low level compared to the main signal. If the pitch follower gives rough or erratic results you should suspect the presence of one or more of the following types of noise. Noise will have the most effect when the main signal is at its softest level.

a) Noise or hum introduced in the pickup or its preamp.
b) Plucking, striking, tonguing, bowing, finger, key, or mechanism noise.

c) Residual or sympathetic vibration in the other strings of a multi-string instrument.
d) Wind, either from the instrument or the weather.
e) Miscellaneous extraneous sounds, such as other instruments in the ensemble, traffic noise, or talking.
f) Sound from the synthesizer or PA leaking back into the PEF.
g) Reverberation, including that introduced by the room acoustics. Reverberation tends to change a monophonic signal into a polyphonic one by holding previous pitches.

Nearly all of the above problems are eliminated by using a high quality contact microphone or pickup. More about pickups a bit later.

4) NO PREDOMINATING HARMONIC. The ideal signal for pitch following would have most of its energy in the fundamental, or spread across a number of harmonics. The worst kind of signal is when one harmonic predominates over the fundamental and over all the other harmonics. The PEF may interpret that harmonic as the real pitch. So might your ear!

5) HARMONICALLY RELATED PARTIALS. Certain sounds, like some bells, will be difficult to pitch follow because they contain a number of frequencies which are not true harmonics of a fundamental, that is they are not exact multiples of the fundamental frequency. The PEF may not give good results because the signal is not strictly monophonic.

The harmonics of some instruments, notably string instruments especially when the strings are worn, are not exact multiples of the fundamental. This is generally not a problem, but may occasionally cause a small glitch or jump in the pitch follower output.

6) The signal must not be excessively weak, because the PEF only tracks signals above a certain loudness. When the signal drops below that level the PEF holds the last pitch. Very weak signals are simply ignored.

HOW TO PICK UP SIGNALS

In live situations, the best way is to use a high quality contact microphone or pickup, especially one designed for the particular instrument, because it eliminates feedback problems and the sounds of other instruments. Although some musicians don't care for the sound of contact pickups, this is not the main issue for pitch following. Besides, a microphone could also be used for direct sound. Contact type pickups are often very critical as to proper placement, and a small change in location may greatly change the amplitude and harmonic content of the signal. Try to use a position which gives strong signals at the fundamental frequency of all the notes. Avoid using cheap pickups that have strong resonances which could excessively favor an upper harmonic of some notes.

For reed woodwinds, a contact pickup on the base of the reed or on the ligature should be tried. On double reeds stick it to the staple, tube, or bocal. This may require removing some cork from the reed, and/or tying the reed differently.

On flutes, and all metallic winds, the best pickup is the type which is attached to a small hole which is drilled in the instrument for that purpose. This is permanent, but when done properly does not harm the instrument. For brasses, a small pickup or microphone placed in the bell works great.

On string instruments, the ideal solution is to have a multi-channel pickup which gives a separate, well-isolated output signal for each string, then select one of these outputs to pitch follow, or use a pitch follower for each string. This is how guitar synthesizer pitch followers work. With a single pickup for all the strings, great care must be taken with playing technique to only play one string at a time, damping out all the other strings. For violins and similar strings, contact pickups should be placed on the bridge if possible, so as to get the maximum fundamental signal without the body resonance effects. The bridge pickup should be closest to the high string. Electro-magnetic pickups (like electric guitar pickups) should be placed as close to the center of the vibrating portion of the string as possible, that is near the neck rather than the bridge, to get the maximum fundamental tone. Solid body guitars work far better than acoustic guitars. Best results will be had from also plucking or bowing the string closer to its center rather than near the bridge.

If an open air microphone is used, it must be placed very carefully, and the room acoustics and extraneous noise must be very well controlled. It must be placed so that it will get a consistent, high level of pitched tone, but very little noise from the instrument mechanisms or breath.

With the voice, the microphone should be placed near the mouth or nose, but above or to the side of the breath stream. Same with the flute or recorder. On woodwinds, much of the sound comes out of the first open finger hole, so the sound moves from note to note. If the player is willing to move the instrument around to keep the right hole near the microphone, reasonably good results may be had. This also allows the player to control the volume level somewhat independently of the actual instrument loudness. The sound coming out of the bell of woodwinds is generally good, but it may be stronger on low notes, and may contain a "pop" when a key is depressed.

Keep in mind that an air microphone placed in the breath stream of the voice or of a wind instrument will pick up pops and wind sounds which you won't hear in the direct acoustic sound, but which will definitely confuse the pitch follower.

On string instruments, strong sound comes out of the holes in the body of the instrument.

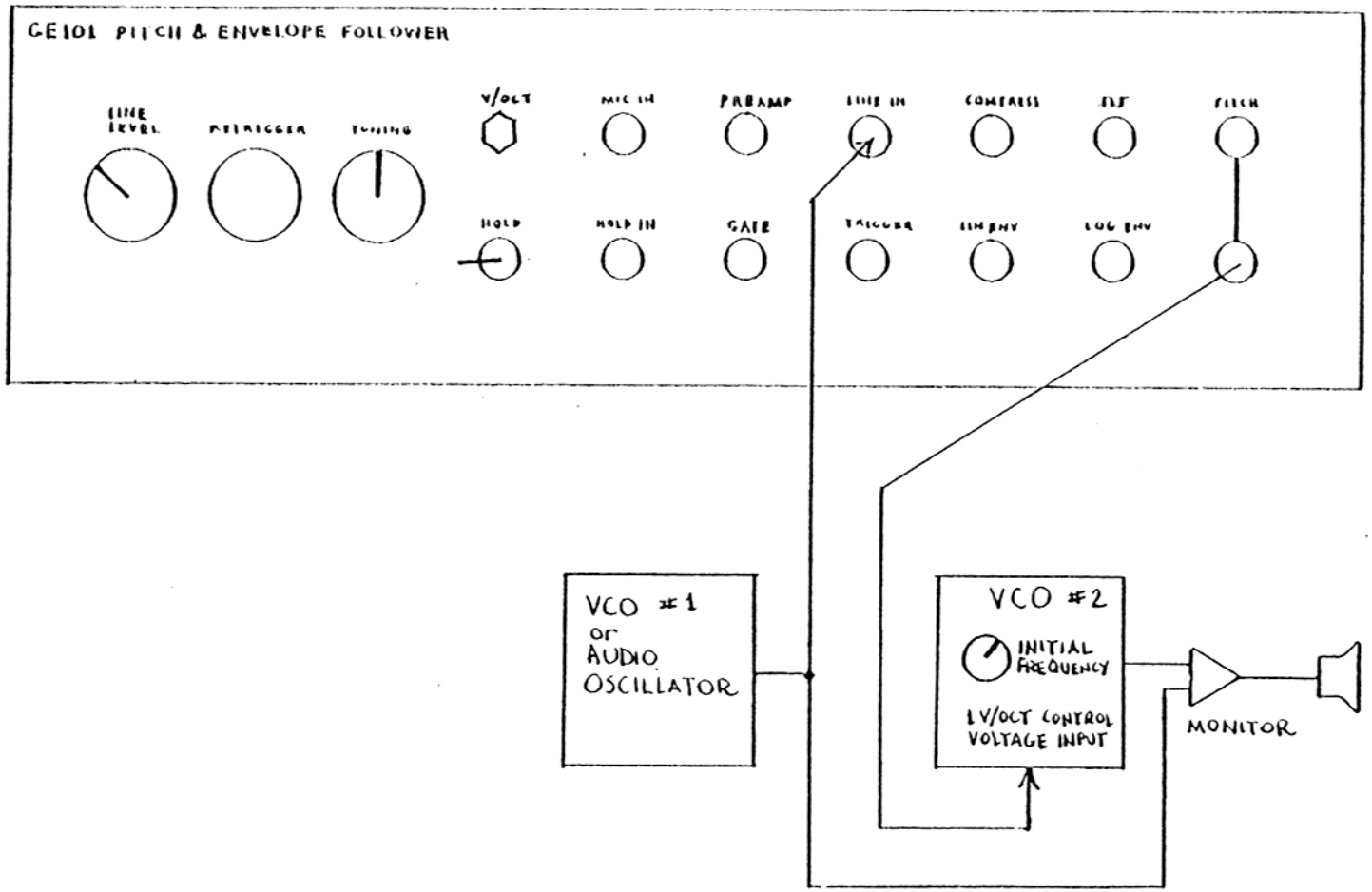
With open air microphones, one must always be careful to avoid reverberent spaces, or any other sounds in the space, INCLUDING THE OUTPUT OF THE SYNTHESIZER.

To get the best results for your applications you will want to experiment with both open-air microphones and contact pickups. Both have their advantages and disadvantages.

RECORDED SOUNDS

Recorded sounds can be used very successfully with the PEF, so long as they were originally recorded with the same precautions as for live sounds, and if the recording is low-noise. Recordings give the advantage that the original sound does not have to be heard if you want to hear only the synthesizer. Better results may sometimes be obtained by experimenting with e.q. before pitch following.

PATCH #1:
ADJUSTING PITCH 1V/OCT TRACKING



Set LINE LEVEL so that GATE l.e.d. is on & OVERLOAD l.e.d. is off.
Set TUNING knob to center position.
Make sure HOLD switch is in center position.
Pitch 1V/OCT tracking is adjusted by means of the panel trim pot labeled V/OCT.
First, loosen the nut. Next, adjust the trim pot with a screwdriver, so that the second oscillator tracks the first one.
Finally, tighten the nut.

INITIAL SETUP - v/oct. tracking adjustment

Refer to Patch #1. Before making the v/oct adjustment on the PEF, be sure your oscillators are all properly tracking at 1v/octave. The PEF has been adjusted at the factory for 1v/octave tracking within .004v (1/20 semitone) over the range of 200 Hz to 3000 Hz, and may be used as a reference for adjusting your oscillators if you wish. Or, if you don't want to change your synthesizer, you can adjust the PEF to it.

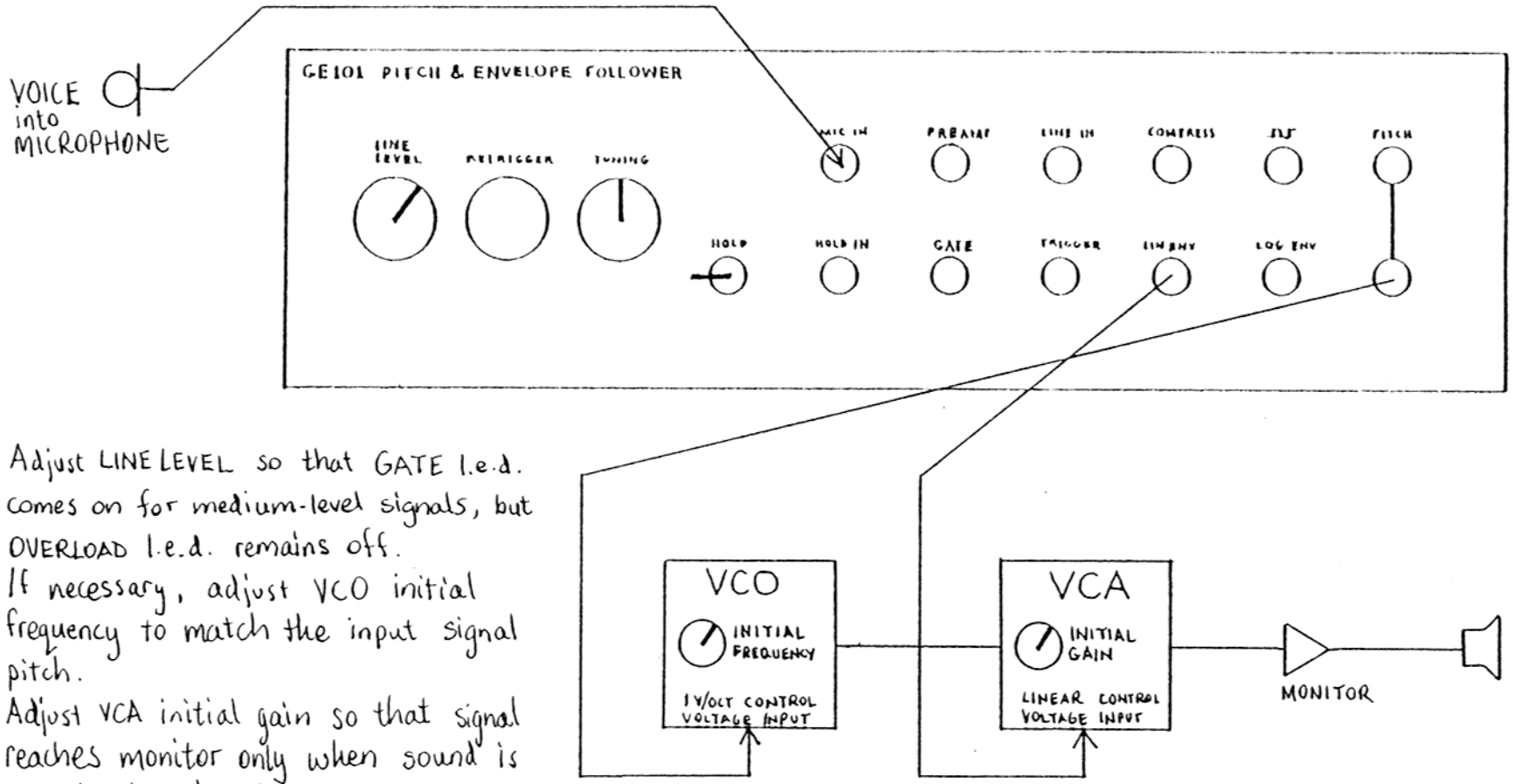
If your oscillators cannot all track identically, it is best to pick the one oscillator which will most often be controlled by the pitch follower and adjust the PEF to it by connecting that oscillator as shown for VCO #2 in Patch #1.

Set up the patch as shown. "VCO #1 or Audio Oscillator" may be any other audio frequency oscillator. Set LINE LEVEL so that the GATE L.E.D. indicator is on, but the OVERLOAD L.E.D. is off. Make sure that the HOLD switch is in the center position. Let the PEF and synthesizer warm up thoroughly (5-10 minutes is plenty for the PEF).

Loosen the outer nut on the V/OCT trimmer on the PEF. Listen to both oscillators simultaneously. Temporarily disconnect the PITCH output from VCO #2. Set the initial frequency on oscillator #1 to a low-medium frequency, like around 200 Hz. Set the initial frequency of VCO #2 to unison with Osc. #1. Now reconnect the PITCH output to VCO #2. This will cause the frequency of VCO #2 to change. Adjust the TUNING knob on the PEF so that VCO #2 is in exact unison with Osc. #1. Now raise Osc. #1 to a medium high frequency, like to around 3000 Hz, or to the highest note you will be using the PEF to follow. Adjust the v/oct trimmer for an exact unison. Tighten the nut on the v/oct trimmer. You are done.

In general the v/oct. adjustments on oscillators and the PEF are much more stable than the frequency itself. If after some time the oscillator is out of tune, first try simply tuning the oscillator frequency. This will nearly always fix the problem, so long as the v/oct adjustment was done carefully in the first place.

PATCH #2: BASIC PITCH & ENVELOPE FOLLOWING



Adjust LINE LEVEL so that GATE l.e.d. comes on for medium-level signals, but OVERLOAD l.e.d. remains off.
If necessary, adjust VCO initial frequency to match the input signal pitch.
Adjust VCA initial gain so that signal reaches monitor only when sound is present at microphone.

Notes:
- keep microphone away from monitor speaker.
- for initial tryout, use nice loud vowel sound without blowing on microphone excessively.

Things to try:
- change VCO initial frequency to an octave above or below the input frequency, or to some other tracking interval.
- use a keyboard, sequencer, or other control voltage source going into the VCO at the same time, in order to program the tracking interval.

PATCH DIAGRAMS AND DESCRIPTIONS---BASIC PITCH AND ENVELOPE FOLLOWING

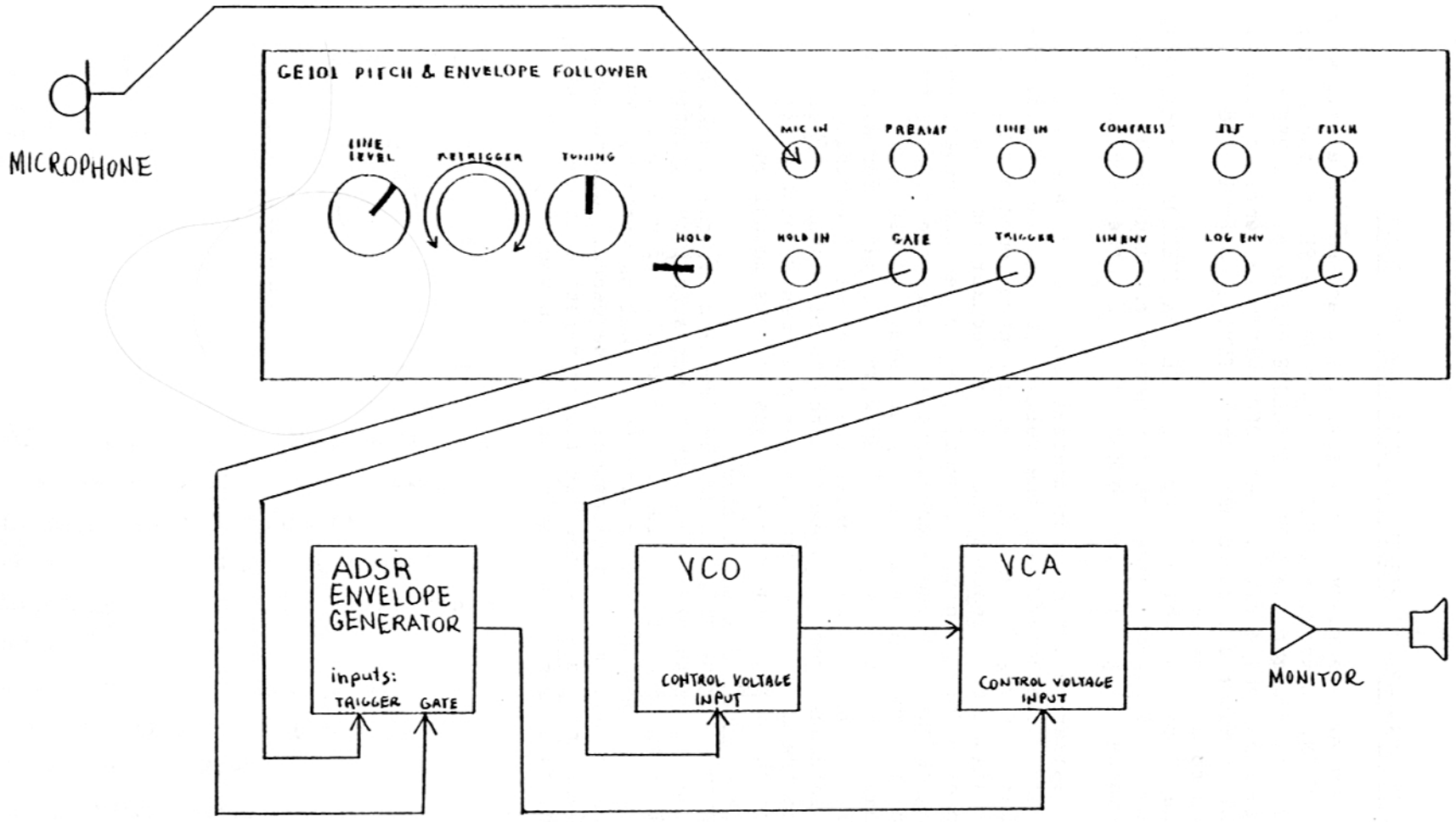
Refer to Patch #2. Now you are ready to try some pitch and envelope following. Connect a microphone to MIC IN. Connect the PITCH output of the PEF to the control voltage input on your VCO, and connect the LINEAR ENVELOPE output of the PEF to the linear control voltage input on your VCA. Set HOLD switch to center position. Set the LINE LEVEL control to about 2 o'clock and center TUNING control. Do not connect synthesizer output to monitor amp yet.

Play or sing into the microphone while observing GATE and OVERLOAD indicators. Adjust LINE LEVEL so that GATE indicator comes on for medium and loud level signals but OVERLOAD indicator remains off (or flickers occasionally for the very loudest sounds).

Now connect the synthesizer output to your monitor amp. If you are using a monitor speaker rather than headphones, keep the volume down and keep the microphone away from the speaker. If there's an initial gain control on the VCA, set it so that the oscillator signal only reaches the monitor speaker when sound is present at the microphone. For an initial tryout, use a nice load vowel sound (like "A") without blowing on the microphone excessively. Place the microphone to the side of your mouth or above your mouth near your nose. Adjust your oscillator frequency to match the input signal. Play with this patch for awhile to get a feel for the PEF. If you notice an excessive amount of glitching, it is most likely due to feedback from the speaker into the microphone, or to wind noise from blowing on the microphone, or improper placement of the microphone. It is important to thoroughly read the sections of this manual on OPTIMUM PITCH EXTRACTION and HOW TO PICK UP SIGNALS.

As you gain familiarity with the PEF, change the frequency of the tracking oscillator to a fifth or an octave above or below the input signal by adjusting either the tuning control or the oscillator frequency control. If you have a sequencer, try controlling the same oscillator with it as well as with the PEF. Now you can use your voice or instrument to transpose the sequence. Or you can use your synthesizer keyboard to transpose the oscillator relative to the input. (Hint: tune the oscillator to unison while playing middle C on your keyboard)

PATCH #3:
PITCH FOLLOWING WITH SYNTHESIZED AMPLITUDE ENVELOPE



Vary ADSR settings and RETRIGGER sensitivity.

Notes:
- If your ADSR has no "TRIGGER" input (or equivalent), then the RETRIGGER control will have no effect. This control adjusts the sensitivity for additional "re"-triggering after the gate is already on.
- When the GATE l.e.d. goes off, the "last" pitch of the input signal is held. If you let the pitch "sag" at the end, or make a noise, then the held pitch may be erroneous. If the release duration of the ADSR is long, then you may hear this error before the VCA turns off.

PITCH FOLLOWING WITH SYNTHESIZED AMPLITUDE ENVELOPE

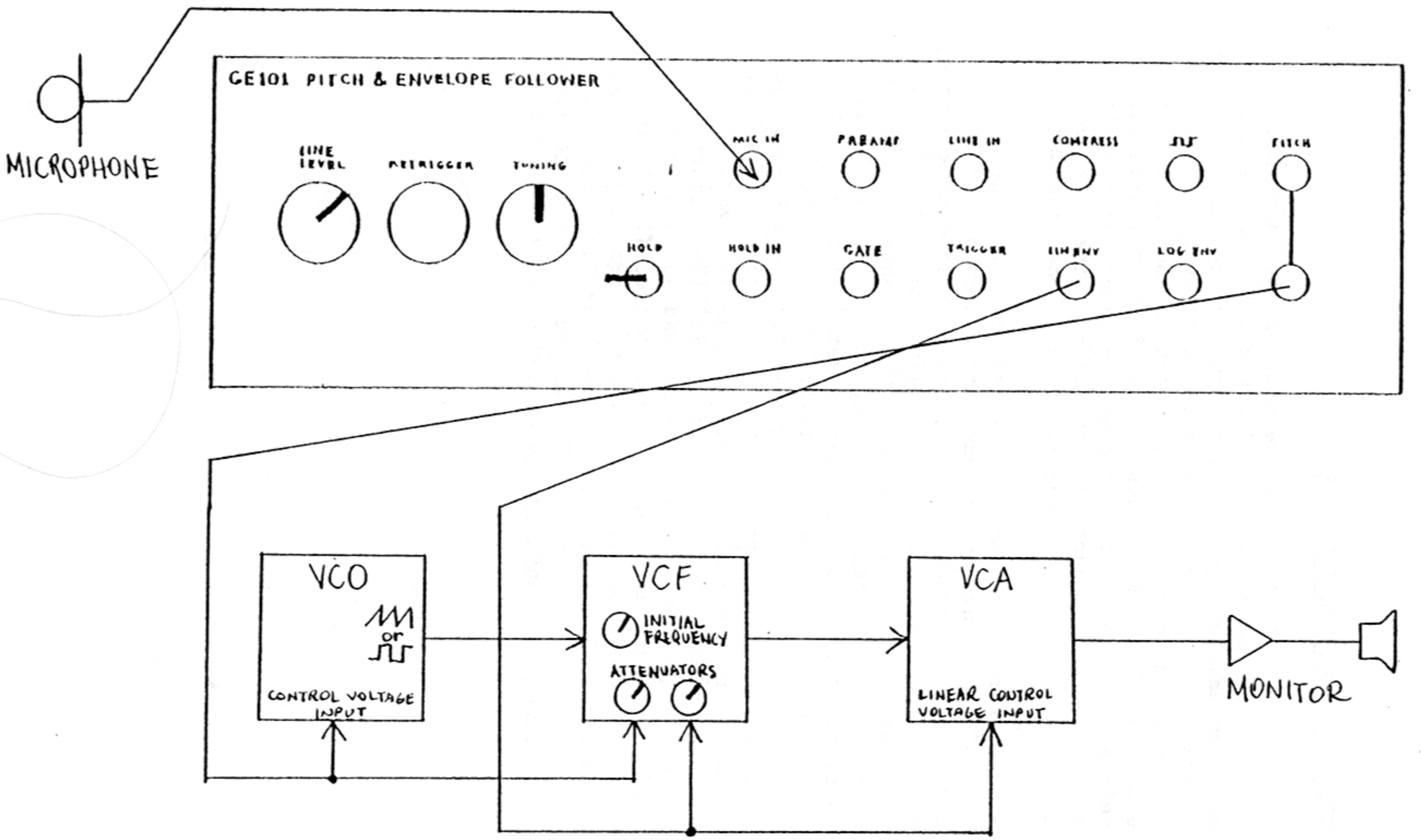
Refer to Patch #3. Basically, this patch is the same as the last one, but instead of using the LINEAR ENVELOPE output of the PEF, you will use the GATE and TRIGGER outputs to control an envelope generator in your synthesizer, which then controls the VCA. Use the same set up procedure as in the last example. The PITCH output is still connected to the control voltage input on your oscillator. But this time, connect the GATE and TRIGGER outputs on the PEF to the gate and trigger inputs of your envelope generator. If your envelope generator doesn't have both gate and trigger inputs, then connect just the GATE to the envelope generator (the retrigger control will have no effect). Connect the envelope output to the control voltage input on the VCA.

Now proceed as in the last example with an initial tryout. Vary the attack, decay, sustain, and release (ADSR) settings on the envelope generator and notice the differences. The last pitch of the input signal is held. When ending a note, it is common for a performer to bend the pitch slightly, although we don't notice it acoustically. The synthesizer, however, will pick up that change in pitch and if the release time set on the envelope generator is long enough, you may hear this "error" before the VCA turns off. This situation is remedied by playing more carefully at the end of notes, or by using a footswitch to hold the last pitch at the end of a note, or by using a faster release setting on the envelope generator, or by using the linear envelope output on the PEF to control the VCA.

If your envelope generator is retriggerable because it has both gate and trigger inputs, you can make use of RETRIGGERING. Turn the RETRIGGER control fully clockwise. Set the envelope generator attack, decay, and sustain to fairly low values. Now make a sound which has sustained volume with occassional accents (like singing "nanananana..."). Be sure to keep the sustained level high enough so that the GATE indicator stays on. You should be able to hear "articulation" from the synthesizer, although it may seem subtle. Try adding a VCF to the patch (before or after the VCA) and connect the envelope generator to it also. The effect will be more obvious.

PATCH #4:

PITCH FOLLOWING & ENVELOPE FOLLOWING WITH FILTER TRACKING PITCH AND/OR ENVELOPE



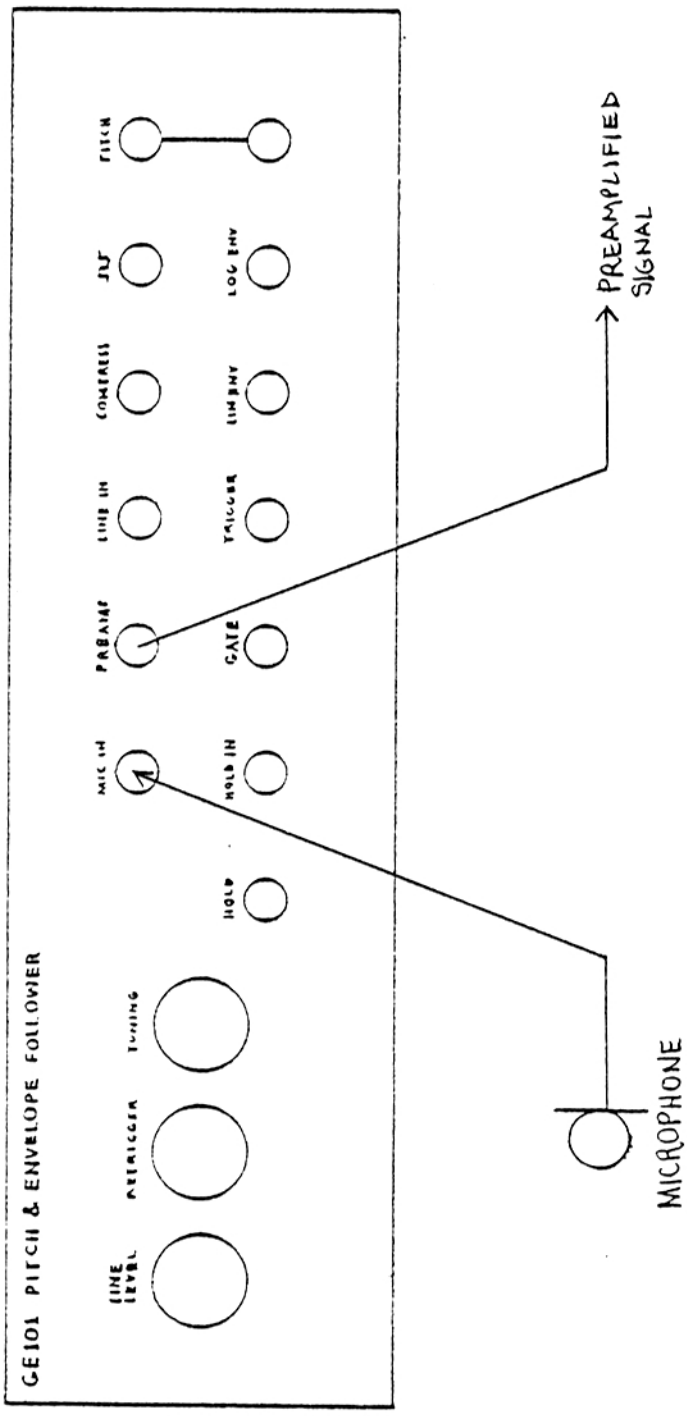
Parameters to vary:
- VCF initial frequency
- VCF "Q" ("Resonance" or "Regeneration")
- Attenuators on VCF control voltages

Elaborations:
- Use ADSR or envelope followers to modulate the pulse width of the VCO.
- Use ADSR to control VCF.

PITCH AND ENVELOPE FOLLOWING WITH FILTER TRACKING PITCH AND/OR ENVELOPE

Refer to Patch #4. Connect one PITCH output to the VCO and the other PITCH output to the control voltage input on your VCF. Since there is only one LINEAR ENVELOPE output on the PEF it is necessary, at this point, to split the LINEAR ENVELOPE output signal by either using a Y connector or running the LINEAR ENVELOPE output to a "multiple" on your synthesizer. Now take these two outputs and connect one to the control voltage input on the VCA and the other to a control voltage input on the VCF. In this configuration, the cut-off frequency on the VCF will change with the pitch and amplitude of the input signal.

Experiment with this patch for awhile. Try varying the VCF initial (or cutoff) frequency and the regeneration (or resonance) controls. You could use both the linear envelope and envelope generator in the same patch. Also try inverting the control to the filter if you have an inverter on your synthesizer.



Note: all the pitch and envelope following capabilities of the GE101 remain available via the LINE IN.

PATCH #5:

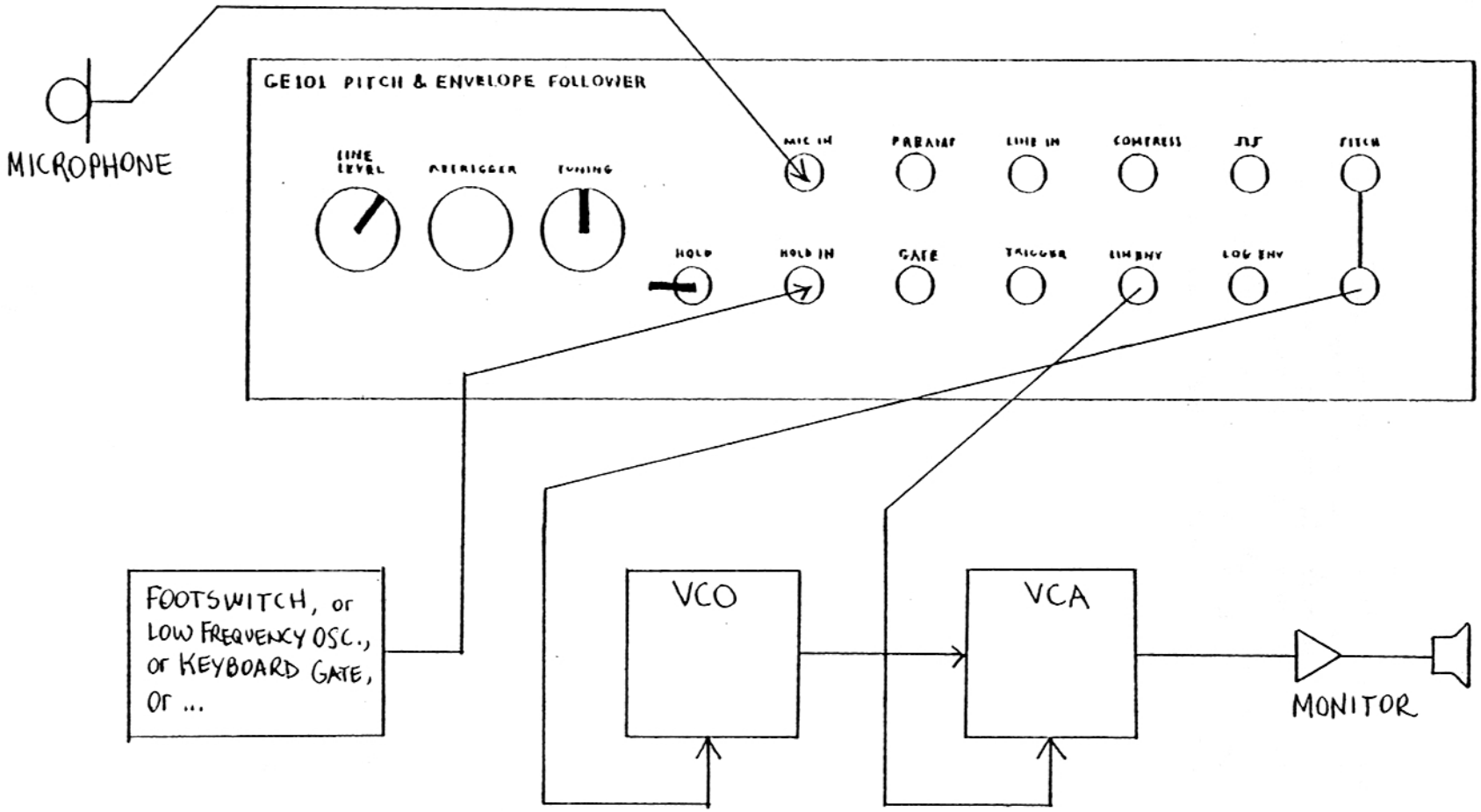
INDEPENDENT USE OF MIC PREAMP

INDEPENDENT USE OF MIC PREAMP

Refer to Patch #5. The mic preamp may be used independently of the rest of the PEF. Connect a microphone to MIC IN. Now connect the PREAMP output to your monitor amp. If you notice distortion in the output signal it may be necessary to attenuate the signal before connecting it to MIC IN.

All the pitch and envelope following capabilities of the model 101 are available through the line input. (If you're not using the line input, the microphone signal can still be used for pitch and envelope following.)

PATCH #6: PITCH TRACK & HOLD EXTERNALLY CONTROLLED



Whenever the voltage at HOLD IN is pulled down to near ground (below about 1V) the PITCH voltage output holds the previous pitch, and the GATE output is kept "on".

Also, try using the logical inverse of a keyboard gate so that the HOLD IN voltage is low when a key is depressed, and high otherwise. The VCO may also be controlled by the keyboard control voltage.

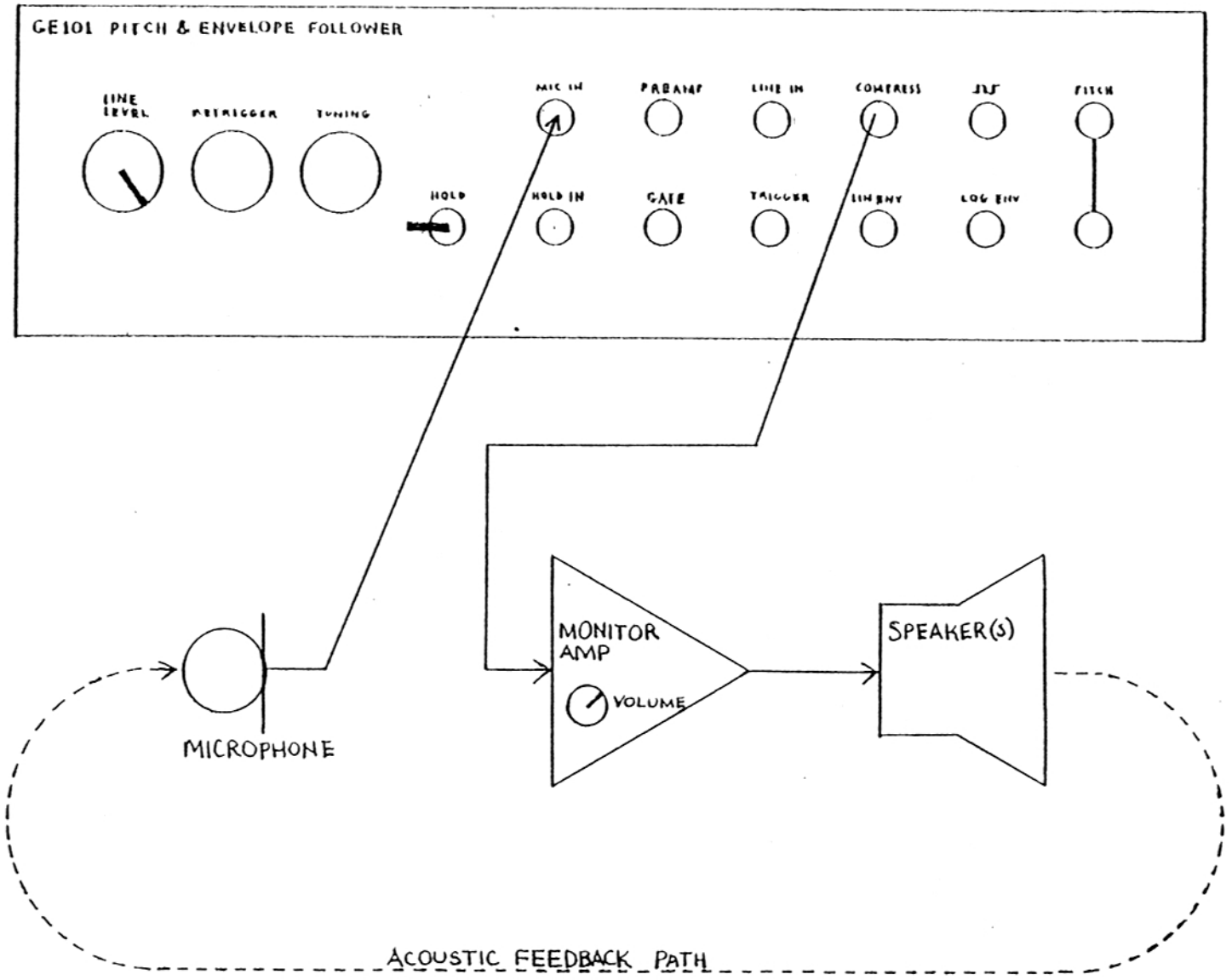
PITCH TRACK AND HOLD EXTERNALLY CONTROLLED

Refer to Patch #6. The PITCH and GATE outputs of the PEF can be externally held or sustained by using a footswitch, or by using a synthesizer control voltage. (such as a low frequency oscillator, keyboard gate, sequencer clock, etc..,) A footswitch is available as an accessory.

Connect the desired control to HOLD IN and make sure that the HOLD switch on the panel is centered. Whenever the voltage at HOLD IN is pulled down to near ground (below about 1volt) the PITCH output voltage is held and the GATE output is kept "on". The gate output of a keyboard is normally low until a key is pressed. If you are using a keyboard gate to activate the hold mode of the PEF, then the PITCH and GATE outputs on the model 101 will be held until a key is depressed. If you "logically"*invert the keyboard voltage, the opposite will occur. Activating the panel hold switch will override any control connected to HOLD IN.

* Logical inversion: change high voltage to zero, and zero to high. If your synthesizer does not have a logic inverter, you can get the same effect by inverting the keyboard gate in a regular inverter, then adding to that a positive bias.

PATCH #7: CONTROLLED ACOUSTIC FEEDBACK



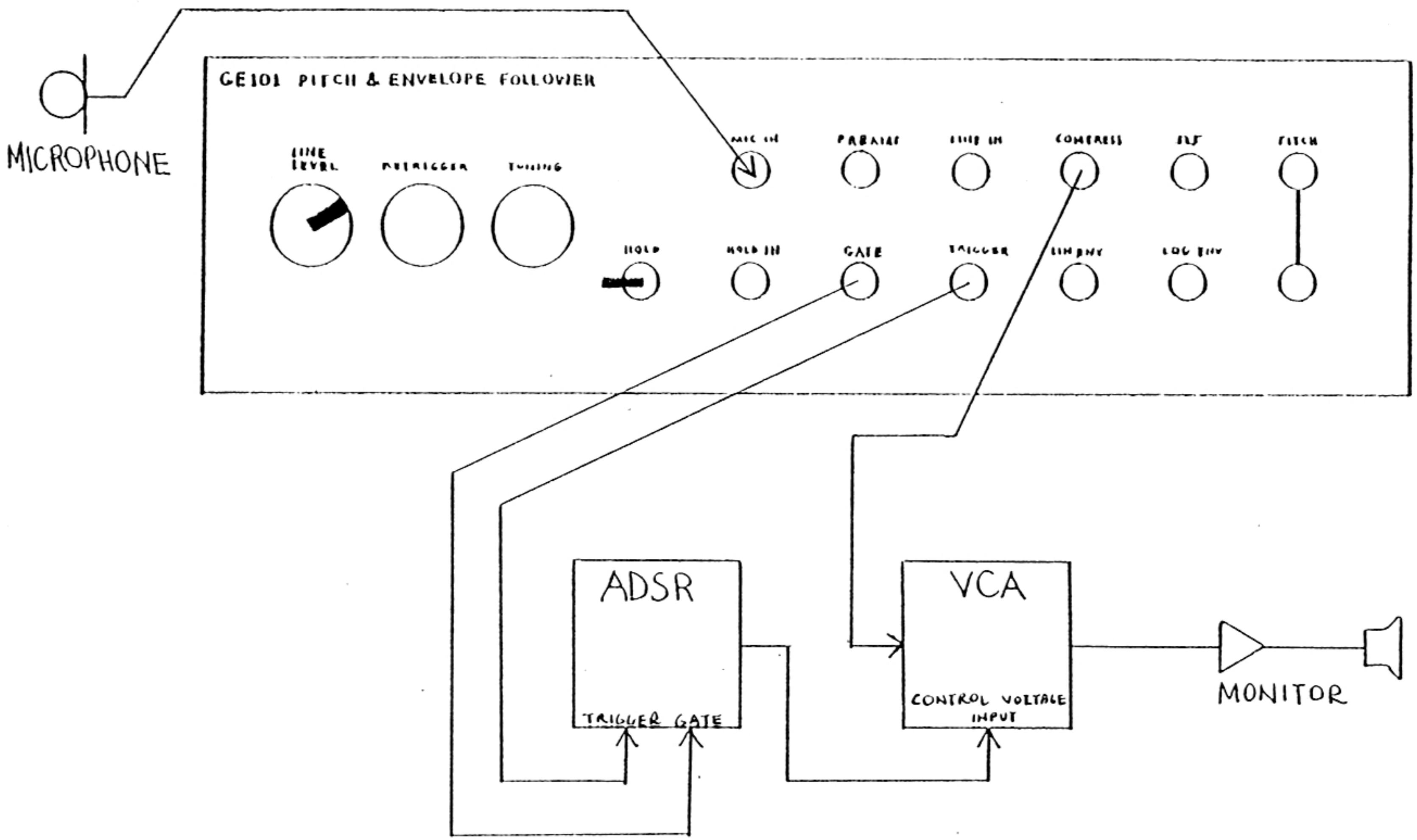
Set LINE LEVEL high.

Any volume settings <u>after</u> the compressor (e.g. on the monitor amp) set the actual feedback volume level.

Things to try:
- Move the microphone & speaker(s) around.
- Put various acoustic filters in the feedback path. E.g. put the microphone

CONTROLLED ACOUSTIC FEEDBACK

Refer to Patch #7. Connect a microphone to MIC IN and connect the COMPRESSOR output to your monitor amp. Keep the LINE LEVEL control turned up high. The COMPRESSOR changes the amplitude of the input signal to a constant 10 volt peak-to-peak signal, whether the input signal is a whisper or a roar. As a result, when the output of the compressor is sent to a speaker and the output of the speaker is fed back into the microphone, the feedback is very controlled. The volume control on the monitor amp sets the actual feedback level. Move the mic and speaker around to obtain different effects. Also, try putting various acoustic filters in the feedback path, by placing the microphone in or near hollow objects, such as your mouth.



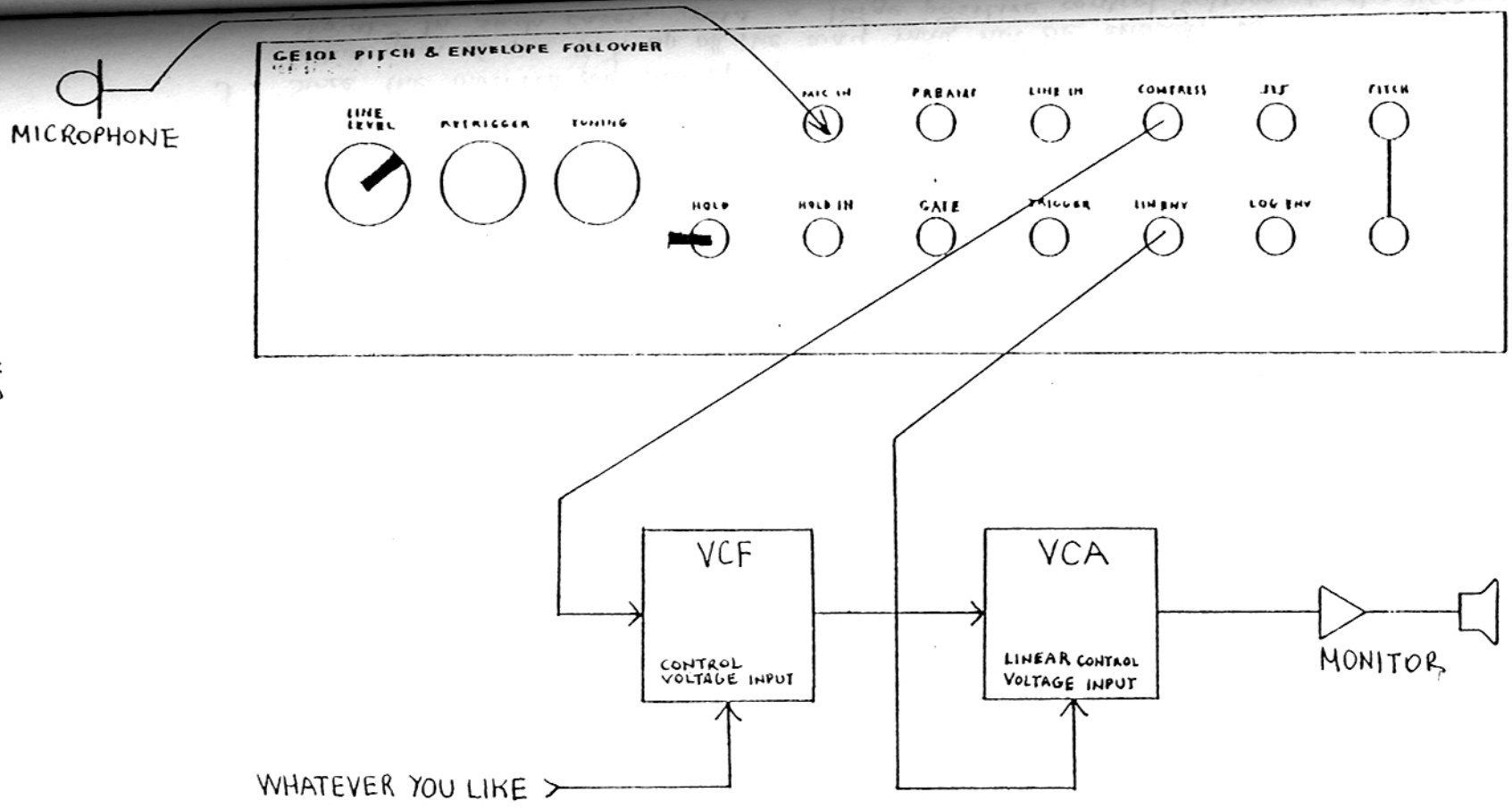
The compressor removes the original dynamics from the signal. The ADSR applies new, synthesized dynamics to the signal at the VCA.

PATCH #8:
ENVELOPE MODIFICATION OF ORIGINAL SIGNAL

ENVELOPE MODIFICATION OF ORIGINAL SIGNAL

Refer to Patch #8. The COMPRESSOR removes the orignal dynamics from the signal. By running the compressor output through a VCA and using an envelope generator to control that VCA, new synthesized dynamics can be added to the compressed signal. Connect the COMPRESSOR output to the signal input on your VCA. Use the GATE and TRIGGER outputs on the PEF to control an envelope generator and connect the output of the envelope generator to the control input on the VCA. Vary the ADSR settings on the envelope generator. Also, try using the linear envelope output on the PEF to control the VCA instead of the envelope generator on your synthesizer. This will return the orignal dynamics to the compressed signal. By filtering the compressed signal rather than the original signal, (Patch #9) signal to noise ratio can be improved and the likelihood of overloading the filter is reduced.

PATCH #9:
FILTERING ACROSS ENTIRE DYNAMIC RANGE

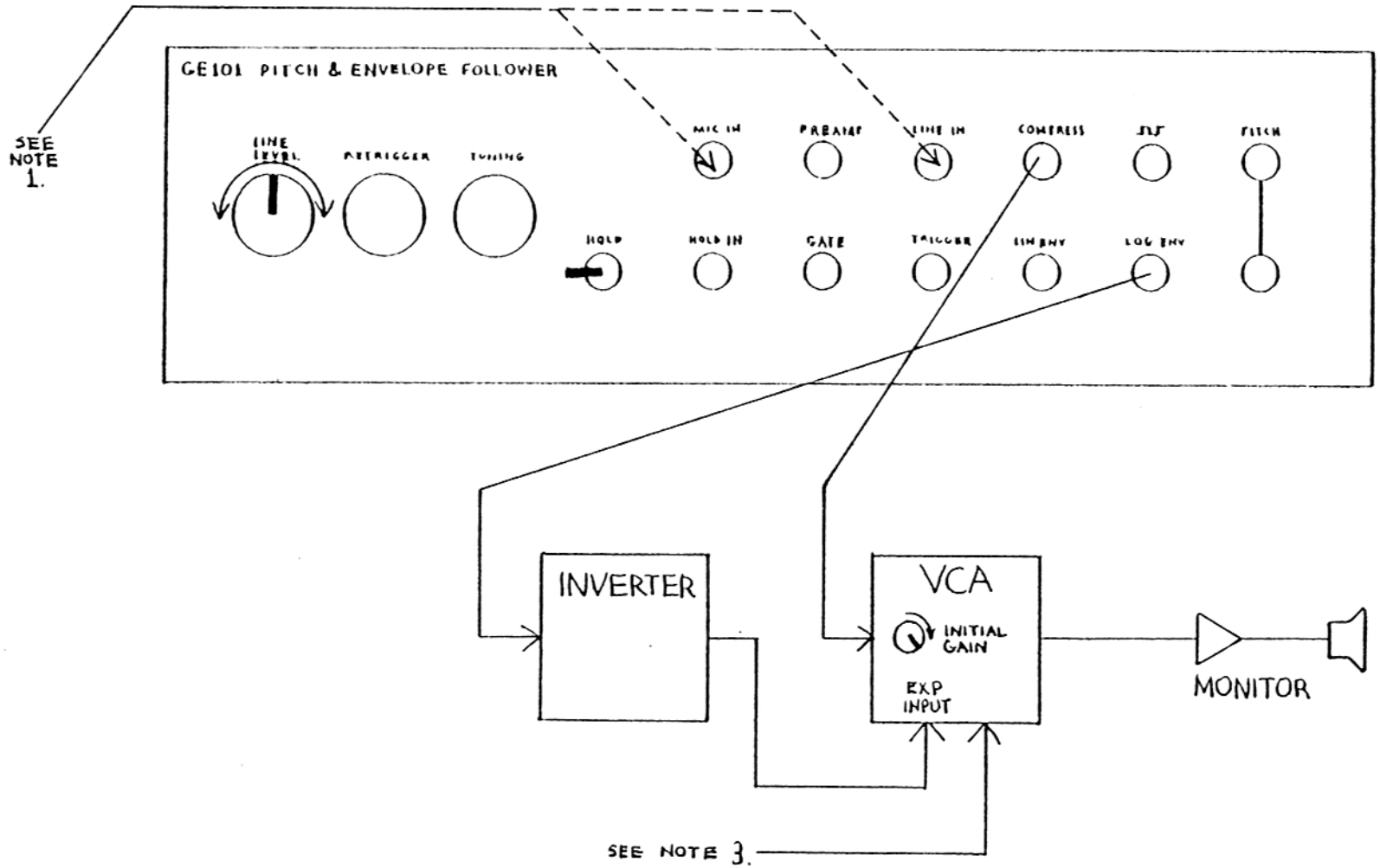


Filtering is applied to the compressed signal rather than to the original signal complete with dynamics. Signal-to-noise ratio is thus improved, and the likelihood is reduced that the filter can be overloaded.

Compression removes the dynamics from the signal. The VCA restores the dynamics to the modified signal.

Effects such as flanging can be added or substituted in place of the VCF.

PATCH #10: DYNAMIC REVERSAL



The output gets softer in inverse proportion to the input loudness.

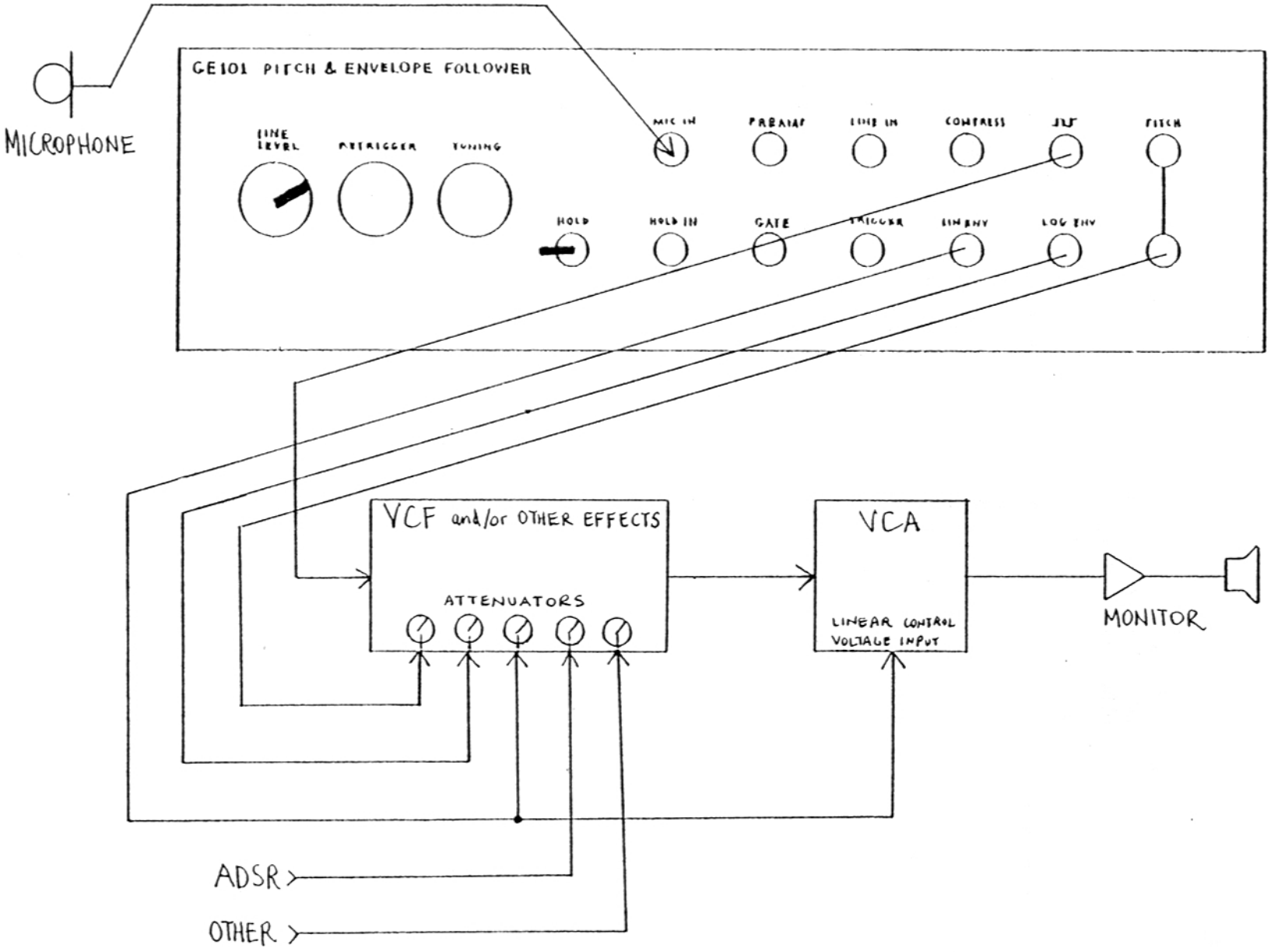
Notes:
1. Try using various sources: voice, tapes, radio, TV, etc. For higher-level signals, use LINE IN.
2. Try adjusting LINE LEVEL, VCA initial gain, and the attenuator at the VCA exponential control voltage input (or at the inverter) to get the nicest effect.
3. Since the inverted log envelope is a large negative signal, even turning the initial gain of the VCA up all the way may not be enough to hear any signal. In such cases, add a large positive control voltage to the VCA.

DYNAMIC REVERSAL

Refer to Patch #10. With the COMPRESSOR output connected to the signal input on the VCA, take the LOG ENVELOPE output of the PEF and patch it to an inverter circuit on your synthesizer. Now, connect the output of the inverter to the exponential control input on the VCA. As a signal source, use your microphone or try the output of your TV or radio. As the input signal gets louder, the output signal will get softer. To what degree is controlled by the LINE LEVEL on the PEF, the VCA initial gain, and the attenuators on the inverter and exponential control input on the VCA. The inverted log signal is a relatively large negative voltage. Turning the VCA initial gain all the way up may not be enough to hear any signal, in which case it is necessary to add a large positive control voltage (bias) to the VCA.

PATCH # 11

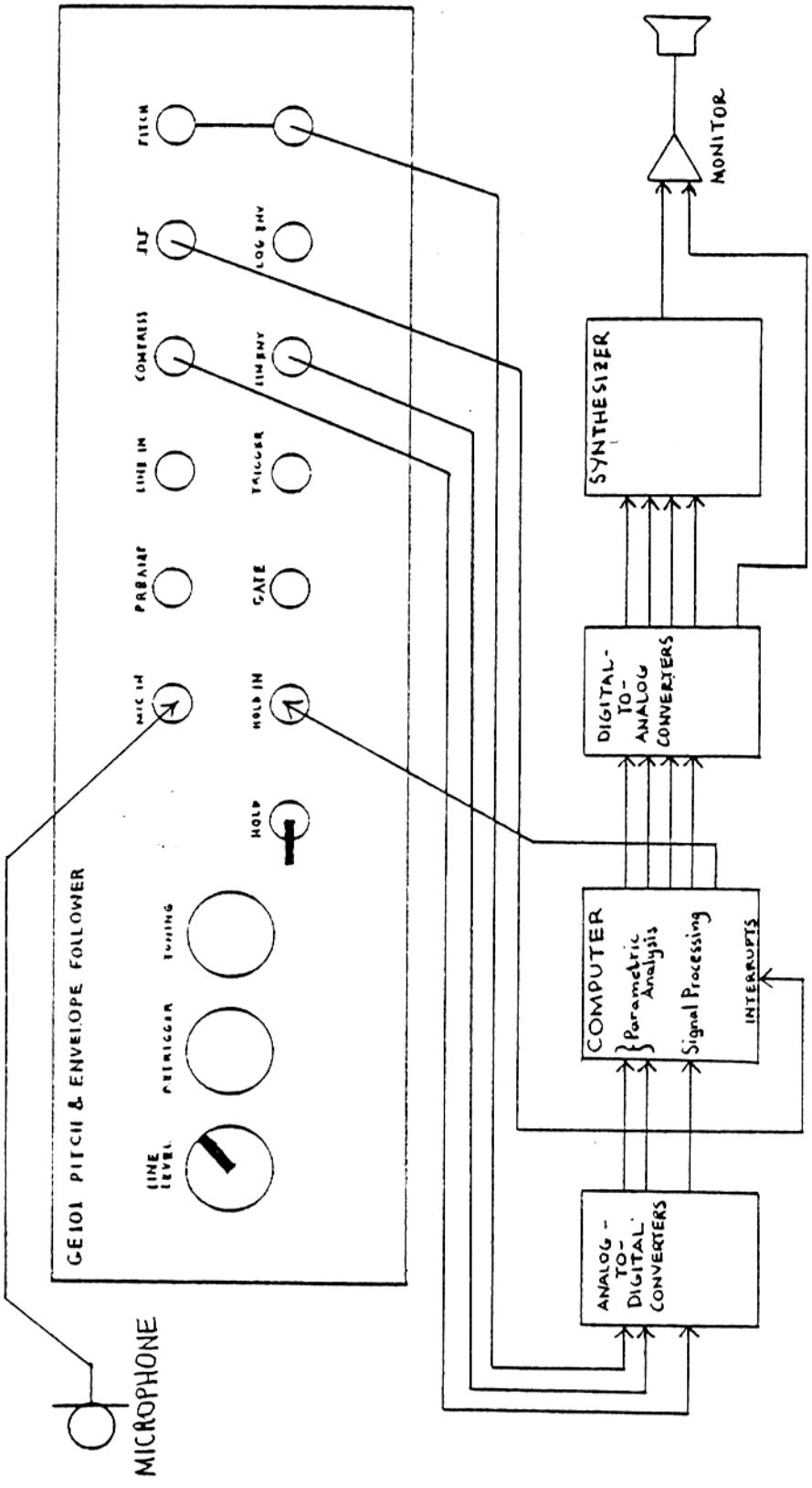
RESYNTHESIZED HARMONIC SPECTRUM



The harmonics of the pulse wave are selectively retained or removed.
Frequency and amplitude of the output continue to track those of the input.

RESYNTHESIZED HARMONIC SPECTRUM

Refer to Patch #11. Connect the PULSE WAVE (⎍) output to the signal input on your VCF, and connect the VCF output to the signal input on your VCA. Now connect the PITCH and LINEAR or LOG ENVELOPE outputs to control inputs on your VCF. Also, connect the LINEAR ENVELOPE output to the control input on your VCA. The pulse wave output is at the fundamental frequency of the input signal, but rich in harmonics. By running the pulse wave through the VCF, these harmonics can be selectively removed or retained by varying the attenuation on the various control inputs. Try using other sources to control the VCF, such as an envelope generator or an LFO.



PATCH #12:
ANALYSIS, PROCESSING, & SYNTHESIS OF SOUND BY COMPUTER

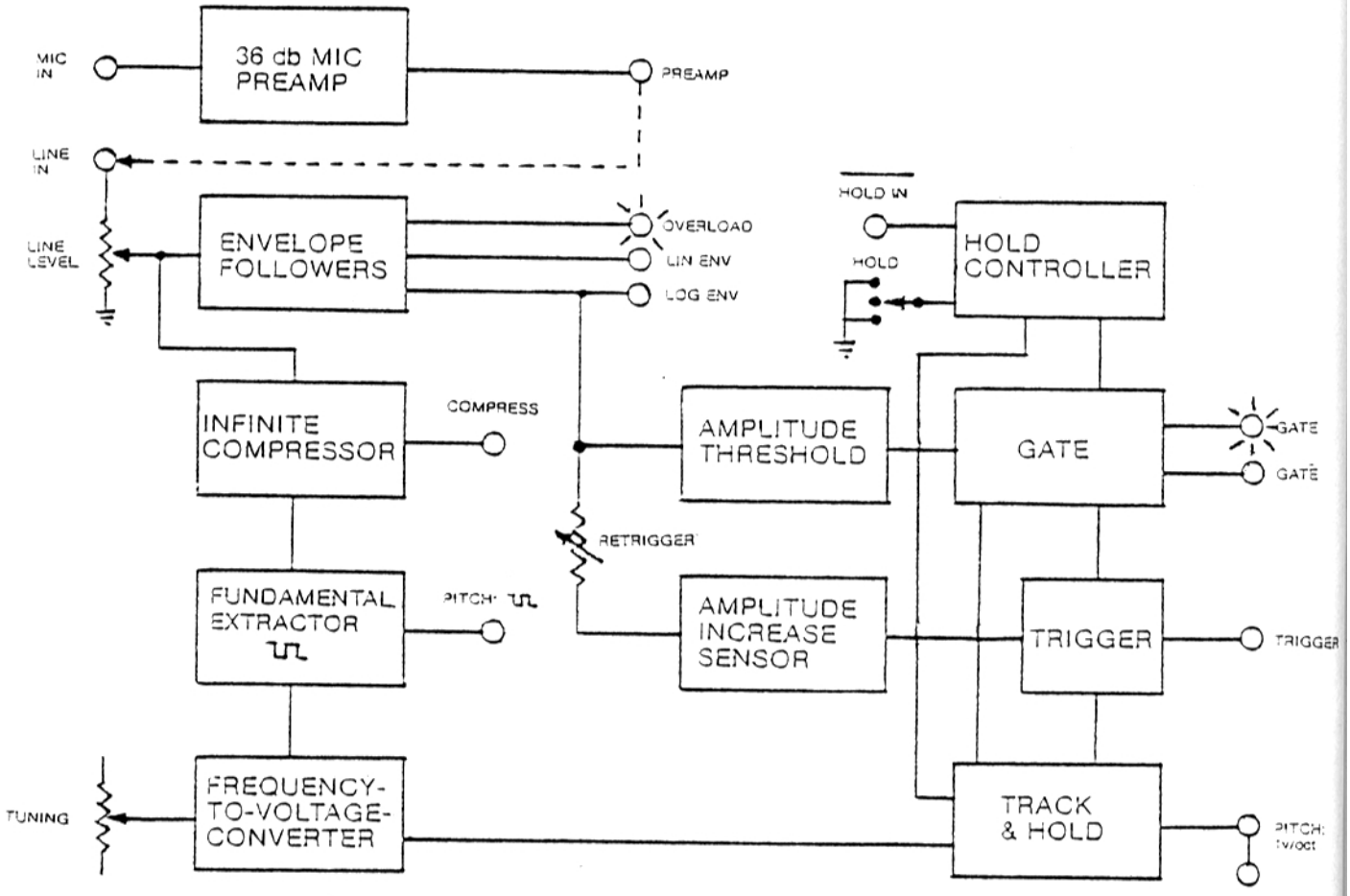
ANALYSIS, PROCESSING, AND SYNTHESIS OF SOUND BY COMPUTER

Refer to Patch #12. Computer music or computer signal processing applications which can benefit from the use of the PEF include interactive performance systems, both digital and hybrid (analog synthesis controlled by computer) synthesis systems, and voice recognition/analysis.

Pitch information can be given to the computer either as the pitch voltage fed through an A/D converter, or as a once-per-cycle interrupt. By feeding the compressed signal (rather than the straight signal) to a fast A/D input, substantial savings can be realized in the A/D converter and computer because a much narrower (few bits) digital data path is needed for handling the signal. The amplitude envelope information has already been extracted, and can be fed to the computer separately.

In such applications, the PEF performs many of the data-intensive computations so as to free the computer for higher-level analysis. In many cases this will allow quite complicated analysis and response to be done in real time with small computers.

MODEL 101 BLOCK DIAGRAM



SPECIFICATIONS

Specified Input Level (SIL):
Odb=1v peak @ 500 Hz (or -36db into MIC IN) with LINE LEVEL control set for 6db attenuation (approx. 2 o'clock)

Overhead: (onset of clipping)
8db above SIL
LINEAR ENVELOPE will be at 16.4v
LOG ENVELOPE will be at 15.4v

Overload Indicator: 6db above SIL.

Preamp Gain (MIC IN to PREAMP out): 36db.

Compressor Output Level:
5v peak-to-peak (trimmable).

Threshold of Compression:
40db below SIL.

Gate Threshold: on: 20db below SIL; off: 26 to 30db below SIL (hysteresis).

Gate Output: on: 5v; off: 0v.

Trigger Output: (normally at 0v)
3ms 5v pulse when either:
a) GATE output goes on, or
b) signal amplitude increases at a rate exceeding RETRIGGER setting.

Linear Envelope Output:
proportional to fullwave peak amplitude. Nominally 5v for SIL. Maximum ripple .22v (5%) @ 500 Hz.

Log Envelope Output: 1v change for 10db change in amplitude. Nominally 10v for SIL (trimmable).

Fundamental Extractor: extracts the pitch (fundamental frequency) from a large variety of timbres. It is not confused by harmonics, but cannot select one pitch out of an input containing more than one, e.g. pitched interference, chords, or certain timbres containing irrational harmonic series, as some bells.

Pitch (⎍⎍) Output: 5v peak-to-peak pulse wave at extracted fundamental frequency. Pulse width is controlled by input waveshape.

Pitch: 1v/oct Output: when signal is above gate threshold, this follows extracted fundamental pitch at 1v/oct (trimmable on panel). When signal is below threshold or hold function is activated, it holds the last pitch.

New Pitch Acquisition Time:
2 cycles of input signal.

Second Pitch Rejection: pitch control voltage ripple .07vac @ -30db, & .03vac @ -40db.

Tuning Control: changes PITCH: 1v/oct output by 2½ octaves up or down.

Hold Function: activated by either:
a) HOLD switch on panel (momentary and locking positions), or
b) pulling HOLD IN below 1v with footswitch accessory or other external switch, or with a synthesizer voltage. HOLD IN is internally pulled up to 15v by a 220K resistor.

1v/oct Tracking Accuracy:
within 4mv (1/20 semitone) 200 Hz to 3 kHz.

Tracking Range: 26 Hz to 20 kHz minimum.

Power Requirements: 117v, 50-60 Hz, 10w.

Specifications subject to change without notice.