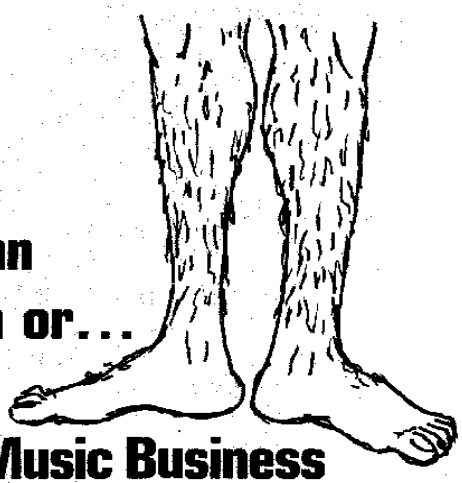
Using Terminal Sections of Vertebrate Anatomy for Increased Control Capabilities of an Electronic Music Synthesis System or... How to Pedal Your Way to Success in the Music Business



by: Marvin Jones

With the release of the PAIA DeArmond foot pedal in the last issue of POLYPHONY a new area of synthesizer control has been opened for experimentation. Foot pedals allow the synthesist to move one step closer to one of the prime goals of electronic music, increased human control over the electronics. Rather than being limited to two hands as control elements, two more human variables can now be used. Undoubtedly, future developments will bring into being brain wave and programmed (computer) control -- all of these being merely extensions of the person operating the machine. But, not to loose our footing here, let's get back to foot pedals and their use as control elements.

The pedal volume control can serve a multitude of uses without any modification at all. The inside of the pedal consists of a 1 meg potentiometer wired as shown on the right. As you can see, there is no capacitive coupling in the unit so it can be used with control voltages as well as audio signals. All you need are some special, easily constructed, patch cords and you're in business. You will need to construct four patch cords, two with shielded audio cable and a 1/4 inch phone plug on one end (to fit the pedal) and a mini-phone plug on the other (to fit the synthesizer). The other two cords use two conductor shielded cable with a 1/4 inch phone plug on one end and pin plugs installed on each of the two conductors on the other end. For easy reference, use two colors of pin plugs on each cord: red plugs for signal lead and black for ground. Connect the shield to the 1/4 inch plug. Remove about 6 inches of the cable cover and shielding on the pin plug end of these cables allowing about 12 inches between plugs just in case a grounded jack is not available near the control voltage jack that you wish to use.

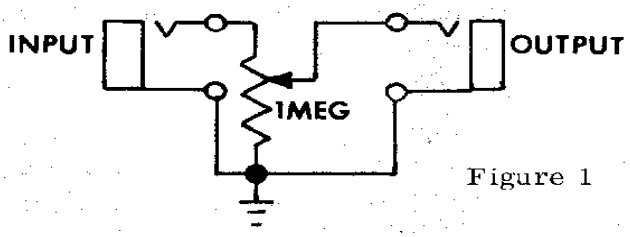


Figure 1

Now that we're past the mechanics of cord construction we can put the pedal to use. The first and most obvious use is that which the pedal was originally intended for -- a volume control. Since using a VCA which generates the same dynamics for each note and an Envelope Generator producing a programmed output level can be rather monotonous this simple patch can be extremely important from a musical standpoint. Patch the synthesizer audio output to the pedal input (labeled "INSTR"), and the pedal output (labeled "AMP") to your external amplifier. You can now add expression through phrasing, dynamic changes over a period of time to accent certain melodies, or accent a particular note within a phrase.

Other audio applications include adding pre-programmed chords or intervals to a basic one note patch via foot control by running the mixed chord or interval through the foot pedal prior to mixing with the single note patch at another mixer or VCA; as shown in figure 2; and adding reverb to selected notes or passages by patching the final signal to an output mixer and to the reverb input as shown in figure 3. The reverb should be set for full reverb effect, and no normal signal. The reverb output can then be passed through the pedal prior to being added to the original at the mixer.

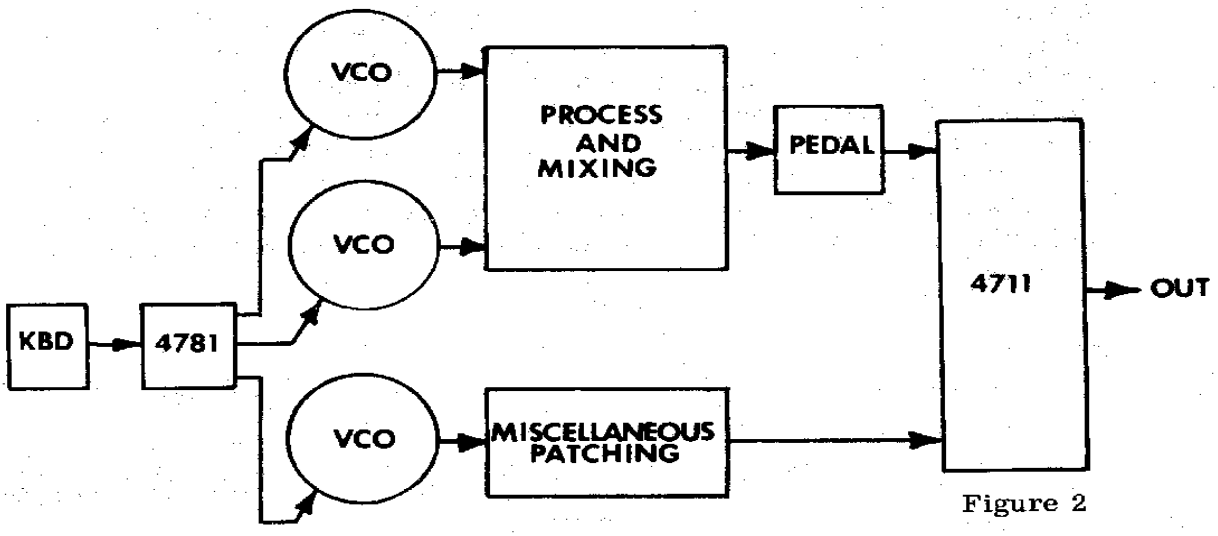


Figure 2

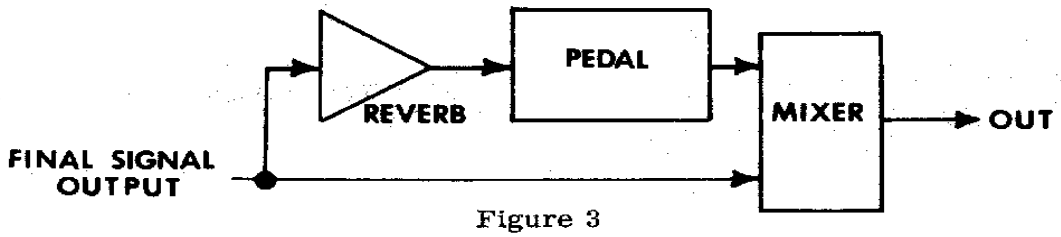


Figure 3

As the pedal has no capacitive coupling, control voltages can be processed without fear of loosing DC levels or low frequency waveforms. For use with control voltages, your other set of patch cords (with pin plug connectors) will be used. Patch configuration is similar to audio use, with the control voltage source being fed to the pedal input, and the pedal output being fed to the module to be controlled.

A basic example would be using the pedal to sweep a filter, similar to a guitar player's Wa-Wa. Adjust a bias supply for the maximum voltage you wish to be fed to the filter. Connect the "hot" plug of the pedal input cord to the preset bias output. The ground plug of this cord can be connected to a 4761 ground jack, or to a "variable" output of some module (control oscillator, envelope generator, etc.) where the variable output control has been set to minimum to ground the output jack. The "hot" plug of the pedal output cord is fed to the filter's control input. The ground plug on the second

cord need not be connected due to the common ground between all modules via front panels and power supplies. Now the pedal can be used just as a guitarist uses his wa-wa pedal, only you can preset the range of your foot action due to the preset bias supply.

An envelope generator output can be used rather than the bias supply, giving the popular "sweeping filter on each note" effect, but using the pedal, you can vary just how far the filter deflects on each note or phrase.

Another popular use is pedal control of vibrato (or modulation of VCO's). This will give the effect popularized by the Mini-Moog modulation wheel, but you won't have to waste a hand doing it. Using the variable output of a low frequency oscillator, select the frequency and Maximum output level (vibrato depth) you will desire. Run the output through a coupling capacitor on the 2720-7 power supply to remove DC level (to eliminate any pitch shifts, or detuning as vibrato is applied), and connect the capacitor output to the pedal input. The pedal output is then connected to a VCO input. (Make sure one of the cords has a ground connection made). Now you can apply vibrato at will by depressing the pedal. Similarly, a bias voltage can be processed by the pedal prior to feeding a VCO to produce foot controlled pitch bending.

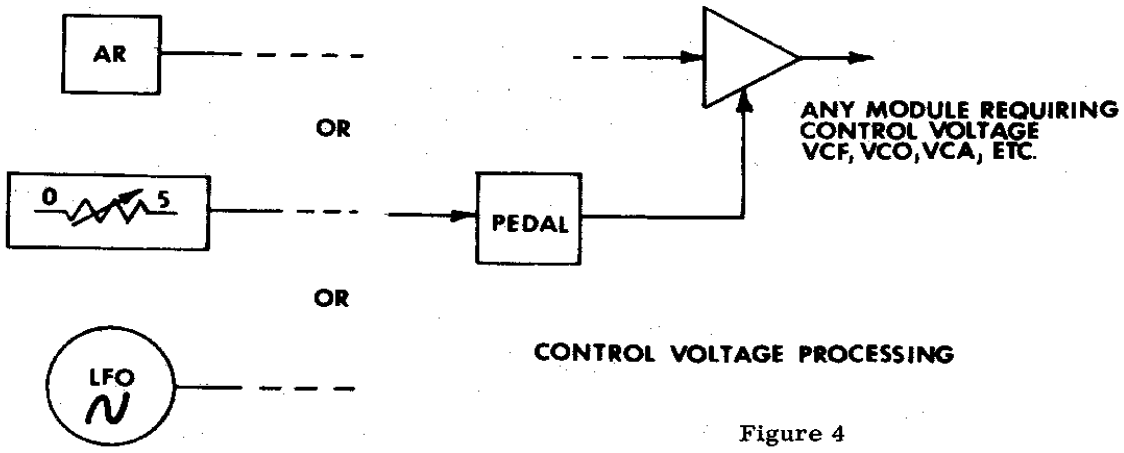


Figure 4

For use as a stereo panning pedal begin by feeding a 5 volt bias to the pedal input. The pedal output is then fed to a jack multiple, where one connection is made to a VCA control input and another connection to the input of an inverter (2720-12). The inverter output is fed to a second VCA, and the inverter offset is switched to 5 volts. A single audio source is fed to both VCA's but each VCA output is fed to a separate amplifier system. When the foot pedal is at minimum the signal is fed to one amplifier, and when the pedal is depressed, the signal will move to the other amp causing a stereo sweep or panning action. A slight variation of this patch would be to feed two separately patched sounds to the two VCAs, and feed the VCA outputs to a mixer. Now you can switch instantly between two completely different sounds at the touch of a toe, or you can select a blend of the two patches by leaving the pedal at an intermediate setting.

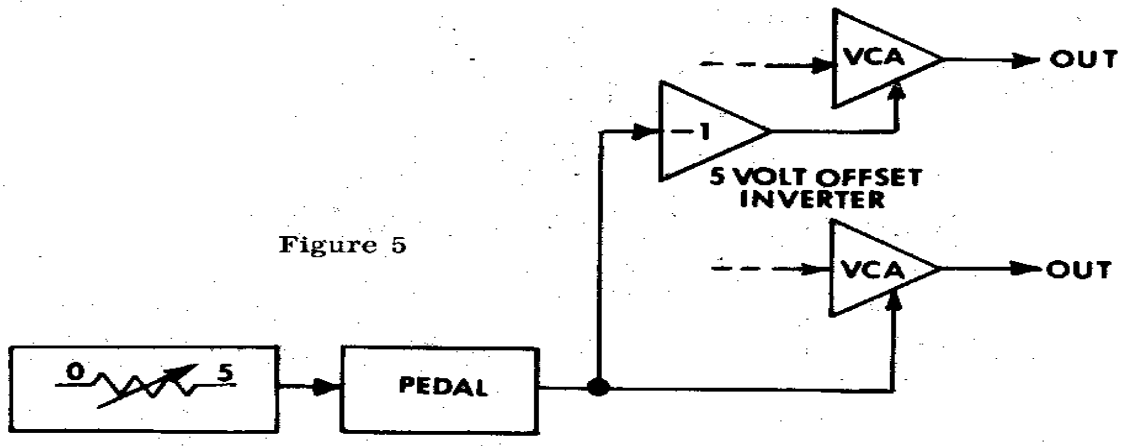


Figure 5

Another interesting type of pedal control can be obtained by using an audio cord to apply a higher frequency signal to the input of the pedal, and using a control voltage co d to apply the pedal output to the control input of a module. Try this with a VCO feeding another VCO or a VCF.

As you can see the possibilities are as unlimited as the synthesizer itself. Everything so far uses only a stock, unmodified pedal! Imagine the capabilities when you start experimenting with installing custom circuitry inside the pedal. The PAIA/DeArmond pedal is well suited to experimentation, as it has areas molded into the case to mount extra jacks, pots, etc. and it even has circuit board standoffs molded on the inside.

There are a lot of easy modifications which can be made to customize your pedal but one of the most beneficial is adding self contained bias supplied to the pedal. This modification need not eliminate the standard "volume control" function, as a switching jack can be used to select either mode of operation. A schematic and required parts list are given below.

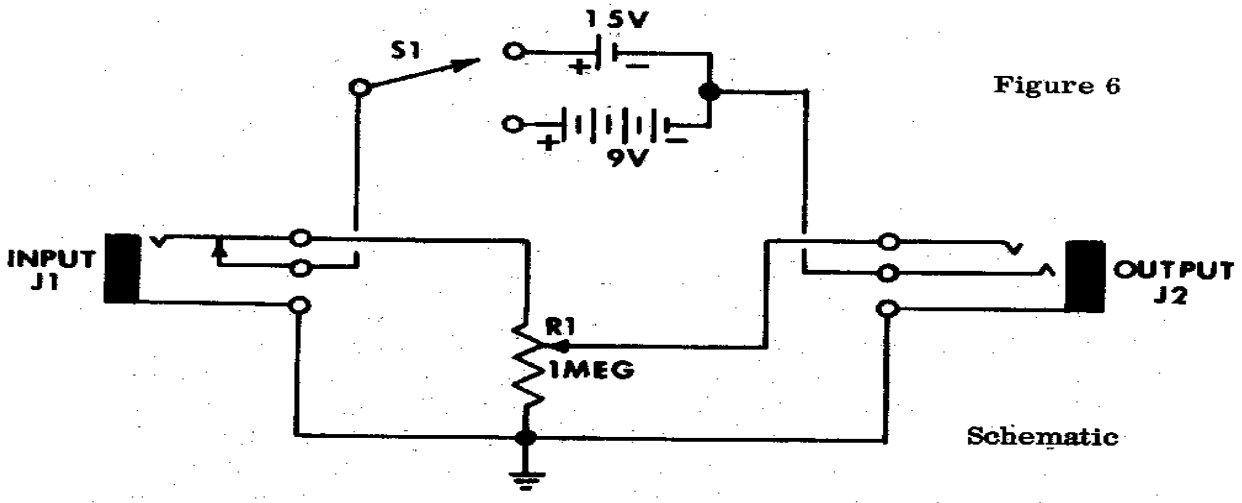


Figure 6

Schematic

PARTS LIST:

1 - PAIA/DeArmond Foot Pedal
R1 - 1 meg ohm potentiometer (supplied with foot pedal)
S1 - SPDT toggle switch (miniature type)
J1 - 1/4 inch closed circuit phone jack (Switchcraft type 12A or similar)
J2 - 1/4 inch 2 conductor phone jack (switchcraft type 12B or similar)
Misc. - 9 volt type battery snap, 9 volt battery holder, size AA penlight battery holder, wire and 9 volt & penlight (AA) batteries.

The battery holders are fastened to the bottom plate of the pedal using hot glue or epoxy. The voltage selector switch is mounted in a hole drilled in the side of the pedal. Also, make sure that the proper type jack is mounted at the input/output jack holes. Since the pedal will still be used for audio signals, keep the wiring between the jacks and R1 shielded (as originally supplied).

Inserting a standard two conductor phone plug into the output jack completes the connection between batteries and ground. The selected battery voltage is applied to the pot via the switch contacts of J1. This allows use of the pedal as a self contained bias supply. Plugging into the input jack disconnects the bias supply and routes an external signal through the pedal normally. Batteries are always disconnected when input is applied or output is removed, so the batteries should last for quite a while. Always be sure to remove all plugs when the pedal is not being used to prolong battery life.

As you can see, by now, a foot pedal (or two) is a very beneficial, as well as fun, addition to a synthesis system. You'll be seeing more about neat gadgets that can be built right into the pedal. The 9 volt bias modification can be used as a foot control for the "Speed" and "Center" jacks on the rear of the PAIA Synthespin and, if you play in a band and your guitar player likes Wa-Wa's, tell him that he hasn't heard a Wa-Wa until he has run his guitar through a 4730 filter set up for foot pedal control. Not only will it have a wider frequency range than any on the market, but it will have high-pass and low-pass response as well as the standard band-pass sound. The capabilities are tremendous, let your imagination take over and be sure to let us know what you come up with.

The 9605 Headphone Buffer Amp kit manual linked below may be referenced for the 5532 op-amp pin and power supply connections in the following schematic using the similar 5558 op-amp with the same pin-out.

http://www.paia.com/talk/viewtopic.php?f=6&t=120

BUILD A WA/ANTI-WA PEDAL

Using the PAIA/DeARMOND Foot Pedal

by: Craig Anderton

The first question is what do I mean by Wa/Anti-Wa. Well, a normal footpedal wa-wa usually has a simple bandpass filter, and you can sweep the bandpass of that filter up and down by a rocking motion with the pedal. In normal practice, the resonant frequency of the filter increases (higher apparent pitch) when you push down on the pedal, and decreases when you pull up on the pedal. By this definition of wa-wa, the anti-wa behaves in exactly the same manner but with one difference: pushing down on the pedal lowers the resonant frequency and pulling up on the pedal raises the resonant frequency.

By itself, this isn't too useful an effect, since you have to reverse your thinking compared to a regular wa-wa pedal. BUT -- if you could combine two filters into one pedal, so that as you pushed down one filter went up and a separate one went down -- and as you pulled up the reverse occurred -- then you'd have something. The effect is quite interesting, especially if you tune the filters differently; more about this later. Frankly, there's no way to describe the sound in print. Let's just say that if you like wa type pedals but have gotten a little tired of the sound, or want something that's a little different, then read on.

Luckily, the Wa/Anti-Wa can be easily configured using a PAIA/DeArmond foot control. Let's look at the schematic:

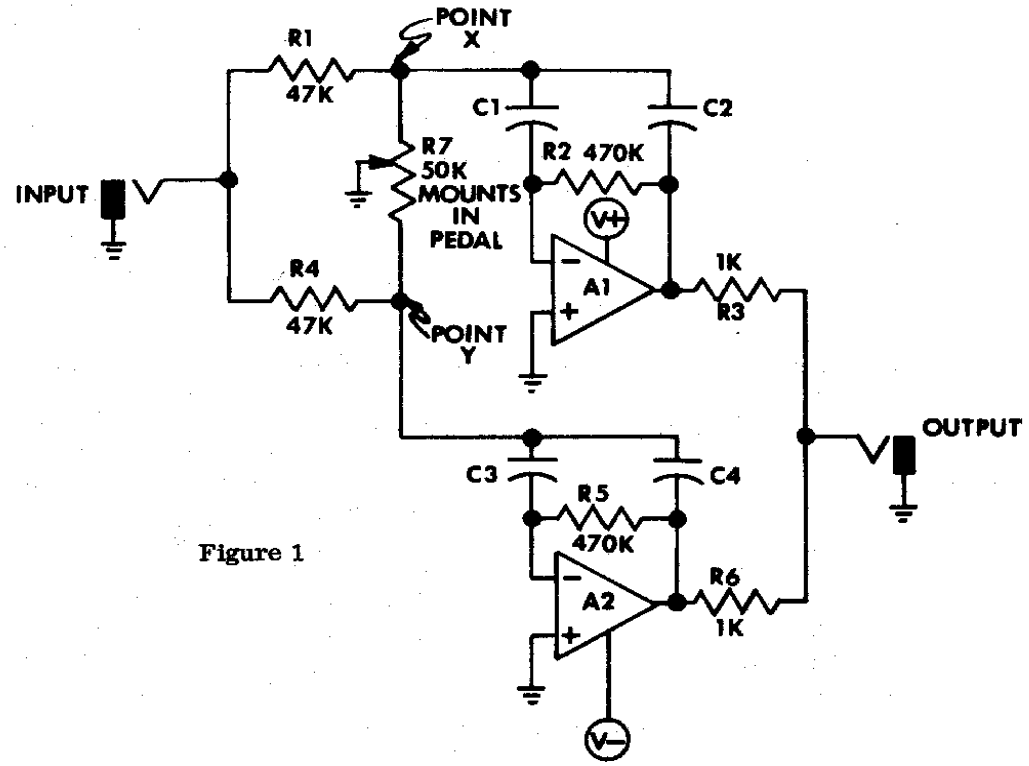


Figure 1

A1 and A2 are operational amplifiers, such as two 741's, a single 5558, a 4739 or whatever. Keep in mind, though, that this is a filter and for best results choose the lowest noise IC you have. You could also use something like an LM3900 if you bias the (+) inputs and add output coupling capacitors. Anyway, each op amp is configured in a filter. The resonant frequency of filter A1 depends upon the resistance from point X to ground; the resonant frequency (r. f.) of filter A2 depends upon the resistance from point Y to ground. Therefore, by connecting each point to the extreme ends of a 50K pot and grounding the wiper, we end up changing the resonant frequencies of the filters --- equally, but in opposite directions.

So, take a PAIA DeArmond pedal and remove the nice 1M pot that's already in there, and replace it with a 50K pot that has a reasonably long shaft (so the little gear thingie can screw onto the shaft). I don't really want to go into details here; the modification is pretty obvious with a pedal sitting in front of you.

For best results, connect up the V+ and V- lines to a regulated source of ± 5v. to ± 15v. Batteries will also work, but a supply is generally a much better idea.

THE FUN AND GAMES PART OF THE WHOLE THING

There are several variables in this circuit that make it fun to experiment with. The tuning of the filter depends upon the value of C1 and C2 for filter A1, and C3 and C4 for filter A2. (Note that these capacitor pairs should be matched). Different instruments will require different tunings. For example, with guitar . 001 for C1 and C2 and . 0039 for C3 and C4 gave wonderful results. With bass, . 002 for C1 & 2 and . 005 for C3 & 4 works pretty well. For electric pianos and such, try . 001 for C1 & 2 and . 005 for C3 & 4. Make sure, though, that you don't tune the two filters the same, as the sound produced is remarkably dull compared to the interesting stuff that occurs when you tune them differently.

Another variable in the circuit is R2. If you'd like a peakier sound and a little more gain, change it to 1M (ditto R5).

The final variable we'll talk about is in the pedal itself. Like most volume pedals, the PAIA DeArmond pedal doesn't give a full pot rotation; unlike most volume pedals, it comes pretty close. I'd recommend playing with the gear / pot combination until you get a sound that pleases you the best. For example, mine is set so that even with the pedal all the way to one extreme there is still a little resistance between point X and ground; at the other extreme, point Y goes almost completely to ground -- just a few hundred ohms stand in the way. I've played with a lot of different choices ... some of them really didn't make it, but after a little experimentation you're sure to hit someplace where you say "Eureka!" and just leave it at that.

PLAYING WITH THE PEDAL

The Wa/Anti-Wa I built has the higher-tuned filter going up in r. f. when I push down on the pedal, with the lower tuned filter going down in resonant frequency. This seemed to work best. You'll find the extra wide throw of the pedal makes the Wa/Anti-Wa even more useful, as you can selectively "Wa" just one filter, just the other, or sweep back and forth over the whole range of the pedal and get a variety of bizarre effects. In any event it's a lot of fun and sounds different from your average Wa pedal ... and it's not at all expensive to build.