

LFO expander **modulation processor**

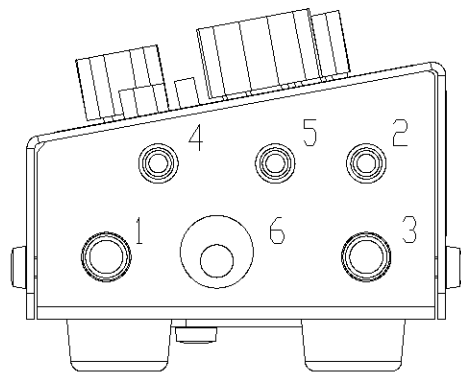
rev 1, 08-2010

Thank you for choosing the LFO-expander to expand the possibilities of your synthesizer.

Connections

All connections are made on the right side. For your convenience, the main out is presented as a standard jack (6,3mm) and minijack (3,5 mm) output. Please use only one of them.

Picture 1: Right-side view



- | | |
|---|--|
| 1 | Pedal-in or CV-in :jack 6,3mm (TS or TRS) |
| 2 | Main out: mini-jack (TS) |
| 3 | Main out: jack (TS) |
| 4 | CV-in: mini-jack (TS) |
| 5 | CV-out: mini-jack (TS) |
| 6 | DC input (12V DC) |

Note:

- | | |
|-----|-----------------------|
| TS | = Tip - Sleeve |
| TRS | = Tip - Ring - Sleeve |
| CV | = Control Voltage |

Power Supply

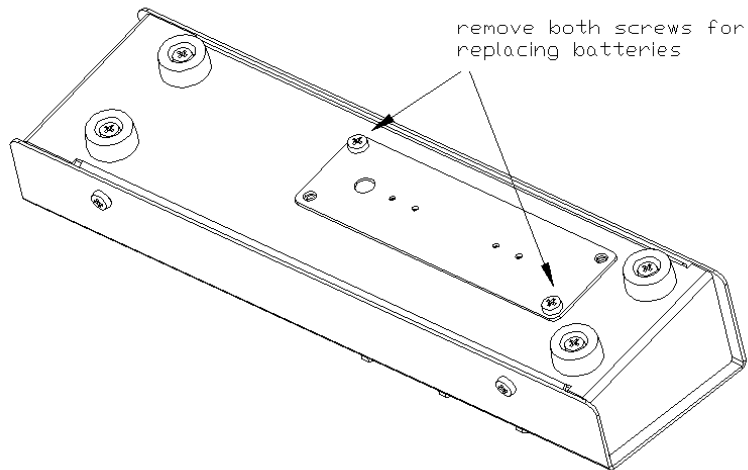
The LFO-expander runs on 2 9V batteries (not included) or on an external DC-power transformer (not included). When using a DC transformer, the batteries will be automatically disconnected. Use a 12V transformer, 250mA or more. GND on the outside, +12V on the center. Inverting the power will cause no harm. Connector type: $\varnothing 6,3\text{mm} \times \varnothing 2,1\text{mm}$

Foot pedal

The foot pedal can be an active pedal (containing a battery itself) with TS-jack or the pedal can be a passive pedal (adjustable resistor) with TRS-jack. We recommend a moog EP2 expression pedal or any pedal with the same specifications. A resistance of 50 k-Ohms works very well for the LFO-expander.

(Re)placing batteries

Picture 2: battery-replacement



Unscrew the 2 bolts as indicated in picture 2. Place 2 9V batteries inside the battery-clamps and connect each of them to one of the leads. Be careful: don't pull the leads. When replacing the battery-cover make sure both batteries fit inside the hole of the housing. Tighten the 2 screws.

When no batteries are installed, connect both connectors inside each other so their metal parts won't cause short-circuit inside the unit.

When batteries are running low of power, LFO frequency will decrease and the unit will perform not as it should be.

General description

The LFO-expander generates an LFO-signal, a sweep signal and can be used to attenuate a CV-signal. The LFO-signal and sweep-signal can be modulated by a foot-pedal, Control Voltage (say from a modular synth), or by hand.

All connections are made on the right side of the LFO-expander. Thanks to that, the expander can be placed just above the keyboard of a minimoog or ARP2600.

LFO

The LFO-circuit generates a rectangular or triangle shaped signal that can be used to modulate pitch (vibrato), filter (wah-wah), amplitude (tremolo) or other destinations on your synth, depending on the possibilities of your synth.

The LFO has an adjustable depth and speed that can be set with the controls on the top-panel.

When applying a signal to the PEDAL IN / CV IN input, or by manually turning the MANUAL knob, both the speed and depth of the LFO signal can be influenced at the same time (!) at independent levels.

Sweep

The sweep-circuit generates a positive or negative voltage, depending on the position of its control-knob. This voltage can be influenced by a signal coming from the PEDAL IN / CV IN input or by manually turning the MANUAL knob.

The range of the sweep-voltage can be selected and you can mix it with the LFO-signal.

Additional CV

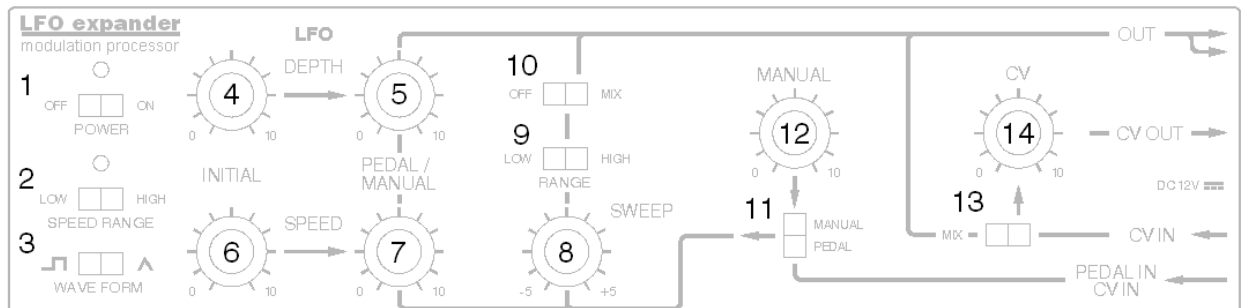
The additional CV-function makes it possible to connect any synth that has CV-in and CV-out jacks (for controlling the pitch of the synthesizer's oscillators), and add a real-time controllable LFO or bend to that synthesizer.

Inside the LFO-expander there's a trimmer to adjust the amount of key-CV when the switch is in "mix" mode. Before shipping the unit this trimmer was set to a 1:1 ratio while the unit was connected to an ARP2600. If your synth's pitch doesn't track 1:1 when it's key-CV is processed by the LFO-expander you'll have to open the LFO-expander by unscrewing all 7 knobs (allan key), remove the 4 screws that hold the housing and adjust the trimmer with a small screwdriver for a 1:1 ratio.

The additional CV-circuit is also handy to process a CV from your modular synth with a knob that's just in front of you. Set the switch to the right to activate this function.

Description of controls

Picture 3: description of controls



- 1 power-switch. Led above switch will light when on.
- 2 speed range switch. Switches from low-speed to high speed. LED above switch will flash indicating LFO-speed.
- 3 Waveform switch. Switches between rectangular and triangle wave shape for LFO signal.
- 4 Initial depth of LFO. This knob controls the portion of the depth of the LFO that will not be influenced by the signal from the pedal-in jack or manual knob (12).
- 5 Controllable depth of LFO. This knob determines how much effect the signal from the pedal-in jack or manual button has on the depth of the LFO.
- 6 Initial speed of LFO. This knob controls the portion of the speed of the LFO that will not be influenced by the signal from the pedal-in jack or manual knob (12).
- 7 Controllable speed of LFO. This knob determines how much effect the signal from the pedal-in jack or manual button has on the speed of the LFO.
- 8 Sweep. This knob controls the amount of CV that will be generated when you control the foot-pedal or manual button (12). The CV can be negative (counter clockwise) or positive (clockwise).
- 9 This button changes the output of the sweep. Usually, set to low for pitch-control, set to high for filter-control.
- 10 Sweep-mix. When turned off, the sweep CV will not be fed to the main out. When set to mix the sweep-CV will be added to the LFO-signal.
- 11 Manual/pedal switch. This switch determines whether the manual-knob (12) or foot-pedal will control the LFO and sweep signals.
- 12 Manual knob. When button 11 is set to "manual", this knob controls the controllable portion of the LFO-depth and speed and controls the sweep-signal.
- 13 CV-mix. This button determines whether a signal applied to the CV-in will be routed to the CV-knob (14) or will be mixed 1:1 with the LFO- and Sweep signals.
- 14 CV knob. This knob controls the attenuation of the CV-signal when button 13 is set to right. The CV-signal will then be routed to the independent CV out.

Connection examples

The next diagrams offer some examples for connecting the LFO-expander to synthesizers. In general, the LFO-expander can be used on almost every analog synthesizer having CV IN and CV OUT. In general, the CV-IN jack of a synthesizer is internally connected to its CV OUT. By inserting a jack into the CV IN, this internal connection will be broken. Now, when you feed the synth's CV OUT to the LFO-expander, it will come back to the synth including the LFO or sweep (bend) signals.

On many synthesizers, the CV IN is routed to the filter-circuit as well (just like the synth's internal keyboard CV is) so the filter cut-off frequency is influenced by the output of the LFO-expander as well. On some synths, this key tracking can be set on or off.

Some additional information:

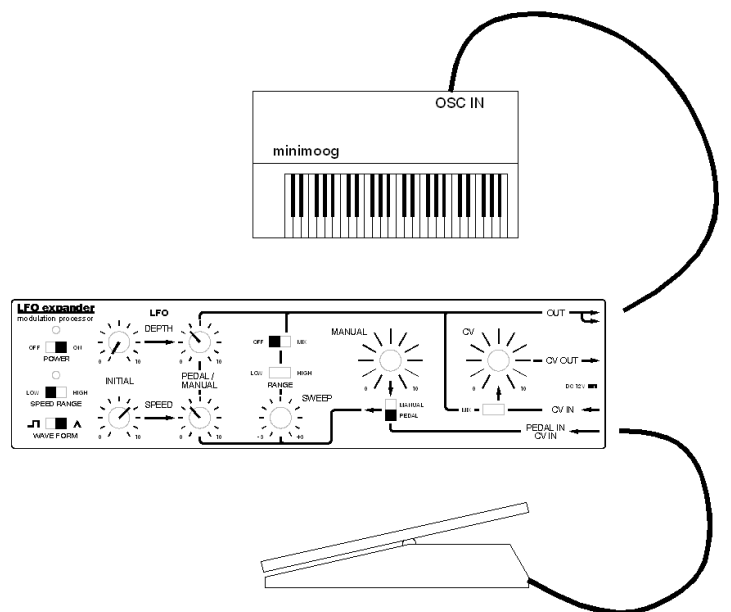
On the Moog model D minimoog, there is no CV out. However, there is an "OSC IN" jack. External signals routed to this "OSC IN" jack are mixed with the minimoog's own keyboard CV.

On the Yamaha CS80, external signals are reversed in polarity. So set the sweep-knob to the left (negative side) to bend the pitch higher or the filter brighter.

On the Yamaha CS50 and CS60, direct currents are filtered out from the external signal. This means pitch bending and very slow LFO's applied to the CS50 or CS60 will lead to unexpected results. Normal LFO-frequencies will not be a problem.

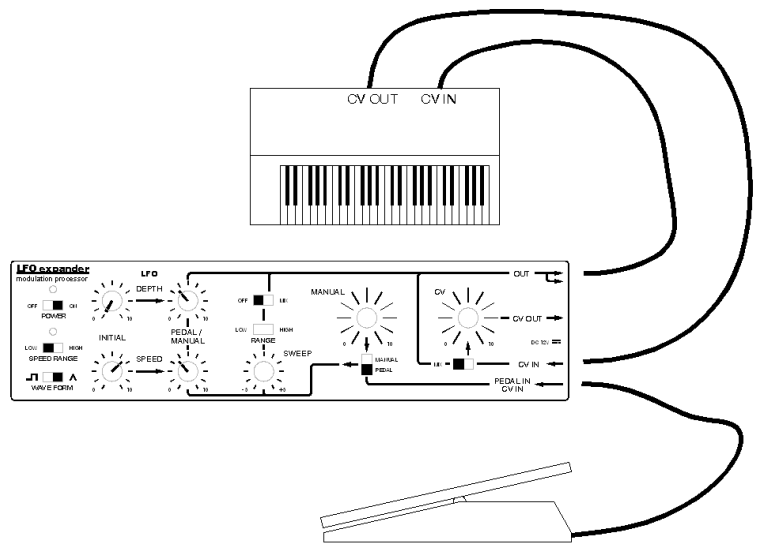
Example 1: Vibrato on model D minimoog.

Connect the foot pedal and minimoog as shown in the diagram. Set the controls as shown. Play the keyboard of the minimoog and use the foot pedal to control LFO speed and depth.



Example 2: Vibrato on monosynth with CV-in / CV-out

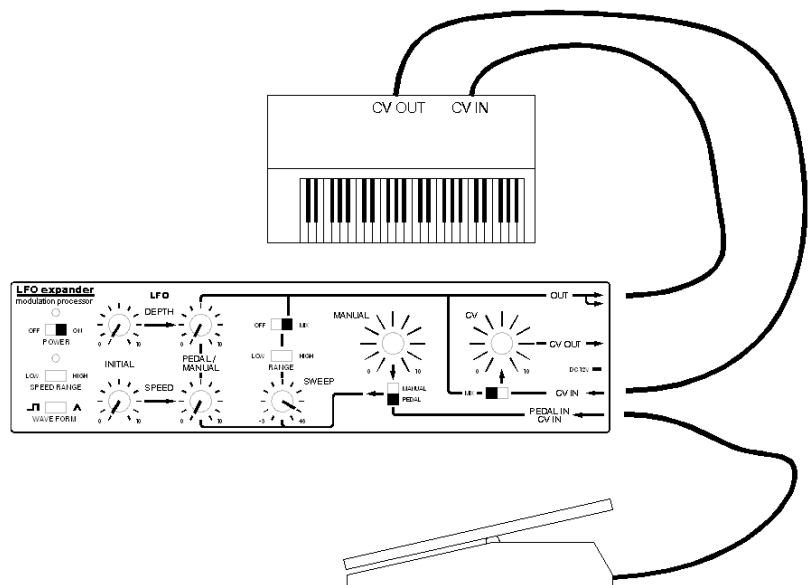
Connect the foot pedal as shown. Connect the synth's KEY CV OUT to the CV IN of the LFO-expander. Connect the main OUT to the synth's CV IN. Play the keyboard of your synth and use the foot pedal to control LFO speed and depth.



Example 3: Pitch-bends on monosynth with CV-in / CV-out

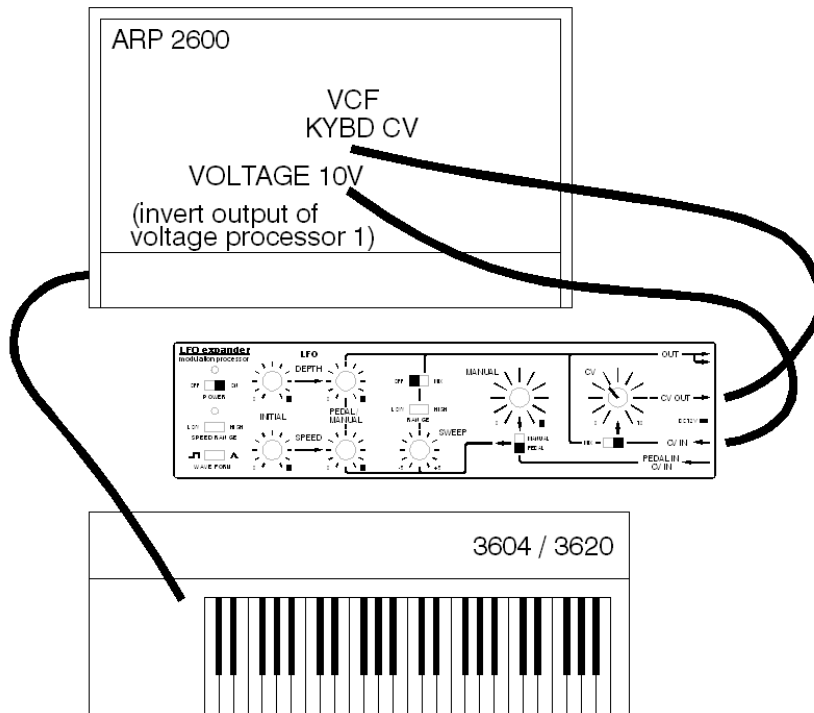
Connections are like example 2. Turn the LFO-controls fully counter clockwise and set SWEEP switch to "mix". The SWEEP knob and RANGE switch can be set to determine the range of the sweep. Remember, the SWEEP knob can be set to positive (upward) or negative (downward) bends.

Note:
Make the connections as shown in example 1 and set the controls as shown over here to make pitch bends on the minimoog.



Example 4: Filter cut-off frequency control on ARP 2600

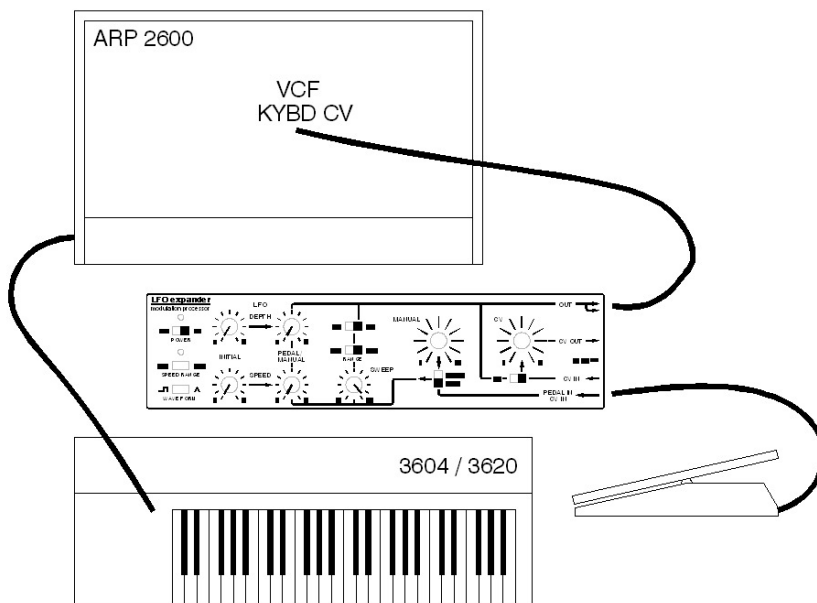
FILTER CUT-OFF FREQ CONTROL



Connect patch cords as shown. Use invert output of voltage processor 1 and move that slider fully to the right. Play the keyboard of the ARP 2600 and turn the CV-knob to create filter sweeps.

Example 5: ARP2600 filter cut-off controlled by passive foot pedal

FILTER CUT-OFF FREQ CONTROL WITH PASSIVE FOOT PEDAL

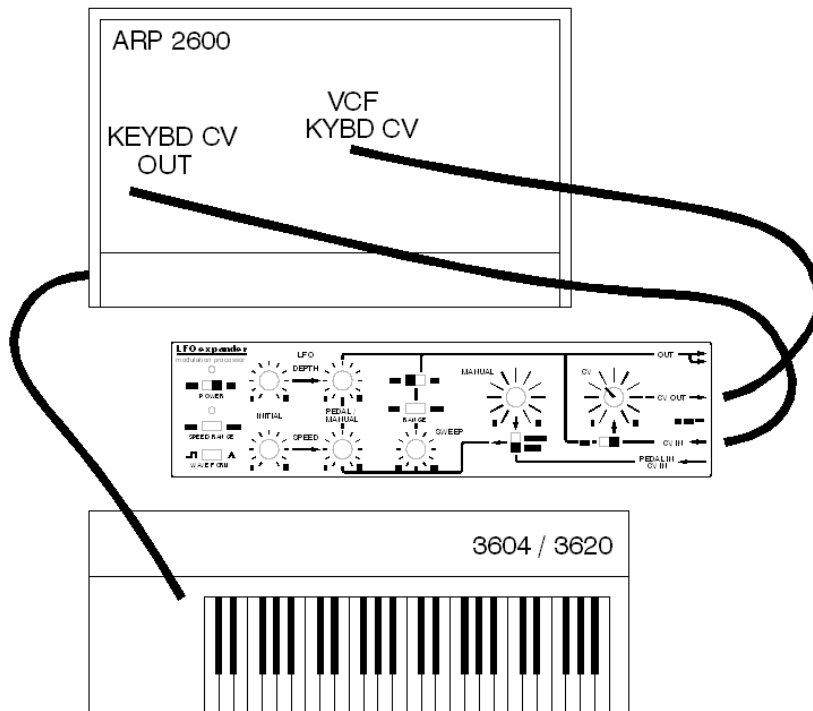


Connect patch cords as shown. Play the keyboard of the ARP 2600 and use the passive foot pedal to sweep the filter cut-off frequency.

Or:

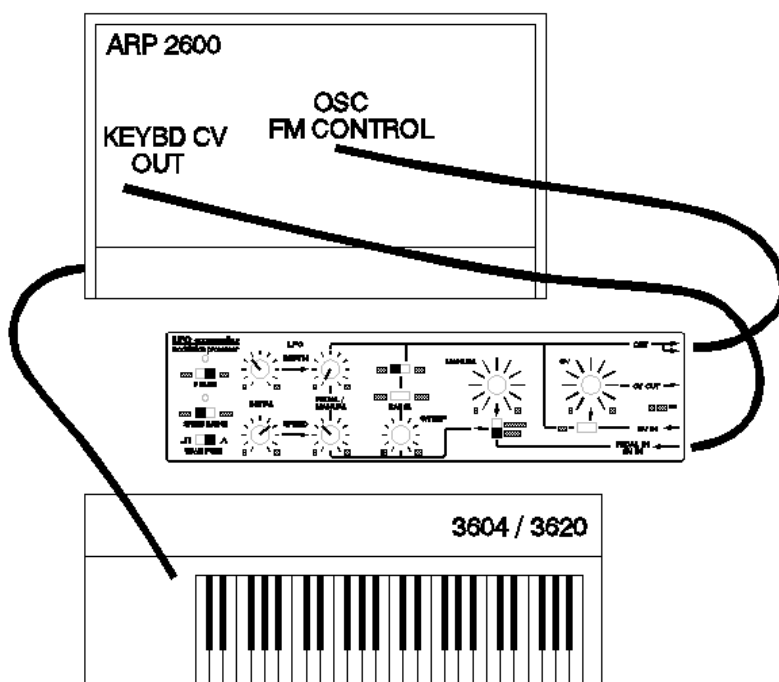
Switch to "manual" and use the "manual" knob instead of the foot pedal

Example 6: Variable filter cut-off keyboard tracking on ARP 2600



Connect patch cords as shown. Play the keyboard of the ARP 2600 and turn the CV-knob to control the amount of filter keyboard tracking.

Example 7: LFO speed keyboard-tracking on ARP 2600



Connect patch cords as shown. Do not use oscillators KYBD CV but one of the other osc inputs. Play the keyboard of the ARP 2600 and notice LFO speed will increase when playing higher keys.

Note: use the 2600's multiples to control 2 or 3 oscillators at the same time.

Example 8: Vibrato on Yamaha CS80

Connect the foot pedal as shown. Connect LFO-expander's main out to "external in" of CS80. Set "external level" halfway. Set CS80's Sub Oscillator function to "EXT." and adjust VCO slider as shown in detail. Use the foot pedal to control vibrato. Now, you can apply vibrato (and change it's speed) by foot-pedal while independently applying other effects (such as VCF-control) by using the keyboards poly-aftertouch. Besides the action of the foot pedal, poly aftertouch can still control the depth for the modulation of vco's, filter and amplification. You can also use the "SWEEP" function to make pitch bends or filtersweeps. Since the CS80's internal LFO (named sub oscillator) is disconnected from the internal signal source (because the function-lever is set to "ext"), the two "speed" levers just above the keyboard are not functioning anymore. However, the "touch control" levers for brilliance and level on both voice-channels (and memory-banks) are still active and can be used to create effects with poly-aftertouch.

Note:

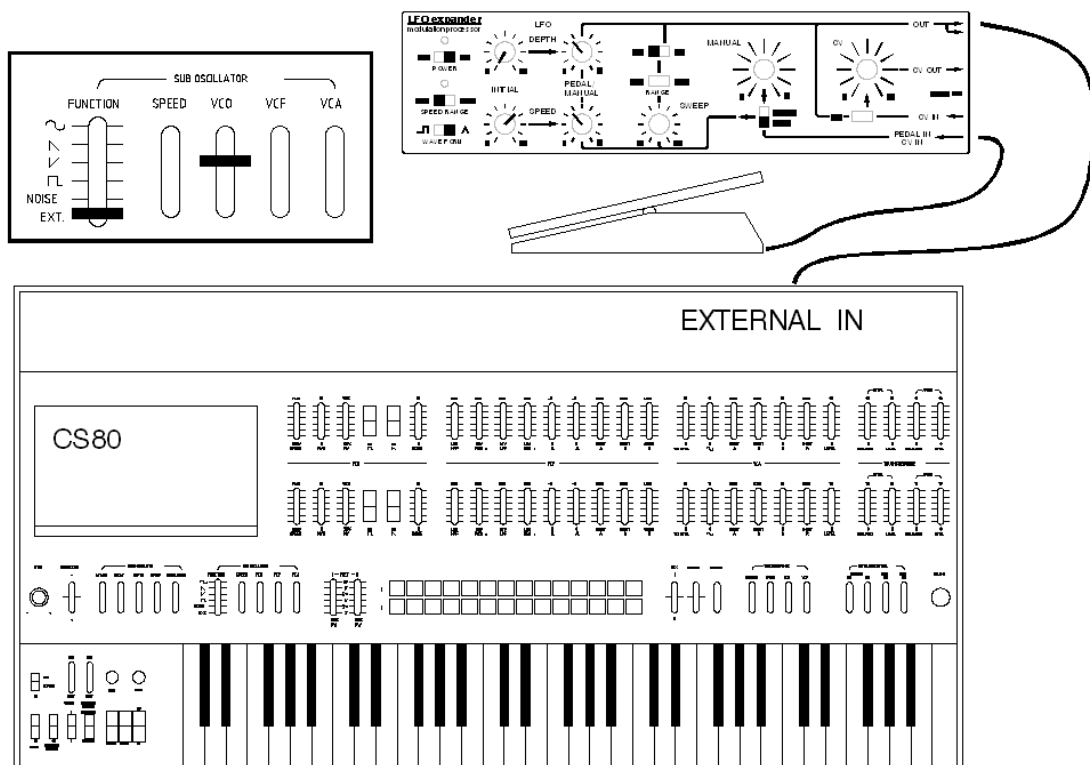
the range of vibrato and pitch bends is limited by the CS80. Maximum is about 3 to 4 semitones up and down. When applying higher levels to the CS, the signal will be clipped, resulting in strange, unnatural (but interesting) waveforms.

Note:

the signal applied to the "EXTERNAL IN" of the CS80 is inverted. Set the SWEEP-knob on the LFO-expander to negative values to create upward bends while pressing the foot pedal.

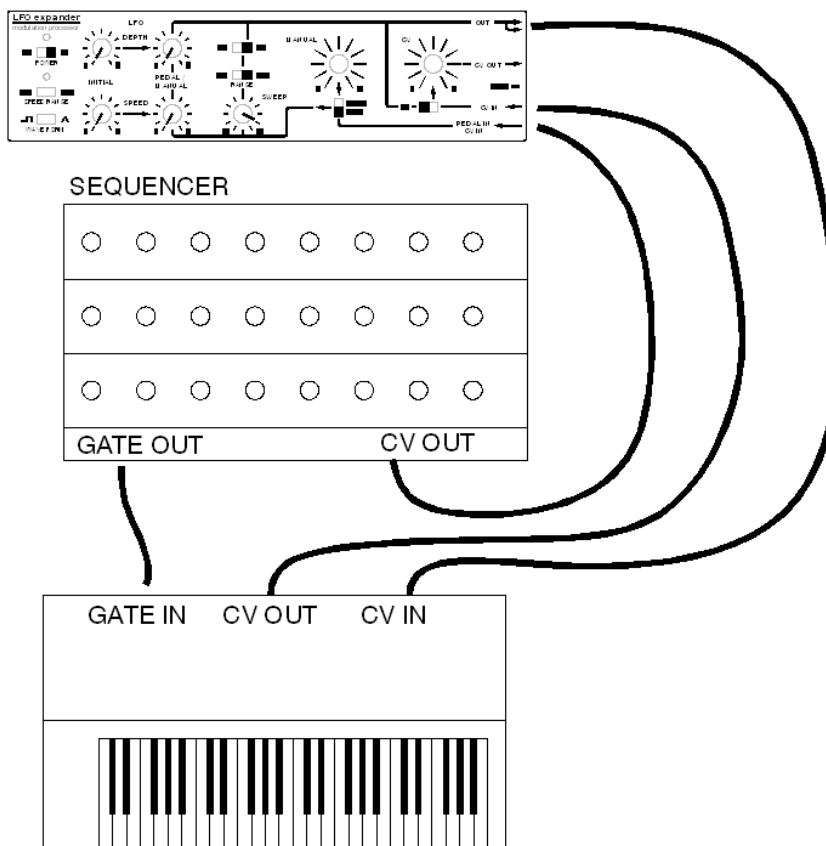
Note:

on the CS50 and CS60, pitch bends will not work correctly because constant-level or slow changing signals are filtered by the CS50 and CS60.



Example 9: Real-time pitch-transposing of sequence

In this example, the LFO-expander's functionality to mix 2 CV's is demonstrated. By adding a keyboard CV to a sequencer CV, real-time transposing of the sequence is possible by pressing keys on the keyboard while the sequencer is running. In this example, the synth's keyboard CV OUT is routed to the LFO-expander's 1:1 CV circuit. The sequencer's CV OUT is connected to the LFO-expander's PEDAL IN / CV IN and routed to the SWEEP-circuit. Now, carefully adjust the SWEEP-knob to obtain a 1:1 amplification of the sequencer's CV out (set SWEEP RANGE to "high"). Connect the main OUT of the LFO-expander to the CV IN of your synthesizer. Connect the GATE OUT of the sequencer to the GATE IN of your synthesizer.



Note:
You can set the LFO-controls to add vibrato to the sequence and free the internal LFO of your synth for other purposes.

other ideas

ARP2600:

Use the LFO-expander's triangle wave to modulate osc2 Pulse Width (PWM).
Use the EXTERNAL VIBRATO IN on your 3620 keyboard to apply LFO or pitch bends to all oscillators.
Use a passive foot pedal to control any input on your 2600 (by using the sweep function).

(semi) modular synthesizer:

Use the output of an envelope to shape the amplitude and speed of the LFO.
Reverse the output of an envelope via the negative sweep function.

Minimoog:

You can now use oscillator 3 as a sound source and use the LFO-expander for modulations (pitch, filter, volume).

Passive foot pedal:

If you own a passive foot-pedal (like most pedals are) but your equipment demands an active pedal (a pedal that creates a voltage) you can use the LFO-expander to convert your passive pedal into an active pedal (by using the sweep-function).

Midi:

Use a midi to CV converter to control LFO speed and depth over midi.

General:

Use the LFO-expander as a second LFO source. For example, use the LFO expander as shown in example 2 for vibrato and use the synth's internal LFO for filter modulation (wah-wah) or auto-key-triggering.

For latest info, please visit www.lfo-expander.com