P9700S Overview

In a P9700S, the 9700K MIDI2CV8 is the power source for the other modules in the kit. A separate power supply is not needed.

The wall-mount transformer for the 9700K is an ac power source which is converted to dc supplies for the circuits on the MIDI2CV8 and sent out to the other modules via the four-circuit dc power connection points (a rectangular area with a group of four solder areas (+) (G) (SG) (-).

The power connector kits in each of the panel accessories for the 9710, 9720 and 9730 have a four-pin header and the wires, terminals, and cover for a 'pig-tail' with the header placed on the module to the left for a daisy-chained buss. The order of the modules across the chassis is 9700 MIDI2CV8, 9720 VCO, 9730 VCF, and 9710 VCA. Notice there is a variation in the direction the header is installed on the 9700K (it faces opposite the way the ones do on the other three modules. The important thing is to get plus to plus, minus to minus, G to G, and SG to SG.

The unregulated dc supplies from the 9700K are on-board regulated to dual 12v supplies on each of the VCO, VCF, and VCA modules.

( ) On page 17 of the MIDI2CV8 manual, for the step describing the preparation of the wall-mount transformer, make a mark or note to put a rubber grommet over the wires before knotting them. This grommet is in the FR-7 chassis hardware package (and/or the 9700FRM package). This grommet will slot into the rear panel of the FR-7 as the modules are assembled into the chassis.

Patch Cords

When making the patch cord set, consider making one or two that are multiples, or ones with two or three wires branching from one connector. This is particularly useful for patches from the Gate-trigger output of the MIDI2CV8.

MIDI2CV8 Pitch CV and VCO Scaling Adjustment (procedural supplement)

The DAC Tune trim can be set by connecting the pitch cv output to a multitester set to measure dc volts in a 0-10v range and then pressing octave spaced keys on the connected MIDI controller while adjusting the trim for 1v change.

Later the VCO will be adjusted with this adjusted MIDI2CV8 output. Note too, it is easier to adjust the VCO pitches when they are in the lower range obtained when the Low-key transpose option is selected as outlined at the top of the Operating Modes pull-out (power-up the MIDI2CV8 while a the lowest key on the connected MIDI controller is pressed--then, the first message received is a note-off (when the pressed key is released) which selects the low-key transpose option).

While a tuner can be useful, it can throw you off if the input is overloaded, clipping the wave and introducing harmonics.

Here's a way to get them by ear... First set the MIDI2CV8 to be outputting 0V for the low key pressed on the controller, by powering the 9700K while holding the low key on the controller so that releasing the key will cause the first message input to the MIDI2CV8 to be a note-off (it interprets this as a signal to output zero volts for this note number). A dvm can now be used to check that octave spaced key presses are outputting a 1v pitch cv change (down to a hundredth of a volt or so) as set by the trim on the MIDI2CV8. The most accurate setting will be obtained if you press octaves that start a few notes above the lowest key, ie if your low key is a C, press D or higher for the lowest octave reading.

The usual tuned setting for the VCO scale trims is about a 1:00 setting for the pointer of there disk which covers a cw range from about 7:00 (ccw) to 5:00 (cw). Start with the trim at 1 o'clock.

After having been powered for a minute or two patch the low-key transposed pitch CV over to the VCOA P2 input. Set the two pitch controls to they're both in-tune at unison at about a mid-rotation setting for the low key pressed on the controller. Play an octave higher and the adjust scaleA for an octave relationship with B. Go back to the low note and adjust the A panel pitch control for unison and then, again, press an octave higher and adjust the scaleA for an octave relationship with B. After going back and forth like this another time or two, you should find the scale is about as close as it can get. Then, do this all again pressing some note a few keys higher than the lowest key (with VCOB adjusted to match at this new low pitch) and confirm/tweak the scale to match for higher pressed octave relationships with B (using the A panel pitch to realign A with B after adjusting the scale). When the scaleA adjustment is complete, move the pitch control over to VCOB P2 and make the panel Pitch and scaleB trim adjustments to get unison and octaves with the VCOA pitch (adjusted to match B for the low key pressed and pitch CV sent to it).

After the scaleB is set, move the Pitch CV over to the VCOA P1 input and listen to the two vcos tracking across the keyboard range (again with the low-key transpose asserted) after aligning their pitch while a higher note is pressed, say the third or fourth octave. Confirm they track for a higher octave pressed and hold as you press keys going down towards the low key. You should be able to turn up the sound of the controller or some other MIDI Sound Module and hear that the tones made from the VCOs can be aligned using the panel pitch controls and follow as you play different ranges on the keyboard (make the alignment between the two when a key pressed in the middle C, A 440 range is pressed--its easier to hear the beating slow as they are tuned).

It helps to keep the VCO Modulation control at minimum so there isn't any possible pw modulation which can make the VCOB pitch change slightly (often, a change of R59 from 91k to 27k prevents this interaction).

A general, monophonic synthesizer patch:

A common configuration is to start with the vc oscillators as the tone generator, to the L and R VCAs for a mix, run through the vc filter for emphasis or de-emphasis of parts of that tone, and then through the vc amplifier to 'frame' the sound. On the FatMan, two sawtooth (ramp) waves from the VCOs go to a LowPass VCF and then to the VCA. Envelope generators modulate the VCF and VCA in response to the Gate trigger which indicates the key pressed/released state. A Pitch CV amount according to the note pressed sets the VCO pitch.

A simple way to implement this lead, mono synth patch on your P9700S is to make the following connections (patches). You may need to make some new cords along the way.

First, we'll make the connections from the MIDI2CV8 operating in mode 1 for a mono voice complement of outputs (power-up with the low note pressed on the MIDI controller and release it a couple of seconds later to put the pitch cv in the best range). Use a single patch cord to go from the Pitch CV output on the MIDI2CV8 to the P1 control on VCO A. This allows you to control both oscillators and the Glide control setting can be adjusted to set the amount of time it takes for the oscillator frequency (pitch) to change for a Pitch CV change. The Pitch control of each oscillator can be adjusted so they are in unison or other relationship (the rest of the patch will need to be made to hear this).

A 'Y' cord or one plug with two wires and plugs on it can be used to connect the Gate trigger output from the MIDI2CV8 to the Gate trigger (G) inputs on the VCF and VCA modules. This will cause their envelope generator modulators to start when a key is pressed.

Connect the two sawtooth waves from the VCOs to the L and R VCA inputs. The mix of the two waves is set with the pan control and the L+R output is the output of this mix and goes to VCF A In. We'll take the output from VCF B LowPass, or the bottom of the six connectors on the right-hand side with the graphic response symbols. Its best to keep the Q controls at midway or so and the Frequency controls slightly different till you develop a feel for the way the filter can accentuate or provide a boost on the signal. This boost can kick the filter into oscillation or overdrive the VCA. The more the Q the more the boost, the less the Q, the less 'dramatic' the filter effect. The more similar the settings of the two series connected filters, the more critical the Q setting. A cyclic VCF modulation is a neat effect too (instead of just an envelope generator sweep in response to the Gate). A Gate plus the cycle setting gives a cycle sync'ed to the key presses.

The VCA A section takes the VCF LowPass output with a single patch cord The VCA A output could patch to a mixer or amp/speaker, etc.

The ADSR controls set the dynamics of the sound as the keys are pressed and the envelope is generated and 'opens' the VCA.

Note the VCO waveform outputs are high level and you may need to set input levels lower than for usual stuff, or, a special patch cord to attenuate the output can be made. I have one that puts a couple of fixed resistors in series from the tip to sleeve circuits on the plug at 9700 end of the cable and the signal is tapped at the junction of the resistors for a more typical 'line-level'. The two resistors are a 10k and a 1k and the 10k attaches a the tip and the 1k at the sleeve. The tap for the signal that wires on to the tip of the plug for the mixer, amp/speaker, etc is from the junction of the two resistors. The

ground circuit is as usual--sleeve terminal to sleeve terminal. The reason its needed here but not on module to module patches is that the modules all share a ground already--the power supply ground circuit--but the synth and the external device don't until one connection is made between them establishing a common ground.

There are many more possibilities. Experiment. Use the testing and calibration sections of the manuals and the descriptions of the controls and connectors as a guide in these experiments.

In the preceding example, only the Pitch CV and Gate trigger outputs derived from MIDI note messages were used. I'll touch on possibilities for all the outputs available in the MIDI converter 'mode one'.

1) Pitch CV - to VCO to control pitch and perhaps to VCF to so filter response varies according to keyboard range.

2) Attack Velocity - a cv output proportional to the speed keys are pressed that is interesting patched to filter control inputs and vca control inputs.

3)Gate - a trigger activated for keys pressed and active for the duration of a key(s) pressed.

4) Trigger Pulse - a trigger activated for a short duration as a key(s) is/are pressed. When this goes to the envelope generators along with the Gate trigger, the envelopes are reiterated for multiple key-downs.

5) Pitch Wheel - a cv output proportional to the setting of the MIDI Controller's Pitch Wheel.

6) Mod Wheel - a cv output proportional to the setting of the MIDI Controller's Modulation (amount) wheel.

7) Aftertouch - a cv output proportional to the value of the MIDI Controller's Channel Pressure message (according to force against keys on the keyboard).

8) Release Velocity - a cv output proportional to the speed a key is released on the MIDI controller. Filter and Amplifier control would be typical.

Its a lot of fun and interesting just to interconnect the modules for sound effects, perhaps introducing external controls (cvs or triggers) from things other than the MIDI converter for these (ie the Theremax, envelope follower/trigger devices, drum machines, etc). The VCO modulator slowly cycling and controlling the LFO frequency of oscillator A and these patched to the filter with it's modulator slowly cycling is an interesting effect. FM or VCA modulator sweeps with the VCO outputs and other 'shortwave radio tuning - like' effects can be accomplished by sending in an external audio signal.

9700K MIDI2CV8 tips

Just to be sure, for MIDI2CV8 operating-mode 1 on MIDI Channel 1, press all DIP Switch levers down, or on (closed).

Then, it is important to remember that changes in settings are only acknowledged on power-up. So if you make a change, power-down and the power-back-up to get the uC to read the settings.

Most likely, the Low-Key transpose option will need to be asserted to put the pitch cv output in the best range. Power-up with the low note on the MIDI controller pressed, wait a second or two and release this note. The pitch cv to the VCO will now operate it in an optimum range.

The two voice and four voice modes 2 and 3 aren't so useful except as a special effect in getting the 'voicing' to change as you play, unless you go to the Multi mode by sending in a program change #0 message to start. Then, the pitch cv and gate trigger sets are 'addressable'. You can control the sets according to MIDI Channel.

Mode 4 gives cvs out according to MIDI Control Change, continuous controller messages--good for remote control sorts of operations.

Mode 5 gives cvs out that are momentary pulses with the amplitude set by the velocity of the note messages (the first eight on a typical five-octave controller). This is good for sounding analog percussion voicing (or digital with analog input triggering).

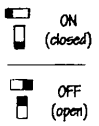
Mode 6 combines monophonic synth control with the DIN Sync signals that can be adapted over to a DIN Sync plug from the mini-phone jacks with a custom made cable.

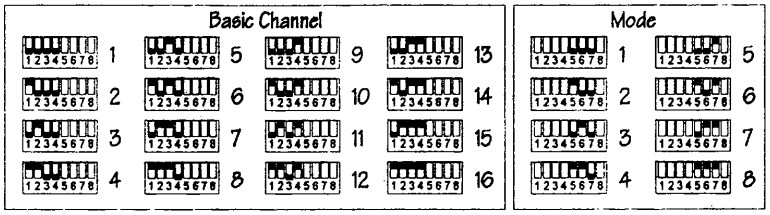
There is no mode 7, and Mode 8 is the Self-Test (output test unless MIDI is input and then, MIDI Test).

9700 MIDI2CV8 Channel/Mode Details

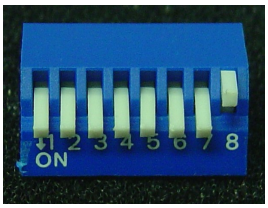
System Default Switch

The DIP Switch S1 sets Basic Channel and Operating Mode as shown in the charts below. Detailed explanations of operating modes can be found in the illustration supplement. Note that the eighth switch section is a spare and is not used in setting channel or mode.

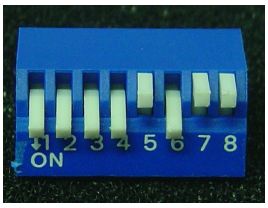




Some Example Images



Channel sections 1-7 on, unused section 8 off.
Channel 1, Mode 1 – One Voice



Channel sections 1-4 on, mode sections 5-7 off-on-off, unused section 8 off.
Channel 1, Mode 6 – One Voice/DIN Sync

Low-Key Transpose - Most digital keyboards assign the midi note number 36 to their lowest key. To the midi2cv8, note 36 corresponds to 3 octaves above the lowest key, so it produces a 3 Volt Pitch CV. To most analog keyboards, 3V. corresponds to the key 3 octaves above the lowest (0V.) key. Consequently, oscillators pitched for use with an analog keyboard will play three octaves higher on a digital keyboard. The midi2cv8 has a Low Key Transpose feature that transposes the lowest key on any keyboard to key #0 for a 0V. output.

Activate this feature by turning on the midi keyboard and holding down it's lowest key **WHILE** the midi2cv8 is turned on or reset. Releasing the key then sets it as the lowest note. After setting Low-Key Transpose you must next do some action that will send a midi Status Byte so the midi2cv8 can know the correct Running Status. Usually rolling the pitch wheel or sending a program change is the easiest way, but in some cases the keyboard controller must be reset by turning it off and back on again.

NOTE: When the V/Hz option is installed, the lowest key defaults to key 36 so Low-Key Transpose will not usually be necessary.

Running Status is a technique used by most controllers to conserve precious midi bandwidth. But if the midi2cv8 was off when the Status Byte came by - or has been reset since the last one - confusion results. If you reset the midi2cv8 and it is suddenly nonresponsive, turn the keyboard or controller off and back on again or otherwise reset its Running Status. If this gets things to respond but the keyboard is suddenly "folded", it means that the midi2cv8 had previously misinterpreted an implicit Note-Off - "no" status (actually the midi2cv8 has forgotten it) and a zero second byte - as a Set Low-Key request. Reset the midi2cv8 to clear the Low-Key Transpose, which is produceing the higher pitches for keys below the faux "Low-Key". Then also reset the controller again or you will be right back where you started.

Mono/Multi - The midi2cv8 defaults to Mono (Multi disabled). Multi is enabled by sending a Program #0 command (piano in General MIDI) on the Basic Channel and is disabled by resetting the midi2cv8. When Multi is enabled, notes on the Basic Channel are assigned to the first output group (Pitch, Gate, etc.), notes on the next channel above the Basic Channel route to output group 2 and so on as output groups are available. For example, in Two Voice Mode with Multi enabled a midi2cv8 set to Basic Channel 4 will route notes on midi channel 4 to output group 1 and notes on midi channel 5 will go to output group 2.

One Voice

Mode 1
1 voice

Provides complete control of a single synth voice. The Gate signal is high as long as any key is down. The 5 ms. Re-trigger pulse occurs each time a new note is played whether the previous key was released or not. Release velocity is assigned only on notes explicitly turned off with a Note Off Status.

Mono (all from Basic Channel)	*Multi*
output 1 = Pitch	No Multi Enabled functions
output 2 = Attack Velocity	
output 3 = Gate	
output 4 = Trigger Pulse	
output 5 = Pitch Wheel	
output 6 = Mod Wheel	
output 7 = Aftertouch	
output 8 = Release Velocity	

Two Voice

Mode 2
2 voice

Provides Pitch, Velocity and Gate control of two synth voices. Gates are legatto (Gate signal does not go low when a new note is assigned to a currently assigned output) and notes are always assigned. Orphan note-offs are ignored (see mode 3). Mod Wheel and Pitch Wheel or two Pitch Wheel outputs are also provided.

Mono	*Multi*
output 1 = Basic Channel Pitch 1	output 1 = Basic Channel Pitch
output 2 = Basic Channel Velocity 1	output 2 = Basic Channel Vel.
output 3 = Basic Channel Gate 1	output 3 = Basic Channel Gate
output 4 = Basic Channel Pitch 2	output 4 = BC+1 Pitch
output 5 = Basic Channel Velocity 2	output 5 = BC+1 Velocity
output 6 = Basic Channel Gate 2	output 6 = BC+1 Gate
output 7 = Basic Channel Pitch Wheel	output 7 = BC Pitch Wheel
output 8 = Basic Channel Mod Wheel	output 8 = BC+1 Pitch Wheel

Mode 3
4 voice

Pitch and Gate control of four synth voices. Gates are leggato and new notes are always assigned. Orphan Note-Offs (when a note is to be turned off on an output that has already been reassigned) are ignored.

Four Voice

Mono	*Multi*
output 1 = Basic Channel Pitch 1	out 1 = BC Pitch
output 2 = Basic Channel Gate 1	out 2 = BC Gate
output 3 = Basic Channel Pitch 2	out 3 = BC+1 Pitch
output 4 = Basic Channel Gate 2	out 4 = BC+1 Gate
output 5 = Basic Channel Pitch 3	out 5 = BC+2 Pitch
output 6 = Basic Channel Gate 3	out 6 = BC+2 Gate
output 7 = Basic Channel Pitch 4	out 7 = BC+3 Pitch
output 8 = Basic Channel Gate 4	out 8 = BC+3 Gate

Mode 4
control change

Converts MIDI Control Change messages for cc0 to cc7 to CVs.

Control Change

Mono	*Multi*
output 1 = Basic Channel cc 0	output 1 = BC cc 0
output 2 = Basic Channel cc 1	output 2 = BC + 1 cc 0
output 3 = Basic Channel cc 2	output 3 = BC + 2 cc 0
output 4 = Basic Channel cc 3	output 4 = BC + 3 cc 0
output 5 = Basic Channel cc 4	output 5 = BC + 4 cc 0
output 6 = Basic Channel cc 5	output 6 = BC + 5 cc 0
output 7 = Basic Channel cc 6	output 8 = BC + 6 cc 0
output 8 = Basic Channel cc 7	output 9 = BC + 7 cc 0

Mode 5
analog drum

This mode provides for control of devices that use variable amplitude pulses for triggering, such as analog drum circuits. Each output corresponds to a key and the each key activation produces a 5ms pulse with amplitude proportional to velocity

Analog Drum

Mono	*Multi*
output 1 = Note 24h	No Multi Enabled Functions
output 2 = Note 25h	
output 3 = Note 26h	
output 4 = Note 27h	
output 5 = Note 28h	
output 6 = Note 29h	
output 7 = Note 2ah	
output 8 = Note 2bh	

Mode 6
din eync

This mode converts MIDI Real Time messages into useful electrical control lines. The 24 ppq clock pulses and run/stop line are as required by DIN-Sync protocols. The 5ms. reset pulse is provided for control of analog sequencers and other applications where a distinction is made between MIDI Start and Continue commands.

DIN Syne

Mono	*Multi*
out 1 = Basic Channel pitch	out 1 = Basic Channel pitch
out 2 = " velocity	out 2 = Basic Channel vel.
out 3 = " gate	out 3 = Basic Channel gate
out 4 = " re-trigger	out 4 = BC + 1 pitch
out 5 = " pitch wheel	out 5 = BC + 1 velocity
out 6 = DIN start reset pulse	out 6 = BC + 1 gate
out 7 = DIN run/stop	out 7 = DIN run/reset
out 8 = DIN 24 ppq 1mS pulses	out 8 = DIN 24 ppq

Mode 8
Self-Test

Output Test - On power-up or reset this test first strobes the eight outputs in sequence, holding each high for 1 second before turning it off and stepping to the next. When all eight outputs have been turned on and off the test next sequentially ramps each output high over a 5 second period and leaves the output high when done. This part of the test loops continuously until midi data is received.

MIDI In Test - When MIDI data is received, the output test is interrupted and the MIDI In LED flashes brightly and regularly to indicate the kind of data that was received as shown at right. Reset to start the test again.

Self-Test