Pulsar 900 Series Modular Synthesizer Owner's Manual

Second Edition, 05/10/2017

Introduction

Congratulations! You have purchased a powerful tool for synthesizer performance and composition. The Pulsar 900 Series Modular Synthesizer is the result of painstaking analysis and emulation of classic, large format (MU), synthesizer modules.

Great care has been taken to make sure that both sound and operation is as close as possible to actual hardware. Some minor differences are intentional for better ease of use. Most of the modules are modeled on modern updates, while some are original designs.

License

When first installed, the P900 will run in demo mode until a valid license has been activated. Intermittent noise bursts will appear after a few minutes of use when in demo mode. Use the License menu to bring up the dialog where the license key can be entered and the license activated. Once your license has been activated, the P900 will no longer require an internet connection in order to run.

You get two activations per license. This allows, for example, installation on both a desktop and a laptop computer with a single license.

The P900 licensing system also supports de-activation from within the license dialog. This allows you to move a license activation to a new computer, for example when you replace a computer. Both activations and de-activations requires a live internet connection.

User Interface

The P900 features a hardware accelerated, high resolution, user interface that allows arbitrary panning and zooming within the confines of the virtual rack, while interacting with controls. It is rendered at a high frame rate to ensure immediate feedback and smooth operation.

Navigation

Track pad two finger gesture, used for panning.
Track pad pinch gesture, used for zooming.
Right click + mouse move, used for panning.
Command key + mouse move, used for zooming.

Controls

Right click + mouse move, linear mapping used for control knobs.
Right click (right or left) used for toggle switches.

Cable connections

Right click and drag, used for patch points. Drag out the white input connector to disconnect patch points. Click and hold a white input connector will highlight any connected patch cable in red. This is useful when you have many connections. Note: Outputs can have any number of connections. Inputs can only have one connection.

Menus

View/Reset - Restores the original rack view.
View/Zoom Lock - Disables zooming capabilities, so that the rack is always aligned the the window.
Rack Size - Configures the size of the virtual rack.

Antialiasing - Controls oversampling. The default is 2X which is fine for most situations. Some audio rate modulation, certain filter configurations and ring modulation may benefit from more aggressive oversampling.

MIDI - Use Learn/Forget to add or remove MIDI controller mappings.

Show/Hide Patch Coords - Controls patch cord visibility. The colored plugs are still displayed which helps to show connections.

Show/Hide Patch Notes - Controls the visibility of the patch documentation window. The support rich text and may include images as well. If enabled, the window can still be closed and will only reappear when the next patch is loaded.

Load/Store - Load or store 128 possible presets. These will respond to MIDI PGM changes. The program name is taken from the patch notes.

Host Preferences - Use Layers flag is the graphics engine, and depends on both the Host and macOS version. Change setting if the GUI is blank or corrupted. The setting is persistent per host.

Clear Patch - Removes all rack connections.
Clear Rack - Removes all installed modules.
License - Displays the license management dialog.

Rack configuration

Double click, used enter slot editing mode.
Double click, used to install the currently visible module.

Once in editing mode you can either use:
Track pad two finger gesture, to scroll up/down in the module library.
Right click + mouse move, to scroll up/down in the module library.
Right click menu, to directly install from a list of modules.
Right click menu, to eject the module in the current slot.
Right click menu, to cancel the editing operation.

Modules

The P900 includes a variety of different modules. However, because of CPU processing limitations and also due to the limitations of the v2 AudioUnit parameter spec, it has a fixed set of modules available as indicated below.

The P900 will only process the audio and control paths that are actually connected. Unused modules or unused module inputs/outputs in the rack do not incur any processing overhead. In addition, it is tolerant of connection loops and will simply detect and ignore them.

BLANK PANEL

Blank panels are automatically installed in each free slot, when a rack is cleared, and when modules are ejected.

930: MIDI/CV CONVERTER (1X)

The MIDI/CV module is where all MIDI events from the host DAW get converted into (virtual) CV/Gate voltages and injected into the modular engine, which runs at the host sample rate or some multiple thereof when oversampled. Smoothing filters are used where needed to avoid audible steps when generating high resolution control voltages from (course) MIDI data.

In addition to the 6 outputs, the MIDI/CV module has a few other functions as well. It stores MIDI programs (patches) and displays relevant MIDI CC events (pitch bend, modulation, velocity and pressure events) as they are received.

This is also where you configure which type of voice allocation to use for the current patch. Mono and Legato both use a single voice where the former will emit gate signals that can be used to re-trigger envelopes for each new key press when a key is held. Both modes use last note priority.

The P900 also supports fully polyphonic configurations in either 4-voice or 8-voice mode. There's quite a structure under the hood to make this possible in a free form modular environment. In order to mimic the behavior of classic polyphonic synthesizers, certain modules must run in a 'global space' such that they are perfectly in sync for each voice. Currently, this applies to the 924 LFO and the 928 S&H modules. What this does is to make it possible to program the kinds of modulations that exist on classic polyphonic synthesizers, where LFOs and some other shared functions are global in nature and are located on the motherboard instead of in each voice card. Secondly, it simply sounds better for most uses.

However, since the 921-B oscillator also can function as an LFO, it is still possible to get non-synchronized, per-voice modulation.

I/O Specification			
PITCH	Keyboard CV	1V/Oct	
GATE	Keyboard Gate	5V	
BEND CV	Pitch Bend	-6V to 6V	
MODULATION CV	Mod Wheel	-6V to 6V	
VELOCITY CV	Key Velocity	-6V to 6V	
PRESSURE CV	Channel Aftertouch	-6V to 6V	

921-A: OSCILLATOR DRIVER (1X)

As with hardware modules, the 921-A oscillator driver has a hidden internal connection to each 921-B oscillator. It contains an exponential converter that controls the base pitch and also the pulse width of all connected oscillators.

The semitone/octave switch sets the scale used for the frequency control, either +- 6 semitones or +- 12 octaves.

I/O Specification			
FREQUENCY	Controls oscillator pitch	1V/Oct	
WIDTH	Controls pulse width	-6V to 6V	

921-B: OSCILLATOR (4X)

The 921-B oscillator's frequency control allows modifying the base pitch by +- 12 semitones.

The range switch modifies the base pitch in 1 octave steps, except for the LO setting which disconnects from the driver and uses a base pitch of 1 Herz.

I/O Specification			
SYNCH IN.	Oscillator hard sync	A/C	
A.C. MODULATE	For A/C pitch modulation	A/C	Will block D/C.
D.C. MODULATE	For D/C pitch modulation	D/C	
SINE	Sine wave	Audio	
TRIANGULAR	Triangle Wave	Audio	
SAWTOOTH	Sawtooth Wave	Audio	
RECTANGULAR	Pulse Wave	Audio	PW set by driver.

CP10: MIXER (3X)

The CP10 is a “clean” mixer. It will not clip or saturate and has a gain of 6 dB. It can be used to mix either A/C or D/C signals.

I/O Specification			
OUTPUTS	A/C or D/C		Inverting output preferred for filter.
INPUTS	A/C or D/C		

904 A/B/C/D/E: FILTER (2X)

The 904 filter module comes in 5 different flavors:

904-A: Transistor Ladder Low Pass
904-D: Diode Ladder Low Pass
904-E: OTA Low Pass
904-F: State Variable Multimode
904-G: Sallen Key Low Pass

The frequency range switch controls the range of the fixed control voltage according to:

1: 1Hz to 5kHz
2: 4Hz to 20kHz
3: 16Hz to 80kHz (limited by SR)

I/O Specification			
SIGNAL INPUT	Audio In	Audio	
SIGNAL OUTPUT	Audio Out	Audio	
CONTROL INPUTS	Filter Cutoff CV	-6V to 6V	Inputs are summed.
NOTCH	Notch filter output	Audio	904-F only.
BANDPASS	Bandpass filter output	Audio	904-F only.
HIGHPASS	Highpass filter output	Audio	904-F only.

911: ENVELOPE GENERATOR (4X)

The 911 envelope generator has a general shape matching the analog equivalent, however the Pulsar version has modified timings with an attack rate closer to that of the Minimoog (which the author happens to like better). Some hard pluck sounds included in the factory presets could not be done without it.

Note that the 911 controls are laid out differently from the typical ADSR. Here you have from top to bottom: Attack, Decay, Release, Sustain

I/O Specification			
TRIG IN	Gate signal	5V	
OUT	Envelope signal	0 to 6V	

995: ATTENUATOR (3X)

As in the original hardware, the 995 attenuator is internally connected from top to bottom. With only the first input connected, each output is active and can have different gain settings.

Insertions break the internal connections and they become independent attenuators.

I/O Specification			
IN	A/C or D/C		
OUT	A/C or D/C		

902: VOLTAGE CONTROLLED AMPLIFIER (4X)

The 902 VCA has two modes, linear and exponential. Linear is normally used for the amp envelope and exponential mode is useful for CV signals.

One example of the latter is pitch modulation controlled by a mod wheel. To get a smooth response you route an LFO through a VCA in exponential mode, controlled by the mod wheel CV. Several factory patches do this. They also show how use the fixed control voltage to offset the modulation CV, so that it starts at 0. That way you get an immediate response from the mod wheel. The VCA reacts to CV only from 0 to 6V, so you would otherwise need to bring the mod wheel up to its center before you get a response.

Note that the first output is inverting per original spec!

I/O Specification			
SIGNAL INPUTS	Audio In	Audio	Inputs are summed.
SIGNAL OUTPUT	Audio Out	Audio	First output is inverting.
CONTROL INPUTS	Amplifier CV	0 to 6V	Inputs are summed.

923: FILTERS (2X)

The 923 module has two 1-pole non-resonant filters. Both the low pass and the high pass filter has a cutoff range from 10 Hz to 10 Khz.

The module also includes white and pink noise generators.

I/O Specification			
LOW PASS IN	Audio In	Audio	
LOW PASS OUT	Audio Out	Audio	
HIGH PASS IN	Audio In	Audio	
HIGH PASS OUT	Audio Out	Audio	
NOISE SOURCE	Audio Out	Audio	

934: RING MODULATOR (1X)

This is an original Pulsar module that features two independent ring modulators.

I/O Specification			
X	Audio In		
Y	Audio In		
XY	Audio Out		

924: LOW FREQUENCY OSCILLATOR (3X)

Original Pulsar module. It outputs 4 different wave forms and features CV control of the LFO frequency. The LFO frequency ranges from 0.1 to 80 Herz. The CV input control attenuates the CV signal.

The reset input responds to a gate signal by resetting the cycle of the LFO waveforms. This is useful when you want the LFO to restart on each key press, for example.

I/O Specification			
SINE	Sine wave	Audio	
TRIANGULAR	Triangle wave	Audio	
SAWTOOTH	Sawtooth wave	Audio	
RECTANGULAR	Rectangular wave	Audio	
CV INPUT	Frequency CV	-6V to 6V	
RESET	Gate signal	5V	

928: SAMPLE & HOLD (3X)

The 928 S&H module samples the input and outputs (a held value) at the rate of either the internal clock or an external clock.

The glide control allows for exponential glide between sampled values, at the specified rate.

I/O Specification			
TRIG IN	Clock signal	LF Audio	
CLOCK OUT	Clock signal	LF Audio	
IN	Audio In		
OUT	Audio Out		

938: OUTPUT MODULE (1X)

The 938 stereo output module provides routing to the inputs of the host DAW. This module has several functions:

It's a summing amplifier that sums all the voices of the P900. Each voice has summing amp input gain stage with saturation of two different types, Class A/B and Class A.

The saturation is variable and an overload indicator shows how much it's engaged. Both saturation types add harmonics and can be very useful for thickening the sound and generally providing 'color'.

The bottom section is where effects are plugged in as inserts. Only effects can be plugged in here.

Without effects, you would normally plug the same VCA output into both inputs. With effects and a mono patch, you normally only plug into the left output and use the Plate Reverb produce a stereo signal for the effect returns that join the stereo bus feeding the DAW inputs. Of course, you have many options available to create a stereo patch; using two filters for example, in which case you can feed the reverb input a stereo signal.

All effects have wet/dry mix options to blend the effect with the dry, or previously effected, signal.

I/O Specification			
LEFT INPUT	Left input to DAW track	Audio	
RIGHT INPUT	Right input to DAW track	Audio	
LEFT SEND	Left effects send	Audio	
RIGHT SEND	Right effects send	Audio	
LEFT RETURN	Left effects return	Audio	
RIGHT RETURN	Right effects return	Audio	

931: ANALOG DELAY (2X)

The 931 Analog Delay is an emulation of a Bucket Brigade Delay (BBD) - a discrete-time analog delay line popular in the 1970s and the early 1980s. The emulation includes the filtering, distortion and noise typical of such delays. The BBD control allows the distortion and noise part of the emulation to be mixed in as desired. When fully attenuated you have a clean delay that can be just as useful as the BBD distortion that provides an interesting color.

Clock Rate sets the rate at which the stored input signal is moved one step along the delay line.

Regen sets the amount of delay feedback.

The Modulation Depth/Rate controls a built-in LFO that modulates the delay line, allowing for some chorus-like effects.

The Wet/Dry Mix blends the effected signal with the dry signal.

933: PLATE REVERB (1X)

The 933 Plate Reverb is using a reverberation network topology similar to those used in high end early 1980s digital effects processors, with modulated tails. It is a very good sounding and flexible reverberation algorithm for which 3 different plate size configurations are provided.

The Bandwidth control is a variable bandpass filter that cuts both low frequency and high frequency content from the effect signal.

When provided with a mono signal, the plate reverb generates a pseudo stereo signal. It also supports true stereo processing.

935: VOLTAGE STORE (3X)

The 935 Voltage Store is a very simple 8-step voltage store. Each step is controlled by a dedicated potentiometer with an adjustable output ranging from -6 to +6 volts.

The Scale switch reduces the output voltage range by half.

The Quantize switch will quantize the output range into a musical division of semitones, for 1V/Oct. This mode is for when using the module to generate pitch CV.

At any given point the module has an active position at one of the 8 steps. The LED is lit for the currently active position.

The Shift input will shift the position one step forward (clock wise) when going high. When the Reverse input is high the module will step backward (counter clock wise).

The Reset input will reset the module to its initial position (top left).

The Output will always reflect the knob setting at the currently active position, modified by the settings of the two toggle switches.

I/O Specification			
SHIFT INPUT	Clock / Gate signal	5V	
RESET INPUT	Gate signal	5V	
REVERSE INPUT	Gate signal	5V	
OUT	CV signal	-6V to 6V	

936: MIDI CLOCK (1X)

The 936 MIDI Clock uses the DAW host to generate synchronized quarter-note clock signals. In addition the module also has three independent clock dividers, each with its own output. Plus a forth output for quarter-note clock output only. The clock signals can be used to drive the 935 Voltage Store, for DAW synchronized sequences.

921: OSCILLATOR (2X)

The 921 oscillator's frequency control allows modifying the base pitch by +- 12 or +- 6 semitones, depending on the setting of the scale switch.

The range switch modifies the base pitch in 1 octave steps.

There are separate auxiliary outputs with independent waveform configuration as well as level.

Rectangular width and CV input works the same as on the 921-B. In fact, the core of this oscillator is the same as 921-B.

The clamping trigger will reset the waveform at the specified clamping point.

The frequency control inputs are all 1V/Oct. The oscillator has its own built-in exponential converter.

WIDTH CONTROL IN	Modulates rectangular width	-6V to 6V	
CLAMP TRIG	Clamps the output waveform	-6V to 6V	
SINE	Sine wave	Audio	
SINE/TRI/SAW/RECT	Waveform	Audio	
SAWTOOTH	Sawtooth Wave	Audio	
RECTANGULAR	Pulse Wave	Audio	PW set by driver.

937: SEQUENTIAL CONTROLLER

The 937 Sequential Controller is essentially a massively expanded 935 Voltage Store. At its core we have three rows of 8 steps, each row with its own scale, quantization settings and outputs. The three rows can run independently, or be chained into 16+8 or 24 steps, according to the setting of the Chain switch. The outputs depend on the chain configuration. So for example, in 24-step mode, you only use the first set of outputs. Each set of GATE/REVERSE/RESET outputs can be used directly, or to drive a connected 935 Voltage Store.

The P900 uses an efficient processing algorithm such that will only process what is actually connected. So, in order for the sequencer to run you need inputs and at least one output properly connected.

On the bottom row we have a set of controls for the actual step sequencer. Each step has a step length plus one of eight possible actions associated with it. The step lengths can be scaled globally by the Step Length knob, which is useful for dialling in a staccato or legato behaviour for a particular sequence. The Step/Edit control is used to navigate the set of 24 steps and indicates which step is currently edited by the Length and Action controls. The step edited is also lit up, however if the sequencer also runs simultaneously it will turn that off as it passes the step. The entire 24-step configuration can be saved in pattern presets. These presets are stored within the patch preset.

The Clear button will initialise all steps to a default configuration. The Random button uses a randomisation algorithm to generate a complete step pattern. Once you have dialled in the notes for each step, you might enjoy trying it out on playback with randomly generated step patterns.

The computer controlled (..ok, it’s virtual) step sequencer, controls and stores step patterns. The actual knob settings however, are saved with the patch preset. The sequencer can use its own DAW synchronized clock, or be driven by the Shift input. The Run input must be high or the Run switch engaged for the sequencer to run.