*S*ERGE *M*ODULAR *M*USIC *S*YSTEMS

CATALOG AND DATA SHEETS

SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED OSCILLATORS

STATE--OF-THE-ART STABILITY

PRECISION TRACKING
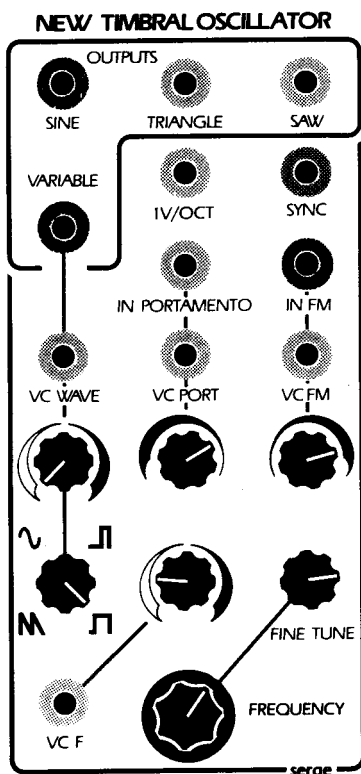
WIDE-RANGE WAVEFORM CONTROL

MULTIPLE WAVEFORMS

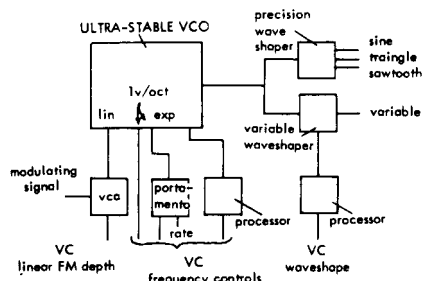LINEAR FM WITH DYNAMIC DEPTH VC

SYNC CAPABILITY

CALIBRATED INPUTS

PROCESSING INPUTS

VC PORTAMENTO CONTROL

NEW TIMBRAL OSCILLATOR

OUTPUTS
SINE   TRIANGLE   SAW
VARIABLE   1V/OCT   SYNC
IN PORTAMENTO   IN FM
VC WAVE   VC PORT   VC FM
FINE TUNE
FREQUENCY
VC F
serge

FUNCTIONAL BLOCK DIAGRAM OF THE NTO

The Serge Modular Systems NEW TIMBRAL OSCILLATOR (NTO) is the state-of--the-art VCO, featuring exceptional range, superb temperature stability, and accurate tracking. Dynamic depth frequency modulation and voltage control of waveform allow unprecedented control over a wide range of sound qualities.

- EXPONENTIAL 1 VOLT/OCTAVE RESPONSE
  Exponential response parallels the response of human hearing perception as well as musical pitch structure. With multiple oscillators, each must respond exponentially to control voltages to allow transposition from key to key and to produce alternative equal-tempered tunings such as quarter and third tones. In addition, the one-volt-per-octave response assures that the New Timbral Oscillator is compatible with most keyboard and computer controllers.

- ACCURATE TRACKING
  When two or more oscillators are tuned, it is expected that they will remain in tune throughout their entire range (in other words, that they track). Even two oscillators which track within a fraction of a semitone will be out of tune at the extremities of their range. Therefore, the New Timbral Oscillators have been designed so that any two will track within one cycle/second throughout their entire musical range.

- TEMPERATURE STABILITY
  Instability of pitch with changes in temperature is the criticism of most synthesizer VCO's. Performers are aware of the disastrous effects of temperature when they must desperately retune oscillators that have drifted during a live performance. The temperature sensitive components are kept at an even 120 degrees by a solid-state "oven". Thus temperature stability is guaranteed from 50 degrees to 100 degrees F.

- WIDE FREQUENCY RANGE
  The frequency range covers from below 16 to 16Khz. With control voltages, the range can be further extended from less than .1 Hz (10 sec/cycle) to greater than 100,000 Hz.

- VARIETY OF WAVEFORM OUTPUTS
  In addition to three standard waveforms (sine, triangle and sawtooth) of exceptional purity, the New Timbral Oscillator offers a variable waveform output providing an amazingly varied range of sounds, unavailable on any other synthesizer. This waveform is voltage controllable, allowing dynamic control of sound quality.

- DYNAMIC DEPTH LINEAR FREQUENCY MODULATION
  Dynamic depth frequency modulation is now available to the analog synthesist. Frequency modulation (FM), the modulation of one oscillator by another, generates both harmonic overtones (found in most acoustic instrument sounds) and non-harmonic overtones (bells, percussive, and electronic timbres). By varying the amplitude of the modulating oscillator, the richness or complexity of the sound can be varied. However, with conventional FM, an annoying pitch shift occurs. With the New Timbral Oscillator, Linear FM avoids this pitch shift, making it possible to maintain accurate pitch control while changing the quality of sound. A built-in VCA assures accuracy and provides dynamic voltage control of Linear FM Depth. Of course, conventional exponential FM is also available on the New Timbral Oscillator.

  The New Timbral Oscillator offers two voltage control inputs calibrated to one volt per octave and one variable voltage control input. One of the calibrated inputs incorporates a variable Portamento. This allows gliding from pitch to pitch at a voltage-controllable rate, set at each oscillator rather than from the controller (such as a keyboard), and therefore independently variable at each New Timbral Oscillator. All of the output levels are "hot", greater than +4 db to ensure maximum signal-to-noise ratio. A Sync input is provided for locking the NTO to another oscillator's fundamental, harmonic, or sub-harmonic frequency.

SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED OSCILLATORS
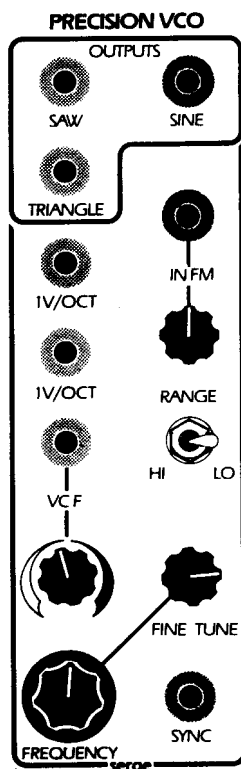
STATE-OF-THE-ART STABILITY

PRECISION TRACKING

LINEAR FM

SYNC CAPABILITY

CALIBRATED INPUTS

PROCESSING INPUTS

PRECISION VCO

OUTPUTS

SAW   SINE

TRIANGLE

1V/OCT   IN FM

1V/OCT   RANGE

VC F   HI   LO

FINE TUNE

FREQUENCY   SYNC

serge

The Precision VCO is a versatile, voltage controlled oscillator offering three high quality waveform outputs (sine, triangle, and sawtooth) and both linear and exponential frequency modulation capabilities. A front panel switch conveniently extends the range of the PCO from the audio range (16 to 16,000 Hz) to a sub-audio range (.1 to 200 Hz) for use as a Low Frequency Oscillator.
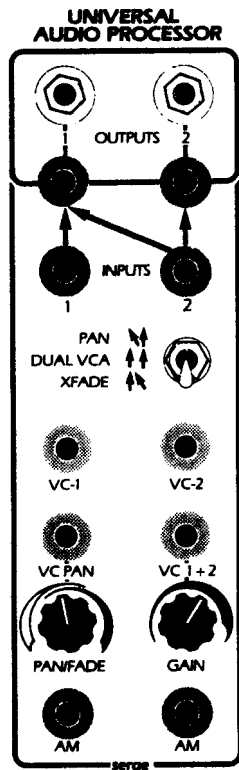
EXCELLENT RESPONSE, TRACKING AND STABILITY
Featuring the identical exponential response, exceptional tracking characteristics, and perfect temperature stability as the NTO, the PCO is especially suited for use with the NTO as a modulation source for dyanamic depth linear FM.

MANY FEATURES
Two calibrated one volt per octave inputs as well as a variable processing input are provided for complex frequency control. FM depth can be varied with the front panel adjustment. All output levels are "hot", greater than +4 db to insure maximum signal to noise ratio when used with subsequent processing. A Sync input is also available for locking the PCO to another oscillator's fundamental, harmonic, or sub-harmonic frequency.
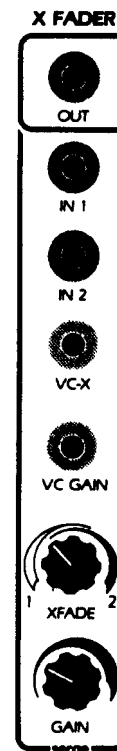
SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED AMPLIFIERS

UNIVERSAL AUDIO PROCESSOR

OUTPUTS 1 2

INPUTS
1   2

PAN
DUAL VCA
XFADE

VC-1   VC-2

VC PAN   VC 1+2

PAN/FADE   GAIN

AM   AM

serge

The UNIVERSAL AUDIO PROCESSOR (UAP) is the ideal VCA module for small
Serge systems because it can function in the following ways:

1. As two independent VCA's with separate signal and control
    inputs.
2. As one equal-power stereo panner. This panner has one input
    routed to two outputs, in a proportion which is voltage
    controlled. The panner can be used for signal routing
    within a system or for the positioning of sound in a stereo
    field. A VCA controls the overall amplitude of the output
    signal.
3. As a voltage controlled cross-fader. As one input signal
    increases in amplitude at the output, the other decreases.

The CROSS-FADER (XFAD) is an equal-power cross fade unit. The module has
two signal inputs. As one signal increases in level at the output under
manual or voltage control, the other signal decreases in level at the
output. This effect is used to accurately fade one sound in while fading
another out. Cross-fading with voltage control permits a smooth
transformation between two different timbres. If a sound and its
reverberated image (available with the Wilson Analog Delay) are sent
through the cross-fader, the reverb mix can be voltage controlled. This
effect can be used to modify the spatial characteristics of a sound event,
from immediate presence to distant ambience. In addition to the cross-fade
function, a VCA controls the output amplitude.

X FADER

OUT

IN 1

IN 2

VC-X

VC GAIN

1 XFADE 2

GAIN

serge

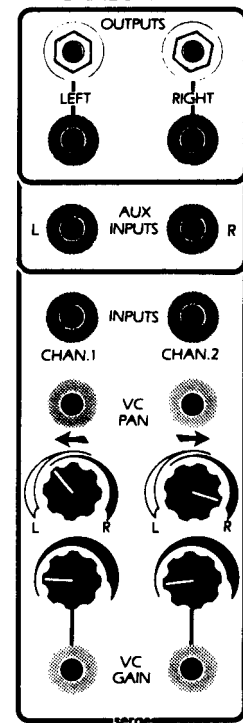# *SERGE MODULAR MUSIC SYSTEMS*

VOLTAGE CONTROLLED AMPLIFIERS

DUAL VCA

The DUAL VCA (2VCA) employs two high-quality VCA's. This module is an excellent inter-patch VCA, featuring very low noise and exponential response. It was designed as a small VCA function for use at various places within a system for internal VCA functions (as opposed to the VCA's for output mixing). Like the new Universal Audio Processor and the Cross-Fader this VCA has an audio taper that is an exponential curve with a 12 db per volt sensitivity throughout the range except below about .5 volts. Below this threshold, the output of the VCA will decrease rapidly to completely attenuate the signal. This response is perfect for our envelope voltage range. and is responsible for exceptionally quiet operation. Control voltage rejection is very high, and the unit cannot be overdriven beyond a gain factor of two.

DUAL CHANNEL STEREO MIXER

The DUAL CHANNEL STEREO MIXER (DCSM) is an alternative output VCA/MIXER/PANNER for two and three-panel systems. The other choice for small systems is the UNIVERSAL AUDIO PROCESSOR (UAP). The UAP can be used for a number of voltage controlled mixing functions, but the DUAL CHANNEL STEREO MIXER is used for the standard output level control (or enveloping) and for voltage controlled panning. The DCSM has two independent channels for stereo panning, whereas the UAP can pan only a single channel when used as a stereo panner. Each channel in the DCSM has two VC inputs, one for amplitude control and one for panning. The panning controls are opposite for the two channels, so that if a single control voltage is used, the output signals will pan in opposite directions. Auxiliary inputs are used to six other signals into the outputs of the module. Signals applied here will not be affected by knobs or control voltages applied to the module. These are mainly useful for linking other mixers (either manual or voltage controlled) to the output bus. The output is available at a pair of banana jacks (for routing the signals to other modules within the synthesizer), and at mini-jacks (for connecting to external amplifiers, tape decks, and other equipment).

SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED FILTERS

Serge Modular Systems offers a new series of voltage controlled filters (VCF's). Innovations in circuit design have eliminated most of the distortion and noise limitations to provide truly transparent Synthesizer filters. The following features are incorporated into all Serge Modular VCF's:

EXTREMELY QUIET OPERATION

PRECISE TRACKING

WIDE RANGE 16 TO 16,000 HZ

LOW DISTORTION

FAST RESPONSE

EXCELLENT CONTROL-VOLTAGE

REJECTION

VARIETY OF CHARACTERISTICS

ULTRA-STABLE

- EXCEPTIONALLY LOW NOISE
  No annoying "pumping" sounds occur at high resonance settings with low-level input signals. This problem is one of the most prevalent in synthesizer VCF's. Clean filter outputs are absolutely essential for wide dynamic ranges.

- ACCURATE TRACKING
  Calibrated 1 volt/octave inputs allow the VCF's to   follow a Precision VCO or New Timbral Oscillator when both filter and oscillator are controlled by keyboard, computer, sequencer or any control voltage source. This type of tracking is required to maintain accurate control of timbre over changing frequencies.

- VARIABLE CONTROL VOLTAGE INPUT
  Attenuation and inversion of control voltages can be processed with a signal knob.

- HIGH STABILITY
  The filters will not overload and go into oscillations under any condition except when they are patch-programmed to oscillate.

- VARIETY OF CHARACTERISTICS
  Three different types of voltage controlled filters are available, each with unique features. It is suggested that various filters be included in a system to maximize the potential for timbral exploration.

The VARIABLE Q VCF (VCFQ) is an excellent general-purpose VCF offering simultaneous low-pass, high-pass, band-pass and notch (band-reject) outputs. The resonance (Q) of this filter is dynamically variable by manual or voltage control. The VCFQ has two signal inputs. One incorporates an automatic gain control to prevent the filter from overloading at high Q settings. The second input has a level control so that the percussive effects of overloading the filter can be exploited. When a pulse is applied to the Trigger input, the filter will ring, producing a damped waveform similar to that produced by striking a resonant object. The nature of this ringing is controlled by the Q and the filter frequency. Percussive effects ranging from clicks to the sound of wood blocks and bell tones can be produced and controlled. This ringing effect can be used in conjunction with signals applied to either of the audio inputs to achieve highly controlled complex tonal qualities.


DAMPED WAVEFORM

VARIABLE Q VCF
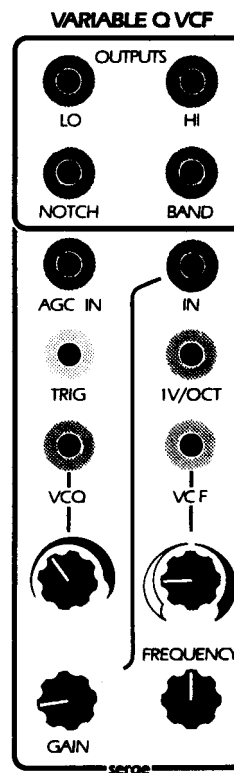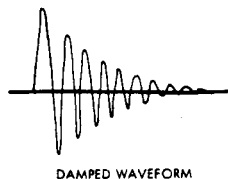
SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED FILTERS

VARIABLE SLOPE VCF
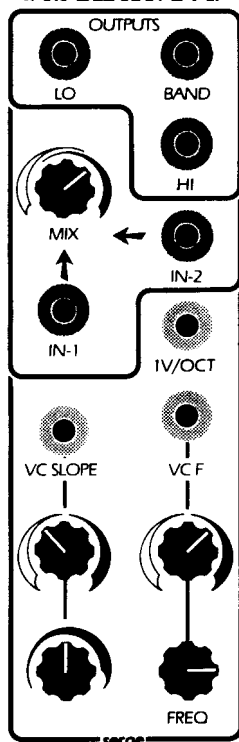
The VARIABLE SLOPE VCF (VCFS) offers unique control of sound quality offered by no other synthesizer manufacturer. All VCF 's offer voltage control of the cut-off frequency, that is, control of which frequencies the filter lets pass. The VCFS allows the amount of filtering to be dynamically controlled as well, from barely perceptible filtering to highly resonant, sharp cut-offs. With the variable slope control in the center position, the VCFS acts as a typical flat-response VCF, with high, low. and band-pass outputs available simultaneously. The slope of the cut-off is 12 db/octave. As the control is moved toward the maximum position, the resonance of the filter increases, so that the cut-off becomes sharper. Although the VCFS will not ring like the VCFQ, it will resonate enough at the maximum setting to pick out harmonics from a complex signal input. As the control is moved to the minimum position, the cut-off slope will decrease to 6 db/octave. This type of change of filter slope has been found to be an effective synthesis technique corresponding well with some of the transformations in acoustic instrument sounds. There are two signal inputs to the VCFS which can be mixed and manually cross faded from the associated knob.


VARIABLE BANDWIDTH FILTER
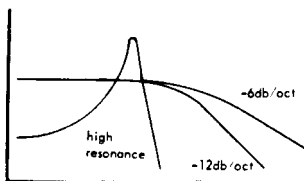
The VARIABLE BANDWIDTH FILTER (VCF2) has a band-pass output which can be varied manually or with voltage control. This is a standard response synthesizer VCF, typical to filters used in many studio systems. In the VCF2, two state-variable VCF's are connected in series to produce a total of five outputs. High pass, low pass, two fixed bandwidth outputs, and one variable bandwidth output are available. The outputs are all flat-response (no resonance) so the VCF2 is suitable for processing concrete sounds without introducing resonant coloration to the timbres. Under voltage or manual control, cut-off frequency of the high and low-pass outputs are affected, as well as the center frequency of the two band-pass outputs. Both center frequency and bandwidth are independently controllable on the variable bandwidth output.
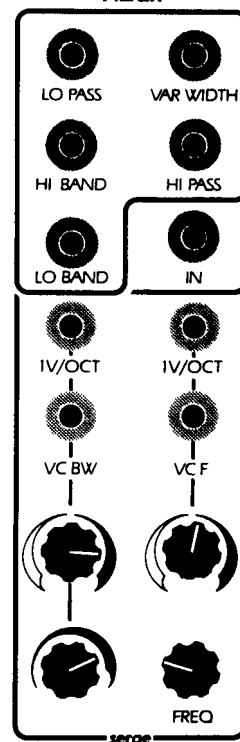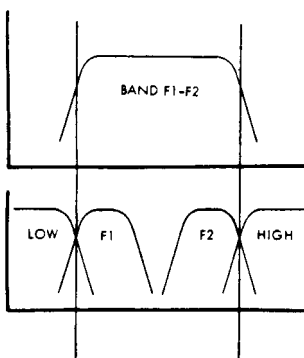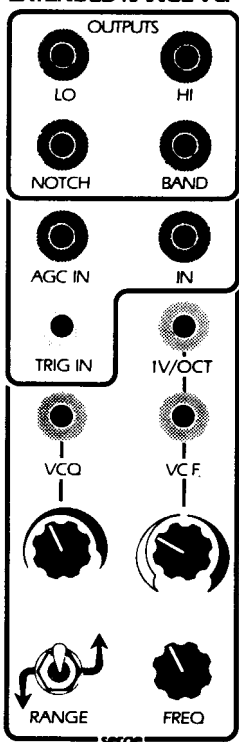
EXTENDED RANGE VCF

In addition to the three VCF's, Serge Modular offers an EXTENDED RANGE VCF (VCFX) which is identical to the VCFQ except it features a second sub-audio range. This low-frequency range allows use as a control voltage processor. A fast envelope or trigger applied to the filter in the low range at high Q settings will cause low-frequency ringing, generating complex envelopes and damped vibrato effects. The VCFX can be patch programmed to oscillate by patching the band-pass output to the manuaal input. The outputs will be in quadrature relationships (90 degrees out of phase).

SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED OUTPUT MIXERS

The Serge Modular Equal-Power Series of VCA functions represents the state-of-the-art in voltage controlled amplifier design. Important features of these modules are:

- **STUDIO QUALITY SPECS**
  The VCA's have extremely low noise and exceptionally low distortion for a clean Output with no "hiss". Wide dynamic range provides optimal control of amplitude. Excellent control voltage rejection eliminates annoying thumps and enables clean sounding amplitude modulation.

- **EQUAL-POWER CONTROL OF PANNING AND CROSS-FADING**
  Linear response assures that panning and percentage cross-fade behave predictably in response to a control voltage, eliminating signal level changes as well as annoying slow and fast areas. Equal Power control assures that the perceived loudness of the VCA's will remain constant at all positions of a signal in stereo or quadraphonic space.

- **MULTI-FUNCTIONAL GAIN CONTROLS**
  The gain control knobs are important mufti-purpose controls. This single knob allows the user to perform a number of functions. In the normal center position, the VCA operates as a typical VCA with a dynamic range of 100 db with a 0 to +5 volt control voltage. As the knob is turned down, the output signal is increasingly attenuated, even though a control voltage is being applied. At the minimum "cut" setting, the input is fully attenuated, regardless of the control voltage. To the left of center position, the knob can control the gain manually to unity gain (output level = input level) , or, when used with control voltages, gain through the VCA can be achieved. Since the gain can be controlled in this manner, different channels can be adjusted to provide the desired mix at the module outputs while the voltage controlled amplitude and panning functions are occuring. This eliminates the need for additional mixers to get a balanced final mix.

VOLTAGE CONTROLLED STEREO MIXER
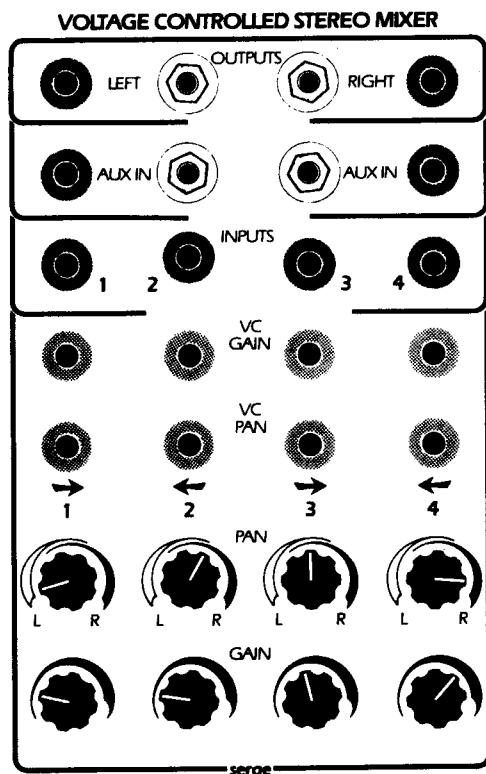
The QUAD INPUT VOLTAGE CONTROLLED STEREO MIXER (QVM) is an excellent low noise mixer for small to medium size Serge systems, since it incorporates an equal power stereo panner as well as a voltage controlled amplifier for each of four inputs. Both signal level and spatial location can be controlled manually or by voltage control. The Mixer is also well suited for external computer control and for automated mix-downs with voltage programmable spatial positioning. Two or more Quad Input Stereo Mixers can be connected together conveniently to form mixers of eight, twelve, or more inputs by connecting the outputs of one to the auxiliary inputs of another. Outputs and Auxiliary inputs are provided with mini-jacks in addition to banana jacks to facilitate hook-up to external audio equipment.

SERGE MODULAR MUSIC SYSTEMS

VOLTAGE CONTROLLED OUTPUT MIXERS
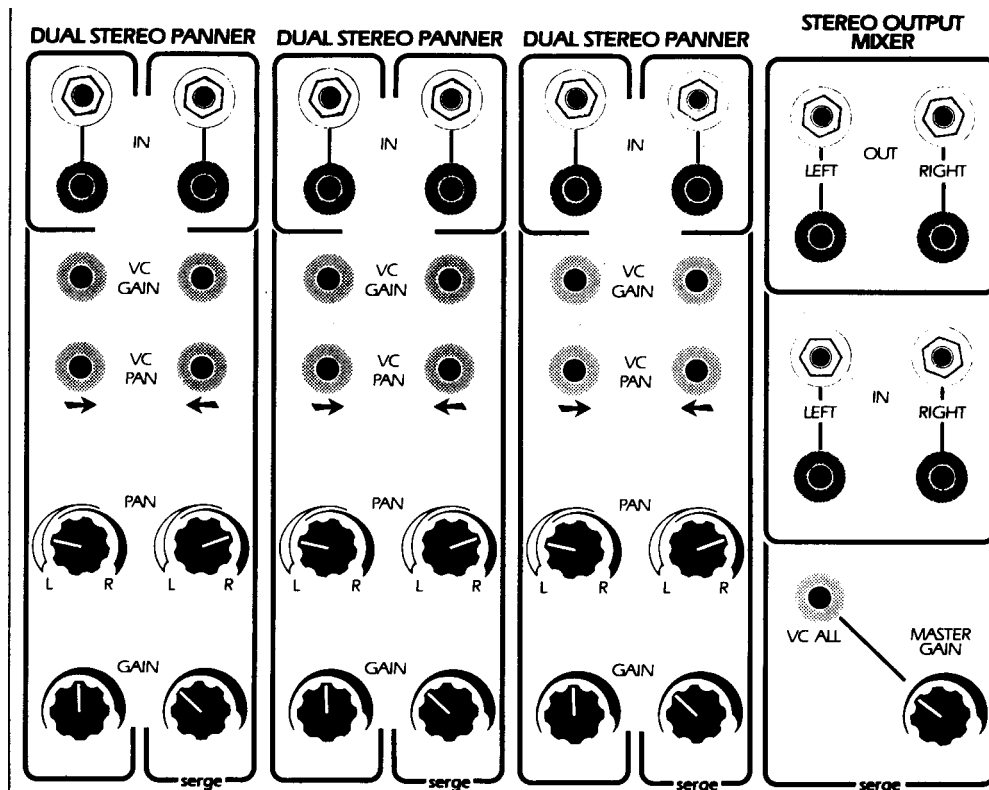
The MULTI-CHANNEL STEREO MIXER (SMX) Is an expandable studio quality output mixer for medium to large Serge systems. From a minimum of six input channels, it is expandable up to 14 channels on one panel. This Stereo Mixer is an indispensable aid for live music performance or can be used with appropriate computer control for automated stereo mix-downs in the studio.

The standard unit consists of three DUAL STEREO PANNERS (PAN) wired to a single Stereo Output Mixer. Each Dual Stereo Channel contains two equal power voltage controlled stereo panners. Each panner is used to position the input signal to a Stereophonic sound field with manual or voltage control. A VCA allows the overall amplitude of the channel to be voltage controlled. Each panner has an input fitted with both a banana jack and a mini-jack for use with signals from within the system and for hook-up to external sources such as tape recorders. Due to the fast response, low noise, and excellent control voltage rejection, location modulation can be achieved up to supersonic frequencies with virtually no noise.

The Stereo Output Mixer sums the stereo signal from each Panner section. An important feature of this output section is a master gain VCA which controls the overall sound level of the two stereo ourput signals. Thus, the entire output mix can be faded in, faded out, or adjusted with a single knob or control voltage. Auxiliary inputs allow non gain controlled inputs to be added directly to the final mix. Mini-phone jacks are included on the outputs to connect directly to other equipment.
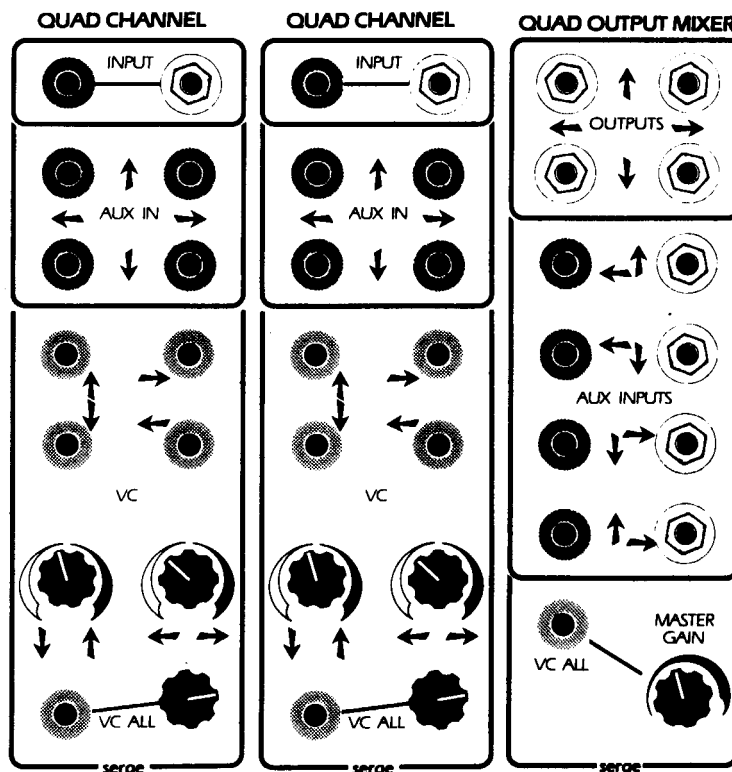
The MULTI-CHANNEL QUADRAPHONIC MIXER (QMX) is the top of the line studio quality output mixer for four channel applications. From a minimum of two inputs, it is expandable up to seven independent inputs. Like the other Serge output mixers, this module is an especially important module for live performance, for computer control of amplitude and location, and for automated mixes in the studio.

The Quad Mixer consists of two or more input sections with a single Quad Output Mixer. An equal-power QUAD PANNER CHANNEL (QPC) IS Used to position the sound image in quadraphonic space. The amplitude of each channel is controlled by a VCA, so that both gain control and spatial location can be realized simultaneously in each Quad Channel. An input is available for mini-phone plug hook up to external audio sources. Due to fast response, low distortion, and excellent control voltage rejection, location modulation can be effected up to supersonic frequencies in quad space with virtually no noise.

The Quad Output Mixer sums the quad signals from each Quad Panner Channel. An important feature of this output section is the master gain VCA, which controls the overall level of the quadraphonic outputs. Thus, the entire output level can be conveniently faded in, faded out, or adjusted with a single knob or control voltage.

There are four Auxiliary inputs, one to each outputs channel. for mixing other signals into the output mixer. There are also Auxiliary inputs on the Quad Pannel Channels which are voltage controlled in such a way that spatial cross-fading can be achieved. The sound from one speaker can be faded out, while a different sound at another speaker is faded in.
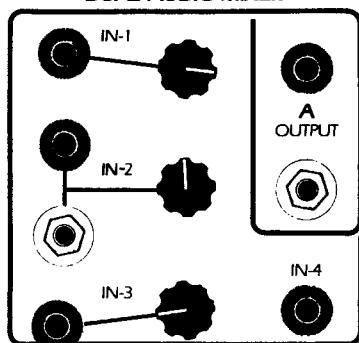
SERGE MODULAR MUSIC SYSTEMS

AUDIO MIXERS (MANUAL)

DUAL AUDIO MIXER

IN-1
IN-2
IN-3
IN-4
A OUTPUT

IN-1
IN-2
IN-3
IN-4
B OUTPUT

serge

AUDIO MIXER

AUX IN   OUTPUT
IN-1
IN-2
IN-3

AUX IN   OUTPUT
IN-1
IN-2
IN-3
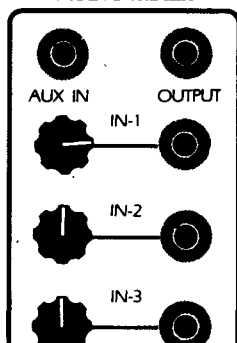
serge

The Serge Dual Audio Mixer (MIX) contains two independent mixers for audio signals. Each section is a four-in/one-out manual mixer. Three inputs have level control knobs and one input is a unity gain (non-attenuated) input. The main output of one section ran be connected to the unity gain input of the other section to create larger mixing units. This module can be used as two audio mixers with three variable inputs, or as one mixer with six variable inputs. Used in combination with other mixers and VCA modules, various mixing functions can be patched. A two-inch version of the Mixer is available if the mini-jack inputs and outputs are not required.
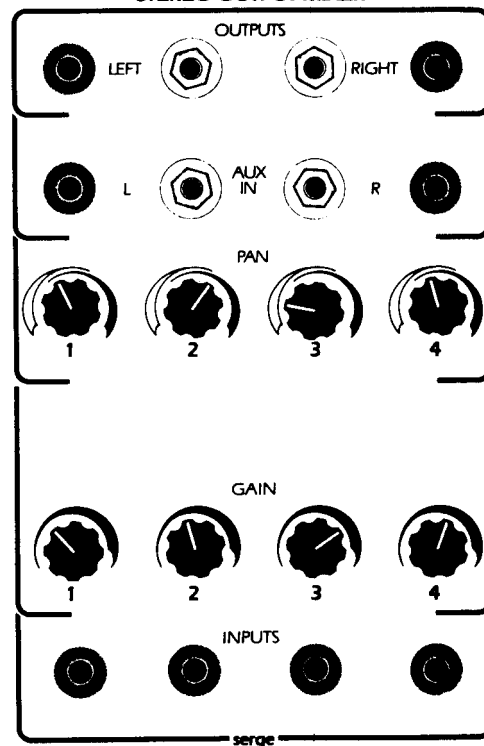
The STEREO MIXER/PANNER (MXP) has a manual level control and a manual pan knob for each of its four inputs. Each panner has one input which is routed to the two outputs in a proportion determined by the setting of the pan knob. Panning can be used for routing signals within a system or for positioning sounds in a stereo field. By connecting the outputs of one mixer to the corresponding auxiliary inputs of another, larger mixers of eight, twelve, or more inputs can be formed. Outputs are also provided with mini-jacks in addition to banana jacks for hook-up to external audio equipment.

STEREO OUTPUT MIXER

OUTPUTS
LEFT   RIGHT
L   AUX IN   R
PAN
1   2   3   4
GAIN
1   2   3   4
INPUTS

serge

MATRIX MIXER

IN-1   IN-2   IN-3
IN-4
1   2   3   4
OUTPUTS
A
B
C
D

serge

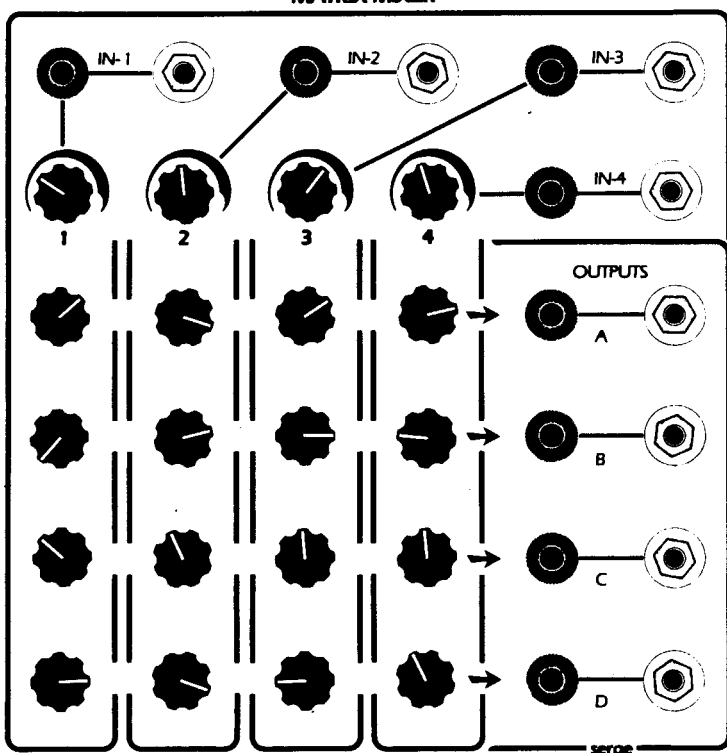The MATRIX MIXER (MAX) is a four-in/four-out mixer with maximum versatility. Each input has four knobs which separately control the level of that input at each of the four outputs. This operation requires the four-by-four matrix. Four additional knobs are included to control the total output level of the four outputs. This arrangement allows the user to set four independent mixes with a separate output level control. Thus, each of the four mixes can be adjusted for the proper output level without affecting the balance of the four input signals. All inputs and outputs have both banana and mini-jacks for ease of interconnection to other audio equipment.

SERGE MODULAR MUSIC SYSTEMS

PREAMPS and ENVELOPE DETECTORS

The new Serge preamps and envelope detectors provide an exceptionally
responsive link between external audio signals and the Serge synthesizer
modules. The key to this responsivity comes from the fact that our detector
was designed to respond to the POWER rather than to the AMPLITUDE of a
sound. No other synthesizer system offers this sophisticated capability.
Human perception of loudness is proportional to the POWER content of a wave,
rather than to its AMPLITUDE. Detecting the AMPLITUDE of a signal produces
an inaccurate envelope, sometimes too soft, and most of the time too loud.
The new Serge detectors are exceptionally accurate, responsive devices which
output a control voltage envelope that is directly proportional to the
perceived loudness of an input signal. It operates over a very wide dynamic
range, in excess of 70 db, (or the difference between a whisper and a subway
train at 15 feet!). The output is accurately log-linear at 12.5 db per volt,
a taper which mates perfectly with the control characteristics of our newest
VCA's. Thus it is possible, for example, to control the loudness of a
synthesizer sound by the sound envelope of a locomotive, a dog barking, or a
voice going from a whisper to a shout. The effect is especially remarkable
because of the accuracy of the responses the whisper is really a whisper,
and the shout a shout.

The PREAMP DETECTOR (PRNV)
allies a Serge detector
with a multi-purpose preamp
suitable for a wide variety
of inputs. The LO-Z input
accepts high output
microphones in the 200 to
1000 Ohms range (such as
most electret microphones),
with a sensitivity suited
for close-mitring
applications such as
instrument or voice pickup.
The HI-Z input accepts
transducers such as guitar
pick-ups and contact
microphones. It is also
suited for amplifying low
level signals from tape
machines, tuners, etc.
Detector and Preamp can be
switched to work separately
or coupled. Sensitivity for
the various microphones and
audio sources can be
adjusted over a very wide
range using the Preamp's
gain control. Please note
that it will not cut the
gain to zero, however.
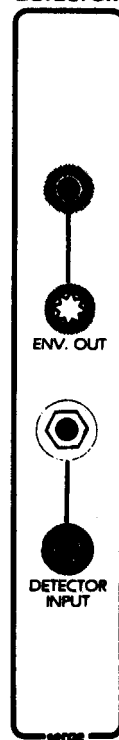
The ENVELOPE DETECTOR
(ENV) and the DUAL
DETECTOR (ENV2) are
stand-alone versions. Both
of these moduleays,
include L.E.D. displays,
and jacks for internal or
external inputs.
Recommended modules for
placement close-by on a
Panel are the Dual Slope
Generators (to provide
variable attack and decay
slopes) and, also, the
Dual Comparator module.
With the Comparator,
exceeding a pre-set
loudness level can be
used to provide a trigger
pulse to initiate any
number of activities
within the synthesizer.

SERGE MODULAR MUSIC SYSTEMS
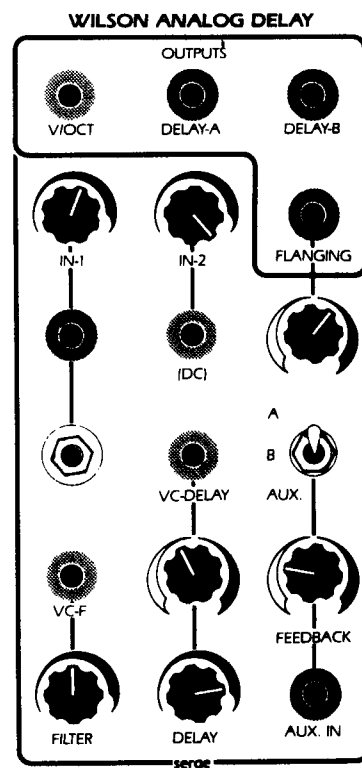
AUDIO SIGNAL MODIFIERS

The Wilson Analog Delay (WAD) was specifically designed to allow internal functions such as filtering, feedback and delay to be determined by the user as a patch programmable function. Features of the Wilson Analog Delay include the following:

- VOLTAGE VARIABLE DELAY OVER A VERY WIDE RANGE, from a minimum of .0005 sec to greater than one half second **

- VOLTAGE CONTROLLED PROGRAMMING OF THE FILTERS WHICH CONDITION THE INPUT AND OUTPUT SIGNALS

  Availability of TWO DELAYED OUTPUTS (A & B), one of which is twice the delay of the other

- A FLANGING OUTPUT with a control to set its depth

- A 1 VOLT PER OCTAVE (V/OCT) OUTPUT to permit controlling external VC filters easily

- THREE INPUTS, each with its own gain control and specific function. IN-1 is the main audio input for internal or external signals. IN-2 is suitable for audio, but also for the input of control voltages to be delayed. IN-3 is connected via a switch to provide feedback selectively from either the "A" or "B" delay outputs, or from the AUX jack. This channel features a processing-type control to scale and invert either the feedback from "A" or "B" or the AUX Signal.

- An INNOVATIVE NOISE-CANCELLATION CIRCUIT which produces a very clean sound, as opposed to the "muffled" quality of more conventional analog delays.

  These features provide an amazingly varied palette of effects. Here are some of the possible ways to use this module:

- VC FLANGER

- "GLIDING" FREQUENCY SHIFT effects (the frequency shift effect is never steady, but is a function of envelopes varying the delay rate)

- STRAIGHT DELAY (perceived as fast repeats as in the delay between two tape recorder heads)

- ECHO CHAMBER EFFECTS, where the delayed signal is fed back into the Analog Delay's input. (The switchable AUX input is particularly valuable for this type effect, especially if an external VCA is inserted into the feedback loop, allowing voltage control of the number of echoes as well as their rate of occurence).

- CHORUS EFFECTS

- VIBRATO EFFECTS

- DELAY AND ECHO OF CONTROL VOLTAGE ENVELOPES (via IN-2). Though the maximum guaranteed delay is .5 second, in practice the delay will go to more than 5 seconds for low frequency signals such as control voltages.

- MODULATION EFFECTS resulting from the modulation of the input signal by the clock internal to the Analog Delay.

  ** The first question often asked about the Analog Delay is how long a delay can it do? The answer to this question is fairly complex. Quite a long delay can be performed by the module. However, as delay becomes longer, the bandwidth of the signal which can be processed by the Analog Delay becomes more restricted. As an example, if it is desired to delay a signal consisting of a sine wave at 440 hz (concert "A"), then better than a half second can be gotten quite cleanly. The same note with a lot of harmonics, say a square wave at 440 hz, if delayed a half second, will produce a very modulated output (if the Analog Delay's built-in filters are opened wide) full of extraneous signals, or will lose its overtones because the filters will remove them. (This is why many other delay modules have a dulling effect at long delays.) The moral to this story is that one function which the Wilson Analog Delay will not do, is to reproduce the full effects of tape delay (i.e. "echo-plexing") without appreciably changing the signal being delayed. But tape delay is a stock effect, usually available to most synthesists (but which can be used with other voltage-controlled functions such as filtering, phasing, frequency shifting, etc., for more sophisticated effects). The forte of this module is its ability to transform signals and control voltages in an incredible number of ways.

WILSON ANALOG DELAY

SERGE MODULAR MUSIC SYSTEMS

AUDIO SIGNAL MODIFIERS

RESONANT EQUALIZER
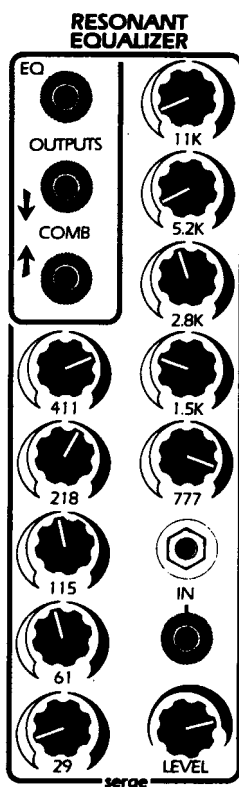
The RESONANT EQUALIZER (EQ) is a unique ten-band filter designed specifically for electronic sound synthesis and processing. Except for the top and bottom frequency bands, all other bands are spaced at an interval of a major seventh. This non-standard spacing avoids the very common effect of an accentuated resonance in one key, as will be the effect from graphic equalizers with octave or third-octave spacing between bands. Spacing by octaves will reinforce a regular overtone structure for one musical key, thereby producing regularly spaced formants accenting a particular tonality. The Resonant Equalizer's band spacing are much more interesting, producing formant peaks and valleys that are similar to those in acoustic instument sounds.

There are three equalized outputs, two which mix the alternate filter bands, and one which is a mix of all filter bands. The upper (↑ COMB) lets pass the outputs of frequency bands at 61 Hz, 218 Hz, 777 Hz, 2.8Khz, and 11 Khz. The lower (↓ COMB) mixes the other bands (29,115,411,1.5K,5.2K).

This equalizer is different from other equalizers in that the bands can be set to be resonant. When the knobs are in the middle position, the response at the main EQ Output is flat. When the knobs are positioned between the 9 and 3 o'clock position, up to 12 db of boost or cut is set at the band. If the knob is set beyond the 3 o'clock position, the band will become resonant, simulating the natural resonance of acoustic instrument formant structures. Below the 9 o'clock position, increased band rejection is achieved.

TRIPLE WAVESHAPER

The TRIPLE WAVESHAPER (TWS) is a non-linear modifier which can transform a sawtooth wave into a sine wave. This module incorporates three independent waveshapers for modifying synthesizer waveforms or for processing signals from preamplified instruments. Although originally designed as a waveshaper for our early oscillators, this module has been found to be a excellent modifier of electronic and acoustic sounds, and is highly recommended for subtle timbral modifications beyond the range of simple oscillator/filter patches.
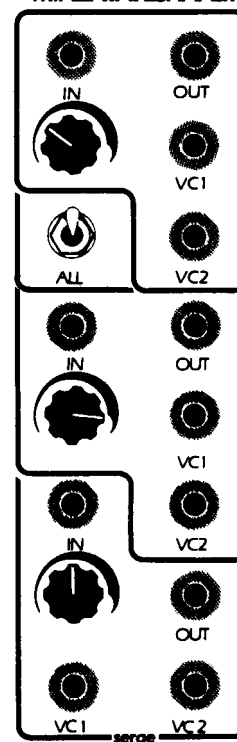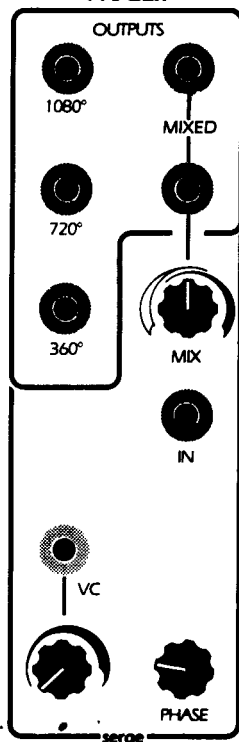
PHASER

DUAL PHASER
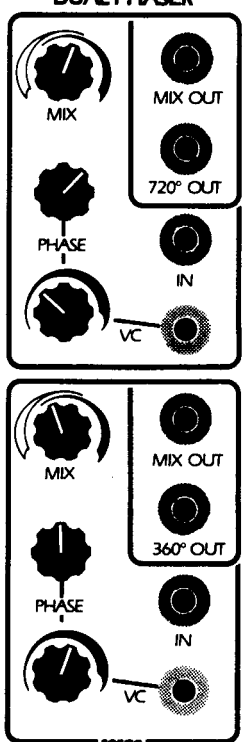
The VC Phaser (PHA) is perhaps the lowest noise and lowest distortion phase shifter available today. As an aid to recreating some of the subtle properties of phase delay in acoustic sounds, three separate outputs are provided with 360 degree, 720 degree, and 1080 degree of voltage controllable phase shift. A MIX output combines the 1080 degree phase shift with the input signal to produce the multiple notch filter effect that is usually associated with phase shifters. The VC Phaser's log-conforming characteristics and the manual and voltage controls enable ultra-smooth, precisely centered sweeps of phase shift for both spatial effects and timbral modification. For high-density systems. a 2'' DUAL PHASER (2PHA) is available.

SERGE MODULAR MUSIC SYSTEMS

AUDIO SIGNAL MODIFIERS

WAVE MULTIPLIERS

For generating and modifying sound, the typical synthesizer patch is VCO-VCF-VCA, linked in series, with suitable control from keyboard, sequencer, or computer. The VCO generates the raw sound, the VCF dynamically varies the timbre (sound quality). and the VCA controls the amplitude and produces the envelope on the sound event. The Serge Modular WAVE MULTIPLIERS (VCM) provide a new link in this chain, representing an advance in synthesizer technology. In this typical patch, the Wave Multiplier could be placed just before the VCF. Like the VCF. the Wave Multiplier affects the timbre. Unlike the VCF, whose action is a subtractive process of filtering frequencies from the input waveform, the Wave Multipliers are able to dynamically process the input waveform to produce new harmonically-related overtones. This function should not be confused with Ring Modulation, since it is a non-linear process using a single audio input. Although it is possible to describe the effect of a VCF by saying the sound gets "bass-heavy", makes a "wah-wah" effect, or sounds "thin" to describe the sound of a Wave Multiplier is much more difficult. The input sound comes out richer in harmonics, somewhat similar to pulse-width modulation and to linear frequency modulation, but with a new characteristic timbre. The nearest we can come to describing the unique sound qualities (there are three different sections) is to say that they alter the timbre in exciting new ways, producing interesting alternative forms of signal processing which are unique in the Serge Modular Music System.
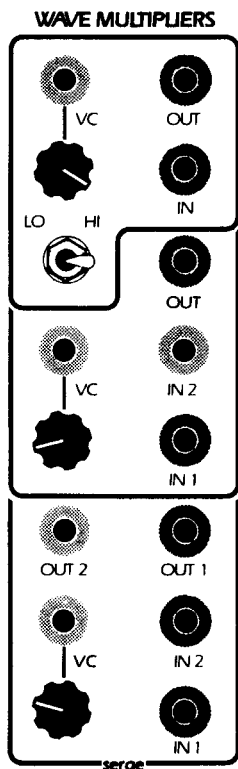
Since there are three entirely separate and different types of Wave Multipliers in this module, an enormously varied palette of new effects can be synthesized.

* The uppermost section is the simplest of the three multiplier sections. but it has two switchable effects. With the switch set at the "HI" position, the module functions to "square-up" an incoming signal. This is not the same as a simple comparator squaring function, though, since there is a rounded flattening of the signal peaks: an effect somewhat similar to overdriving a tube amplifier (except that in this version the process is voltage controllable!). With the switch in the "LO" position, the module is a linear gain controlled VCA. This is useful for various functions such as amplitude modulation and for gating signals into the other sections.

* The middle Wave Multiplier provides a sweep of the odd harmonics (1,3,5,7,9,11,and 13th) when a sine wave is applied to its input and the knob is turned up or a control voltage is swept from low to high. This effect is similar to overblowing a wind pipe closed at one end, and thus the module can be used to produce the sounds of various wind instruments. A second input is included to allow two signals to be mixed before processing, a technique that we have found to be very usable. This module can be used to explore timbral areas beyond the range of ring modulation because there are more varied harmonics than the sum and difference tones.

* The bottom Wave Multiplier performs non-linear waveshaping known as full-wave rectification, but with sophisticated level-compensating conditioning as well. Actually the circuit uses three full-wave rectifier sections linked in a very refined controllable format. Each section can double the frequency of a sine or triangle wave applied to its input. Thus sweeping the VC input over its range will produce a smooth timbral transition using the even harmonics (second, fourth, and eighth). Many other partials are present in this basic sound, however, and the sonorities are very rich and varied. A notable feature of this multiplier is that the full-wave rectification is not accompanied by a reduction in the output amplitude. There is no alteration of the essential level of the sound. There are two inputs to provide mixing before processing, and two outputs. One output is a "squared up" version of the other. This output resembles voltage controlled pulse width modulation (only much more interesting).

The Wave Multipliers are among the most powerful timbral modifiers available on any analog music synthesizer. The rich varieties of inter-patch possibilities are nearly inexhaustible, and these possibilities combined with the flexibility of other Serge modules will provide unique synthesis tools for the person who is eager to experiment with entirely new classes of sounds. The Wave Multipliers provide what has too often been lacking in electric musics. a means of generating sounds as complex and dynamically variable as those found in acoustic sound sources. Yet these are also precision modules which respond accurately to control voltages, so they may be used to give repeatable results in the most exacting analog or digital applications.

SERGE MODULAR MUSIC SYSTEMS
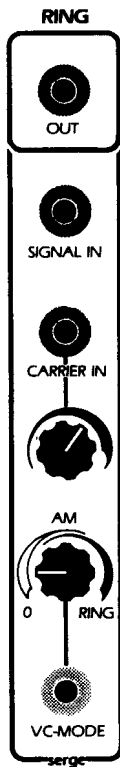
AUDIO SIGNAL MODIFIERS

RING

OUT

SIGNAL IN

CARRIER IN

AM

0   RING

VC-MODE

serge

Our new RING MODULATOR (RING) is a brand new design which incorporates greatly improved specifications. Features include the following:

• A VERY CLEAN SOUND down to very low signal levels (unlike conventional modulators where distortion increases at low levels).

• 80 DDS OF CARRIER SIGNAL REJECTION.

• INAUDIBLE NOISE OUTPUT.

• NO SQUELCH CIRCUIT IS REQUIRED due to the low noise characteristics, therefore annoying signal dropouts and "pumping" effects are totally absent.

• INTERNAL WAVESHAPING OF CARRIER to add to modulation effects

The sum total of these design improvements is a Ring Modulator capable of treating the most subtle acoustical signals, without the coloration typically associated with even the best previously available ring modulators.

The versatility of the Serge Ring Modulator is enhanced by the added feature of voltage and manual control of the entire spectrum of modulation possible: from zero modulation (i.e. the original, untreated input signal) through amplitude modulation to full ring modulation. This allows many shadings of effect, manual or automatic with voltage controls. The ability to control the Carrier level manually and through voltage control allows the output to be level controlled, as well. Through the use of an internal signal processor for the Carrier, additional effects can be produced by waveform modification of the carrier signal. When the module is set to full Ring Modulation from the lower knob or voltage control. the output signal contains the sum and difference frequencies of the Signal Input and the Carrier Input. If both signals are pure sine waves (only one frequency component), the output will be a composite signal consisting two frequency components: the sum and the difference frequency of the Signal and Carrier. If the Carrier level is increased beyond the mid-position, then the carrier waveform will become slightly rounded, and new frequency components will be produced. Each of these new components will also modulate with the Signal input to produce a sum and difference frequency, and the output signal will become richer in harmonics. This effect is unique to the Serge Ring Modulator, and allows another dimension in timbral modification.

Although this module may be one of the most sophisticated in the SERGE system, it only takes up one inch of Panel space. (Recommended as companion modules placed near the RING MODULATOR are the various Preamps and VC Oscillators.)

SERGE MODULAR MUSIC SYSTEMS

AUDIO SIGNAL MODIFIERS

Now you can control your synthesizer with signals from microphones, instrument pickups, or recordings of voices, wind instruments, string instruments, animal calls-let your imagination set the limit.

Combined in one sophisticated package is a comprehensive set of signal analyzing and processing functions. Subtleties of pitch, loudness, and articulation are converted to voltages for controlling any parameters of your synthesizer, accurately and flexibly. And the preamp, compressor, and pulse wave outputs give you added versatility.

PITCH & ENVELOPE FOLLOWER

BLOCK DIAGRAM
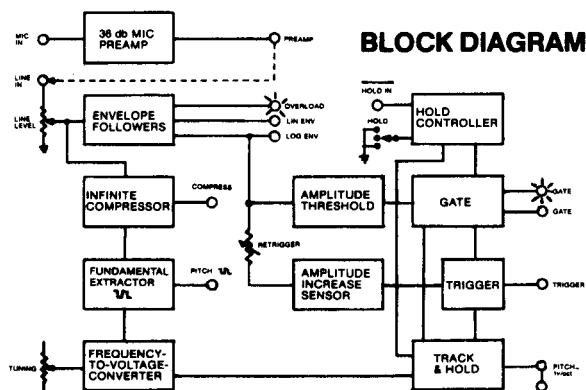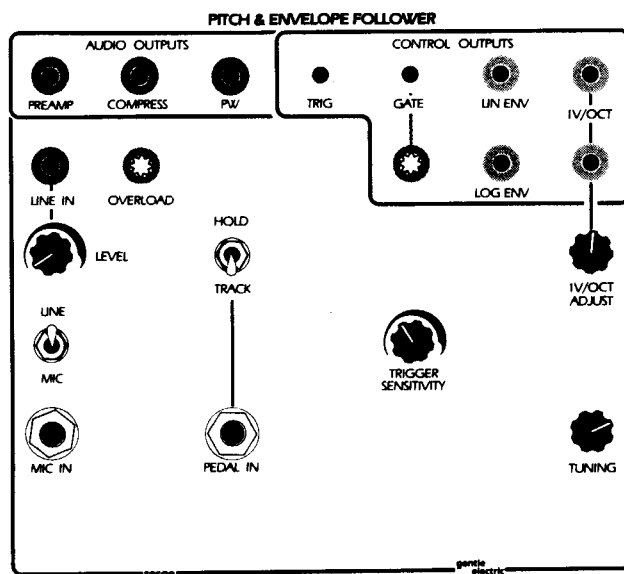
BASIC PITCH & ENVELOPE FOLLOWING
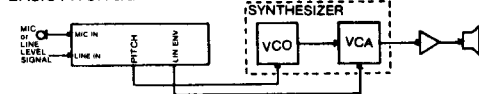
PITCH FOLLOWING WITH SYNTHESIZED AMPLITUDE ENVELOPE
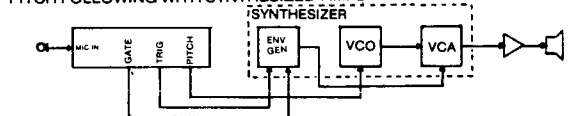
EXTERNALLY CONTROLLED PITCH TRACK & HOLD
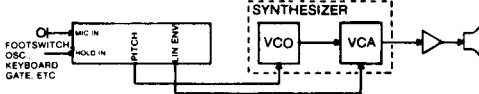
PITCH & ENVELOPE FOLLOWING WITH FILTER
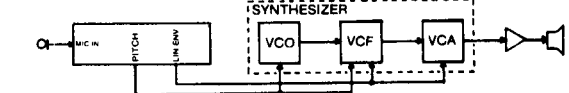
ENVELOPE MODIFICATION
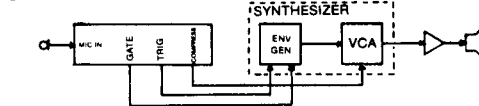
FILTERING ACROSS ENTIRE DYNAMIC RANGE
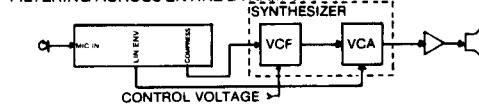
RESYNTHESIZED HARMONIC SPECTRUM
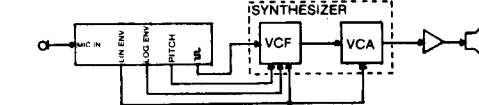
CONTROLLED ACOUSTIC FEEDBACK
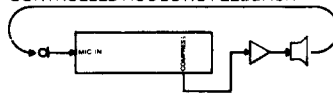
REVERSED DYNAMICS
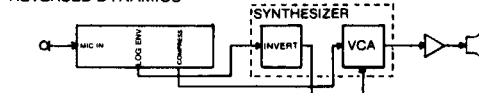
ANALYSIS, PROCESSING, SYNTHESIS OF SOUND BY COMPUTER
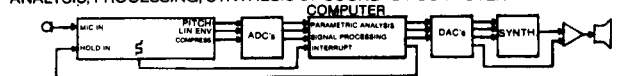
INDEPENDENT USE OF PREAMP & COMPRESSOR
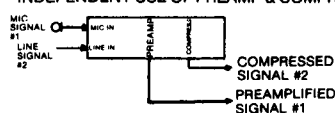
SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS

The TOUCH ACTIVATED KEYBOARD SEQUENCER (TKB) is an extremely versatile
manual and automatic controller, combining the functions of a
touch-sensitive keyboard, a voltage programmer (pre-set selector), and a
sequencer. As a keyboard-programmer it permits the performer to access up
to 16 separate stages of 4 voltage presets and trigger pulses. The touch
programmer can be used to change the settings of other modules through
voltage control, altering the characteristics of a sound patch and
routing/switching events in live performance or in the studios.
Additionally the keyboard produces a scale of equal interval voltage
"notes" and generates a common trigger pulse which duplicates the function
of a traditional synthesizer keyboard. This equal-interval voltage can be
set to produce the chromatic scale, or any equal division of the musical
scale (6 notes per octave, 3 notes per octave, 24 notes per octave, etc). A
PRESSURE output senses the amount of area touched on the touch pads and
produces a corresponding control voltage. This feature allows an additional
expressive parameter to be controlled while playing the touch pads.

As a sequencer this module permits a wide variety of sequencer effects,
since the 16 stages can be programmed to go forward and reverse, can be set
to run through any desired number of stages (from 1 to 16), and can be
triggered to skip among stages in a semi-random pattern. These sequencer
functions can be further enhanced using the touch keyboard to interact with
the sequencer so that the sequence length and stage access can be
programmed at a touch in actual performance. In addition, a second
four-stage sequencer is built in to sequence vertically through the four
rows (A,B,C,D), making it possible to switch from one sequence row to
another and to produce sequences up to 64 stage in length.

Specific features include light-emitting diodes on each stage for immediate
visual indication of sequences/programmer activity, dual RESET inputs for a
variety of rhythmic effects, and a HOLD function to disable sequencing. The
KEYS switch is included to partially disconnect the keyboard function from
the sequencer. This allows the user to use the KV (Key, Voltage), KP (Key
Pulse), and PRESSURE outputs from the keypads as a strictly manual
controller, independently of the 16 stage sequencing action.

SERGE MODULAR MUSIC SYSTEMS
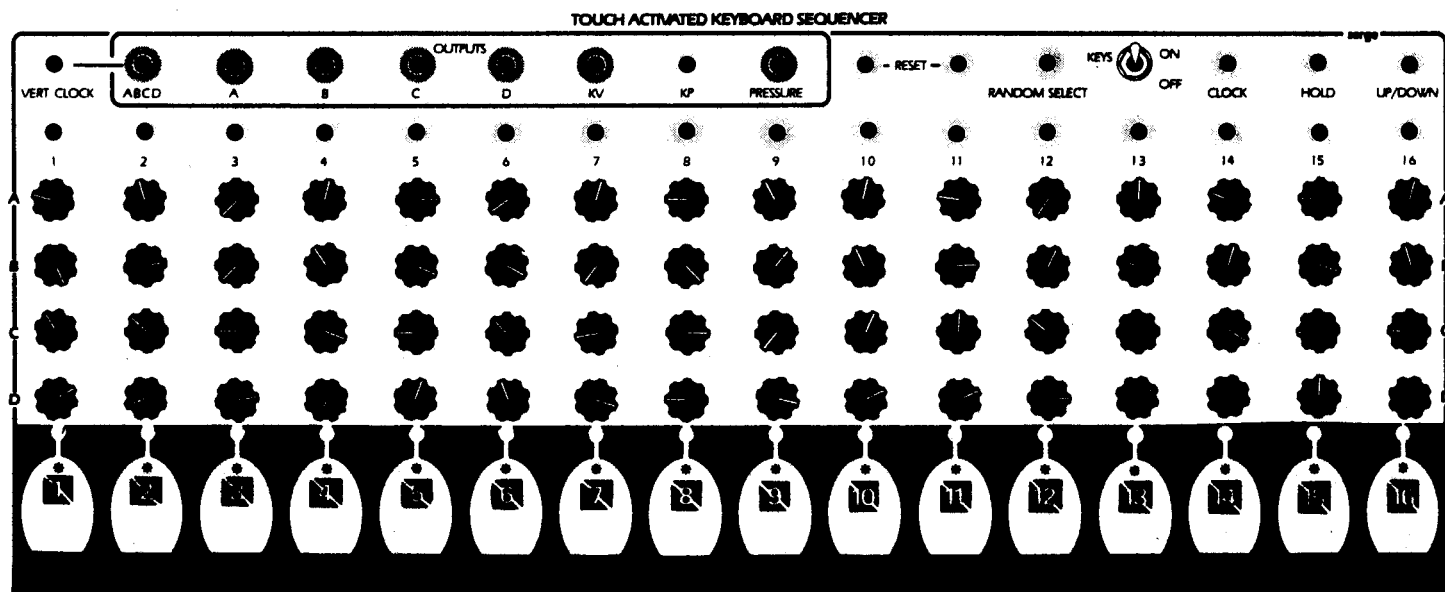
CONTROLVOLTAGE GENERATORS and MODIFIERS

SEQUENCER

4 STAGE SEQUENCING PROGRAMMER
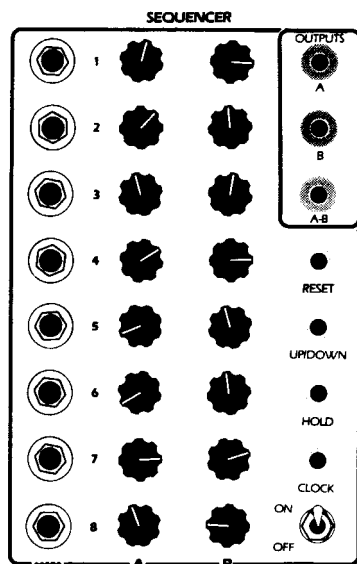
Years ago Serge Modular manufactured a four-stage Sequencer Programmer which was discontinued when the sixteen stage Touch Keyboard Sequencer came into production. Musicians have often wondered what happened to it, since they liked its economy, and the fact that its modest dimensions did not tie up an entire Panel for a couple of preset voltages. Our new line of Sequencer Programmers was designed to fill this need. These new controllers are far more powerful than our early model, however, since we have incorporated most of the functions which have proven so successful in the Touch-Keyboard.

Features common to all the SEQUENCER PROGRAMMERS (SQP4-8) include the ability to be used as push-button, manual programmers and/or as multi-versatile sequencers. As in the Touch Keyboard, the length of sequences can be programmed interactively via the pushbuttons: thus sequence lengths can be changed in performance while a sequence is running. Other sequencing capabilities include RESET, UP/DOWN, HOLD pulse inputs, and a switch to START or STOP the sequencer. PULSE STAGE SELECT inputs allow triggers from other modules to turn specific stages on. Doubled output jacks are for use with a built-in Quantizer (more details on this option are available in the catalog description of the Quantizer). A unique feature is the A-B output (read A minus B). This outputs the difference between the voltages available separately at A and E, a feature resulting in interesting harmonic effects when the three outputs are controlling VCOs.

The real power of the new shorter length Sequencer Programmers, however, is their use in tandem with one another. Two sequencers are more interesting than one. They can be phased one against the other with the same or separate clocks. They can be patched to interract with each other, providing an incredibly varied palette of rhythmic patterns. A master unit can control one or more slave sequencers, resulting in highly controllable flurries of tonal sequences being modulated both harmonically and rhythmically.

The series includes 4, 5, 6, 7, and 8 stage Sequencer-Programmers taking up one inch more Panel space than they have stages (two inches more, if the built-in Quantizer is included). The exception is the SEQUENCER (SEQ8), a module with only two rows of output presets, but with 8 stages of sequencing in only four inches.

The built-in Quantizer option is available for all of the Sequencer-Programmers except for the four-stage unit and the Sequencer. If the Quantizing function is desired for the four-stage unit or the eight-stage Sequencer. then the two-inch Quantizer module can be patched when needed.

(The 6 and 8 stage Sequencer-Programmers are not shown.)

5 STAGE SEQUENCING PROGRAMMER

QUANTIZER

7 STAGE SEQUENCING PROGRAMMER

SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS

QUANTIZER

INPUTS   OUTPUTS

1
2
3
4
5
6
7

SELECT

1/6   1/3

serge

QUANTIZER (TKB)

INPUTS   OUTPUTS

1
2
3
4

SCALE SELECT   TKB OUTS

1/3   A

1/6   B

                 C

                 D
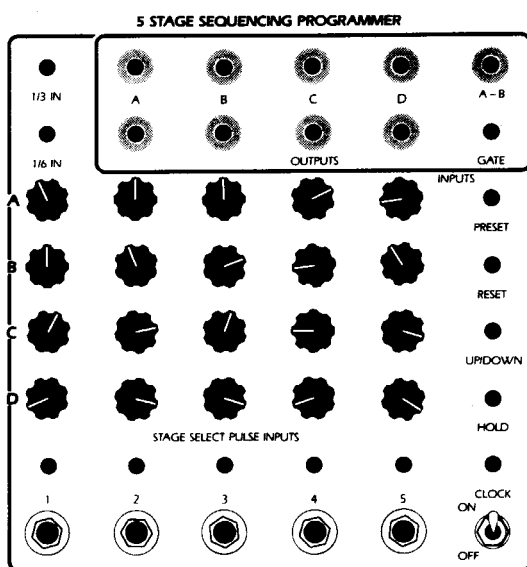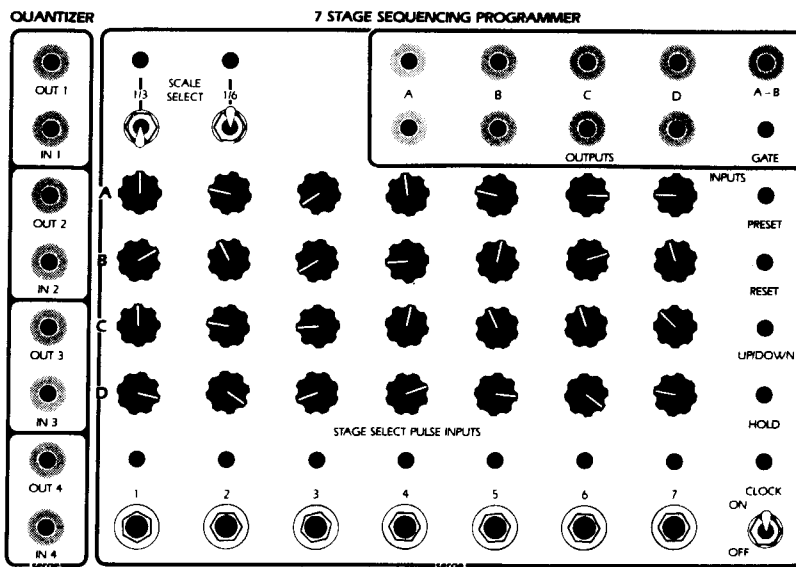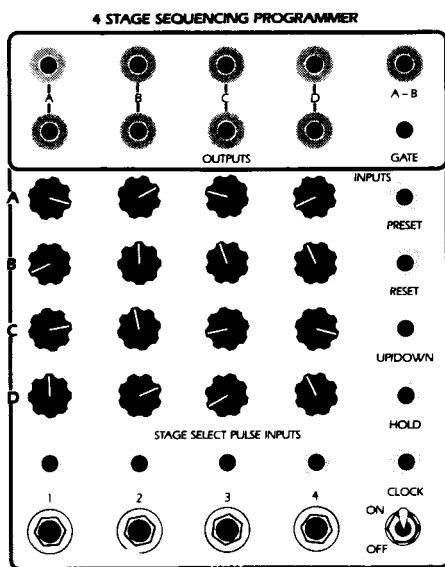
serge
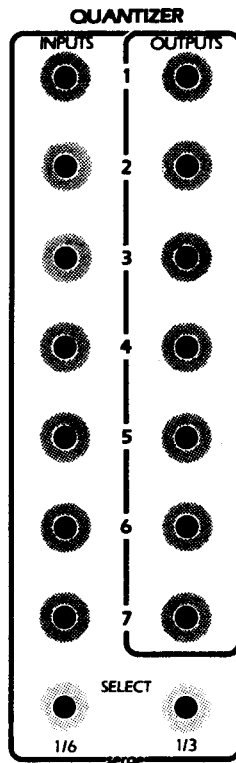
The QUANTIZER (QUAN) provides a simple means to turn any control voltage into voltage steps corresponding to well tuned (equal-tempered) tones of the musical scale. It is scaled to 1 volt per octave. Thus, a zero to +5 volt envelope at the Quantizer's input produces a staircase of voltages corresponding to a chromatic scale spanning five octaves.

If patched to the 1 volt per octave input of an oscillator tuned to "E", a gradual slope of 1 volt applied to the input of the Quantizer will produce the following steps of the musical scales:

E-F—F#-G-G#-A-A#-B-C-C#-D-D#-E.
(normal chromatic scale)

If the 1/6 Scale Select is HIGH, then the scale produced will be:

E-F#-G#-A#-C-D-E.
(whole-tone scale)

If the 1/3 Scale select is HIGH, then the scale produced will be:
E-G*-C-E.
(scale of major third steps)

If both the 1/6 and 1/3 inputs are high, the scale will be:

E-F-G#-A-C-C#-E.
(alternating half-step/minor third step)
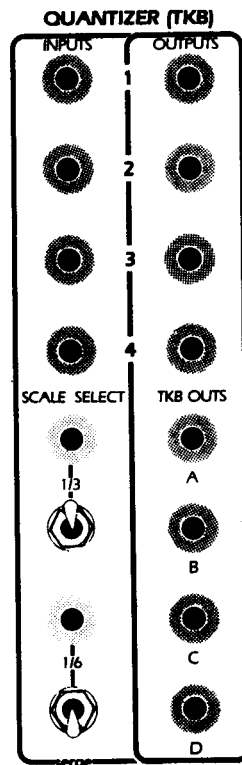
Since the Scale Select inputs can be activated very quickly, the Quantizer can produce a very wide variety of tonal effects, quickly moving between four different types of musical scales (chromatic, whole-tone, the augmented triad, and a six-step major-minor scale often heard in certain oriental musics).

The basic Quantizer features seven or eight channels, depending on the model. Available as a "stand-alone" module, the Quantizer has seven channels and takes up two inches of panel space. Other models are available, however, with some of the channels "hard-wired" to provide quantized outputs for other Serge modules such as the various Sequencer Programmers and the Touch Keyboard. The (TKB) Quantizer takes up 2 inches. The Sequencer Programmer Quantizers take up only one extra inch (in addition to the Sequencer Programmer - see section on Sequencer Programmers).

Accuracy of the Quantizer is 3 cents maximum deviation from the ideal equal-tempered semi-tone over a five octave range (i.e. just about the limits of pitch sensitivity of the human ear). Response time for all channels is about 8 milliseconds.

Recommended modules for placement adjoining the Quantizer on a Panel are the Analog Shift Register and the Processor.

SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS

DUAL UNIVERSAL SLOPE GENERATOR
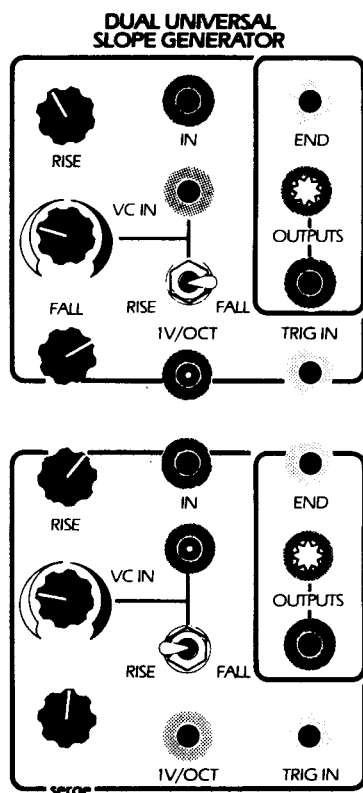
Block Diagram Representation of ½ Dual Universal Slope Generator
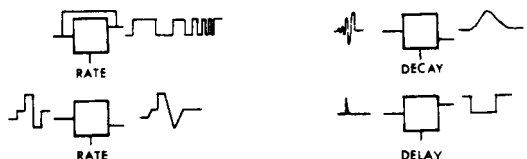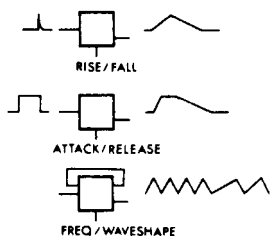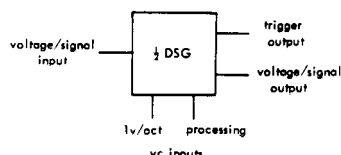
The DUAL UNIVERSAL SLOPE Generator (DSG) is the ultimate patch-programmable control voltage generator in the Serge system. At least one (DSG) is recommended for almost every Serge system. and in most cases, a number of these are desirable. People familiar with our previous series of "slewing" modules know about the importance of this kind of function in a large patchable synthesizer system. For those unfamiliar, it is advised that the various applications as outlined here and in the Serge Owner's Manual are studied. The uses of this module are numerous, some duplicating functions found on other synthesizers, some totally unique to the Serge system. Most systems require a number of control voltage generators to control the various signal processors and modifiers. Sources of trigger, pulses (clocks), control voltage processors (portamento's), regular repeating voltages (LFO's) are standard synthesizer requirements. The Dual Slope Generator is the main module providing these functions in the Serge system.

The Universal Slope Generators are unity gain voltage followers with voltage controllable slopes. The range of control is exponential, extremely wide, and the Rise and Fall times can be controlled independently. The range of the Slope Generator is from sub-sonic to high audio frequency. Trigger inputs and trigger outputs allows each section of this dual module to function as a transient (envelope) generator, pulse delay, or in a "cycling mode" (to produce an LFO or clock). Since the Rise and Fall times are voltage controllable, this adds another dimension to the above functions. Two VC inputs are available, one is calibrated at 1 volt per octave (within about 3%), and the other is fully adjustable in the negative and positive direction. This VC input can control either the positive slope (rise), negative slope (fall), or both.

The linearity and accuracy of the slewing amplifiers allows them to be used in the most exacting applications, such as processing the output of a keyboard or sequencer to produce portamento functions. Note that this portamento function has a separate rate control for rising notes and falling notes... An interesting portamento effect.

Among the functions which one Slope Generator can be patch-programmed to perform are the following:

• VC Transient Envelope Generator. The envelope is simply started With a trigger, or may be used with a gate input to obtain a steady-state sustain level on the envelope. This envelope will repeat if the END trigger output is connected to the TRIG IN input.

• VC LFO. Patched as mentioned above, a wide-range, low-cost, space-efficient Low Frequency Oscillator can be patched when needed. The Slope Generator is often used as an LFO since it is more cost effective than a regular oscillator switched to a low frequency range. it has a built-in LED to show its current output level, and it has a synchronized trigger output. The waveform can be set from saw to triangle, and the rising ramp can be voltage controlled independently of the falling ramp.

• VC Portamento device. The accuracy of these devices makes this portamento function useful with keyboards and for generating control voltages of arbitrary shapes and times with computer control. Analog control of slopes allows the computer to do less "number crunching", and frees the processor from time-consuming routines that are more easily handled in this low-cost multifunctional hardware.

• Envelope Follower (Detector). The decay rate is voltage controllable with the unique function that under voltage control, the response may be moved from positive peak detection to negative peak detection.

• VC Pulse Delay (Monostable). When the unit is triggered, it will produce an envelope set by its Rise and Fall knobs (and VC's) and then the END pulse will go high. This may be used to trigger another Slope Generator, ADSR, or advance a sequencer.

• Sub-Harmonic Series Generator (Divider). If a series of triggers are applied to the TRIG IN jack that are faster than the total rise plus fall time, then the unit will divide the incoming triggers by a whole number. This allows the user to program synchronized rhythmic relationships (such as 2 against 3, 13 against 11, and so on). If the Slope Generators are set to audio frequencies, and the incoming triggers are in the audio range, then the output will be the sub-harmonic series. This is similar to the "hard sync" sound found in other synthesizers (and is the main reason that it is not included on Serge VCO's).

• Audio Oscillator. The range reaches 4000 Hz, and the waveform has variable symmetry (saw to triangle).

• Non-Linear Audio Processor. The slew limiting is voltage controllable, so a sawtooth wave input will progressively be transformed into a triangle wave. This aspect allows the Unit to be used as a low-fidelity VCF!

SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS

SMOOTH FUNCTION GENERATOR
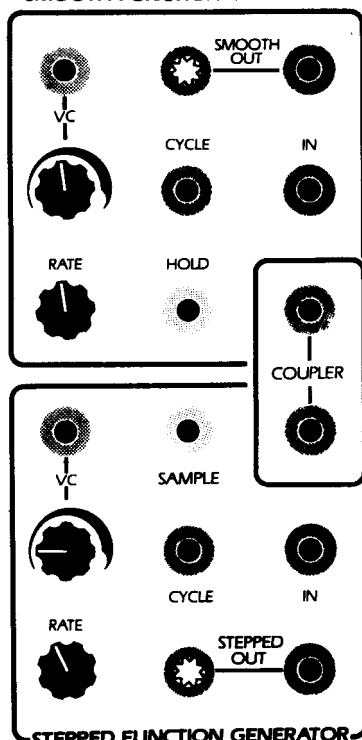
The SMOOTH & STEPPED FUNCTION GENERATOR (SSG) is s a complex multi-functional module to provide various slew and sample functions.

* The Smooth section will place a positive and negative slew (glide) on a changing input voltage for lag effects, voltage controlled portamento, and non-linear, low frequency filtering. With the CYCLE jack patched to the input, the Unit will oscillate yielding a voltage controlled triangle wave LFO. A high level into the HOLD input will hold the current output level, whether the unit is oscillating or processing an external control voltage. This is identical to a track-and-hold function.

* The Stepped function can be used as a sample-and-hold with voltage controlled slew rate limiting. Slew rate limiting limits the size of the step at the output. With the step size limited to a small value, if the input is a random voltage, the output is a random voltage also, but it will only vary slightly from step to step, gradually covering the entire range of the input random voltage. No large changes in the output will be allowed. With the Cycle jack patched to the input and a trigger applied to the Sample input, complex staircase waveforms are generated.

* The COUPLER is an internal comparator comparing the Smooth and the Stepped outputs. This is useful for generating complex control voltages and for patching a random voltage generator. In fact, the Random Voltage Generator module is a Smooth & Stepped Generator internally patched to function exclusively as such. If random voltages are often used, a Random Voltage Generator is a more space-efficient module, but if they are used seldomly, the Smooth & Stepped Generator can be patched when needed (but can be used for other functions when not used as a random voltage generator). Note that a Noise Source is needed for use of the Smooth & Stepped Generator as a random voltage generator.

STEPPED FUNCTION GENERATOR

The DUAL TRANSIENT GENERATOR (DTG) provides two independent outputs with voltage controllable rise and fall times. This module is identical to the Dual Universal Slope Generator except that it does not have all of the front panel features. This module is a useful, space-effective unit to be used for many of the same functions as the Dual Universal Slope Generator. Common uses of the Dual Transient Generator are for simple "AR"-type envelope generation, as a dual voltage-controlled low frequency oscillator, or as a voltage-controlled clock (especially suitable for clocking the Touch Keyboard Sequencer or any of the Sequencer Programmers). These functions can be patched with the Dual Universal Slope Generator, but since many of the features are left unused in these patches, the Dual Transient Generator provides the same function while using less front Panel space.

DUAL TRANSIENT GENERATOR
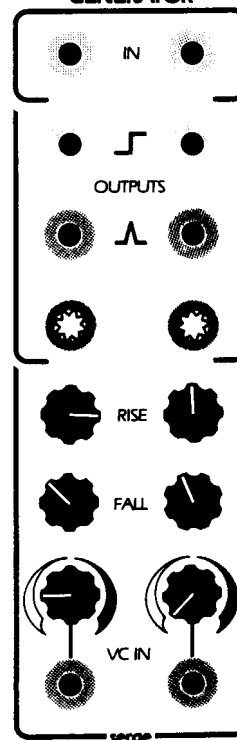
SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS
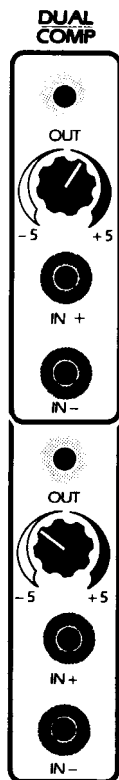
DUAL COMP

The DUAL COMPARATOR (COM) provides several often useful house-keeping functions within the Serge system:

- Logical Decisions: If the + input is greater than the - input, then the output will be high. If not, then the output will be low.
- Level Detection. A pulse will be generated whenever an input voltage reaches a pre-set threshold. For example, when an envelope detector reaches a certain loudness level, it can be used with the Comparator to generate a pulse to activate or de-activate other events programmed within the synthesizer.
- Voltage variable pulse width modulation of any of the Serge oscillators.
- "Squaring" audio signals, whereby frequency related pulses are derived from an input signal. These pulses can be used for frequency sub-division (via a Dual Slope Generator or Sequencer), or as raw audio, rich in harmonic content.

In addition to the +/- inputs, each of the Comparators include a front-panel knob to manually set a threshold.

SCHMITT TRIGGERS

The DUAL SCHMITT TRIGGER (STR) is similar to the Dual Comparator, except that it has been optimized for squaring up audio signals. The Schmitt Trigger is a single-input comparator with hysteresis. Hysteresis means that the switching thresholds are different for an input signal depending upon whether it is going up or down. This feature can be used with an envelope and VCA functioning as a noise gate to reject low-level background noise in audio applications.

The Schmitt Triggers can be used for level detection, plus they have a function unique to the module: both sections of the module can be used as a "set-reset flip-flop". Essentially, this is a memory element. A pulse or level into the SET input sets the R/S output high. This output will stay high independently of the activity at the SET input. It is reset to zero when the RESET input receives a pulse of sufficient level.
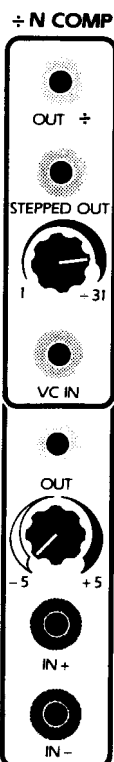
÷ N COMP

The ÷ N COMPARATOR (NCOM) consists of two sections: a comparator and a voltage-controlled pulse divider. The divider section outputs a pulse once every "N" comparator pulse, where "N" is a number from 1 to 31, settable with a control voltage at the divider's VC input (or manually via the divider's control knob). Additionally, the Divider outputs a staircase wave with "N" steps. This will produce whole-tone steps when plugged into the 1 V/Oct input of a VCO.

This module has two distinct areas of use (in addition to the normal functions of the comparator).

- For audio frequencies, the divider can be set to output sub-divided frequencies with digital precision. Output frequency depends on "N". If "N"=2,3,4, etc., the output frequencies will be an octave, an octave and a fifth. or two octaves below the input, repectively. Because "N"is voltage controllable, arpeggios and various melodies can easily be programmed. The nature of this type of division (integer division), results in frequencies that fall along the sub-harmonic series, a series that has great tonal charm.
- For sub-audio frequencies, the divider acts like a counter, outputting a pulse only after "N" number of input pulses. Input pulses can be fairly random, or regular. This capability is especially powerful for determining tempos and rhythmic patterns when using several sequencers (especially if the "N" vc input is taken from one of a sequencer's rows of controls). In a more random situation, using a microphone preamp/detector as input. the divider might be set to count how many times a sound of a certain loudness will have occured, and be set to trigger an event upon reaching the count. Since the count can be made variable (from 1 to 31), fairly complex and subtle inter-actions can be generated.

SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS
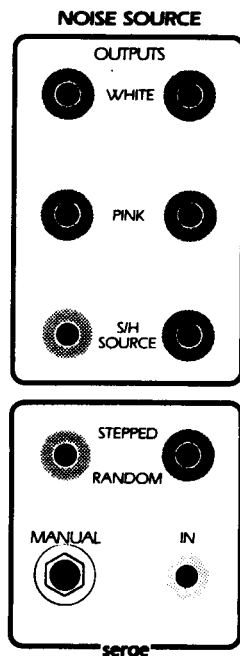
NOISE SOURCE

The NOISE SOURCE (NOI) generates both white and pink noise waveforms. The S/H Source output produces the necessary input for a sample and hold function to produce equi-probable random voltages, similar to a 1/F distribution function. Additionally, the Noise Source features a random voltage output which can be stepped through random voltages by triggers or from a pushbutton on the module.

RANDOM VOLTAGE GENERATOR

DUAL RANDOM GENERATOR

The RANDOM VOLTAGE GENERATOR (RVG) produces random voltages which vary smoothly or in a step-wise manner. Random timing pulses are also available. Rate of change of all outputs is voltage controllable over a wide range. IMPORTANT NOTE: The Random Voltage Generator must be internally connected to the Noise Source module. and therefore must be placed on the same Panel as the Noise Source or Random Source module. The Random Voltage Generator is now available as a 2" DUAL RANDOM VOLTAGE GENERATOR (2RVG) unit for high-density systems.
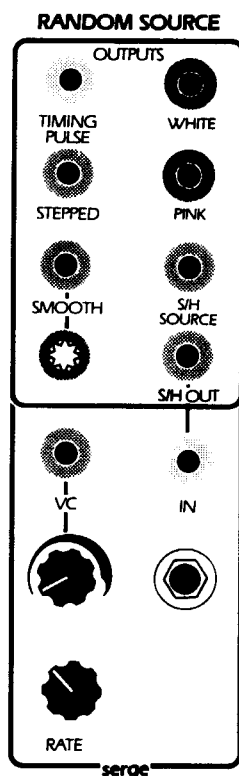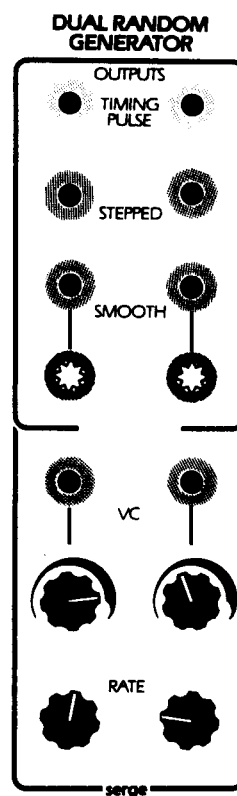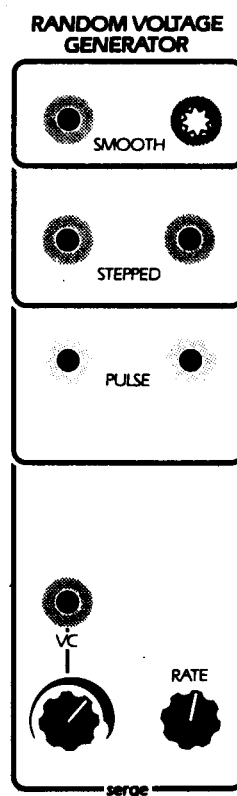
RANDOM SOURCE

The RANDOM SOURCE (RS) allies a Noise source with a Random Voltage Generator in one single module.

SERGE MODULAR MUSIC SYSTEMS

CONTROL VOLTAGE GENERATORS and MODIFIERS

ANALOG SHIFT REGISTER

OUTPUTS

3

2

1

SAMPLE IN

AUX PULSE   PULSE IN

serge

DUAL ANALOG SHIFT REGISTER

SAMPLE IN

OUTPUTS

3

2

1

PULSE

PULSE OUT

serge
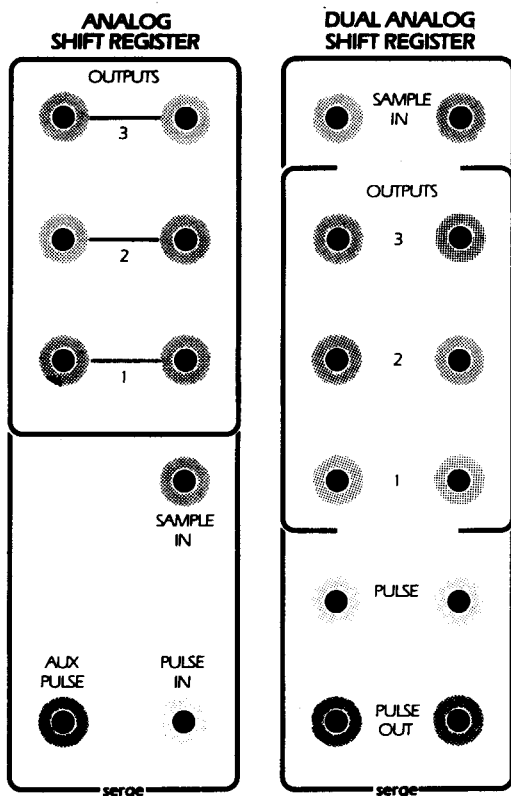
The ANALOG SHIFT REGISTER (ASR) is a sequential sample and hold module for producing arabesque-like forms in musical space (see diagram). Whenever pulsed, the previously held voltage :is sent down the Line to three consecutive outputs to produce the electrical equivalent of a canonic musical structure. A pulse output permits linking two or more Analog Shift Registers together to form longer patterns. the DUAL ANALOG SHIFT REGISTER (2ASR) is available for high-density systems.
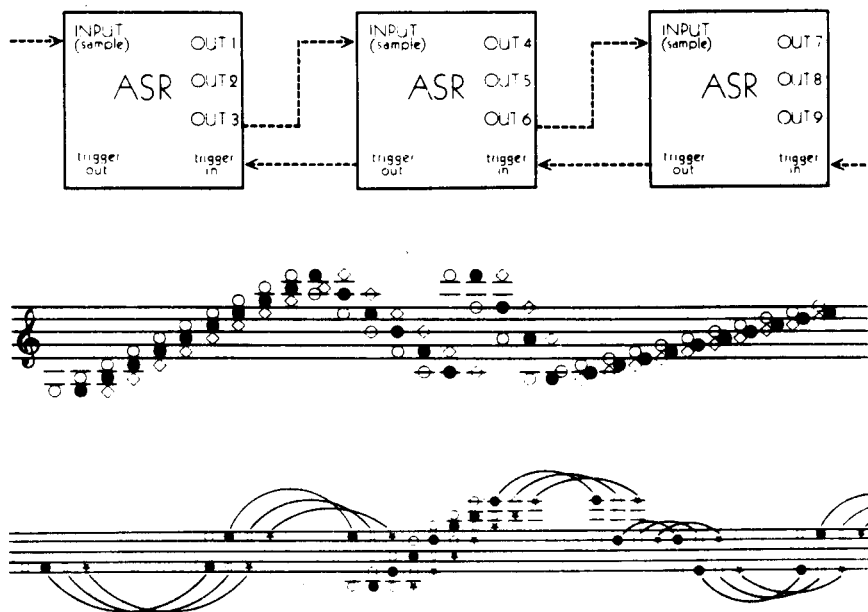
ASR effect with four voices.
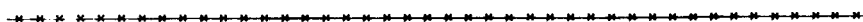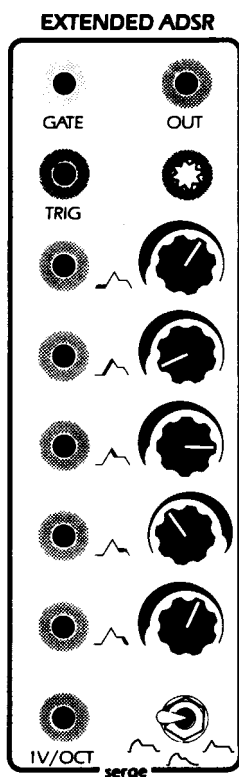
-Clock.

- Two of the four voices in
  conventional notation.

EXTENDED ADSR

GATE   OUT

TRIG

1V/OCT

serge

The EXTENDED ADSR (ADSR) is a complex envelope generator using the four segment envelope normally encountered in keyboard synthesizers. This ADSR, however, is designed with extra features such as voltage control of each section, an initial voltage controllable delay time, switchable slopes, and a master voltage control. Each segment may be manually set and voltage controlled, so the module may be used with or without keyboards as a versatile, programmable control voltage generator. In addition to the normal Attach, Decay, Sustain, and Release segments, an Initial Delay time is included. This allows multiple envelopes to be initiated from a single trigger or gate, delayed with respect to one another. Ramps for the Attack and Release segments can be switched to either linear or exponential slopes with the three-position switch. In the left position, the Attack will have an exponential slope. In the middle position, both the Attack and Release will have an exponential slope, and in the right position, all will have linear slopes. A master 1V/OCT control will control all slope times to allow such effects as decreasing the entire envelope time as the pitch of an associated oscillator increases. This phenomenon is typical of many acoustic instrument envelopes.

SERGE MODULAR MUSIC SYSTEMS

PROCESSORS and CONVENIENCE MODULES

ACTIVE PROCESS'R
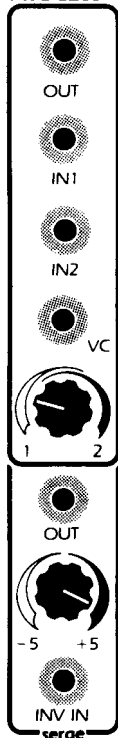
The ACTIVE PROCESSOR (ACPR) is an accurate, linear cross-fader for either control voltages or audio signals. This module provides an important link in complex patches, allowing the user to smoothly change from one control voltage to another. It is possible to cross-fade between different envelopes, for example, or to gradually switch control over a bank of oscillators from one output of a sequencer to another output. A scaling buffer is included in the bottom section to further invert and process control voltages.

DUAL PROCESSOR

The CONTROL MODULE (C/M) is provided for economic utilization of extra panel space and as a low-coat source of manual triggers. Also included are two sections for attenuating control voltage or audio signal levels.

The DUAL PROCESSOR (PRC) is two independent circuits for adding and inverting control voltages. Full processing control of level and polarity of three inputs voltages Is provided. A manual offset voltage can be set to be added to the other three inputs.

C/M
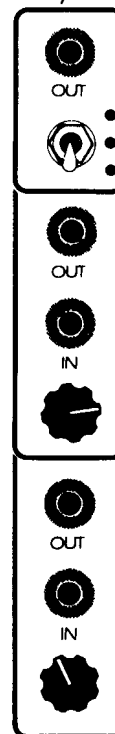
SCALING BUFFERS
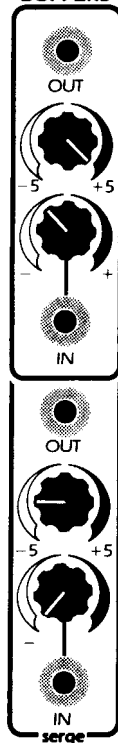
The SCALING BUFFER (BUFF) is useful for controlling two or more modules from the same control voltage. A single knob and an offset voltage allows a change in the settings and response of modules simultaneously. The pitch and tracking of two or more oscillator or filters can be changed without re-adjusting the individual processing inputs or frequency knobs for each module.

SCALING PROCESSOR

The SCALING PROCESSOR (SPRC) is similar to the Dual Processor except it has three sections. The top two sections have one fixed gain input and one input with full processing. The bottom section has two inputs with full processing control (scaling and inverting) as well as an offset control. A fixed +5 volts is available at all times for use as an offset bias for the above sections or to change the range of a module or set or modules.
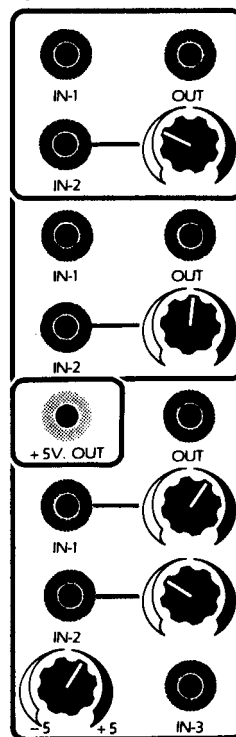
SERGE MODULAR MUSIC SYSTEMS

POWER SUPPLY, PATCHCORDS, and PACKAGING

- The POWER SUPPLY (PWR) for the Serge System is a high-quality multiple-output supply delivering +12 volts and -12 volts. The Power Supply comes mounted in a small chassis box (3"x7"x12") and is completely assembled with AC line cord, fuse, switch, and terminal block for easy connection to Panel/Rack power cables. For systems larger than four panels, two power supplies are required. At special request for assembled systems only, the power supply can be built into the same panel with the Touch-Activated keyboard Sequencer or 4 inches of panel space can be left unfilled to accomodate the built-in power supply.

- The PATCHCORD KIT (POM) consists of 10 banana patch cords of various lengths and colors. For large systems, a few extra long lengths are usually needed, so the LONG PATCHCORD KIT is offered.

- The PANEL/RACK (P/R) is a two part package consisting of a pre-punched front Panel (7"x17") for mounting all of the Serge modules, and a Rack assembly to hold the printed circuit card behind the front panel. The P/R includes all hardware, wire, and connectors needed to assemble the finished system. The Panel and Rack fasten together to form a sturdy unit which can be conveniently mounted into a variety of cases, wood frames, equipment racks or Chassis Boxes.

- The CHASSIS BOX (2 1/2"x7"x17") provides a compact and rugged means of packaging a Panel/Rack. Boxes are recommended for most systems, since they provide protection for the printed circuit boards and offer shielding for sensitive circuitry. Many find that no other case is needed, since the Panels in Chassis Boxes can be quickly packed into traveling cases for transportation or storage, then easily unpacked and set up when needed (simply connecting one connector for each Panel to the power supply). Chassis Boxes can be mounted into custom metal or wood cabinets, and the RACK MOUNTABLE CHASSIS BOX (ROX) is available for installation into standard 19" equipment racks.

- The WOODEN CABINET for Assembled Serge systems houses 4 Chassis Boxes for 4 Panels of Modules. The power supply is built into the unit. Other size cases may be available on a custom basis. Contact Serge Modular for alternative cabinets.

THE ADVANTAGES OF BANANA JACKS AND PATCH CORDS

One request we often receive from people who have not had "hands on" experience with our systems before ordering is to replace the banana jacks with other type of jacks, typically mini-phone jacks. Usually, the person is worried about patch incompatibility with other equipment, or is just used to a particular type of patchcord. Banana jacks have a number of advantages, and we suggest another alternative for patching between the Serge synthesizer system and other audio gear. The advantages of banana jacks is that they never require the use of "mults", since the patchcords are stackable, a single output jack can be sent to a number of input jacks without needing a special multed adapter. This is especially important in the Serge synthesizer since there are a lot of patchable functions and sub-functions. If you .look closely at the modules, you'll notice a lot of jacks. While not every jack will be used in every patch, patches in our system tend to get a little more complex than other systems which have more limited module functions. Another advantage of the banana patchcord system is the superior reliability of the molded banana patchcords themselves. You are always assured of firm contact to the jack ....There is a large area of contact from plug to jack, providing a positive mechanical connection. The cords themselves are color-coded according to length, so finding the right length patchcord is easy. Also the heavy insulated wire used on the banana patchcords make them less tangle-prone than the other types of wire. You'll find that you won't need many long patchcords in the Serge system, since the system itself is very space effective (usually about one quarter the size of typical studio modular instruments), and many of the patches will be within the same module or group of modules. Which brings us to the point of shielded versus unshielded cables: The banana cables are single-wire, unshielded. We can do this in the Serge synthesizer since our output impedances are very low, and the distance between patch points is usually quite short. For patching longer distances, and to other equipment, we do provide alternative types of audio connectors such as mini-phone jacks, RCA phono jacks, and standard phone jacks. The problem of connecting to other equipment is best solved by including some space on the Serge system for Adaptors. These can be from banana jack to RCA phono, mini-phone jack, or phone jack. This allows the use of banana patchcords within the Serge synthesizer, yet allows easy hook-up to other gear with no new cables or expensive and troublesome in-line adaptors required. Please note that many of the audio modules include alternate types of jacks as a standard feature to allow patching to external equipment.

WARRANTY

All factory assembled Serge systems are warranted against defective materials, parts, and workmanship for TWO YEARS. A two-year warranty is also extended to kits, but it applies solely to the circuit boards (parts and materials) supplied with the kit. Defective panel-mounted components will be replaced free of charge if they are returned to us within 90 days. Within the warranty period, kit circuit boards will be checked and repaired free of charge if they are sent to the factory. Warranties become effective on the date of shipment. It is the purchaser's responsibility to seek payment from the carrier for damages sustained in transit. All warranties are void in the event of physical or electrical abuse, as determined by the manufacturer. Shipping charges for all warranted repairs will be paid by the purchaser. No other warranties are expressed or implied.

572 Haight Street • San Francisco CA 94117 • (415) 621-6898

SERGE MODULAR MUSIC SYSTEMS

NOTES ON PUTTING A SYSTEM TOGETHER

The most difficult part of getting started on a synthesizer is deciding on the module selection. We have a large variety of different modules, and probably no one would ever have every single one in a system. Unlike pre-packaged systems the Serge system is aimed at a wide variety of applications requiring systems of varying sizes. There are a few basic building blocks for any synthesizer:

• VOLTAGE CONTROLLED OSCILLATORS

Unless you intend to exclusively process external signals from acoustic pick-ups, microphones, tapes, or other external devices, signal generators such as oscillators or a noise source must be used (only one noise source is needed no matter how large the system). If accurate control over the entire audible spectrum is desired, then the choice should be a number of New Timbral Oscillators and Precision VCO's. If the extra features on the New Timbral Oscillator are not always required, it is often better to choose Precision VCO's, or at least not use New Timbral Oscillators only, since many of the specialized functions incorporated into the New Timbral Oscillator can be achieved using other modules with the Precision VCO. If exact pitch control is less important, or if you are designing a small nucleus of modules for future expansion, it might be better to use the multi-functional modules. These can be patched to function as oscillators when needed, but may perform other functions for other patches. The Dual Universal Slope Generator, the Dual Transient Generator, and the Smooth and Stepped Function Generator are examples of such modules that can function as low-cost patch-programmable oscillators.

• VOLTAGE CONTROLLED AMPLIFIER FUNCTIONS

Another integral element of most synthesizers is the VCA. The number will depend on the size of the system, the number of signal sources to be amplitude controlled or modulated, and the complexity of the patch. Since VCA's are often used as the last link in a patch, we have incorporated VCA's into the Output Mixers along with voltage controlled spatial location. If spatial location is not important for your applications, simpler VCA functions are advised. Such as the Dual VCA or Cross-Fader. For small systems the Universal Audio Processor is highly recommended since it gives the versatility of two VCA's and includes panning and cross-fading.

• AUDIO PROCESSORS

Signal processing is a critical portion of electronic synthesis, and we offer a very wide line of modules. Some are typical to most synthesizers, and others are unique to the Serge system. Filters are essential so we offer three basic types of VC filters. The Variable Q VC Filter is the standard recommended filter. For larger systems, a variety of filters is usually desirable, but avoid the tendency of concentrating too heavily on filters at the expense of leaving out some of the other different signal processors. The Wave Multipliers and Triple Waveshaper allow timbral and dynamic alterations not available in other synthesizers. The Wilson Analog Delay, the Frequency Shifter, and the Ring Modulator are high-powered modules that extend the palette Of effects available. These and other types of signal processors such as the VC Phaser, the Resonant Equalizer, and the Dual Comparator allow the synthesist to add complexity and "animation" to electronic waveforms. Also don't Overlook some of the basic elements such as simple manual mixers. These modules are necessary in even the smallest systems.

• CONTROL VOLTAGE GENERATORS, PROCESSORS, AND CONTROLLERS

Control modules are essential and they can be categorized as two types:

1. Programmable controls which can happen automatically according to other voltage controls and to manual settings. and
2. Controllers which are used as performance devices.

The automatic controls can be as simple as a low frequency oscillator to produce vibrato or slowly moving cyclic changes, or can be very complex. The Touch Activated Keyboard Sequencer, all of the Sequencing Programmers, and the Pitch and Envelope Follower provide powerful performance interfaces between the performer and the instrument (s), and many others can be used. Pressure controllers, joysticks, foot-pedals, electronic keyboards, and other sophisticated controllers such as light sensors computers and microprocessors are easily connected to the Serge system.

Control voltage processors add another dimension to patches in the analog synthesizer. The Smooth and Stepped Function Generator, the Dual Universal Slope Generator, the Dual Comparator, the Analog Shift Register, the Active Processor, and the Quantizer further extend the hierarchy of sound synthesis and control, and along with some of our specialized audio processors, these sophisticated modules enable synthesis of the highest order.

• POWER SUPPLIES, PACKAGING, AND PATCHCORDS

Each Serge system requires certain regulated voltages to operate. The Power Supply will provide the proper power for up to four panels. Those purchasing a few modules for incorporation with other equipment may be able to use other existing supplies.

All of the Serge modules are designed around the Panel/Rack. This is a single unit which can accomodate up to 16" of our modules. The Panel/Rack mounted in the Chassis Box serves as a convenient case for a small system, and will provide maximum portability for larger systems as well. Custom wood cabinets are available for mounting Panel/Racks. Rack mount adaptors are available for standard equipment racks.

The Serge system uses banana type patchcords throughout. One and a half to two patchcord kits per Panel is recommended. For larger systems (greater than 4 Panels), at least one kit of long patchcords is advised.

SERGE MODULAR MUSIC SYSTEMS

WORKSHEET

← 16″ →   ← 16″ →

WORKSHEET

SERGE MODULAR MUSIC SYSTEMS

SAMPLE TWO-PANEL SYSTEM
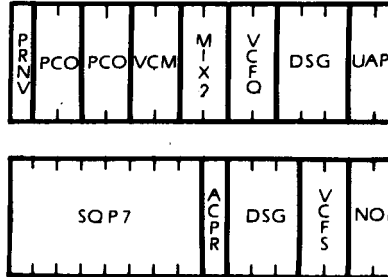

```
TWO-PANEL SYSTEM, ASSEMBLED

*  *  *  *  *  *  *    *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
QUAN        ITEM   DESCRIPTION                                  PRICE          AMOUNT

   1        PRNV   PRE AMP DETECTOR                             160.00         160.00
   2        PCO    PRECISION VC OSCILLATOR                      175.00         330.00
   1        VCM    VC WAVE MULTIPLIERS                          230.00         230.00
   1        MIX2   DUAL 3-INPUT AUDIO MIXER (2-INCH)            100.00         100.00
   1        VCFQ   VARIABLE 'Q' VC FILTER                       170.00         170.00
   2        DSG    DUAL UNIVERSAL SLOPE GENERATOR               170.00         340.00
   1        UAP    UNIVERSAL AUDIO PROCESSOR                    155.00         155.00
   1        SQP7   7-STAGE SEQUENCER PROGRAMMER                 300.00         300.00
   1        ACPR   ACTIVE PROCESSOR                             162.00         162.00
   1        VCFS   VARIABLE SLOPE VC FILTER                     165.00         165.00
   1        NOI    NOISE SOURCE                                 142.00         142.00
   2        BOX    CHASSIS BOX FOR PANEL/ RACK                   15.00          30.00
   2        P/R    PANEL/RACK AND PC MOUNT HARDWARE              25.00          50.00
   1        PWB    POWER SUPPLY                                 100.00         100.00
   3        POM    POMONA PATCHCORDS (10)                        20.00          60.00

SUB-TOTAL                                                                     2514.00
LESS 5% DISCOUNT                                                             -125.70
PLUS SALES TAX (6.5%)                                                           0.00

TOTAL                                                                         2388.30
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TWO-PANEL SYSTEM, KIT FORM

*  *  *  *  *  *  *    *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *    *  *  *  *  *    *  *  *  *  *  *  *
QUAN        ITEM   DESCRIPTION                                  PRICE          AMOUNT

1           PRNV   PREAMP DETECTOR                              130.00         130.00
2           PCO    PRECISION VC OSCILLATOR                      138.00         276.00
1           VCM    VC WAVE MULTIPLIERS                          160.00         160.00
1           MIX2   DUAL 3-INPUT AUDIO MIXER (2-INCH)             70.00          70.00
1           VCFQ   VARIABLE 'Q' VC FILTER                       139.00         139.00
2           DSG    DUAL UNIVERSAL SLOPE GENERATOR               140.00         280.00
1           UAP    UNIVERSAL AUDIO PROCESSOR                    115.00         115.00
1           SQP7   7-STAGE SEQUENCER PROGRAMMER                 225.00         225.00
1           ACPR   ACTIVE PROCESSOR                             136.00         136.00
1           VCFS   VARIABLE SLOPE VC FILTER                     125.00         125.00
1           NOI    NOISE SOURCE                                 115.00         113.00
2           Box    CHASSIS BOX FOR PANEL/RACK                    15.00          30.00
2           P/R    PANEL/RACK AND PC MOUNT HARDWARE              25.00          50.00
1           PWB    POWER SUPPLY                                 100.00         100.00
3           POM    POMONA PATCHCORDS (10)                        20.00          60.00

SUB-TOTAL                                                                     2011.00
LESS 5% DISCOUNT                                                             -100.55
PLUS SALES TAX (6.5%)                                                           0.00

TOTAL                                                                         1910.45
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*S*ERGE *M*ODULAR *M*USIC *S*YSTEMS

SAMPLE FOUR-PANEL SYSTEM

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            FOUR-PANEL SYSTEM, ASSEMBLED WITH WOODEN CABINET

    * * *   * * *   * * * * * * * * * * * * * * * * * *   * * * * * * * * * * * *
    QUAN    ITEM    DESCRIPTION                           PRICE        AMOUNT

      1     PRNV    PREAMP DETECTOR                       160.00        160.00
      3     PCO     PRECISION VC OSCILLATOR               175.00        525.00
      1     RING    RIND MODULATOR                        140.00        140.00
      2     VCM     VC WAVE MULTIPLIERS                   230.00        460.00
      1     VCFQ    VARIABLE 'Q' VC FILTER                170.00        170.00
      1     EQ      10-CHANNEL RESONANT EQUALIZER         220.00        220.00
      1     QVM     FOUR-INPUT VC STEREO MIXER/PANNER     410.00        410.00
      1     NTO     NEW TIMBRAL OSCILLATOR                275.00        275.00
      1     MIX2    DUAL 3-INPUT AUDIO MIXER (2-INCH)     100.00        100.00
      2     DSG     DUAL UNIVERSAL SLOPE GENERATOR        170.00        340.00
      1     VCFS    VARIABLE SLOPE VC FILTER              165.00        165.00
      1     PHA     VC PHASER                             175.00        175.00
      1     SEQB    8-STAGE SEQUENCER                     240.00        240.00
      1     QTKB    QUANTIZER FOR TKB                     325.00        325.00
      1     RS      RANDOM SOURCE                         300.00        300.00
      1     PRC     DUAL CONTROL VOLTAGE PROCESSOR        110.00        110.00
      1     NCOM    DIVIDE BY 'N' COMPARATOR              170.00        170.00
      1     DTG     DUAL VC TRANSIENT GENERATOR           155.00        155.00
      1     TKB     TOUCH ACTIVATED KEYBOARD SEQUENCER    800.00        800.00
      1     CAB     WOODEN STUDIO CABINET                 450.00        450.00
      6     POM     POMONA PATCHCORDS (10)                 20.00        120.00

    SUB-TOTAL                                                         5810.00
    LESS 10% DISCOUNT                                                 -581.00
    PLUS SALES TAX 6.5%                                                  0.00

    TOTAL                                                             5229.00
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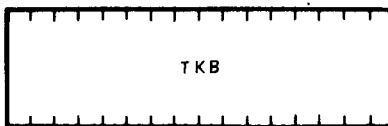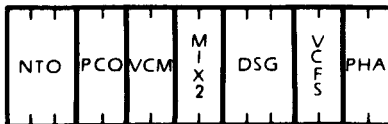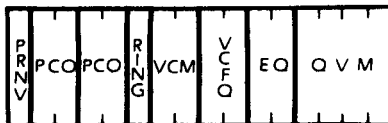


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            FOUR-PANEL SYSTEM, KIT FORM WITH WOODEN CABINET

    * * * *   * * *   * * * * * * * * * * * * * * * * * * * * * * *   * * * * * *
    QUAN      ITEM    DESCRIPTION                         PRICE        AMOUNT

      1       PRNV    PREAMP DETECTOR                     130.00        130.00
      3       PCO     PRECISION VC OSCILLATOR             138.00        414.00
      1       RING    RING MODULATOR                      110.00        110.00
      2       VCM     VC WAVE MULTIPLIERS                 160.00        320.00
      1       VCFQ    VARIABLE 'Q' VC FILTER              139.00        139.00
      1       EQ      10-CHANNEL RESONANT EQUALIZER       163.00        163.00
      1       QVM     FOUR-INPUT VC STEREO MIXER/PANNER   305.00        305.00
      1       NTO     NEW TIMBRAL OSCILLATOR              207.00        207.00
      1       MIX2    DUAL 3-INPUT AUDIO MIXER (2-INCH)    70.00         70.00
      2       DSG     DUAL UNIVERSAL SLOPE GENERATOR      140.00        280.00
      1       VCFS    VARIABLE SLOPE VC FILTER            125.00        125.00
      1       PHA     VC PHASER                           147.00        147.00
      1       SEQ8    8-STAGE SEQUENCER                   180.00        180.00
      1       QTKB    QUANTIZER FOR TKB                   285.00        285.00
      1       RS      RANDOM SOURCE                       260.00        260.00
      1       PRC     DUAL CONTROL VOLTAGE PROCESSOR       75.00         75.00
      1       NCOM    DIVIDE BY 'N' COMPARATOR            140.00        140.00
      1       DTG     DUAL VC TRANSIENT GENERATOR         125.00        125.00
      1       TKB     TOUCH-ACTIVATED KEYBOARD SEQUENCER  610.00        610.00
      1       CAB     WOODEN STUDIO CABINET               450.00        450.00
      6       POM     POMONA PATCHCORDS (10)               20.00        120.00

    SUB-TOTAL                                                         4655.00
    LESS 10% DISCOUNT                                                 -465.50
    PLUS SALES TAX (6.5%)                                               0.00

    TOTAL                                                             4189.50
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              FOUR-PANEL SYSTEM, KIT FORM (NO CABINET)

    * * *   * *   * * * * * * * * * * * * * * * * * * * * * * *   * * * * * * *
    QUAN    ITEM DESCRIPTION                             PRICE        AMOUNT

      1     PRNV PREAMP DETECTOR                         130.00        130.00
      3     PCO  PRECISION VC OSCILLATOR                 138.00        414.00
      1     RING RING MODULATOR                          110.00        110.00
      2     VCM  VC WAVE MULTIPLIERS                     160.00        320.00
      1     VCFQ VARIABLE 'Q' VC FILTER                  139.00        139.00
      1     EQ   10-CHANNEL RESONANT EQUALIZER           163.00        163.00
      1     QVM  FOUR-INPUT VC STEREO MIXER/PANNER       305.00        305.00
      1     NTO  NEW TIMBRAL OSCILLATOR                  207.00        207.00
      1     MIX2 DUAL 3-INPUT AUDIO MIXER (2-INCH)        70.00         70.00
      2     DSG  DUAL UNIVERSAL SLOPE GENERATOR          140.00        280.00
      1     VCFS VARIABLE SLOPE VC FILTER                175.00        175.00
      1     PHA  VC PHASER                               147.00        147.00
      1     SEQ8 8-STAGE SEQUENCER                       180.00        180.00
      1     QTKB QUANTIZER FOR TKB                       285.00        285.00
      1     RS   RANDOM SOURCE                           260.00        260.00
      1     PRC  DUAL CONTROL VOLTAGE PROCESSOR           75.00         75.00
      1     NCOM DIVIDE BY 'N' COMPARATOR                140.00        140.00
      1     DTG  DUAL VC TRANSIENT GENERATOR             125.00        125.00
      1     TKB  TOUCH ACTIVATED KEYBOARD SEQUENCER      610.00        610.00
      6     POM  POMONA PATCHCORDS (10)                   20.00        120.00
      4     P/R  PANEL/RACK AND PC MOUNT HARDWARE         25.00        100.00
      4     BOX  CHASSIS BOX FOR PANEL/RACK               15.00         60.00
      1     PWB  POWER SUPPLY                            100.00        100.00

    SUB-TOTAL                                                         4465.00
    LESS 10% DISCOUNT                                                 -446.50
    PLUS SALES TAX (6.5%)                                               0.00

    TOTAL                                                             4018.50
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SERGE MODULAR MUSIC SYSTEMS

HOW TO PUT A SYSTEM TOGETHER

1. Make a list of the modules you want.

2. Diagram the placement of the modules on one or more Panel/Racks on the provided worksheet.

3. Decide how you wish to package your system. Panel/Racks are required For all systems. Chassis Boxes are optional, but recommended. Custom wood cabinets are easily made to fit around the Panel/Rack-Chassis Box package.

4. Calculate the number of Patchcord Kits you will need, and the Power Supply requirements.

MODULES (please itemize on separate sheet)	$ _____
PANEL/RACKS, number needed:	+$ _____
CHASSIS BOXES, number needed:	+$ _____
PATCHCORD KITS, number needed:	+$ _____
POWER SUPPLY(s):	+$ _____
SYSTEM COST, subtotal	$ _____
less discount, if applicable	-$ _____
TOTAL:	$ _____
California residents please add 6 ½% sales tax	+$ _____
TOTAL	$ _____
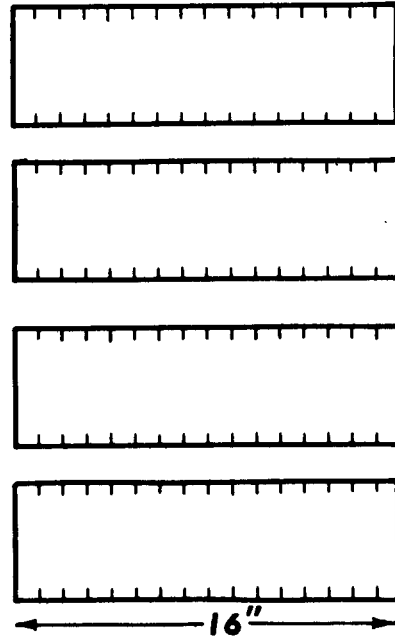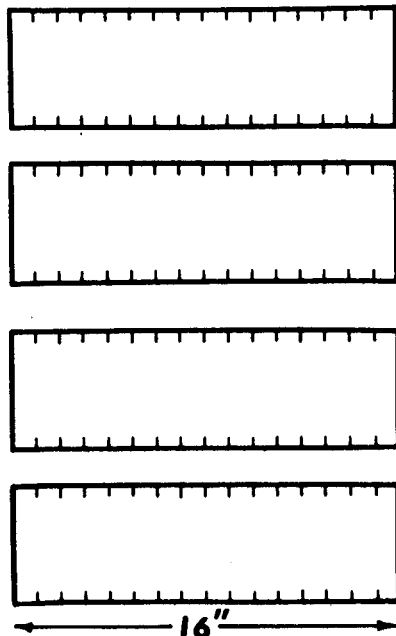
*S*ERGE *M*ODULAR *M*USIC *S*YSTEMS

PRICE LIST

Effective July 1982

SIZE	CODE	MODULE NAME	KIT PRICE	ASS'B PRICE
		VOLTAGE CONTROLLED OSCILLATORS		
3"	NTO	New Timbral Oscillator	207.00	275.00
2"	PCO	Precision VCO	138.00	175.00
		VOLTAGE CONTROLLED AMPLIFIERS		
2"	UAP	Universal Audio Processor	115.00	155.00
1"	2VCA	Dual VCA	110.00	150.00
1"	XFAD	VC Cross-Fader	115.00	155.00
2"	DCSM	Dual Channel Stereo Mixer	180.00	230.00
		VOLTAGE CONTROLLED FILTERS		
2"	VCFQ	Variable 'Q' VC Filter	139.00	170.00
2"	VCFS	Variable Slope VC Filter	125.00	165.00
2"	VCF2	Variable Bandwidth VC Filter	150.00	190.00
2"	VCFX	Extended Range VCFQ	143.00	175.00
		VOLTAGE CONTROLLED OUTPUT MIXERS		
4"	QVM	Voltage Controlled Stereo Mixer	305.00	410.00
8"	SMX	Multi-Channel Stereo Panner	560.00	675.00
2"	PAN	Dual Stereo Panner Channel	165.00	193.00
6"	QMX	Multi-Channel Quadraphonic Mixer	465.00	536.00
2"	QPC	Quad Panner Channel	180.00	206.00
		AUDIO MIXERS (MANUAL)		
3"	MIX	Dual 3-Input Audio Mixer	75.00	105.00
2"	MIX2	Dual 3-Input Audio Mixer	70.00	100.00
4"	MXP	Four Input Stereo Mixer/Panner	95.00	155.00
6"	MAX	Matrix Mixer	195.00	320.00
		PREAMPS & ENVELOPE DETECTORS		
1"	PRNV	Preamp Detector	130.00	160.00
1"	ENV	Envelope Detector	90.00	125.00
1"	ENV2	Dual Envelope Detector	160.00	210.00
		AUDIO PROCESSORS		
3"	WAD	Wilson Analog Delay	390.00	470.00
2"	EQ	Resonant Equalizer	163.00	220.00
2"	PHA	VC Phaser	147.00	175.00
2"	2PHA	Dual VC Phaser	290.00	340.00
2"	TWS	Triple VC Waveshaper	96.00	130.00
1"	RING	Ring Modulator	110.00	140.00
2"	VCM	VC Wave Multipliers	160.00	230.00
7"	PEF	Pitch and Envelope Follower	450.00	570.00

SIZE	CODE	MODULE NAME	KIT PRICE	ASS'B PRICE

CONTROL VOLTAGE GENERATORS AND MODIFIERS

SIZE	CODE	MODULE NAME	KIT PRICE	ASS'B PRICE
16"	TKB	Touch Activated Keyboard Sequencer	610.00	900.00
5"	SQP4	4-Stage Sequencer Programmer	180.00	240.00
6"	SQP5	5-Stage Sequencer Programmer	195.00	260.00
7"	SQP6	6-Stage Sequencer Programmer	210.00	290.00
8"	SQP7	7-Stage Sequencer Programmer	225.00	300.00
9"	SQP8	8-State Sequencer Programmer	240.00	320.00
4"	SEQ8	8-Stage Sequencer	180.00	240.00
1"	QSEQ	Quantizer for 5-8 Stage SQP's	270.00	305.00
2"	QUAN	Quantizer	270.00	305.00
2"	QTKB	Quantizer for TKB	285.00	325.00
3"	DSG	Dual Universal Slope Generator	140.00	170.00
3"	SSG	Smooth & Stepped Function Generator	140.00	180.00
2"	DTG	Dual VC Transient Generator	125.00	155.00
1"	COM	Dual Comparator	100.00	125.00
1"	NCOM	Divide-by-N Comparator	140.00	170.00
1"	STR	Dual Schmitt Trigger	100.00	125.00
2"	NOI	Noise Source	115.00	142.00
2"	RVG	Random Voltage Generator	140.00	165.00
2"	2RVG	Dual Random Voltage Generator	265.00	315.00
2"	RS	Random Source	260.00	300.00
2"	ASR	Analog Shift Register	125.00	140.00
2"	2ASR	Dual Analog Shift Register	245.00	275.00
2"	ADSR	Extended ADSR Envelope Generator	140.00	180.00

PROCESSORS AND CONVENIENCE MODULES

SIZE	CODE	MODULE NAME	KIT PRICE	ASS'B PRICE
1"	ACPR	Active Processor	136.00	162.00
2"	PRC	Dual Processor	75.00	110.00
2"	SPRC	Scaling Processor	85.00	120.00
1"	BUFF	Scaling Buffer	65.00	105.00
1°	C/M	Control Module	25.00	45.00
1"	ADP	Adaptors (4 Mini, RCA, or Phone)	10.00	17.00

POWER SUPPLY, PATCHCORDS, AND PACKAGING

SIZE	CODE	MODULE NAME	KIT PRICE	ASS'B PRICE
	PWB	Power Supply in Small Chassis Box	100.00	100.00
	POM	Pomona Molded Cables (10)	20.00	20.00
	POML	Long Pomona Molded Cables (10)	22.00	22 00
	P/R	Panel/Rack	25.00	25.00
	BOX	Chassis Box	15.00	15.00
	ROX	Rack Mountable Chassis Box	25.00	25.00
	CAB	Wooden Cabinet for Four-Panel System	450.00	450.00

(price includes 4 Chassis Boxes, 4 Panel/Racks, and Power Supply)
(Wooden Cabinets must be shipped air freight - approx $100)

SIZE	CODE	MODULE NAME	KIT PRICE	ASS'B PRICE
	MAN	Introduction to the Serge Modular Music System		12.50

(Manual included with all system orders.
If ordered separately, please enclose $2.50 for shipping.)

There is a 5% discount on orders over $2000, 10% on orders over $3000. All orders are F.O.B. San Francisco, so please include shipping charges (approximately $15 per panel). Excess will be refunded. All orders are shipped via United Parcel Service within the U.S. Overseas orders are shipped via Air Freight (about $45 per panel). California residents please include 6 1/2% sales tax.

Delivery times range from 2 to 8 weeks. Contact us for current delivery schedules.