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Rewind

APPENDIX I
USING EXTERNAL SOUND SOURCES

The Euro-Serge Modular Synthesizer can use any sound as an audio signal so long as it has been converted to a varying voltage of the appropriate level. These can be sounds of people talking, instruments playing, airplanes overhead, dogs barking, hummingbirds humming. The Euro-Serge can mix, filter, ring modulate, amplitude modulate, and wave shape these sounds. It can also put new envelopes on these sounds or extract envelopes from them to use elsewhere. It can use these signals to frequency modulate oscillators and, with a comparator, check for amplitude peaks to trigger anything from the Touch Sequencer to envelope generators.

The Euro-Serge system has high-impedance, line-level inputs. This kind of input allows one module to control many other modules without losing accuracy, and is almost impervious to electrical damage. Most Control Voltage inputs are from 50K to 200K ohms. Audio inputs are from 22K to 100K ohms.

Sound sources fall into two broad categories of impedance and voltage level:-

1. Line Level, high-impedance signals, which can be used directly in the Euro-Serge, and
2. Low-impedance, low-voltage signals which must be pre-amplified before using.

Line-level sources include tape recorder outputs, headphone outputs and the LINE or AUX output of mixers and pre-amplifiers. There are a few microphones which are also line-level, but these are not common.

Low-level sources include almost all microphones, instrument pick-ups and record player cartridges. All three of these sound sources must be pre-amplified before they can be used on the Euro-Serge.

Available Pre-Amplifiers:

1. The Euro-Serge instrument and microphone pre-amplifier
2. Most portable and studio mixers have microphone and instrument inputs and line-level outputs. Often these mixers can also accept line-level signals and provide the user with a switch to choose between the inputs.
3. Component stereo systems have pre-amplifiers and turntable inputs. The line-level output may be labelled TAPE OUT, LINE OUT or AUX OUT. This is the most common way to pre-amplify a record.

4. Most tape recorders have a microphone input which will pre-amplify the microphone. The signal can be taped, and played back, used directly, or the tape recorder can be switched to SOURCE and the input, or source, will appear pre-amplified directly at the output.

5. Small, moderate quality pre-amplifiers can be purchased at electronic stores.

6. Electric guitars and other instruments with pick-ups need to be pre-amplified. Most stage type amplifier "heads" have a LINE OUT which can be used directly with the Euro-Serge. Otherwise, small instrument pre-amps are required.

APPENDIX II
SENDING EURO-SERGE SIGNALS OUT

The output levels of all Euro-Serge modules are line-level signals and can be sent directly to the LINE or AUX input of any electronic sound device including pre-amps, amps and mixers. These levels are also appropriate for sending signals to such devices as reverb units or graphic equalizers. The output impedance of most Euro-Serge modules is about 300 ohms.

For tape recording purposes the Euro-Serge signal can be sent directly to the Line Inputs of a tape recorder, or to the line-level inputs of a mixer and then to a tape recorder.

Auxiliary mini-jack inputs and outputs can be found on most Euro-Serge mixers and should used to inter-connect to other equipment to prevent hum, crosstalk and static.

Some inputs and outputs of external devices have "balanced" lines with two signals lines and one ground line. Typically these lines use XLR connectors. Many microphones have balanced lines which permit longer cables to be sued before hum becomes noticeable. These lines must be unbalanced before being connected ti mini-jacks, unbalanced phone jacks or RCA jacks on the Euro-Serge. There are three ways of unbalancing a balanced line:-

- Connecting one of the 'hot lines' to ground,
- Using a balanced-in, grounded-out transformer,
- Using a mixer that balances and unbalance signals.

To send Euro-Serge or line-level signals any distance it is a good idea to use shielded wire. To send low-level signals long distances it is advisable to use a balanced line. because it is possible to send low-impedance signals extremely far (say 1000 feet) without hum building up, it is often wise when sending line-level signals such distances, to use a transformer to convert it to a low-impedance balanced signal, with a second transformer at the far end of the line receiving it back to an unbalanced signal.
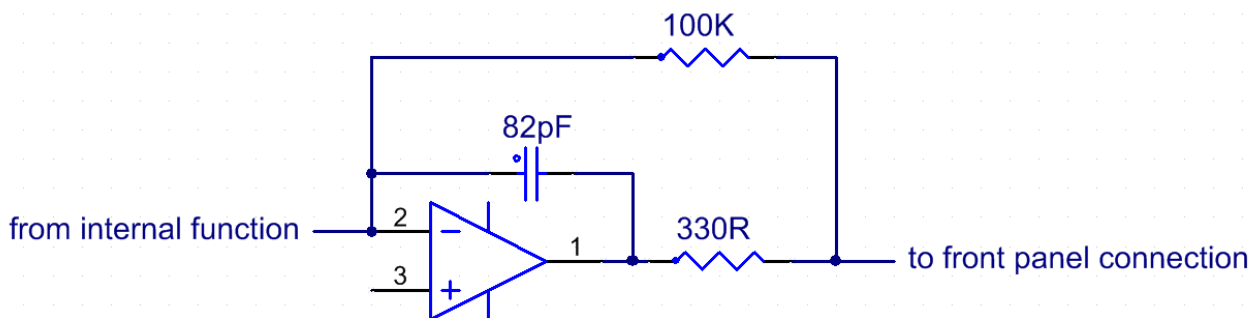
Figure 8.1 - Typical output buffer in Euro-Serge modules

Some Euro-Serge modules are fitted with either balanced inputs or balanced outputs and those, of course, can be used for direct connection to balanced devices.

APPENDIX III
EXTERNAL CONTROL VOLTAGES

Almost all control voltage sources on the Euro-Serge, such as the envelope generators, the Touch Sequencer, the Random Voltage Generator and the non-Sine wave oscillator outputs have a voltage range of about 0V to 5V. Using the Processor Module or Processing Inputs this range can be effectively increased to -10V to +10V. The great majority of Euro-Serge VC inputs respond to voltages in this range, though some only respond to positive voltages. These VC inputs can accept voltages in this range from ANY source including other synthesizers, home built circuits, foot-pedals and/or voltage-out keyboard units. In fact, because of the extremely high impedance of the inputs on the Euro-Serge, DC voltages greater than 12V (up to 25V) can be used without damage to the Euro-Serge, though will generally drive the module out of its effective range.

Voltages that are too low can be amplified by using a Processor module and sending the voltage to all inputs (this technique also works with audio voltages using either a processor or mixer).

All frequency dependent modules have VC inputs which operate on a 1V/Octave ratio. Other voltages that are not of this range can be scaled using Processor modules or the processing inputs on the modules and then "tuned" by ear.

There are some synthesizers on the market that have exponential control voltages with linearly responding modules, The Euro-Serge, and most synthesizers, operate in the opposite fashion. Because of these differences, control voltage generators such as keyboards and sequencers from these other synthesizers cannot be used with the Euro-Serge in a meaningful manner.
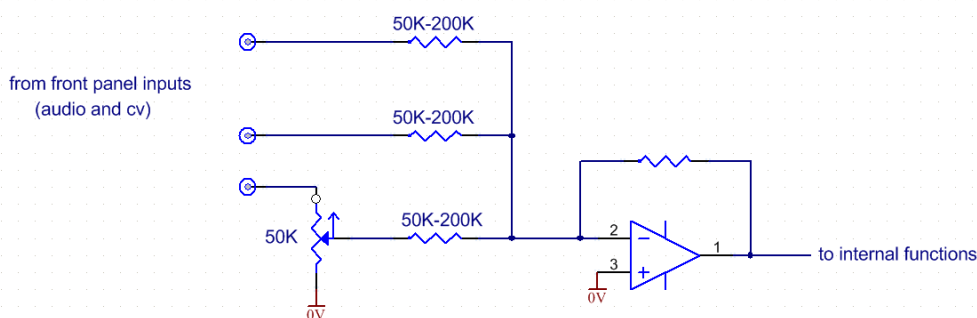

Figure 8.2 - Typical input network on Euro-Serge modules

APPENDIX IV
East Coast - West Coast - Best Coast

The world of synthesizer systems can be broadly split in to two styles which have been named East Coast and West Coast. The difference between these systems basically boils down to how a 'sound' is created and manipulated.

East Coast

In the East Coast systems have a subtractive synthesis patch entirely oriented towards the filter. This is your classic VCO-VCF-VCA connection with ADSR type envelopes for the VCF and VCA. The envelopes generators typically have only a single output. The oscillators usually have very simple waveforms such as saw tooth and square wave. The filter is then used to produce the timbres. This patch makes sense for playing with a black and white type keyboard. It produces a limited but pleasing range of timbres and is easy to operate and understand.

Modules in an East Coast system tend to be fairly rigid and defined so that, for example, an LFO is pretty much always just an LFO, perhaps getting up to audio rate, but generally having only a single function

Manufacturers like Moog, ARP and Oberheim fall under the East Coast banner.

Modules names tend to be descriptive of their function and so we see modules such as:-

- VCO - Voltage Controlled Oscillator,
- VCF - Voltage Controlled Filter,
- VCA - Voltage Controlled Amplifier, and
- ADSR - Envelope Generator (Attack Decay Sustain Release)

each with a defined function and generally not much variation outside of that.

West Coast

In the West Coast systems there are 3 possible synthesis modes. Additive, non-linear wave shaping and dynamic depth FM are the primary synthesis modes. East Coast subtractive synthesis is typically not DIRECTLY supported. Good approximations of subtractive synthesis can be patched on the Serge with cascaded filters. These instruments are oriented towards controlling with a multiple output sequencer or multiple output complex envelope generator in-

stead of a black and white keyboard. They produce a larger and more importantly, different set of timbres than the simpler East Coast instruments.

The classic patch in a West Coast instrument involves two blocks. The first is a complex oscillator which supports both non-linear wave shaping and dynamic depth FM. The second signal processor is a Lowpass Gate or "frequency and amplitude domain processor". The primary timbre generation is done directly with the oscillator, and the Lowpass Gate just tweaks the amplitude and frequency character. These two blocks are designed to be controlled by one complex envelope generator with multiple outputs routed to all the timbre factors.

Manufacturers like Serge, Buchla and Wiard fall under the West Coast banner.

Modules in West Coast systems are not automatically based on traditional (electronic) musical terminology - generalised electronic functional names are generally adopted where they provided better descriptions than electronic music parameters giving us modules such as:-

- Positive Slew Generator,
- Negative Slew Generator,
- Wave Multiplier, and
- Voltage Processor

These modules can often be patched/configured for a variety of different functions. The Universal Slope Generator is a prime example as it can be configured as:-

- a Voltage Controlled Envelope Generator,
- a Voltage Controlled Portamento,
- a Voltage Controlled LFO,
- a Voltage Controlled Oscillator,
- an Envelope Follower, and
- a Sub-Harmonic Generator

This is a somewhat simplified explanation to illustrate subtle points about the two systems. Actual usage involves a combination of both techniques.
Notions of East and West Coast synthesis are rejected by some contemporary commentators on the basis that while they may have had truth in the late 1960s and early 1970s, most modern synthesizers can implement both approaches and achieve fairly complex timbres regardless of their format.

This may be so, but it also misses an important point: that so many introductions to synthesis are focused on East Coast (i.e. subtractive) approaches that it surely risks masking the richness of the subject. West Coast can be educationally expedient, particularly in the way that they enable complex and evolving timbres to be created from only two or three building blocks.

Best Coast

Euro-Serge systems would also tend to be classified under the West Coast banner but with the move in to the world of the EuroSynth, the Euro-Serge can now be classified as Best Coast as it is now able to be combined with sonic sources from a wide range of eclectic modules.

Best Coast can be educationally expedient, particularly in the way that they enable complex and evolving timbres to be created from only two or three building blocks.

APPENDIX V
Serge Tcherepnin

Serge was born in Issy-les-Moulineaux, near Paris, the son of composer Aleksandr Nikolayevich Tcherepnin and grandson of composer Nikolai Nikolayevich Tcherepnin. His mother was Chinese pianist Lee Hsien Ming. He had his first instruction in harmony with Nadia Boulanger and studied from 1958 to 1963 at Harvard University with Leon Kirchner and Billy Jim Layton. He became a naturalized American citizen in 1960. In 1961 he studied at the Darmstadt Vacation Courses with Luigi Nono. He then studied in Europe with Pierre Boulez, Herbert Eimert, and Karlheinz Stockhausen (Palmer and Schrader 2001). Between 1966 and 1968 he worked at the studio for electronic music of the Cologne Hochschule für Musik.

From 1968 to 1970 he participated in the Intermedia Program at New York University (Palmer and Schrader 2001). Starting in 1970 he taught composition and electronic music at the School of Music-California Institute of the Arts in Valencia, California where in 1973 he created The People's Synthesizer. He has been involved with the development of synthesizers such as the Serge Modular, manufactured by his own company Serge Modular Music Systems, founded in 1974 (Palmer and Schrader 2001), as well as TONTO.

After closing his company Serge Modular Music Systems in 1986 he returned to France (Palmer and Schrader 2001). He has composed works for tape and electronic instruments, multimedia works, chamber music, a Kaddish for speakers and chamber ensemble (1962, on a text of Allen Ginsberg) as well as pieces for saxophone and for piano.

His brother Ivan Aleksandrovich Tcherepnin was also a well-known composer, as are two of Ivan's sons, Stefan (born 1977) and Sergeï (born 1981).

Doug Lynner

San Francisco Bay Area composer/performer Doug Lynner is known for his intimate, "In-The-Circuit" modular synthesizer performance style. That style, combined with his devotion to the intrinsic value of sound, has given birth to his "Living Synthesis" compositions - part fixed composition, part improvisation, and part circuit immersion. His process is to create unique instruments for each performance that are self active and cross influencing in which he participates through direct interaction with each instrument's autonomic activities through their knobs, switches and patch cords.

Doug received a BFA in Music Composition from the California Institute of the Arts where his mentors were Morton Subotnick, Harold Budd, James Tenney, Leonid Hambro and Nicholas England. There he recorded on the Buchla 200 and began a lifelong relationship with Serge Tcherepnin.

He was the editor and publisher of Synapse Magazine, the first electronic music magazine, and is known for his Patch of The Week modular synthesizer video tutorial series.

Ken Stone

Ken is an over-enthusiastic synth hobbyist who started dabbling when modular synthesizers were both rare and expensive. His initial exposure to them was in 1974 when he heard the album "Popcorn" by Electric Coconut. Not long after that, the travelling music teacher brought his newly acquired Minimoog to school.

It would be several years before Ken was able to get a synth of his own. In the mean time, DIY electronics was the only way he could produce any sound-makers. It wasn't until December 1980 that he was able to convince his father to buy him one, and even then, it was a very minimal system – modular, of course. That synthesizer was a Roland System 100M modular, specifically, one 110 VCO-VCF-VCA module, one 140 2 ENV-LFO, one 191J 5 module system rack, and the 181 49 keyboard controller. The only way to fill the gaps in the 191J was DIY. Unfortunately, back in those days, information was scarce and key parts were impossible to find.

Fast forwarding to the late 1990s, Ken discovered other modular synth fans on the internet, and was soon offering the fruits of his DIY hobby to others, in the form of a web site that detailed his projects, and for those who were interested, PCBs for them as well. His intention was to help others build their own synthesizers.

As his own synthesizer grew, so did his web site, and the number of designs available.

A number of times after designing what he thought was a new and innovative module he would discover it had already been done before, by Serge Tcherepnin.

After that he looked closer at Serge Systems and liked what he saw, adopting the form factor for his own PCBs.

Serge Tcherepnin was contacted, and soon, by agreement, Serge's designs were also being made available to DIYers again

While Ken is more often involved with the electronics in his synthesizers than actually producing music, he has been known to publicly share the occasional recording.

Laurie Biddulph

I started my first brief encounter with music taking piano lessons and exams while at high-school. A school friend helped me build my first electronic project - the PE Sound Synthesiser. Which was then followed by the Elektor Piano and eventually by the Elektor Formant.

But then along came my future wife to be, Tricia. Electronics took a bit of a sideline and then after meeting up with a college mate (Chazz), we and 2 other friends of Chazz, formed a group calling themselves Four-Wheel-Drive. After about a year the band signed up with an agent and renamed themselves Harmony Road. As a 4-piece dance band playing popular songs from the 60's and 70's they performed at events like Weddings, 18th/21st parties, corporate evenings and clubs.

Emigrating to Australia in 1984 meant leaving all those electronic goodies behind and I didn't touch a keyboard or do much with music until in the mid 1990's when my interest in electronic-music was revived having listened to some Jean Michel Jarre albums. At the time Gene Stopp had his ASM-1 pcb and I was excited by the possibility of getting his soldering-iron out and building a great synthesizer.

As a result of problems trying to locally source components for his ASM-1, I started a small hobby-business to provide kits of parts for the ASM-1. In 2002 Gene passed the ASM-1 over to me and I supplied it along with kits before upgrading it to the ASM-2.

ELBY Designs has been the fruition of my long-term interest in electronics and music and has grown to be a small business supplying a wide range of pcbs, kits and modules for the electronic synthesizer market. It has also allowed me to dabble with pcb and software design which has culminated with the Panther family of EuroSynth modules encompassing designs from Ian Fritz, Ken Stone and now, of course, Serge Tcherepnin.

APPENDIX VI
PUTTING A SYSTEM TOGETHER

The most difficult part of getting started is deciding on the module selection. The Euro-Serge comprises a large variety of different modules, and probably no one would ever have every single variety of module in a system. Unlike pre-packaged systems the Euro-Serge system is aimed at a wider market 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 audio spectrum is desired then the choice should be the number of ASM321 Basic VCO's.

For less demanding oscillator applications the ES20 1973 VCO is an ideal choice offering good tracking and stability. It also includes voltage controlled wave shaping, an important part of the Euro-Serge concept.

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 ES114 Universal Slope Generator, the Transient Generator, and the ES15 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 of modules installed 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 in to the ES31 Stereo Output Mixer along with voltage controlled spatial location. If spatial location is not important for your applications, simpler VCA functions are advised.

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 Euro-Serge system. Filters are essential so we offer two basic types of VC filters. The ES33 Variable-Q VCF 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 (ES04, ES17 and ES18) and the ES10 Triple Wave Shaper allow timbral and dynamic alterations not available in many other synthesizers. The ES79 Ring Modulator is a high-powered module that can extend the palette of effects available. These and other types of signal processors such as the ES22 Resonant Equalizer and the ES11 Triple 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 AND MODIFIERS

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 and to manual settings,
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 ES28 Touch Sequencer provides a powerful performance interface between the performer and the instrument(s) and many others can be used. Pressure controllers, foot-pedals, electronic keyboards and other sophisticated controllers such as light sensors, computer are easily connected to the Euro-Serge system

Control voltage processors add another dimension to patches in the analogue synthesizer. The ES15 Smooth & Stepped Generator, the ES114 Universal Slope Generator, the ES11 Triple Comparator, the CGS734 Analogue Shift Register and the ES37 Quantizer further extend the hierarchy of sound synthesis and control along with some of our specialised audio processors, these sophisticated modules enable synthesis of the highest order.

- **POWER SUPPLY**

Each Euro-Serge system requires certain regulated voltages to operate. The ED705 Power Busboard will provide the proper power and along with the ED704 can be configured to handle even the largest systems.

The ED705 is a high-quality multiple output supply delivering +12 volts and -12 volts. The power supply comes on a small pcb sub-assembly complete with a 12-module busboard. The ED705 requires and external laptop-style 15VDC power supply for connection to your AC supply. Multiple ED705's can be installed on larger systems to increase the load capacity of the power system, while ED704's can be added to increase the number of module outlets.

- **PATCH CORDS**

The Euro-Serge system promotes the use of the 4mm banana type patch cord but can also be supplied with the more 3U popular 3.5mm jacks if preferred.

4mm patch cords are available in a variety of lengths each of which is colour-coded to aid with quickly following patches in a complex path. Generally you will need a mix of the short to middle sized patch cords but in larger systems you will need to include a number of the extra long leads.

3.5mm patch cords are available from a number of EuroRack suppliers.

- **PACKAGING**

All of the Euro-Serge modules are designed around the 3U EuroCard modular racking system. This is a system of 3U Racks that can be housed in to a single unit or multiple smaller units. Our Studio Series offer the user with a range of widths and heights and afford the user with a complete no-fuss solution to housing your Euro-Serge system. Our Lite Rack and Tower Rack solutions are designed for those wishing to customise their own external enclosure for their systems.

We offer a number of Studio System packages which are pre-configured with a nominal mix of ED705 and ED704 and include all mounting hardware and cables to put the assembly together.
To put your own system together you should:

1. Make a list of the modules you want. You can refer to our pre-configured systems for guide lines on suggested modules

2. Use one of the 'module design' programs on the web to experiment with the size and number of racks, as well as experiment with the positioning of your modules in the system
3. Decide how you wish to package your system. One or more 3U Racks are required for all Euro-Serge systems. End-cheeks and boxes are, often, optional, but recommended.
4. Calculate the number of patch cords you will need and the power supply requirements.

If this all seems too hard then you should consider one of our pre-configured Euro-Serge systems. These designs have been collated by the undisputed guru of the classic Serge, Doug Lynner.

Okay so let's put some systems together.........
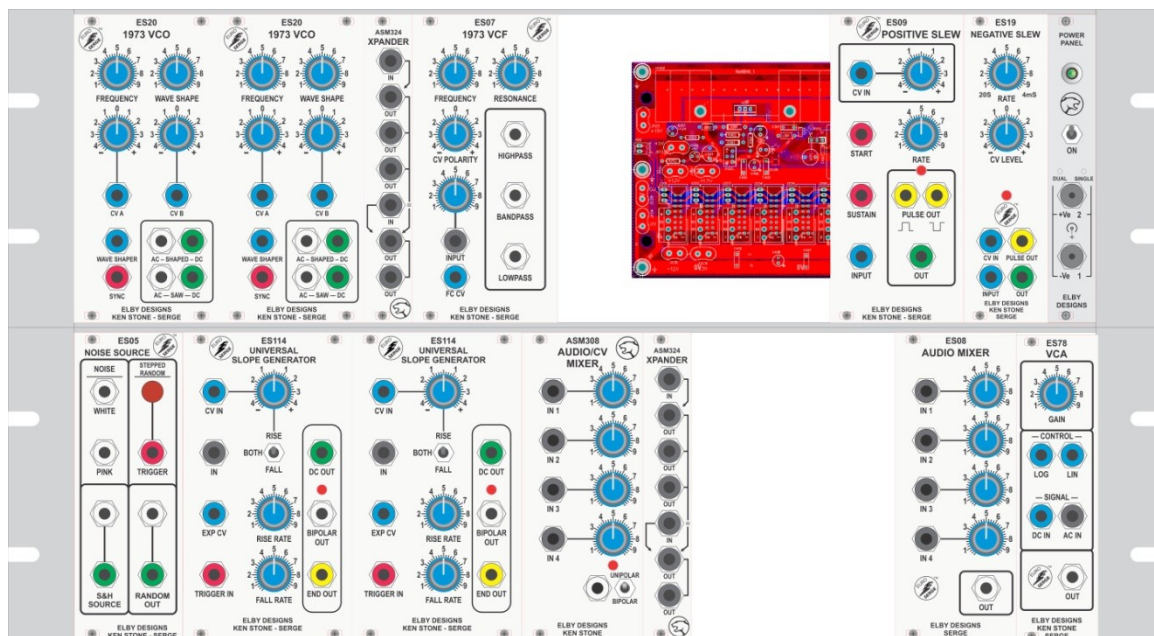
System 1 - The Teaser

For power and distribution we will need:-

- 1x ED705
- 1x ED704
- 1x Busboard Cable Set - 20cm
- 1x 4HP Power Panel
- 1x 15VDC 3.8A Brick

We now have the 'frame' in to which we can fit our modules so let's get selecting. We will start with:-

2x ES20 1973 VCO
1x ES07 1973 VCF
1x ES78 VCA
2x ES114 USG
1x ES05 Noise Source
1x ES09 Positive Slew
1x ES19 Negative Slew
1x ES08 Audio Mixer
1x ASM308 CV Mixer
2x ASM324 Xpander

System 2- The Mover

This system has been designed with portability in mind. It is still a large system but fits in to a 12U 104HP folding case like that shown here

System 3 - The Classic

This is the first full system and makes extensive use of the full 1973 Serge Catalogue range where possible.

For power and distribution we will need:-

- 1x ED705
- 2x ED704
- 2x Busboard Cable Set - 20cm
- 1x 4HP Power Panel
- 1x 15VDC 5A Brick

For the modules we will select:-

3x ES20 1973 VCO
1x ES07 VCF
2x ES78 VCA
2x ES114 USG
1x ES05 Noise Source
1x ES09 Positive Slew
1x ES19 Negative Slew
1x ES04 VCM 1
1x ES17 VCM 2
1x ES18 VCM 3
1x ES11 Triple Comparator and Schmitt Trigger
1x ES21 10-Stage Sequencer
1x ES23 Sequence Programmer

2x ES24 4-Stage Programmer
1x ES10 Triple Waveshaper
1x ES84 Peak & Trough
1x ES79 Ring Modulator
2x ES14 Voltage Processor
1x ES15 Smooth & Stepped Generator
2x ES08 Audio Mixer
2x ASM308 CV Mixer
4x ASM324 Xpander

That's all Folks