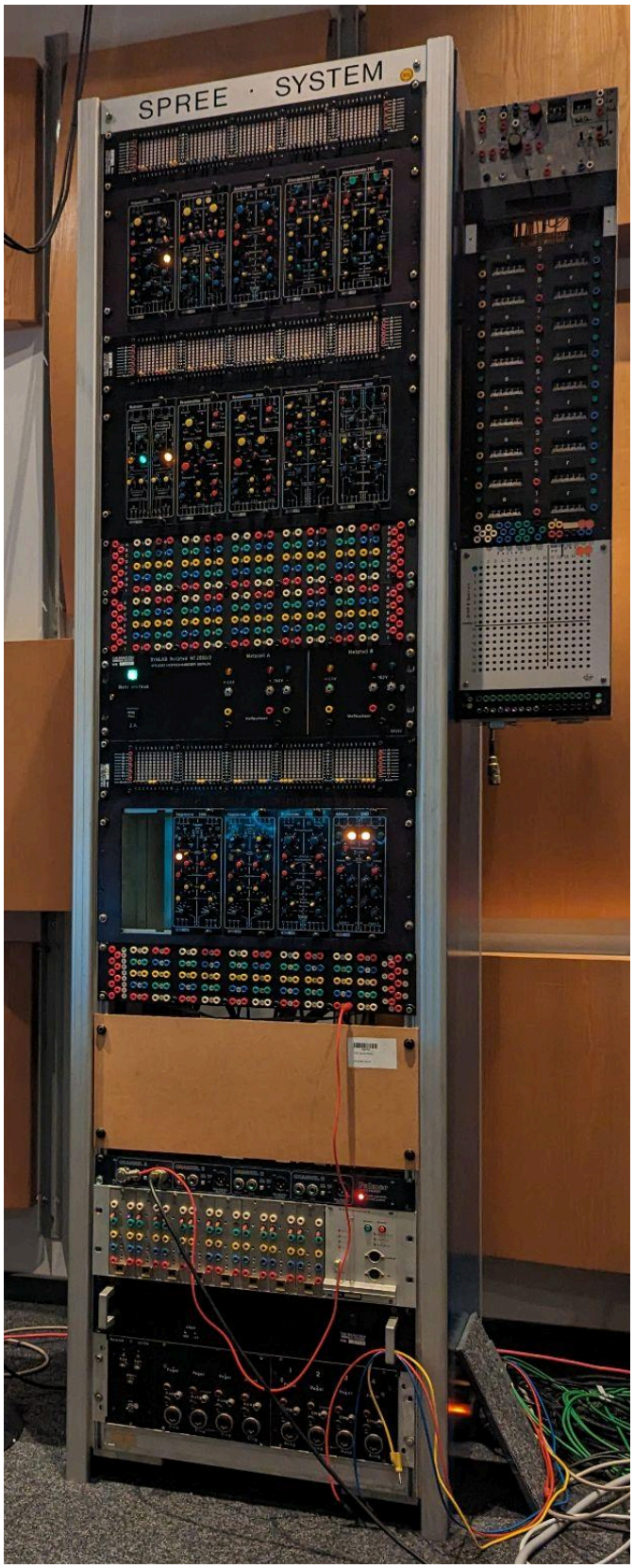
SynLab / Spree System Handbook

Table of Content



Before starting the system

Handbook revision: 0_2

A brief history of the Synlab

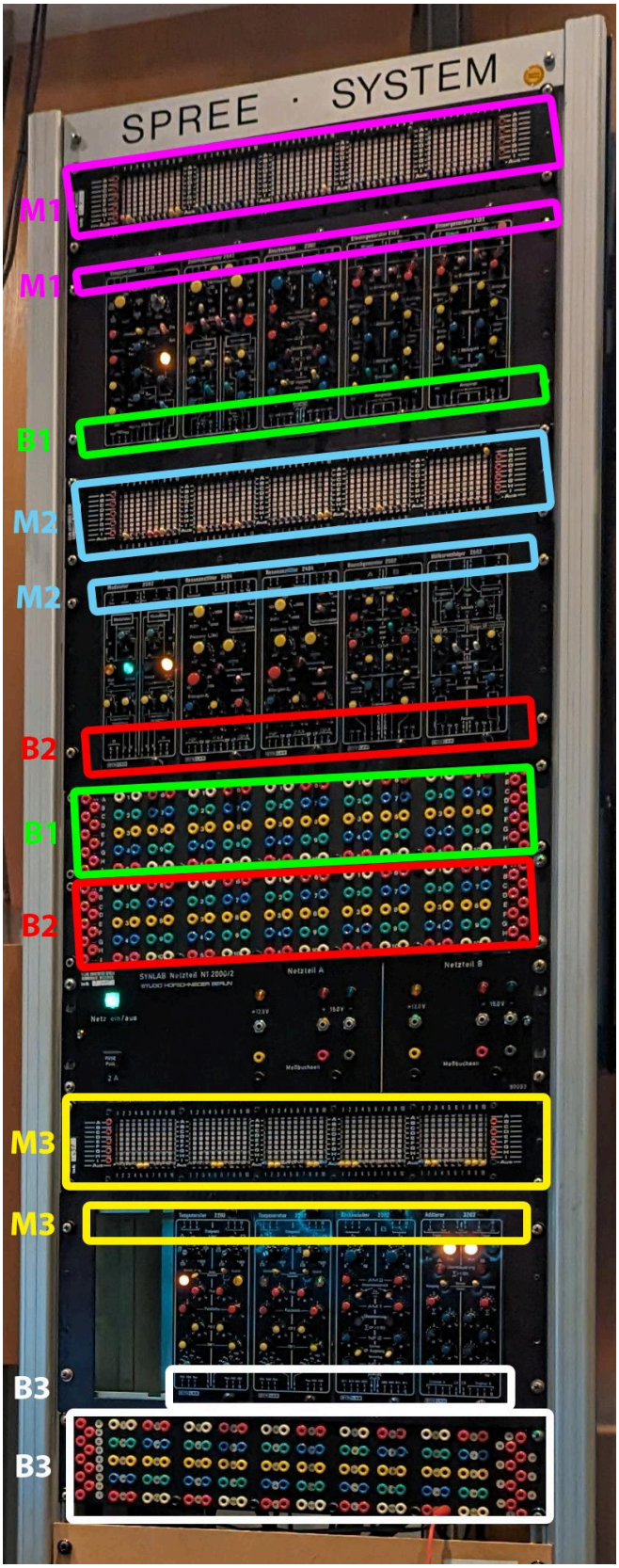
The SynLab is an analog modular synthesizer system designed by Studio Hofschneider in the 1970s. There are two known versions. A large one at the Folkwang University in Essen and a smaller version at the Technische Universität Berlin. The instrument is heavily inspired by the ARP 2500. It features different modules for advanced synthesis and was extremely tuning stable for its time, due to hand selected components and the epoxy casting around crucial components to increase temperature stability. The price, adjusted for inflation, is believed to be around half a million euros [1].
The SynLab in the TU Studio houses 14 modules fulfilling various functions for synthesis. The original SynLab at the Folkwang University only features matrix based routing, while the one in the TU Studio in Berlin is also routed via banana jacks due to the high production costs of the matrices.
This manual attempts to translate the functionality into a more modern modular synthesis approach making the SynLab more accessible.

[1] Peter Forrest: A-Z of Analogue Synthesisers Part Two: N-Z

Synthesis Workflow

The Modules can be connected by 2 different routing systems. The matrix routing is labeled on the top of the modules (M1-M3) and the patching via the banana jacks is indicated on the bottom of the modules (B1-B3).
The bottom and top inputs/outputs on the modules may be called differently, but sometimes achieve the same functionality. (e.g. FM/f0 @ 2404)
Synthesis can be achieved by connecting the appropriate modules and using the Palmer audionomix DI box at the bottom of the rack to extract the signals.
Keep in mind which row of banana jacks and routing matrices are connected to which rows. The two upper banana jack sections (B1/B2) can easily be mixed up.

The mod matrices can create connections between modules by sliding the numbered sliders into the same rows indicated by the letters (A-I).
I recommend (especially for beginners) to mainly use the banana jack routing system as almost all of the functionality can be realized with it except for a few edge cases.
The mod matrices can also be connected to the banana jack routing



system via the numbered jacks on the sides of the banana jack modules (B1-B3).
M1(A-I) is connected to B1(A-I) and M2(A-I) is connected to B2(A-I) and so forth.
The mod matrix rows (A-I) are not normalized to each other. This means that M1 row A and M2 row A are not the same bus by default. These can be connected though by patching B1 A to B2 A

General Translation

Bottom/Top	Translation
NF	Audio input
FM/f0	Osc / Filter CV input for pitch or cutoff
AM/A0	VCA CV input
Tor	Gate
Trig	Trigger
Übersteuerung	Clipping (Which has a lovely characteristic on this instrument)
Ein	On
Aus	Off

The arrows at the top and bottom of the modules indicate whether the channel is an input or output.

Tor, Trig and CV are all Eurorack compatible.
Tor and Trig are confirmed to work above 5V but may also respond from 0.7V upwards depending on the module.
CV for the Oscillators is the typical 1V/Oct.

Resonanzfilter 2404 (VCF)

Description

The 2404 cassette contains a combination of low-pass, high-pass, band-pass and notch (LP = “Lochpass”) filters with the same cut-off or center frequency (fo). With the coarse and fine frequency controls, f0 can be continuously adjusted in a range from 16 to 16,000 Hz. The f0 and FM control voltage inputs have a maximum sensitivity of 1 octave per volt. The cut-off frequency is determined by the sum of all applied control voltages and the internal setting. The notch filter frequency can be shifted by more than ± 2 octaves compared to the original cutoff frequencies ($\frac{Lochfreq}{f_0}$).

At minimum filter quality (Q1) and switch setting "Normal", the bandpass output (BP) has a gain of -6 dB at f0 and falls by 6 dB per octave above and below fo. In the high pass (HP), frequencies lower than f0 are attenuated by 12 dB per octave, while frequencies higher than f0 up to 90 kHz (-3 dB) remain unaffected. The low-pass filter (TP) has a correspondingly inverse behavior, from 0 Hz to f0 there is no influence, after f0 the signal is attenuated by 12 dB per octave. The notch filter (LP) has a linear frequency response of less than -50 dB except for the notch. If the filter Q is increased with the corresponding control or via the external control inputs (exponential control characteristic: doubling of the Q per volt), a resonance peak at f0 appears in all four outputs, except in the notch filters output (LP) if the hole frequency is equal to fo. The gain in this resonance peak is numerically equal to Q, and the 3 dB bandwidth is equal to f0/Q. The Q can be varied from 0.5 to 512, changing the bandwidth from two octaves to 1/32 of a semitone. To avoid overloading the filter at high Q, the input signals must be attenuated accordingly using the NF 1, 2 controls. A red indicator signals a possible overload condition. In the "Begrenzt" switch setting, the resonance peak is reduced to 0 dB depending on the "Filtergüte Q" setting.

This seems to be a very close reproduction of the ARP2500 filter, which is a legendary state variable filter with epoxy cast sub modules for the current mirrors that form the OTA’s. These act as the gain cells for the Integrators.

Quirks and Tricks

The interesting quirk of this module is the insanely high resonance (Q) that can ironically be achieved in the “Normal” mode.
The “Begrenzt” mode on the other hand quiets the incoming signal to prevent clipping and thus gives the resonant peak a lot more dominance.
Another interesting feature that is also inspired by the arp 2500 filter (1047) is using a Tor / Trig signal to resonate the filter. This can create percussion sound with variable decay depending on the resonance set. This feature is called “Tastaturperkussion” and is located in a separate section on the upper right of the module.
Particularly interesting is the notch filter that has the ability to offset that notch from the filter’s regular corner frequency F0. This leads to interesting behaviors at high resonance settings emphasizing harmonics at the corner frequency, and a cut at the notch’s offset frequency.

Known defects

The left 2404 has a crackling $\frac{Lochfreq.}{f_0}$ knob

Translations

Begrenzt	Limited
Filtergüte	Resonance
Tastaturperkussion	Keyboard Percussion
Abklinggüte	Resonant Decay
QM/Q1	Resonance CV input
NF	Audio input
FM/f0	Cutoff CV
TP	Lowpass output
HP	Highpass output

BP	Bandpass output
LP	Notch output
Lochfreq.	Notch cutoff frequency

Tongenerator 2201/2202 (Oscillator)

Description

The 2201 cassette contains a voltage-controlled tone generator.
The frequency can be determined internally via an eight-octave step switch, a two-octave fine control and a transposition switch of nine octaves (audio/subaudio). The frequency can be changed over a range of twenty octaves (0.015 Hz to 16,000 Hz) via the external control inputs (three with full sensitivity of one octave per volt and two inputs that can be attenuated). Sine, triangle, square, pulse and sawtooth waveforms are available at separate outputs. Unlike the 2202 model, all waveforms are available simultaneously. Two additional outputs each supply one of the five waveforms independently of each other, one normal and inverse and the other with attenuable amplitude, possible zero line shift and display of the waveform via a control lamp.
The pulse width is adjustable from 0 to 100% and can be modulated via an attenuatable control input (Pbm). The maximum sensitivity of this modulation input is 10% per volt. All input impedances are greater than 50 kOhm, and the output impedance is 1 kOhm. The outputs of different generators can be connected together for summation without hesitation. The typical deviation of the exponential control characteristic in the audio range is ± 0.1 % from the ideal characteristic. After a warm-up time of one hour, the frequency changes by 1/60 of a semitone per hour at an ambient temperature of 25°C ±10°C. This generator therefore outperforms any orchestral instrument in terms of frequency stability. The distortion factor of the sine function is typically less than 0.25 % at 1000 Hz. The rise and fall times for the square wave and pulse and the return sawtooth edge are around one microsecond.

The 2202 cassette contains two independent voltage-controlled tone generators. Both are identical in function and design. The sine, triangle, square, pulse and sawtooth waveforms are available at the switchable output.

Quirks and Tricks

- These are not just traditional oscillators but also the systems LFOs and main clock sources

Known defects

2201:

- Strange glide on freq change, could there be correlation to the shit “Fein” knob that is probably a fix from somebody
- Mod matrix input 3 seems broken

2202 Left:

- Left channel lamp is constantly on
- Right channel lamp is broken

2202 Right:

- Right channel extremely low volume on pulse waveform mode
- Both channel lamps are broken

Translations

Bereich	Range
NF	Audio input
FM/f0	Pitch CV
Pulsbreite	Pulse width
Pbm	Pulse width modulation

Abschwächer 2302 (VCA)

Description

The 2302 cassette contains two independent voltage-controlled amplifiers. Both amplifiers are identical in function and design.

Two mixable signals at the signal inputs (NF1, NF2) can be attenuated in amplitude by more than 80 dB with switchable DC or AC voltage coupling, whereby a linear or exponential control characteristic can be selected. An overload control indicates via a lamp that the sum of the signal voltages exceeds the maximum permissible value of ± 10 volts. Three control voltage inputs at the top of the module with a maximum sensitivity of -10 dB per volt (with exponential characteristic set) and two inputs (AM1, AM2) with attenuable sensitivity are available. In both operating modes, the attenuator reaches gain 1 when the sum of all control voltages is +10 volts. The signal-to-noise ratio is greater than 70 dB in relation to full scale ± 10 volts. The distortion factor at 1000 Hz is less than 1% in the attenuation range 0 to -50 dB. The upper cut-off frequency is over 50 kHz.

Known defects

The upper 2202 has several defects:

- Mod matrix channel 10 broken
- Clipping indicator broken on both channels
- The right channel linear mode is broken

Translations

NF	Audio input
AM/A0	VCA CV input
NF-Kopplung	Audio input coupling
Gleichspg	DC
Wechselspg	AC
Steuercharakteristik	Control voltage curve

Addierer 3202 (Mixer)

Description

The 3202 cassette contains two independent 4 channel mixers. Both can be turned on and off via buttons or the matrix inputs on top. The module can be used to phase invert the signals via a toggle switch and has a red clipping indicator lamp per channel.

Known defects

- “Ein” lamps broken on both channels
- Sometimes turns the channels off by itself especially when connecting or disconnecting certain parts of the system
- Some noticeable leakage in off state

Steuergenerator 2122 (Envelope Generator)

Description

The 2122 cassette contains two independent envelope generators. Both are identical in function and design.

The available output voltage can be determined by five adjustable parameters (delay time, decay time, sustain level and release time). These types of envelope generators are commonly referred to as HADSR. This device operates exponentially during rise and fall times. In the idle state, the output voltage is 0 volts. After a start signal is applied, which can be a tor signal or a tor and a trig signal, the output voltage rises from 0 volts to +10 volts with the selected rise time (0.5 ms to 2 s) after the set (switchable) delay time of 1 ms to 3 s (indicated by a red indicator lamp) has elapsed. It then drops to the holding level (0 to +10 volts) with the decay time (1 ms to 3 s). As long as a tor signal is present (indicated by a green indicator lamp), the output voltage retains this value and then drops to 0 volts with the release time (1 ms to 3 s). With the exception of the delay, all times can be extended by a factor of 10 via the switches at the bottom of the module. The control signal generated in this way runs from 0 to +10 volts at the “Normal” output and from 0 to -10 volts at the “Invers” output.

This “ADSR curve” is generally required to give an audio signal an amplitude envelope with the Abschwächer 2302 and a formant contour with the Resonanzfilter 2404 or to control other voltage controllable units. If the “Tor + Trigger” operating mode is selected with the “Startsignal” switch, a control signal is only generated if both a Tor and a Trig signal are present. The advantage of this operating mode is that if a Tor signal is present, each Trig pulse from the hold level results in a renewed rise to +10 volts with subsequent decay to the hold level. The indicator lamp in the button already responds to the Tor signal.

Known defects

Steuergenerator 2122 A:

- Left channel:
  - Top input 5 is broken
  - Not responding to mod matrix but to banana jacks
- Right channel
  -

Steuergenerator 2122 B:

- Left channel:
  -
- Right channel
  - Top input 6 is broken
  - Not responding to mod matrix but to banana jacks

Translations

Verzögerung	Delay / Hold time
Anstiegszeit	Attack time
1. Abklingzeit	Decay time
Haltepegel	Sustain level
2.Abklingzeit	Release time

Zufallsgenerator 2502 (S&H)

Description

This cassette contains two independent units, each with an instantaneous value memory, a noise generator and a voltage-controlled clock generator. The units are identical in function and design.

They are used to generate control signals that are random or periodic in nature. The internal noise generator is connected to the input of the memory via an attenuator ("Rauschen int."), with an additional signal ("Signal ext." - bottom) that can be added via a further attenuator and unattenuated via the "Signal ext." input (top). After the arrival of a clock pulse from the internal generator, the "Manuell" button or an externally generated pulse, the voltage of the signal currently present is recorded in the memory and stored until the arrival of the next clock pulse. In this way, a series of individual random voltage values can be generated by sampling the internal noise signal or a series of periodic voltage sequences by sampling an external periodic signal. If such a voltage sequence is fed, for example, to a voltage-controlled oscillator (tone generator 2201 or 2202), a series of random or periodically changing pitches is generated. Sampling a slow sawtooth produces a staircase voltage that results in a scale or arpeggio.

The frequency of the internal clock generator can be voltage-controlled over more than 15 octaves and can be varied in two ranges from 0.03 Hz to 400 Hz using the controls on the front panel. The FM control input (top) has a sensitivity of 1 octave per volt, while the FM input (bottom) can be switched off (int/ext) and attenuated (clock frequency mod). In the "int" position, the sampled signal itself is used for modulation. An externally supplied clock signal (clock ext up and down) can be used either as a trigger signal or as a gate signal. In trigger mode, a sampling pulse is generated when a clock voltage level of +3.5 volts is exceeded. In gate mode, the output follows the input when the clock voltage level of +9 volts is exceeded and the last value is saved when it subsequently falls below this level. The storage pulse with a length of 10 µs is available at the "SP"

output as a voltage jump from 0 to +10 volts. It is always generated when a clock pulse is fed to the memory internally or externally (only in trigger mode). The internal clock generator A can be used to control both memories simultaneously.

Quirks and Tricks

- This module can be used for classic sample and hold style modulations.

Known defects

- Left channels “Taktgenerator” is broken but manual triggering is still possible

Translations

Rauschen	Noise
Taktfrequenz	Clock speed
Takt ext	External Clock
FM	Clock speed CV
Rauschen int	Internal noise
Ausgang	Output
Speicher	Sample and Hold memory cell

Modulator 2802 (Ringmod)

Description

The 2802 cassette contains two independent ring modulators. Both are identical in function and structure.

The modulator is specially designed to generate sounds with extensive harmonic or inharmonic overtones. The two inputs NF A and B (bandwidth: 0 to 20,000 Hz) are linked together by the modulation process according to the mathematical formula A*B/10. If A and B are sinusoidal signals of the same amplitude with the frequency f1 and f2, the spectrum of the output signal consists only of the sum (f1+f2) and the difference (f1-f2). The original frequencies f1 and f2 are suppressed by more than 60 dB. If A and B are complex waveforms (e.g. sawtooth or any other sound), the output signal contains the sum and difference frequencies of all fundamental and harmonic waves.

If the input signals are selected skilfully, the modulator can be used to generate subharmonic partials, as is common for synthesizing bell and gong sounds. The modulator can be switched on and off via two illuminated buttons (Mod, Unmod) or via external gate and trigger signals. In "Unmod" mode, the signal is sent to the output and its amplitude can be attenuated using a control (Unmod gain). In this case, the signal B is replaced by a DC voltage of 0 to +10 volts, which results in the amplitude of the output signal from the transfer function A*B/10.

In the "Mod" operating mode, two DC voltages (enharmonically preselectable control voltages) are connected to the two separate outputs A and B, which are used to detune the generators that supply the input signals A and B. In this way, the modulated output signal can be modulated. This allows the pitch of the modulated output signal to be brought into a desired relationship with the unmodulated signal. The "Stimmung" control influences both outputs in the same way, while the "Intervall" control only changes output B.

Translations

NF	Audio input
Verstärkung	Gain
Stimmung	Intonation
Enharmonisch vorwählbare Steuerspannungen	*Black magic*

Rauschgenerator 2002 (Noise Generator)

Description

This cassette contains two independent noise generators, each with a filter with voltage-controlled frequency and quality and switchable characteristics. Both generators are identical in function and design.

The filter frequency can be shifted manually over eight octaves (coarse frequency) and two octaves (fine frequency) or voltage-controlled over ten octaves (16 to 16,000 Hz). The filter has the behavior of a high-pass (HP), band-pass (BP) or low-pass (TP) filter. The quality (Q) can also be varied manually or voltage-controlled from 0.5 to approx. 100. An input (f0) with a maximum sensitivity of 1 octave per volt and an attenuatable input (FM) are available for voltage control of the frequency. An attenuatable input (QM) with inverse characteristic (higher voltage corresponds to lower quality) is available to control the quality.

The available output voltages are: white or pink noise with attenuable amplitude, low-frequency noise (random noise) with variable rate of change and additionally filtered pink noise.

The combination of noise generator - controllable filter enables the generation of infinitely variable narrowband noise (e.g. third octave noise), as required for wind noise and whistling voices.

Known defects

Output 8 behaves a bit differently to output 3 (Zufallsrauschen)

Translation

FM/f0	Filter CV
QM	Resonance CV
Filtergüte	Resonance
HP	Highpass
BP	Bandpass
TP	Lowpass
Weiß	White
Rosa	Pink
Rauschspektrum	Noise spectrum
Ausgangsamplitude	Output volume
Änderungsrate	Rate of change in noise

Hüllkurvenfolger 2602 (Envelope Follower)

Description

This module features two independent envelope followers. A signal can be inserted via the 6.35mm input jack on the front panel. A comparator is used for generating a Trig and Tor signal dependent on the threshold set by the “Schwelle” knob. The left envelope follower features a linear characteristic while the right one has a logarithmic curve. The time constant / cutoff frequency can be adjusted by the τ_{Ein} knobs. The blue “Verstärkung” knobs feature a variable gain on the input signals and have a three way range switch next to them. The module can be utilized for interconnecting the SynLab to other musical systems.

Quirks and Tricks

Very interesting for sidechaining certain aspects of the synthesis
E.g. traditional ducking sidechaining of kick and bass
Bass patch with VCA (2302) at end of chain
Kick drum -> “NF-Eingang” 6.35mm @2602
Bottom 5 (A) @2602 -> Bottom 3 (AM1) @2302
Adjustment of 2602 to speed and groove

Known defects

Right “Sperre” lamp is broken, but the mod matrix for it still works

Translations

NF-Eingang	Audio input
Sperre	Blocking comparator
Schwelle	Threshold
Folger	Follower
Hüllkurve	Envelope
τ_{Ein}	Time constant / Slew rate

Verstärkung	Amplification

Example Patch