Sample & Hold (S\H) Section

LFO NOISE   S&H   ON   INT   EXT

S\H IN   ACCENT   CLOCK   BPM

S\H

S\H IN
Selects the parameter that the S&H will "sample" to input the note in the capacitor sequencer.

ACCENT
The S&H track can be used as an accent track. If the S&H track is used for accents, the S&H gate control will be fired with ENV2 on Track 4. If the S&H is not used for accents, the S&H gate control will remain on Track 2.

CLOCK
If the clock source is switched to "internal", the LEPLOOP will use it's own 24pp resolution BPM clock.

If the clock source is switched to "external", the LEPLOOP will sync to MIDI clock or Sync 24 and will receive MIDI notes for trigger the 5 tracks.

THE LEPLOOP WILL NOT RESPOND TO NOTE CHANGES VIA MIDI.

In order to advance the analog capacitor sequencer by MIDI note-on message. MIDI clock source is not necessary, you can disable MIDI clock signal by hitting SHIFT+ MENU

ANALOG SEQUENCER
The S&H input sample the lfo or noise generator and it will store the CV value for that input and maintain it until the next time it cycles through.

What this means is that the 16 capacitors that store the values for the S&H will actually "sample" the analog value of the LFO or Noise (and what they trigger, be it an oscillator or envelope) and store it in it's analog memory. Thusly, the LEPLOOP has a 16-step analog recorder, much like an analog delay. Over time, as the analog sequencer cycles through its pattern, the signal will degrade and the sound will change. This is because the capacitor can only store the signal for a limited amount of time.

The analog sequencer is digitally controlled tempo-wise, and will work in conjunction with the digital track sequencer.

Mixer Section

CASSA   VCA1   VCA2   VCF   MIXER
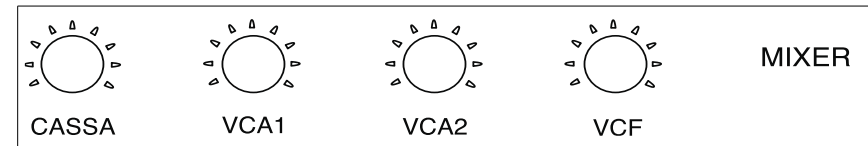
MIXER

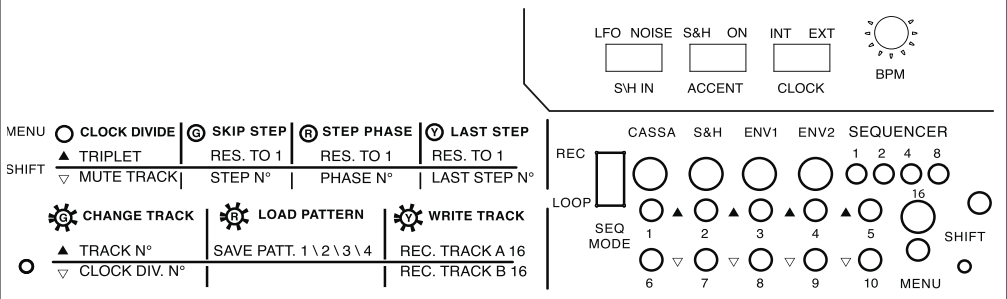These four knobs control the volume of the :

Bass Drum (CASSA)
VCA1
VCA2
VCF
The Bass Drum (CASSA) has it's own dedicated output, when connected the CASSA volume knobs remain active for the MIX output.

Digital Sequencer Section

LFO NOISE S&H ON   INT EXT

S\H IN   ACCENT   CLOCK   BPM

MENU   ○ CLOCK DIVIDE   Ⓖ SKIP STEP   Ⓡ STEP PHASE   Ⓨ LAST STEP

SHIFT   ▲ TRIPLET   RES. TO 1   RES. TO 1   RES. TO 1

▽ MUTE TRACK   STEP N°   PHASE N°   LAST STEP N°

⚙ CHANGE TRACK   Ⓡ LOAD PATTERN   Ⓨ WRITE TRACK

▲ TRACK N°   SAVE PATT. 1\2\3\4   REC. TRACK A 16

▽ CLOCK DIV. N°   REC. TRACK B 16

REC
LOOP
SEQ MODE

CASSA S&H ENV1 ENV2 SEQUENCER

1 2 4 8

1 2 3 4 5   16

6 7 8 9 10   MENU

SHIFT

There are four digital instruments (signified by colored LED lights), and the analog sequencer (signified by small red LED lights)

GREEN: Bass Drum (Cassa)
RED: S&H or Bass Drum Accent
YELLOW: ENV1
BLUE: ENV2 or ENV2+S&H

The maximum length for each digital track is 32 Beats. A digital track can be divided into sub tracks. The maximum pattern length for the analog sequencer is 16 notes. The analog sequencer may also be divided. The analog sequencer output may be routed to VCO1, VCO2 and CUT MOD.
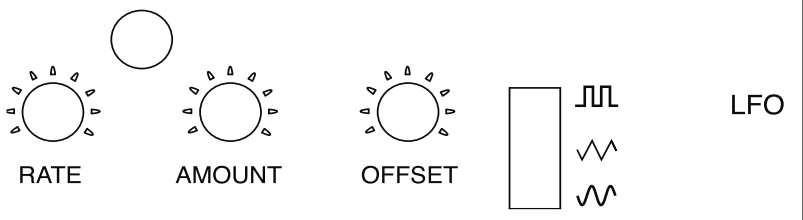
BPM: Sets the speed of the internal clock (ie. execution speed).

CLOCK: Select internal clock (BPM) or external (MIDI).

MENU: Navigates through the 7 available menus, each menu has a different colored LED and set parameters.

SHIFT: Alternate function for the menu keys.

LFO Section

RATE   AMOUNT   OFFSET

LFO

LFO

RATE
Controls the speed of the low frequency oscillator.

AMOUNT
Controls the amount of LFO applied to the OSC1 , OSC2, CUT MOD, RES MOD, VCA1 & S&H. A low setting will cause the parameters above to be affected in a gentle way. Increase the amount and the parameters will be affected more wildly.

The LFO is used for repetitive tasks, and is handy for tasks that need to be automated.

You will notice a white LED blinking in time with the LFO cycle.

OFFSET
Determines the positive or negative offset of the LFO waveform, when in central position the waveform it's centered.

SQUARE, TRIANGLE OR SINEWAVE SWITCH
Determines how the LFO will behave. A Square wave will cause the LFO to sound choppy, a Triangle wave will be less choppy, and a Sine wave will cause a mild rise and fall of the LFO signal.

Bass Drum (Cassa) Section

CASSA

FREQ   RESONANCE   DIST   ACCENT
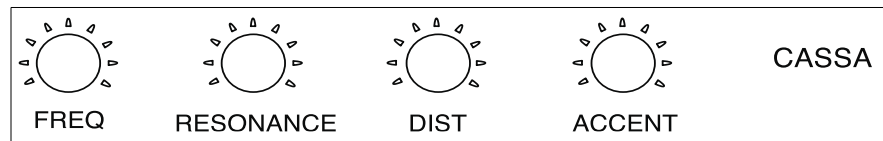
CASSA

FREQ
Controls the pitch of the bass drum oscillator.

RESONANCE
Controls the brightness of the bass drum oscillator. Higher levels of resonance will cause the bass drum to create a warped, nasty bass drum sound.
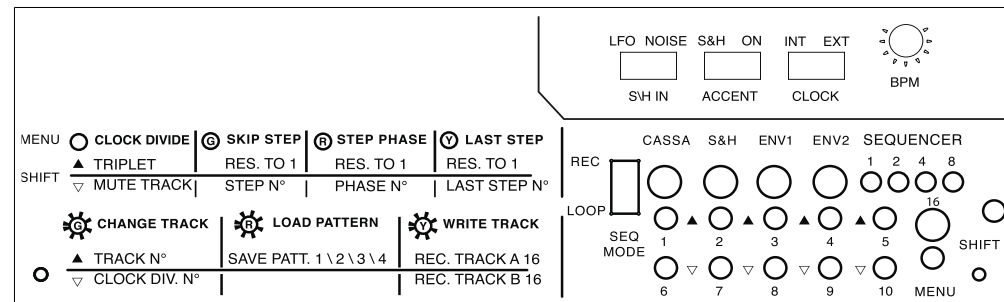
DIST
Add more distortion for an overdriven, blown-speaker sound.

ACCENT
When used in conjunction with the sequencer, the ACCENT control will create a loud, accented bass drum sound.

Analog Sequencer Section

SEQ MODE: When in REC position notes from S&H are recorded on analog sequencer and delayed by 1 loop at the output.
In the LOOP position notes are not recorded, those present in memory are continuously looped. When powered up, the analog sequencer is empty, no output will be sent from analog sequencer if SEQMODE is not in the REC position.

Each instrument can be sequenced as a rhythmic track and has variable parameters.

TRACK: Select the rhythmic track
7 tracks are available, and each track is 32 bits in length .
3 of the pattern tracks are fixed (non-editable) and 4 are user-programmable.

STEP PHASE: The bit-position being read inside a track (advances continuosly and loops at the end). Changing this parameter will shift a track played by an instrument to a different bit-position. If STEP is set to a value other than 1 , this parameter will switch between subtracks.

CLOCK DIVIDE: The execution speed for each instrument; the internal clock is divided by CPP (clocks per pulse). The CPP can be 3, 6, 1 2 or 24 in triplet mode and 2, 4, 8 or 16 in duplex mode. A higher CPP setting increases the length of time between pulses, resulting in slower tempi.

LAST STEP: The last position read by the sequencer before returning to the beginning of the sequence.

STEP: The number of bit-positions skipped when sequencer reads the track, some examples:

0 = track stopped.

1 = normal increment (1, 2, 3, 4, 5...).

2 = double increment (1, 3, 5, 7, 9... or 2, 4, 6, 8, 10... dependent on PHASE).

3 = triple increment (1, 4, 7, 10, 13... or 2, 5, 8, 11, 14... or 3, 6, 9, 12, 15...).

30 = reverse double increment (...10, 8, 6, 4, 2 or ...9, 7, 5, 3, 1 dependent on PHASE).

31 = reverse (5, 4, 3, 2, 1 ...).

If STEP = 2, the track is split into two different 16-step subtracks which are selected with PHASE.

If STEP = 4, the track is split into four different 8-step subtracks.

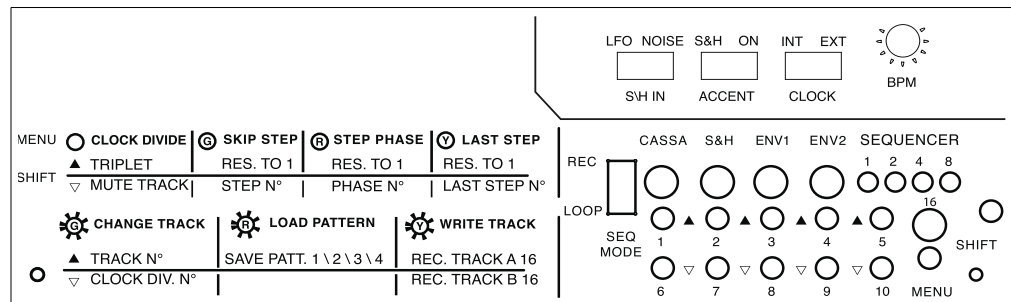Different combinations of LAST STEP and STEP will generate nearly every possible metric.

ABOUT THE ANALOG SEQUENCER
This is a true analog sequencer because notes are stored into 16 capacitors switched by analog multiplexer.
As the capacitors are subject to discharge The note pitches will slowly decrease.
It's not possible to store the note value in memory.

Digital Sequencer Section

LFO NOISE S&H ON INT EXT
S\H IN ACCENT CLOCK BPM

MENU	CLOCK DIVIDE	SKIP STEP	STEP PHASE	LAST STEP		CASSA S&H ENV1 ENV2 SEQUENCER
SHIFT	▲ TRIPLET	RES. TO 1	RES. TO 1	RES. TO 1	REC	1 2 4 8
	▽ MUTE TRACK	STEP N°	PHASE N°	LAST STEP N°	LOOP	16
	⚙ CHANGE TRACK	® LOAD PATTERN	▽ WRITE TRACK		SEQ MODE	1 2 3 4 5 SHIFT
	▲ TRACK N°	SAVE PATT. 1 \ 2 \ 3 \ 4	REC. TRACK A 16			6 7 8 9 10 MENU
	▽ CLOCK DIV. N°		REC. TRACK B 16			

MENU 1 : CLOCK DIVIDE (MENU LED = OFF)

Double or Half speed

SHIFT ▲ MUTE ON/OFF if ON the instrument will not play.
SHIFT ▽ Displays binary value for clock divide parameter

The eight possible CLOCK DIVIDE values are:

0 = 1/1   4 = 1/16
1 = 1/2   5 = 1/32
2 = 1/4   6 = t riplet of 1/8
3 = 1/8   7 = t riplet of 1/16

Only for the ANALOG SEQUENCER:
When CLOCK DIVIDE = 0 analog sequencer increments are controlled by ENV2 track (BLUE led):

SHIFT ▲ Toggles RESET MODE analog sequencer is reset to first step when S/H RED led track blinks
SHIFT ▽ Set clock divide to 0 to enable ENV2 control (see above)

MENU 2: SKIP STEP (MENU LED = GREEN)

Increase/Decrease STEP parameter for each instrument

SHIFT ▲ Set to default (STEP=1)
SHIFT ▽ Displays binary value for STEP parameter

MENU 3: PHASE (MENU LED = RED)

Increase/Decrease PHASE parameter

SHIFT ▲ Set to default (PHASE=0)
SHIFT ▽ Displays binary value for PHASE

MENU 4: LAST STEP (MENU LED = YELLOW)

Increase/Decrease LAST STEP PARAMETER

SHIFT ▲ Set to default (LAST STEP=32)
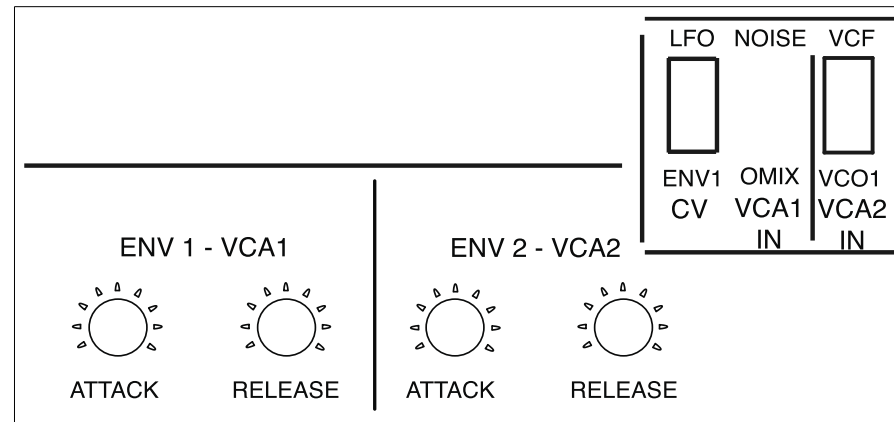SHIFT ▽ Displays binary value for NUM

MENU 5: CHANGE TRACK (MENU LED = BLINKING GREEN)

Increase/Decrease TRACK number (0 thru 7)

SHIFT ▲ Displays the binary value for the TRACK
SHIFT ▽ Displays the binary value for the clock counter

∞

Envelope (ENV) / Voltage Controlled Ampli?er (VCA) Section

LFO NOISE VCF
ENV1 OMIX VCO1
CV VCA1 VCA2
IN IN

ENV 1 - VCA1   ENV 2 - VCA2

ATTACK   RELEASE   ATTACK   RELEASE

ENV 1 – ENV2

ENV 1
Controls the Attack and Release of either VCA1 or CUT MOD. This allows the user to create a ramp up Attack and a ramp down Release.

ENV 2
Controls the Attack and Release of either VCA2 or RES MOD. This allows the user to create a ramp up Attack and a ramp down Release.

VCA 1 – VCA 2

The VCA controls the level of the input signal with a control-voltage.

VCA 1 IN
This switch allows the user to choose between one of two input signals: NOISE or OSC MIX.
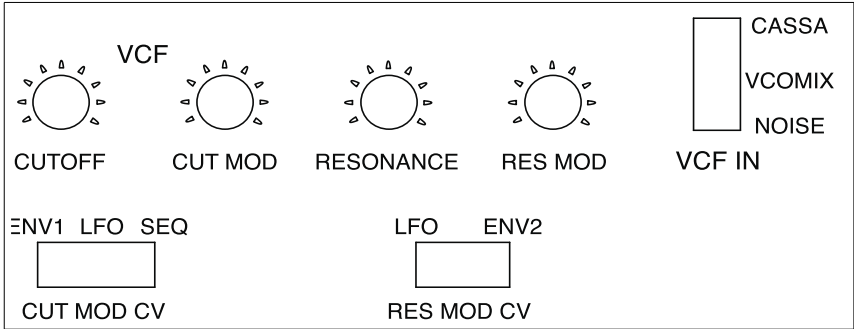
CV
This switch allows the user to choose between either the LFO or ENV1 as the control voltage.

VCA 2 IN
This switch allows the user to choose between one of two input signals: VCF or OSC1 .

∞

Filter Section

VCF

CUTOFF
This knob removes high frequency audio from the signal path.

CUTMOD
This knob controls the amount of modulation received from either ENV1 , LFO or the ANALOG SEQUENCER.

RESONANCE
this knob controls the resonance of the ?lter. The ?lter will self-oscillate above a certain point.

RES MOD
This knob controls the amount of modulation received from either the LFO or ENV2.

CUTMOD CV
This switch selects whether ENV1 , LFO or the ANALOG SEQUENCER modulates the CUTOFF.

RES MOD CV
This switch controls whether the RESONANCE is modulated by the LFO or ENV2.

VCF IN
This switch controls whether audio from the KICK DRUM (CASSA), VCO MIXER or WHITE NOISE is ?ltered.

Digital Sequencer Section
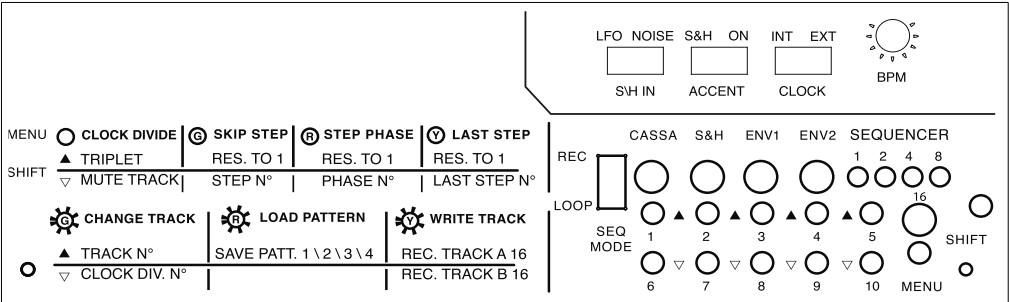
MENU 6: LOAD/SAVE (MENU LED = BLINKING RED)

In this case, the ten keys have a different meaning than previous menus; each key loads a complete set of parameters for all instruments (ie. switches between one setup and another). There are 6 fixed setups and 4 are user defined. Keys 1, 2, 3, 4 load user parameter setups. Keys 5, 6, 7, 8, 9, 1 0 load fixed parameter setups. To save a user setup, press SHIFT along with one key between 1 thru 4. Each configuration loads a complete set of parameters (clock divide, step, last step, step phase, track) for each instrument plus one set for the analog sequencer.

MENU 7: RECORDING RHYTHM TRACK (MENU LED = BLINKING YELLOW)

KEYS 1, 2, 3, 4

Selects one of four recordable tracks and its corresponding instrument. Once the pattern has been selected the whole sequencer stops.
Press ▲ on selected track to insert a note (yellow led on).
Press ▽ on selected track to insert a pause (yellow led off).
The number of step being inserted is shown on the four sequencer LED lights (1, 2, 4, 8) and the green LED light (16). At the end of a recording, the sequencer restarts and new track is saved to memory.
SHIFT Allows recording of two separate 16 step subtracks A and B. Press SHIFT together with 1, 2, 3 or 4 for recording A subtrack. Press SHIFT together with 5, 6, 7 or 8 for recording B subtrack.
The 2 subtracks can be changed in PHASE menu.
The PHASE is set automatically according with subtrack that has been recorded.

TIP : in any menu to quickly return to MENU 1 : CLOCK DIVIDE (MUNU LED = OFF)
   hold down MENU button for more than 1sec.

Digital Sequencer Section

Oscillator Section

DISPLAY PARAMETERS IN BINARY CODE

Some of the above menus have a "display binary value" function that enables the monitoring of some parameters. By holding SHIFT down press the ▽ key for the instrument that you want to monitor.
While the key is held down, the four sequencer LEDs and the menu LED show a binary configuration. The value of the parameter is obtained by summing the numbers of all LEDs that are lit (1, 2, 4, 8, 16). For example, if you are in last step menu (YELLOW) and press shift + 6, led 4 and 8 may lit this means that the value of last step for cassa is 4 + 8 = 12 .

RHYTM TRACKS : HOW THEY ARE MADE AND HOW THEY ARE PLAYED

Tracks 1 to 3 are internally embedded in firmware and are not editable. Each track is a sequence of 32 bits representing 32 steps, if bit = 1 the instrument plays, if the bit = 0 it doesn't. At the end of the sequence the cycle resets to beginning. Here is the bit sequence for track 1 .

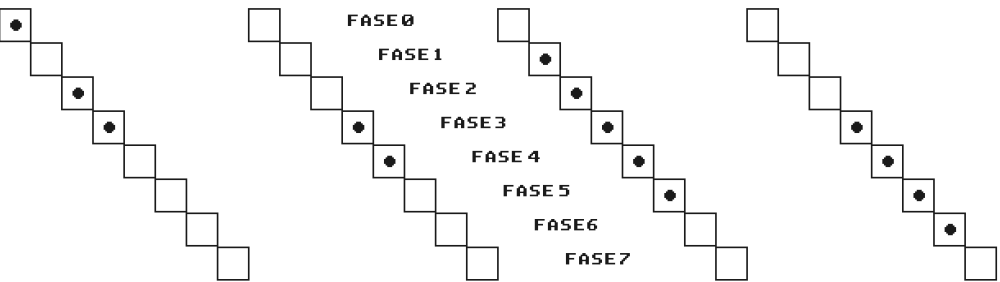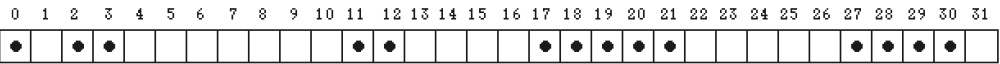| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
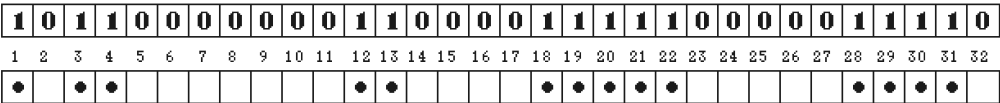
Internal tracks contain basic rhythms that would be a waste to program in user memory. Track 1 has the step parameters split into 8 basic rhythms, each rhythm is 4 steps long. To play these rhythms, the parameter STEP has to be set to 8 .
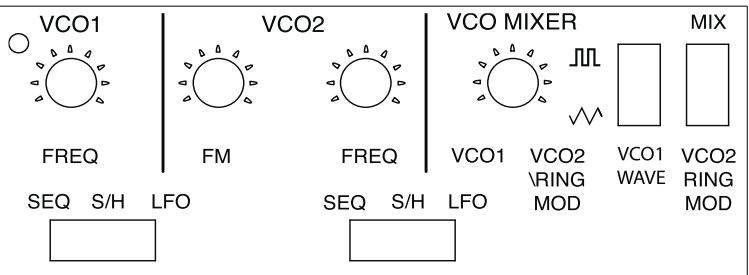
When STEP=8 the sequencer jumps every time by 8 steps (see picture).

After 4 jumps by 8 step the sequencer has completed a full loop and is back at the beginning.

With the PHASE parameter you can skip between the 8 basic rhythms.

FASE0
FASE1
FASE2
FASE3
FASE4
FASE5
FASE6
FASE7

VCO1 — FREQ — SEQ S/H LFO

VCO2 — FM — FREQ — SEQ S/H LFO

VCO MIXER — VCO1 VCO2\RING MOD

MIX — VCO1 WAVE VCO2 RING MOD

VCO1

SEQ-S/H-LFO
Selects the source for VCO1 pitch: Sequencer, Sample & Hold or LFO.

VCO1 FREQ
By turning this knob, you are able to change the pitch (frequency) of VCO1 and the sequenced melody will be transposed up or down in pitch.

VCO1 WAVE
There are two waveforms available for selection: Square or Triangle Wave.

VCO2

SEQ-S/H-LFO
Selects the source for VCO2 pitch: Sequencer, Sample & Hold or LFO.

VCO2 FREQ
By turning this knob, the user is able to change the pitch (frequency) of VCO2, and the sequenced melody will be transposed up or down in pitch.

VCO2 WAVE
There is one waveform available for selection: Sawtooth wave.

VCO2 FM
This knob allows the user to Frequency Modulate VCO2 with VCO1.

VCO Mixer

VCO MIXER KNOB
The VCO MIXER knob controls the volume balance level of OSC1 & OSC2. Turn the knob completely to the left and only OSC1 will sound. Turn the knob completely to the right and only OSC2 will sound.

VCO1 WAVE SWITCH
This switch allows the user to change the wave of VCO1 from Square wave to Triangle wave.

MIX/VCO1 RING MOD SWITCH
With the switch in the "up" position, the VCO MIXER KNOB will balance the volume of the oscillators. With the switch in the "down" position, the VCO MIXER KNOB controls the amount of ring modulation for VCO2 for maximum\correct effect put the knob all right on vco2\ring mod.
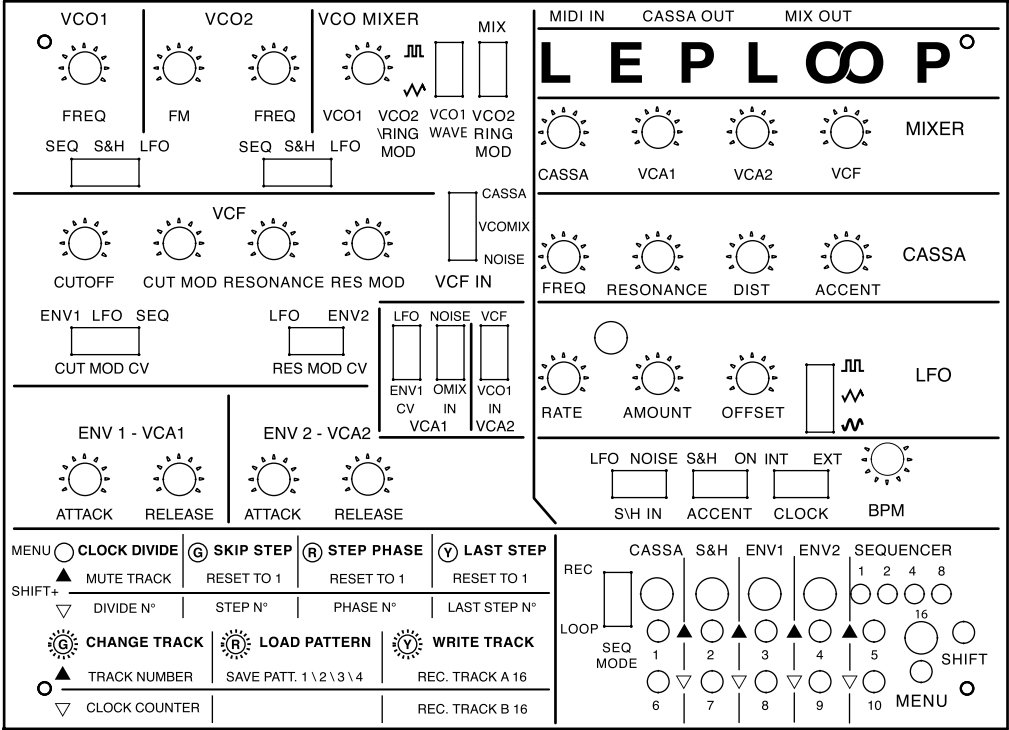
Introduction

Laboratorio Elettronico Popolare (L.E.P.) is proud to present to you
a one-of-a kind analog synthesizer, sequencerand drum machine :
THE LEPLOOP
Small in nature but aggressive in sound, the user will be able to create a variety of analog timbres and beats.
The LEPLOOP was designed to be a minimalistic electronic music live-performance groove-box,
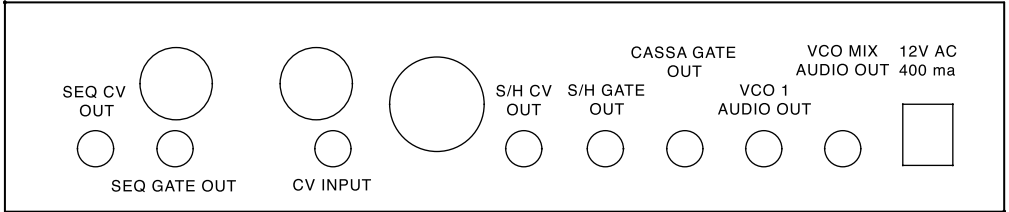which can be used to create a variety of electronic musical style.
The LEPLOOP can be synched via MIDI to another LEPLOOP for tempo-synched operation
or to another MIDI device or sequencer to receive sequence start&stop instruction.
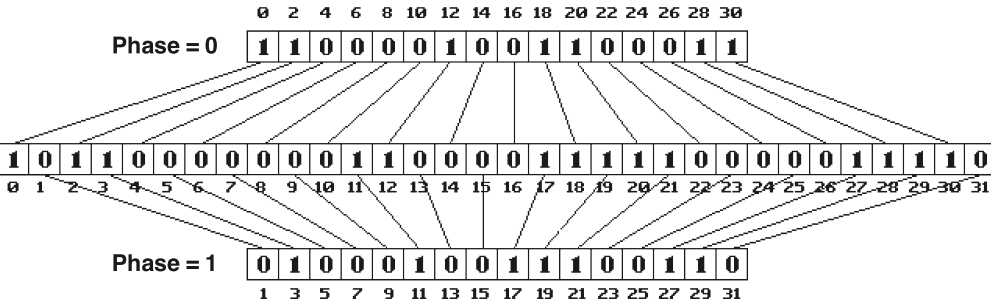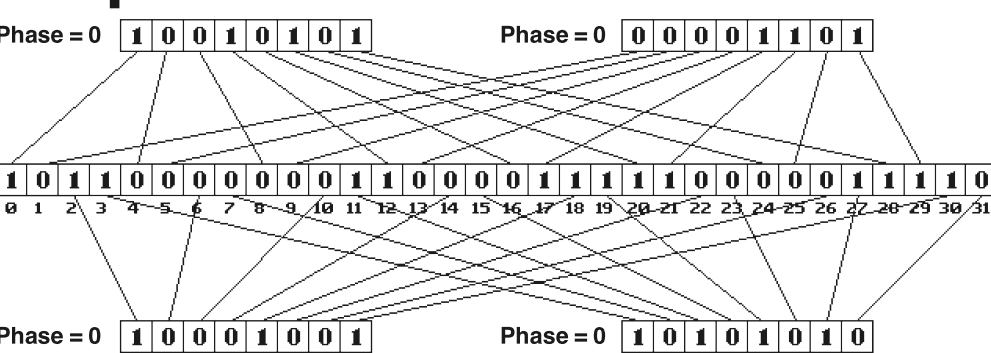Read further to find out what else your LEPLOOP can do.
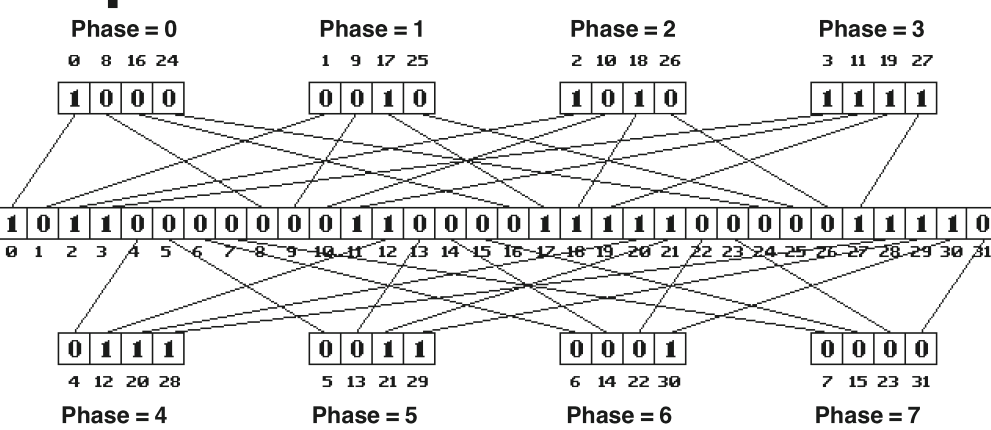
Front Panel

Back Panel

Step = 2

	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Phase = 0	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	1

1 0 1 1 0 0 0 0 0 0 1 1 0 0 0 1 1 1 1 1 0 0 0 0 0 1 1 1 1 0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
Phase = 1	0	1	0	0	0	1	0	0	1	1	1	0	0	1	1	0

Step = 4

Phase = 0 1 0 0 1 0 1 0 1   **Phase = 0** 0 0 0 0 1 1 0 1

1 0 1 1 0 0 0 0 0 0 1 1 0 0 0 1 1 1 1 1 0 0 0 0 0 1 1 1 1 0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Phase = 0 1 0 0 0 1 0 0 1   **Phase = 0** 1 0 1 0 1 0 1 0

Step = 8

Phase = 0	Phase = 1	Phase = 2	Phase = 3
0 8 16 24	1 9 17 25	2 10 18 26	3 11 19 27
1 0 0 0	0 0 1 0	1 0 1 0	1 1 1 1

1 0 1 1 0 0 0 0 0 0 1 1 0 0 0 1 1 1 1 1 0 0 0 0 0 1 1 1 1 0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

| 0 1 1 1	0 0 1 1	0 0 0 1	0 0 0 0
4 12 20 28	5 13 21 29	6 14 22 30	7 15 23 31
Phase = 4	Phase = 5	Phase = 6	Phase = 7

Midi Implementation

When you turn on the LepLoop is in MIDI OMNI mode, it receives on all MIDI CHANNELS.
For set a specific MIDI channel (1to16), go on **menu 5 = blinking GREEN led and hit the button n° 5 or n°10.**
If you press up button n° 5 go on MIDI ch. 1, down button n° 10 go on MIDI ch. 16.
For back in MIDI OMNI mode hit SHIFT + UP BUTTON N°5\DOWN BUTTON N° 10.

The LepLoop can receive MIDI clock, Start and Stop messages.
For disable the midi clock hold, SHIFT + MENU = CLOCK IN ON\OFF
With custom cables it is possible receive DIN synch clock signal and synch 2 LepLoop

4   5   1   3

LepLoop IN   Synch24 \ DIN OUT
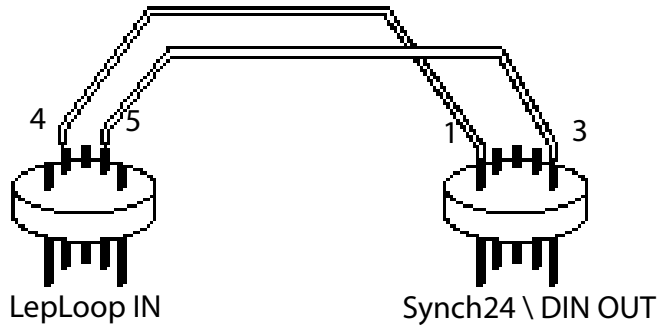
Midi Implementation
each group of 16 note have a different trigger combination.

C -2 – D# -1   TRIGGER ENV2 + SEQUENCER STEP ADVANCE

F -1 – G0   TRIGGER OF THE 4CH SHORT GATE TIME

G#0 – B1   SEQUENCER STEP BY STEP ADVANCE

C#2 – D#3   TRIGGER 4CH FREE GATE TIME (DEPEND ON MIDI NOTE DURATION)

E3 – G4   TRIGGER ENV2 + SEQUENCER STEP ADVANCE

A4 – B5   TRIGGER OF THE 4CH SHORT GATE TIME

C6 – D#7   SEQUENCER STEP BY STEP ADVANCE

F7 – G8   TRIGGER 4CH FREE GATE TIME (DEPEND ON MIDI NOTE DURATION)

There are various triggering combinations, such as:

Cassa   A4
S/H   A#4
Cassa + S/H   B4
ENV1   C5
Cassa + ENV1   C#5

TECHNICAL DETAIL

All the sound generators are analog.
12 Volts AC, 400 mA.
Made in Milano, Italy 2010

LABORATORIO ELETTRONICO POPOLARE

LEP

- 2 Voltage Controlled Oscillators (2 VCO's)
- Kick Drum Generator With Resonance, Distortion and Accent Controls
- White Noise Generator
- 24 dB/Octave Low Pass Voltage Controlled Filter (VCF)
- 2 Voltage Controlled Amlifiers (2 VCAs)
- 2 Attack-Release Envelope Generators (2 A-R ENV's)
- Low Frequency OSC
- 16 Step Analog Sequencer
- 4 Track, 32 Step Digital Sequencer
- 4 Channel Mixer

L.E.P. Laboratories, Italy Presents:

LEPLOOP

Synthesizer, Sequencer & Drum Machine
Created by Peppo Lasagna & Tonylight

User Manual
User Manual
User Manual
User Manual

Manual Designed By KM kirk markarian