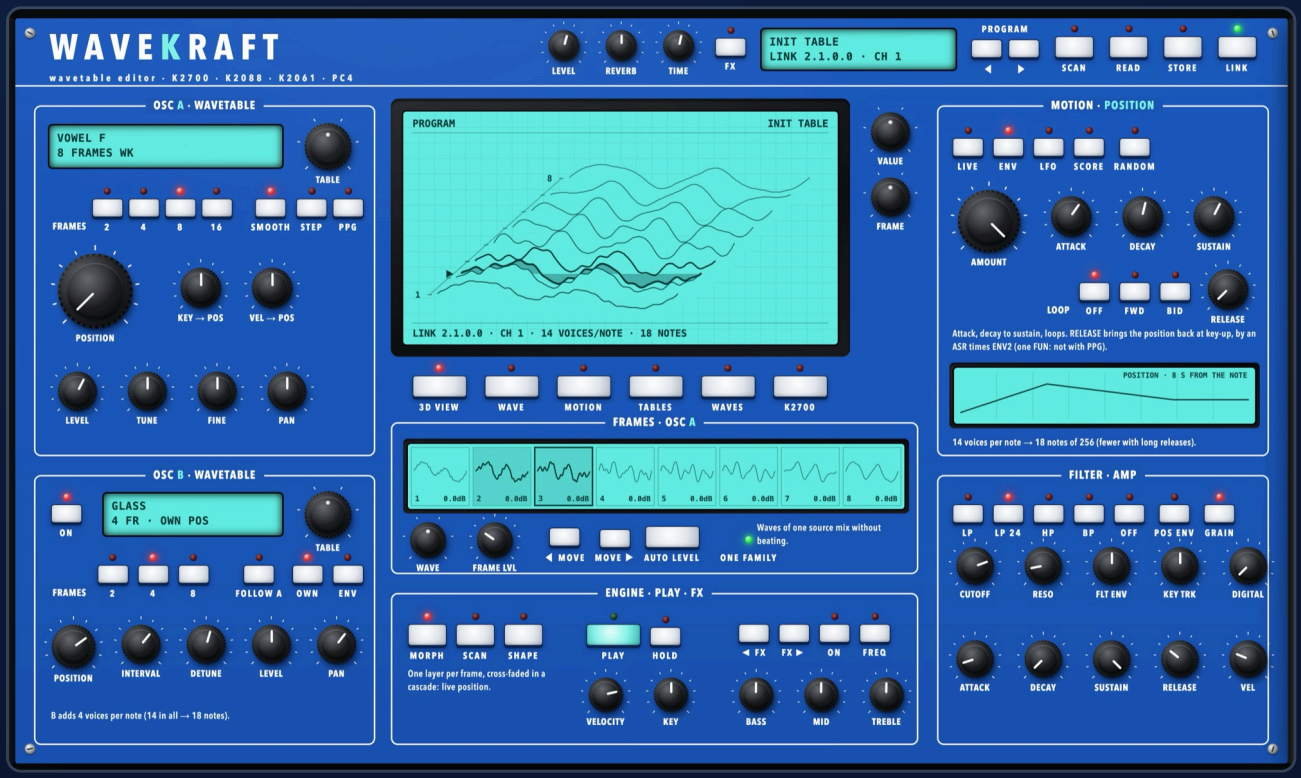
KURZWORLD

WAVEKRAFT

The complete tutorial on wavetable synthesis, and the user manual

From the first idea to a working program on your Kurzweil.



For the Kurzweil K2700, K2088, K2061 and PC4

kurzworld.com

WAVEKRAFT: The Complete Tutorial and User Manual
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About this guide

A wavetable is a row of single-cycle waves and a position that moves along it. The K2700 has no such oscillator. WAVEKRAFT writes one out of VAST: one layer per wave, cross-faded in a cascade, with ramps in the FUNs that leave only the two neighbouring waves sounding, wherever the position is.

Pick one of 79 tables: 17 built from the K2700's own ROM and 62 from a pack of 740 waves made from formulas. Move the position with the mod wheel, pressure, the bender, a slider, an envelope, an LFO, the velocity, the key, a 16-step score or at random: slow tides for a pad, a bright strike that falls away for a piano, one still wave for a bell. Everything the panel sets is a K2700 program, and a stored program moves by itself with no computer attached.

79
tables: 17 on the K2700's ROM, 62 on our own waves

740
waves of our own in one .K27, each with eight roots

2 to 16
waves a table, one K2700 layer each

410
programs in three banks, from slow tides to one still wave

How to read it

Read it in order, or go straight to the part you need. Part one is the theory, for any instrument. Part two is about motion, where most of the sound is. Part three is the editor. Part four builds a wavetable oscillator on a Kurzweil, step by step. Part five is the user manual: every control and every message of WAVEKRAFT, section by section.

The tutorial's interactive labs are on kurzworld.com/wavekraft, where the tables, the ramps and the journeys can be moved by hand.

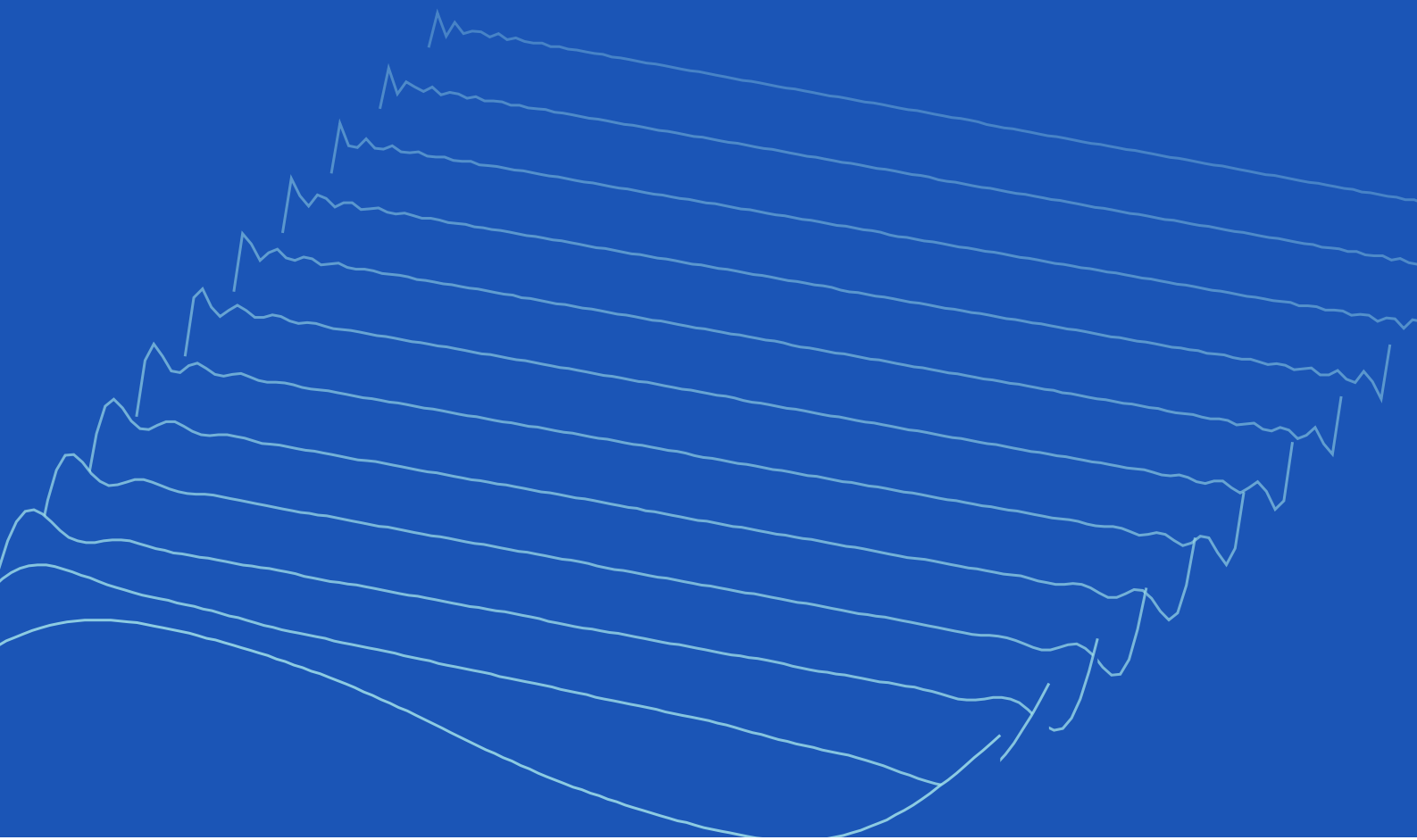
What you need

Platform	A native macOS app; a web version runs free on kurzworld.com (see Web).
Keyboard	A K2700, K2088, K2061 or PC4 on USB, for the LINK, SCAN, READ and STORE. The programs, the waves and the effect chain are compatible with all four. WAVEKRAFT makes no sound of its own: your keyboard plays and keeps every program.
Waves	17 tables need only the keyboard's ROM. The other 62 need the pack WAVEKRAFT WAVES.K27 loaded on it, about 24 MB of samples.
Polyphony	256 ÷ the voices a note: 2 frames, 128 notes; 8 frames, 32; 16 frames, 16. The panel always shows it.
Web	Chrome or Edge on a computer, your keyboard on USB (Web MIDI). No sound of its own. Safari and the iPad have no Web MIDI.

PART ONE

Wavetable synthesis

What a wavetable is, what goes into one, and how it differs from every other way of changing a sound.



WAVETABLE SYNTHESIS

A row of waves and a place on it

A wavetable oscillator stores many single-cycle waves in a row and plays one place on that row. Change the place and the note keeps playing while its wave changes. That place is called the position, and moving it is the whole technique.

A single cycle is one period of a waveform kept as a list of numbers, 128 of them in the waves of this book. Read the list round and round and you hear a note; read it twice as fast and the note goes up an octave. The list says nothing about pitch, only about shape, and shape is timbre: any cycle is a sum of harmonics, and the harmonics are what you hear.

A table is a set of such cycles chosen so that neighbours are related: a sine that grows into a saw, a pulse getting narrower, one vowel turning into another. The classic hardware held 64 of them to a table, software often 256. Each cycle in a table is called a frame.

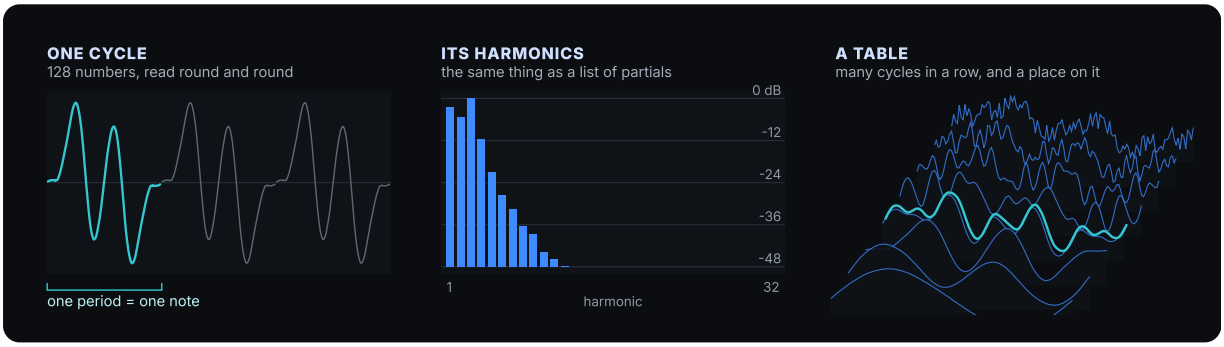


Fig. 1. One cycle from the FILTER table of WAVEKRAFT's pack, its harmonics, and the whole table with a position in it. A cycle and its harmonics are one thing described two ways.

The position is a single number. At one end you hear the first frame, at the other the last. In between, the oscillator has to decide what to play, and that decision is the difference between the modes further down. The picture shows one table with the position part of the way along it.

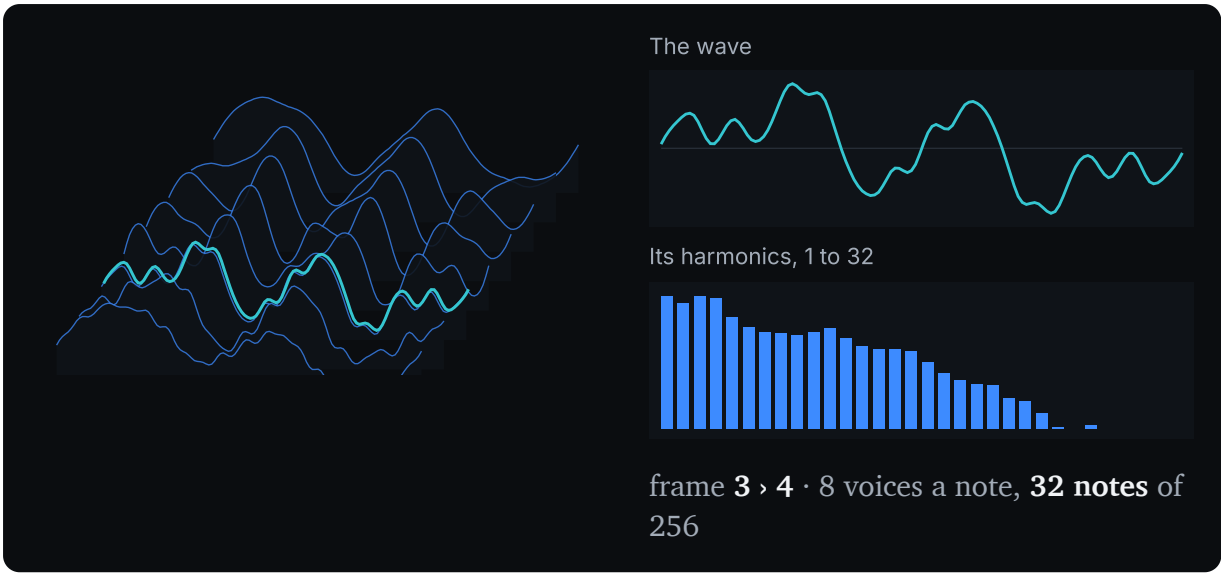


Fig. 2. VOWEL F in 8 frames, the position between waves 3 and 4: the table from the side, the wave at that place, and its harmonics.

WHY IT IS WORTH HAVING

One note that travels

A filter makes a sound darker or brighter by taking harmonics away. A table can go anywhere its frames go: from a sine to a spectrum of narrow peaks, from one vowel to another. The note changes what it is, and it changes while you hold it.

Timbres a filter cannot make

Frames can add harmonics that were not there, move formants or open a gap in the spectrum, in either direction.

One envelope, two jobs

An envelope can move the position and open the filter together, so timbre and brightness arrive as a single gesture.

Movement under the hand

On a wheel, pressure or a slider, the position becomes a playing control, like the pressure of a bow.

A wave per key or per strike

Key and velocity can choose the place in the table: softer notes on a duller frame, higher keys on another.

Bells and glass

Frames with sparse partials are bells on their own, with no modulation at all: the classic digital bell is a still position.

Two tables against each other

Two oscillators on two tables, or on the same table at different places, make a sound that neither has alone.

WHAT GOES IN A TABLE

A table is a path through timbre

A table can hold any waves at all, but the ones that work follow one idea from end to end. Draw a table as a picture, with the waves from left to right and the harmonics from bottom to top, and the idea is there to see.

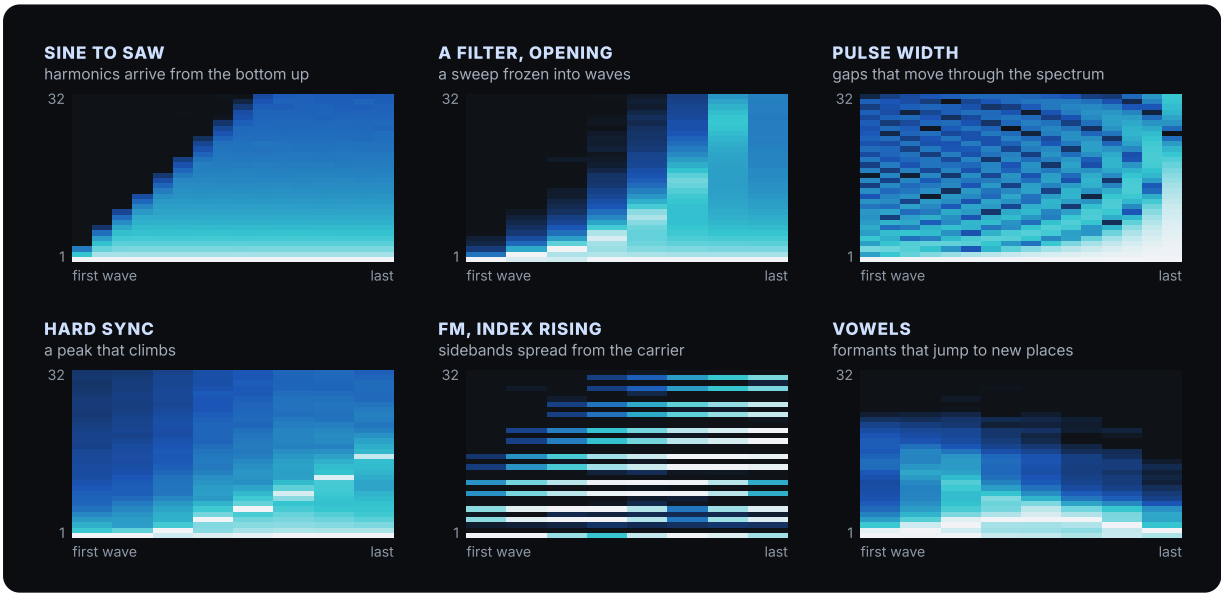


Fig. 3. Six tables of WAVEKRAFT's pack. Each column is one wave of the table and each row one harmonic, 1 at the bottom and 32 at the top. The brighter the square, the louder that harmonic.

Kind of table	How it is made	What you hear as it moves	Good for
Harmonic rise	harmonics added one by one, the sine first	brightness with no filter in it	pads, organs, soft leads
Filter sweep	one wave through a filter that opens wave by wave	a filter sweep frozen into waves; with resonance, a peak that climbs	basses, brass, plucks
Pulse width	a pulse getting narrower	harmonics that drop out and come back	strings, hollow leads
Hard sync	a wave restarted ever later in its cycle	a tearing, vocal peak that climbs	leads
FM	a sine modulated with a rising index	sidebands spreading out from the carrier	electric pianos, bells, metal
Formants	peaks at fixed frequencies that change from wave to wave	one voice changing vowel	choirs, talking pads
Sparse partials	a few narrow peaks far apart	struck metal or glass: held still, it is already a bell	bells, glass, mallets
Registers	sums of a few harmonics, like drawbars	stops being drawn	organs
Cycles of a sound	cycles taken at points along a sound that changes by itself	that sound's own evolution, at any speed you like	imitative and hybrid sounds

MAKING ONE

Six rules for a table that moves well

A table is only as good as the steps from one wave to the next. These six rules apply on any instrument, and all of WAVEKRAFT's tables follow them.

One idea from end to end
A table is a single gesture. Mix two ideas and a sweep sounds like a change of program half way through.

Darkest first
With the waves in order of brightness, a larger position is always brighter, so an envelope, the velocity or the key mean what you expect.

Neighbours that agree
The same fundamental phase and the same harmonic signs, so that a blend keeps what two waves share. Next section.

One level
Every wave at the same RMS, or the position will move the volume as well as the timbre. WAVEKRAFT's 640 whole waves sit within 0.1 dB of each other.

A version for every octave
High notes have no room for high harmonics. A wave needs fewer of them as it goes up the keyboard: see the section on aliasing.

As many waves as the journey needs
Two waves are a morph, four to eight are a path, sixteen a long road. On a Kurzweil each one costs a voice per note.

A table is also a library. It does not have to be swept. A wave with sparse partials is a bell with no modulation at all, and a good table is a set of related single cycles to choose from. Of WAVEKRAFT's 640 whole waves, 453 are more than 3 dB away from every other, and the rest are the gentle steps that make a passage continuous.

BETWEEN TWO WAVES

Jump or blend

Two neighbouring frames are two different lists of numbers. When the position lies between them, the oscillator can play one or the other, or a mixture of both.

Jumping is the oldest answer. The position is rounded and one frame plays at a time. With few frames the jumps are heard, and the result sounds more like a sequence of waves than a sweep. **Blending** crossfades the two neighbours, point by point: the sound moves smoothly, at the cost of a multiplication per sample and per oscillator. **In-betweens** are what the first commercial wavetable

instruments did: the blends were worked out once, when a table was loaded, and kept as extra frames. Playing was jumping again, in steps small enough to read as a sweep. **Spectral morphing** is the modern answer: it blends harmonics instead of samples, level by level and phase by phase, and needs an oscillator built for it.

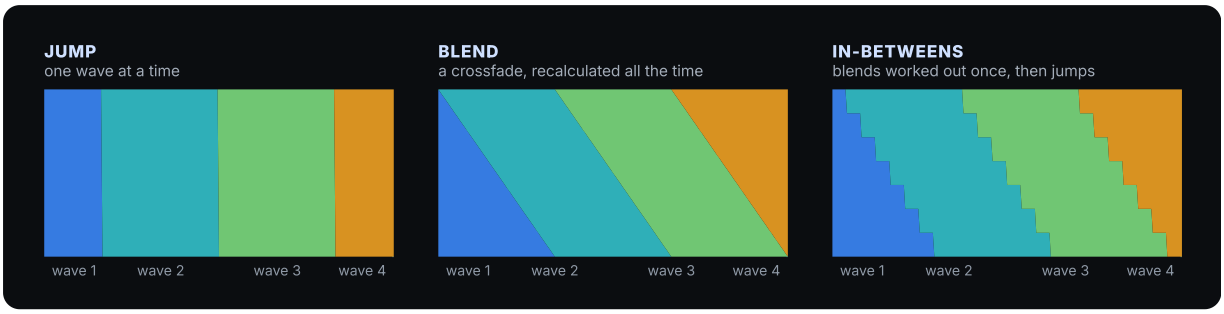


Fig. 4. Four waves across the position, three ways. Each colour is how much of one wave sounds. The last picture has 8 levels a passage. WAVEKRAFT has all three on the panel: STEP, SMOOTH and PPG.

PHASE

A blend is only as good as its phases

A blend adds two waves sample by sample. Whatever the two have in common adds up if it is in phase. A harmonic in opposite phase in the two frames cancels half way, and the sound dips or turns hollow for the length of the passage. So tables are normally built with neighbours that agree: the same fundamental phase, the harmonics with the same signs.

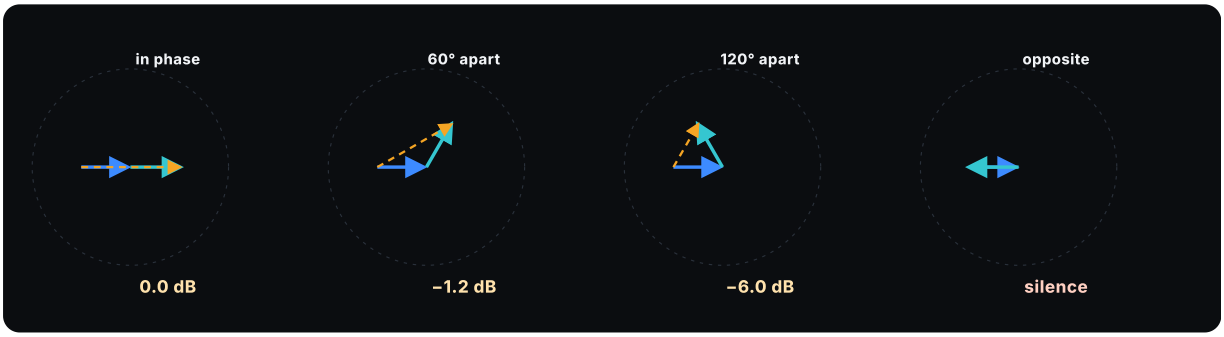


Fig. 5. One harmonic, half way through a crossfade. Blue is its part from one wave, light blue from the other; the dashed amber line is what you hear. In phase nothing is lost, at 120° it is 6 dB down, in opposite phase it is gone.

BANDS AND ALIASING

Why a table needs more than one copy of each wave

A digital oscillator cannot produce frequencies above half its sample rate. Whatever a wave asks for above that limit comes back, mirrored, at a frequency that has nothing to do with the note.

At 48 kHz the limit is 24 kHz. A wave of 24 harmonics is fine at C3 and at C5; at D7 only its first ten fit, and the others fold back down as inharmonic tones. The usual cure is to keep several versions of each frame, with fewer harmonics for higher notes, and to choose by pitch.

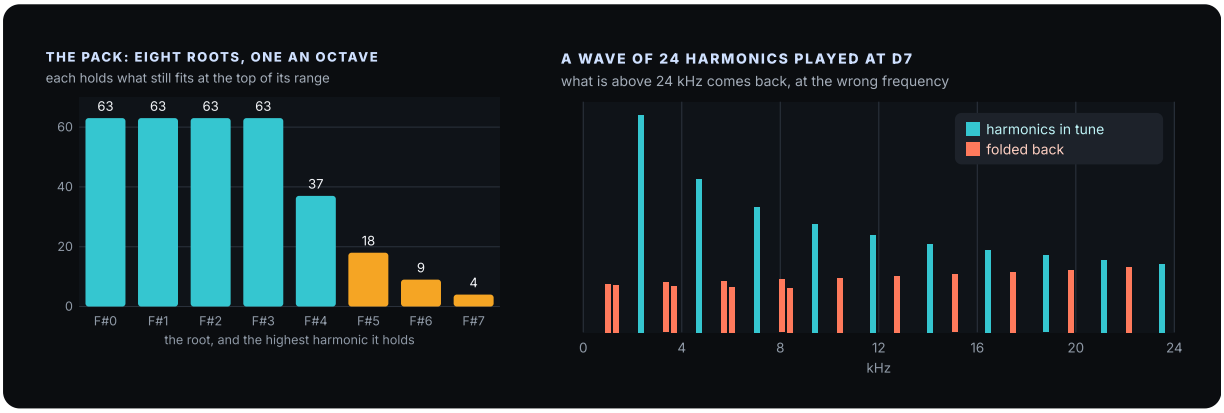


Fig. 6. Right: a 24-harmonic wave at D7, what stays in tune and what folds back. Left: how the pack's 640 whole waves deal with it: eight roots, one an octave from F#0 to F#7. Up to F#3 each holds 63 harmonics; above that, what stays below 20 kHz half an octave over the root.

On the K2700 this comes with the sample player: a sample at 48 kHz can be played at most one octave above its root, so a keymap needs a root in every octave anyway. WAVEKRAFT's waves use that. The ROM tables inherit the roots of the K2700's own factory keymaps.

Root	Samples a cycle	Stored as	Frequency	Harmonics (WK waves)
F#0	2048	128 words × 16	23.4 Hz	63
F#1	1024	128 words × 8	46.9 Hz	63
F#2	512	128 words × 4	93.8 Hz	63
F#3	256	128 words × 2	187.5 Hz	63
F#4	128	128 words	375 Hz	37
F#5	64	a shorter cycle	750 Hz	18
F#6	32	a shorter cycle	1.5 kHz	9
F#7	16	a shorter cycle	3 kHz	4

RESOLUTION

The sound of the first machines

The first wavetable instruments read cycles of 128 words at 8 bits. That low resolution is a flavour to reach for when you want it, and not part of the definition: a wavetable can be as clean as the waves in it.

The staircase. A wave read without interpolation holds each word until the next. That adds images of every harmonic: harmonic n gets copies at 128m ± n, at n / (128m ± n) of its level. Harmonic 30 has one at harmonic 98, 10.3 dB down. At C2 that is 6.4 kHz and clearly there; at C4 it is 25.6 kHz and gone. This is why such waves sound grainier low on the keyboard.

The bits. At 8 bits one step of a word is 48 dB below full scale. The wave is the same in every cycle, so the rounding error is too, and it lands on exact harmonics. It belongs to the waveform, and nothing hisses.

The modulation. On those instruments the control voltages of the filter and amplifier were refreshed every 38.4 ms or so, about 26 times a second, which gives a sweep a fine grain of its own.

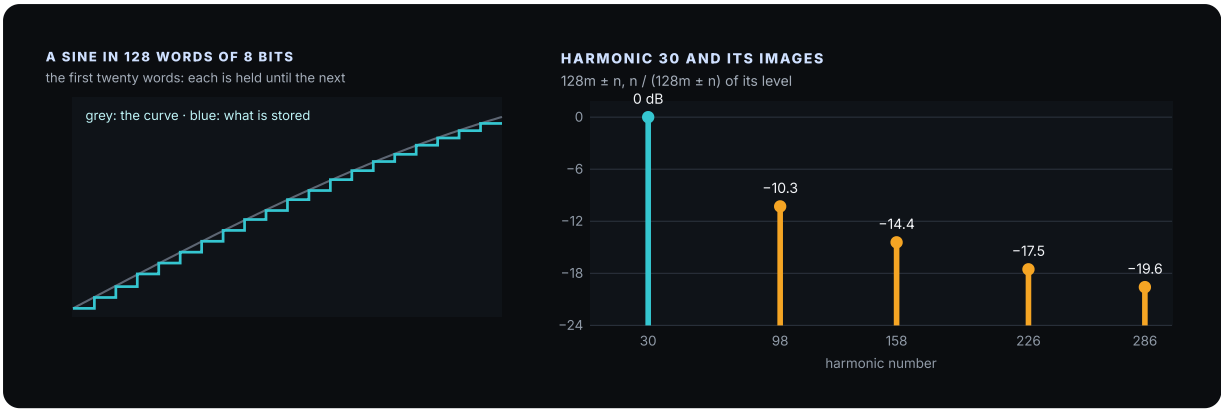


Fig. 7. Left: the first twenty words of a sine in 128 words of 8 bits, against the curve. Right: harmonic 30 and the images the staircase adds to it, with their levels.

WAVEKRAFT's own waves carry the first two in their data: 128 words of 8 bits, with each word held for 16, 8, 4 or 2 samples at the low roots, so the staircase and the rounding are really there in the samples. The third is the **GRAIN** button, and the K2700's own resolution is taken down by **DIGITAL**. Both are further down.

NEIGHBOURS

Wavetable, wave sequence, vector, filter

Several techniques change a sound by moving through waves. They are easy to confuse, and they do not sound alike.

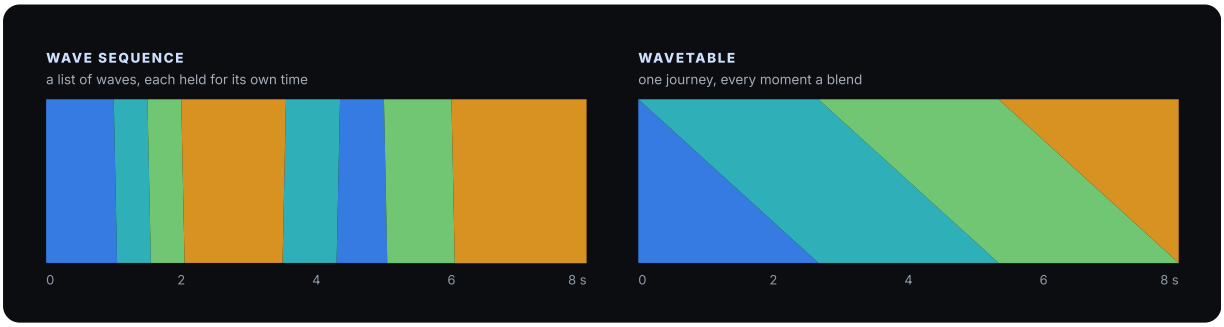


Fig. 8. The same four waves for eight seconds. In the sequence each wave is an event with its own length. In the table there are no events: every moment is a blend on the way somewhere.

Technique	What moves	What you hear
Wavetable	a place along a row of related single cycles	one tone whose harmonics change continuously
Wave sequencing	a list of waves or samples, each held for its own time	a pattern of timbres, in rhythm
Vector	the balance of four sounds, by a joystick or envelopes	four fixed sounds in changing proportion
Filter sweep	a cutoff over a fixed wave	harmonics leaving from the top down, in order
Additive	each harmonic on its own envelope	anything, at the price of a great many controls
FM	the depth of one oscillator on another	harmonics that appear and vanish in a pattern set by the ratio

The line between the first two is speed and blend. Take a table with few waves, jump between them quickly, and it stops being a sweep and becomes a row of separate events. Slow it down and blend, and the waves dissolve into one moving colour. Most of what makes a wavetable sound right is on that side of the line, and Part two is about staying there.

HISTORY

Where it comes from

1958
MUSIC II
At Bell Labs, Max Mathews computes sound by reading a stored wave in a loop: the table-lookup oscillator, on a mainframe.

1978–79
PPG Wavecomputer 360
Wolfgang Palm's instrument plays through tables of single-cycle waves, with a position moving along them. It has no filters.

1981
PPG Wave 2
Digital oscillators and an analog filter on every voice. The 2.2 of 1982 has two oscillators a voice and the 2.3 of 1984 has 12-bit converters and eight parts.

1986
Prophet VS
Four waves mixed by a joystick: vector synthesis, a close neighbour of the wavetable.

1989
Waldorf Microwave
Digital wavetable oscillators with analog filters: the sound goes on after the PPG.

1990
Korg Wavestation
Wave sequencing: lists of waves, each with its own time, one after another.

2000s

Software

Hundreds of frames blended in real time, spectral morphing, and tables the user draws or imports.

2026

WAVEKRAFT on the K2700

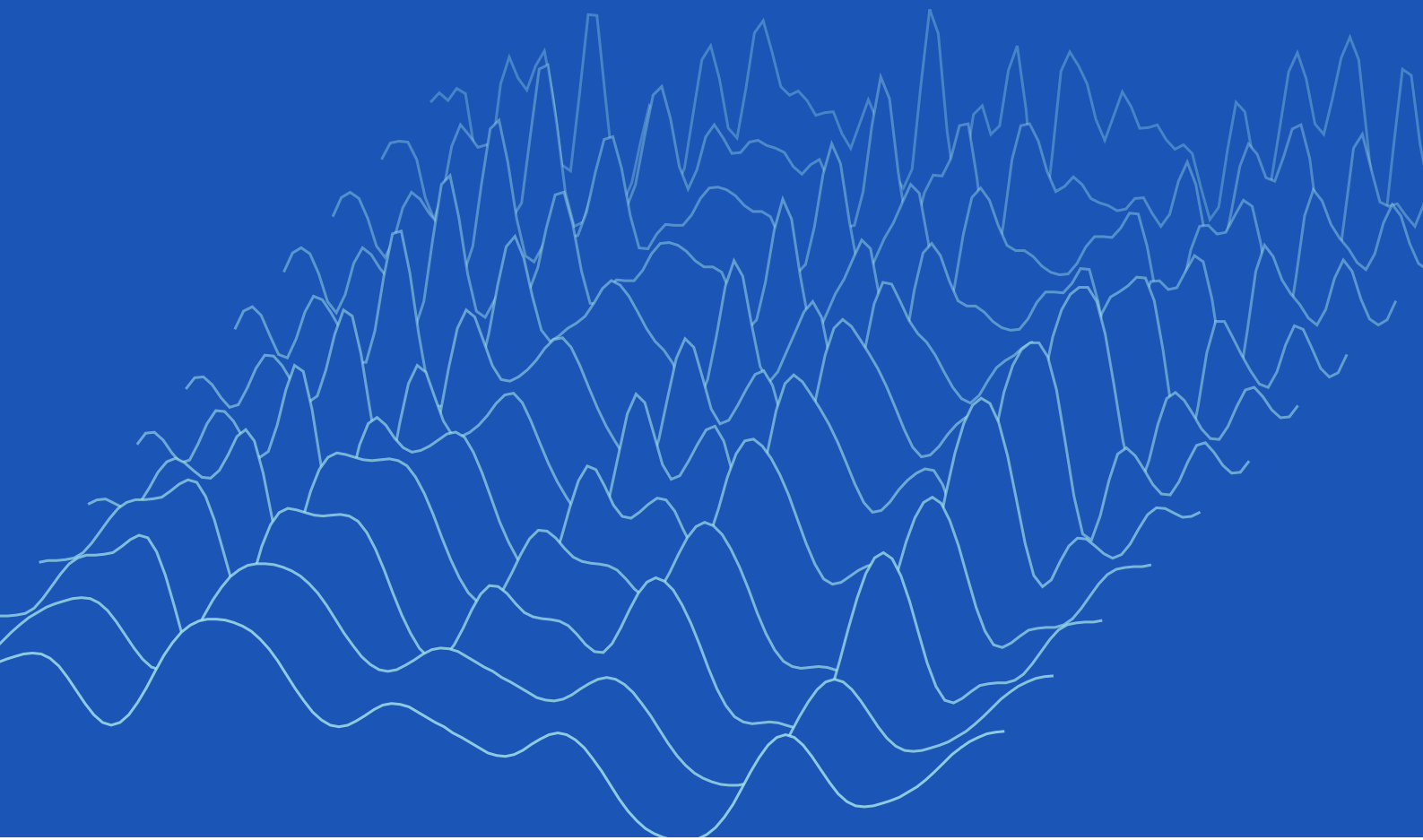
Wavetable synthesis on keyboards that have none: tables of waves written as ordinary Kurzweil programs.

A PPG table holds 64 waves of 128 eight-bit words, but only a few key waves are stored. The rest are worked out once, when the table is loaded, and while a note plays the machine jumps from one wave in memory to the next, in the middle of a cycle. Software later made the same idea much bigger: hundreds of frames, blended in real time, and tables the user can make. WAVEKRAFT has a mode for each way of thinking about it, the blend and the jump in small steps, and the K2700's own synthesis does the rest.

PART TWO

Motion

A table is a map and the motion is the journey. What to move, how fast, where to stop, and what each kind of sound wants.



WHY MOTION MATTERS

The table is the map. The motion is the sound.

The same table can be a pad that never settles, a piano that opens at the strike or a bell that does not move at all. What makes the difference is how the position travels.

Slow travel

Pads, textures, voices. The position wanders for as long as the note is held, in journeys of 8 to 20 seconds, so a held chord keeps changing colour.

A gesture at the strike

Pianos, strings, plucks, brass, basses. The timbre moves once, in the first moments, and then rests on one wave: bright at the strike and darker after, as real instruments are.

Held still

Bells, glass, organs, simple pads. One wave, or two side by side. The choice of wave is the sound, and the table is a very good library of single cycles.

THE VOCABULARY

Nine ways for a note to travel

Every motion in the banks is one of these. Each picture is 24 seconds of one note, with the place in the table from the first wave at the bottom to the last at the top.

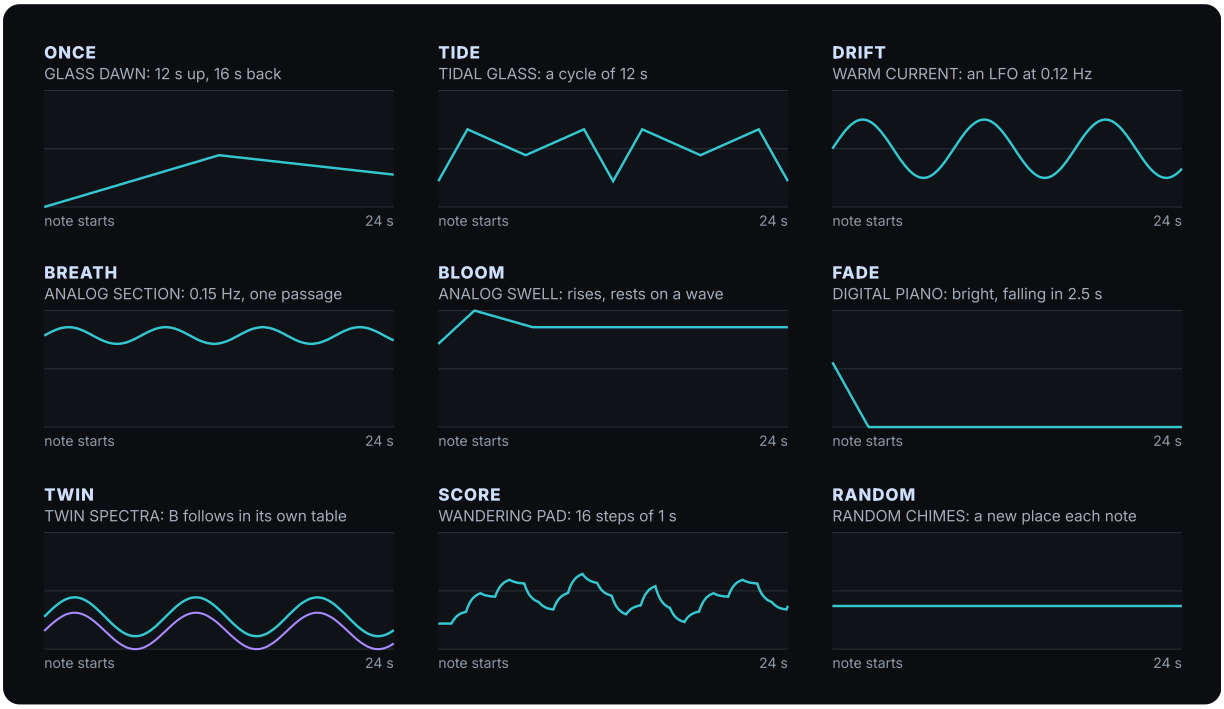


Fig. 9. Nine programs from the banks.

Gesture	On the panel	How it goes	Best on	Program
ONCE	ENV, loop off	up in 8 to 20 s, then part of the way back	pads, textures	GLASS DAWN
TIDE	ENV, loop BID	a cycle of 8 to 20 s, uneven, back and forth for as long as the note lasts	pads, strings, textures	TIDAL GLASS
DRIFT	LFO	0.06 to 0.12 Hz, over 2 to 9 waves	pads	WARM CURRENT
BREATH	LFO	0.1 to 0.2 Hz, over one passage	strings, voices, organs, winds, leads	ANALOG SECTION
BLOOM	ENV	up in 1 to 5 s, then resting on a wave	swells, brass, leads	ANALOG SWELL
FADE	ENV	bright at the strike, falling from bright to dark over 1 to 5 s	keys, bells, plucks	DIGITAL PIANO
TWIN	OSC B, FOLLOW A	two tables travelling together, each at its own place	pads, keys	TWIN SPECTRA
SCORE	SCORE, smoothed	16 steps of 1/4 to one bar, gliding from one to the next	slow sequences, pads	WANDERING PAD
RANDOM	RANDOM	a new place on every note, held	plucks, bells, basses	RANDOM CHIMES

Two more belong to the player. LIVE gives the position to the mod wheel, pressure, the bender or a slider on CC 20, and the hand is the envelope. VEL → POS and KEY → POS choose a place per note: a harder strike on a brighter wave, a higher key on a thinner one. The place then stays where it was chosen.

User manual: the motion, page 73

RATES

Slow, but not too slow

Timbre moves well when it moves slowly. But every note starts its own envelope and its own LFO, so a motion has to happen within the time a chord is held, or nobody hears it.

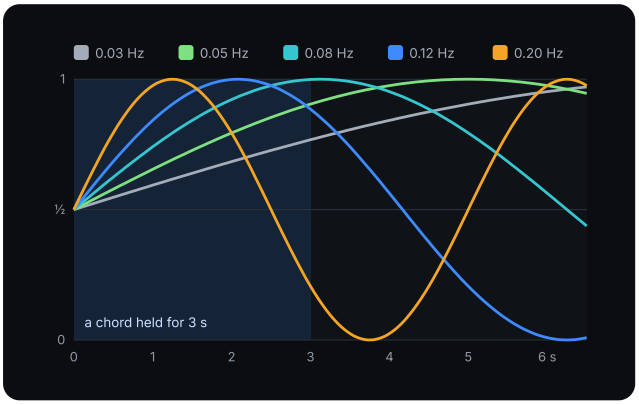


Fig. 10. An LFO as a note starts it: half way up and rising. At 0.03 Hz a chord of 3 seconds hears under a tenth of a cycle. At 0.12 Hz it hears more than a third.

Not too slow. A cycle of 33 seconds is lovely on a chord that lasts a minute, and on a chord of three seconds it is a sound that hardly moves. WAVEKRAFT's first bank uses LFOs of 25 to 50 seconds and envelopes of 8 to 20 seconds, for long notes. The second brings the pads to 0.08 to 0.12 Hz and tides of 10 to 14 seconds, and you hear them from the first moments of a chord.

Not too fast. Past about 0.2 Hz a change of timbre stops being a colour and starts being an effect, or a sequence. None of the slow motions in the banks goes faster. The gestures at the strike are another matter: they are over in a second or two, and you hear them as part of the attack.

THE RULES

Six rules for a musical journey

End on a wave

A motion that stops comes to rest on a frame, never half way between two. The envelope's sustain level is chosen so that it lands there.

Slow only where it blends

A slow passage exposes any cancellation between two waves, and a quick one hides it. Long journeys stay on passages that cross cleanly. An attack can go through anything.

Uneven is alive

A tide that rises in 2 seconds and falls in 4 does not repeat like a sine. Up, back part of the way, up again: no machine going round.

Set the colour, then hold it

Classic sounds change at the strike and then stop. A piano that keeps wandering is no longer a piano.

Give it something to move against

OSC B held on one wave, an octave up or a few cents away, is a fixed point that makes the motion of A easier to hear.

Effects that leave room

A slow chorus, and a reverb that depends on the sound: about 3.5 s for pads and choirs, 2.3 s for strings and bells, 1.7 s for plucks and brass, 1.1 s for organs and basses.

SOUND BY SOUND

What each kind of sound wants

These are the ranges used in the two banks that move: a starting point for any sound you build, on WAVEKRAFT or by hand.

Sound	Tables	Position	Filter and amp	Programs
Pads	HARMONIC RISE, DRAWBARS, ADDITIVE	ENV up in 1.5 to 16 s and back in 3 to 20 s, or LFO 0.02 to 0.12 Hz	LP up to 9 kHz; attack 0.8 to 3 s; release 2.5 to 4 s	GLASS DAWN, TIDAL GLASS
Strings	SAW BRIGHTEN, ANALOG	ENV up in as much as 3 s and back in up to 6 s, or LFO 0.05 to 0.18 Hz	LP 2.5 to 7 kHz; attack up to 1.8 s; OSC B 4 to 8 cents away	STRING ENSEMBLE, ANALOG SECTION
Choirs, voices	VOWELS, CHOIR + PAD	ENV up in 1.5 to 8 s, or LFO 0.04 to 0.12 Hz	LP 6 to 8 kHz; attack 0.5 to 2 s; release 1.5 to 3 s	OOH CHOIR, VOWEL MORPH
Electric pianos, keys	KEYS, HARMONIC RISE	a bright strike and a fall of 0.24 to 5 s, or VEL → POS	LP up to 12 kHz; no attack; decay 1 to 6 s; velocity 10 to 20 dB	DIGITAL EP, EVOLVING EP
Bells, mallets	BELLS + GLASS, HARMONIC RISE	a fall of 0.3 to 4 s, RANDOM, or a slow LFO	LP 8 to 12 kHz; velocity 10 to 16 dB	MARIMBA, RANDOM CHIMES
Plucks	KEYS, HARMONIC RISE, ANALOG	a fall of 0.24 to 1.5 s	no attack; decay 1 to 3 s; no sustain; velocity 14 to 16 dB	KOTO, HARP GLOW
Organs	DRAWBARS, ORGAN WAVES	VEL → POS chooses the registration, or LFO 0.1 to 0.15 Hz	attack from 5 ms; full sustain; velocity 0 to 4 dB	DRAWBAR ORGAN, CHURCH BLOOM
Brass	SAW BRIGHTEN, ANALOG	ENV up in 0.04 to 2 s and back in 0.5 to 3 s	LP 2.5 to 6 kHz; attack 0.04 to 1.2 s; OSC B 5 or 6 cents away	SYNTH BRASS, BRASS BLOOM
Winds	HOLLOW ODD, ADDITIVE	ENV up in 0.04 to 0.1 s, or LFO 0.12 to 0.18 Hz	LP 4 to 7 kHz; attack 20 to 80 ms	CLARINET, REED MORPH
Basses	ANALOG, VS DIGITAL, HOLLOW ODD	a quick fall of 0.2 to 1 s, or VEL → POS	no attack; release 0.1 to 0.2 s; full sustain	DIGITAL BASS, TOUCH BASS
Leads	SAW BRIGHTEN, VOWELS, HOLLOW ODD	ENV up in 0.02 to 1.5 s, or CC 20	LP 5 to 9 kHz; attack 10 to 20 ms	WAVE LEAD, SINGING LEAD
Sequences	HARMONIC RISE, DRAWBARS, KEYS	SCORE, 16 steps	LP 6 to 9 kHz; attack up to 0.3 s	RHYTHM PAD, SLOW STEPS
Textures	HARMONIC RISE, METAL FX	ENV up in 4 to 20 s and back in 6 to 25 s, or LFO 0.02 to 0.08 Hz	attack 2 to 3 s; release 4 to 6 s	METAL WIND, METAL TIDE

HELD STILL

Simple sounds: one wave, two at most

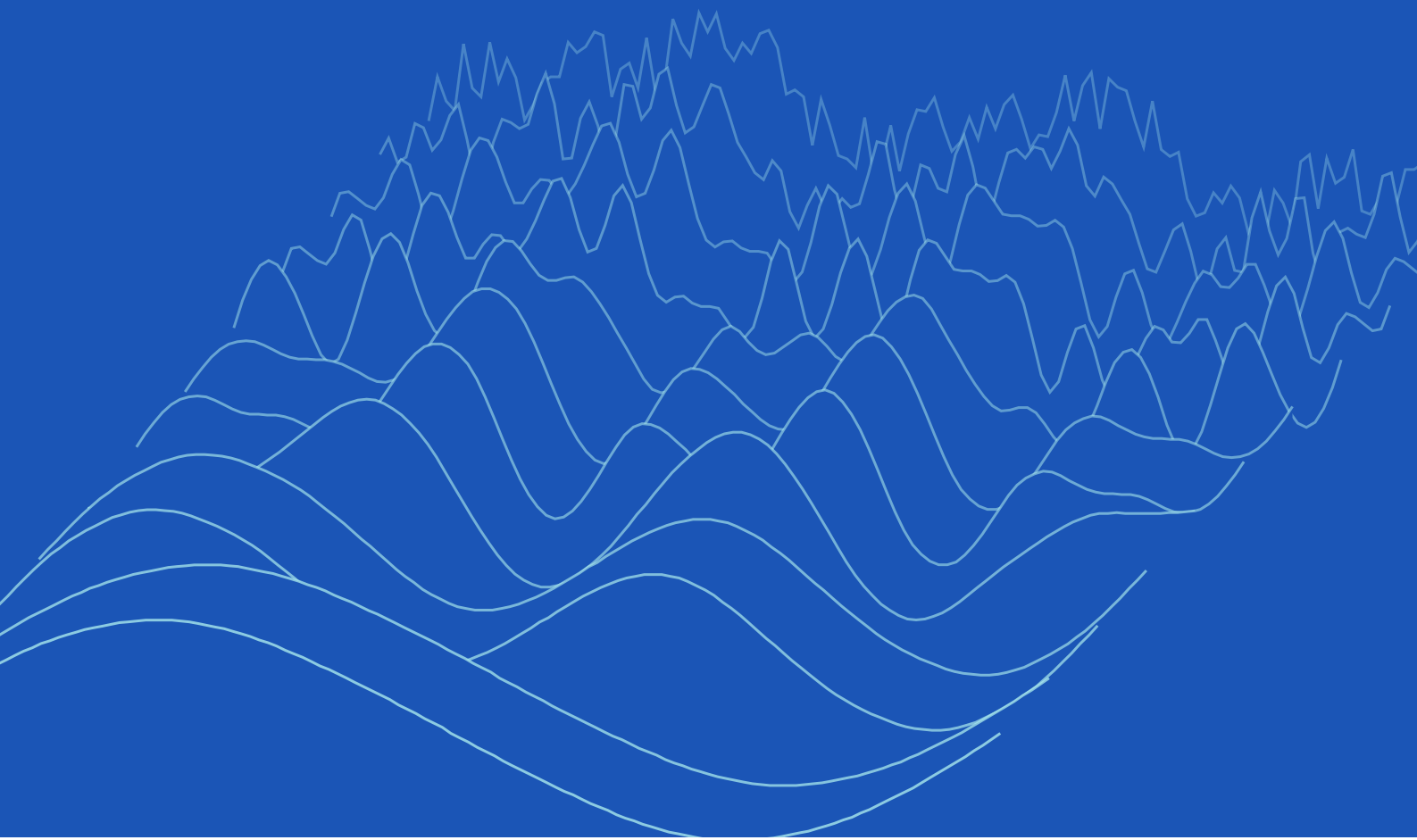
The 210 programs of WAVEKRAFT WAVES are the other half of the art: 172 of them rest on one wave an oscillator, and the slider on CC 20 moves it if you want. OSC A takes a wave and OSC B takes its neighbour a few cents away and 5 dB down, or another family one or two octaves up and 10 to 16 dB down. Two to six voices a note, so chords are never short of polyphony.

Sound	Recipe	Programs
Bells	Immediate attack, no sustain, a long tail. The filter opens and closes with the note, and the reverb is large.	24
Glass	Thin brightness from high harmonics, with high-pass and band-pass filters.	14
Mallets	Short and round. Velocity opens the filter or changes the wave, and the reverb is small.	14
Digital keys	Digital electric pianos: a falling sustain, medium chorus, very responsive to velocity.	20
Soft pads	Slow attack, A and B detuned and spread across the stereo, a low filter, plenty of chorus and reverb.	26
Digital strings	A soft saw or a phased one, medium attack, wide chorus, a low-pass with a slow envelope.	14
Voices	Fixed formants. The wheel or a slow envelope changes the vowel, in a wide chorus.	14
Organs	No filter envelope, short attack, a steady tone, a flanger or chorus for movement.	12
Brass and reeds	The filter opens at the attack like a breath, with soft attacks.	12
Flutes	Almost a sine. Breath by velocity and pressure, in a room.	8
Basses	Centred, few effects, a filter with a short envelope.	16
Soft leads	Monophonic in spirit, the wheel or pressure on the wave, a discreet delay.	12
Plucks	A dry attack and a filter closing fast. The delay gives the space.	14
Atmospheres	Slow motion, always between two waves.	10

PART THREE

The editor

Everything above on one panel, in real time on your K2700.



WHAT THE EDITOR DOES

One panel, and the K2700 does the playing

WAVEKRAFT is an editor for the K2700. It has no oscillator and no sound of its own: it writes K2700 programs and sends them over USB while you play them on the K2700.

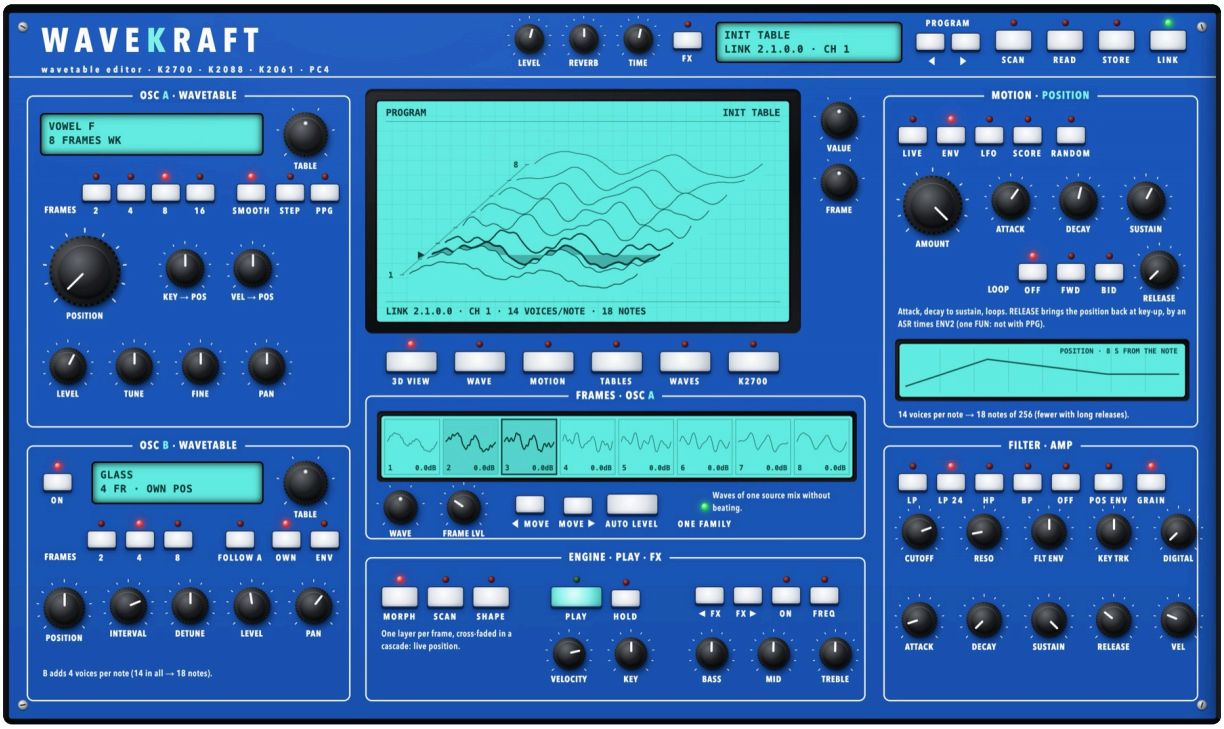


Fig. 11. The panel: OSC A and OSC B, the display, the FRAMES strip, ENGINE · PLAY · FX, MOTION · POSITION and FILTER · AMP. Top right: PROGRAM, SCAN, READ, STORE and LINK.

Section	What is there
OSC A	TABLE, FRAMES 2, 4, 8 or 16, SMOOTH, STEP or PPG, POSITION, KEY → POS, VEL → POS, LEVEL, TUNE, FINE, PAN
OSC B	ON, TABLE, FRAMES 2, 4 or 8, FOLLOW A, OWN or ENV, POSITION, INTERVAL, DETUNE, LEVEL, PAN; with ENV, ATTACK, DECAY and DEPTH
The display	3D VIEW, WAVE, MOTION, TABLES, WAVES and K2700, plus the FX and programs pages; VALUE and FRAME beside it
FRAMES	the frames of the selected oscillator: WAVE, FRAME LVL, ◀ MOVE, MOVE ▶, AUTO LEVEL, and a light that says when they are all of one family
ENGINE · PLAY · FX	MORPH, SCAN or SHAPE; PLAY, HOLD, VELOCITY and KEY; ◀ FX, FX ▶, ON, BYPASS, and three knobs for the selected effect
MOTION · POSITION	LIVE, ENV, LFO, SCORE or RANDOM, AMOUNT and each one's own controls, and a line that says what that costs in voices
FILTER · AMP	LP, LP 24, HP, BP or OFF, POS ENV, GRAIN; CUTOFF, RESO, FLT ENV, KEY TRK, DIGITAL; ATTACK, DECAY, SUSTAIN, RELEASE, VEL
The top row	LEVEL, REVERB, TIME, FX; PROGRAM ◀ ▶; SCAN, READ, STORE, LINK

User manual: the panel at a glance, page 64

THE TABLES

79 tables from three places

The TABLE knob goes through all of them, and the display says where each one comes from: ROM, OWN or WK. Whichever you pick, it plays the same way: each frame is one K2700 layer on one keymap.

17 on the K2700's ROM

Factory keymaps that hold a single cycle at every root. Every K2700 has them, so they take no sample memory. 89 frames over 66 different keymaps, each measured on the K2700 for level.

12 own tables (WKX)

96 waves whose neighbours share no harmonic, so the K2700's cascade cannot comb them: vowels, FM, FILTER, PWM, SYNC, ORGAN, BELLS, CHIP, COMB. The fundamental plays in a layer of its own.

50 WK families

640 whole waves, fundamental included, in 30 families of 16 and 20 of 8. A wave can play alone, so a simple sound takes 1 to 3 of them.

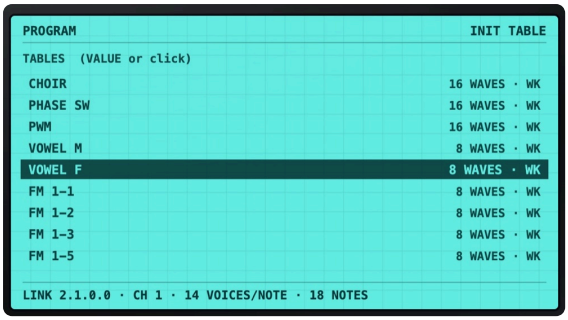


Fig. 12. The TABLES page. A table's waves in the pack show NOT LOADED if the pack is not on the K2700.

Chosen on the instrument. A crossfade between two ROM cycles is smooth only if their shared harmonics are in phase, and factory keymaps are not made for that. Each ROM table was played on the K2700, held still on every wave and half way through every passage, at C2, C3 and C5, and cut down wave by wave to what crosses well, in order from dark to bright.

METAL FX is inharmonic and made for textures. **HIGH PARTIALS** is for playing held still.

ROM table	Waves	Where it travels cleanly
HARMONIC RISE	10	all (one slight at C5)
ADDITIVE	5	all (one slight at C5)
DRAWBARS	4	all
HOLLOW ODD	4	all, slight at C5
EVEN SPECTRUM	4	from wave 2 to 4
HIGH PARTIALS	4	none: held still
ANALOG	8	1 to 2, and 6 to 8
SAW BRIGHTEN	5	2 to 4
PULSE WIDTH	4	2 to 3, slight
OB WAVES	4	1 to 2
ORGAN WAVES	4	1 to 2
VOWELS	5	4 to 5
CHOIR + PAD	4	3 to 4, slight
BELLS + GLASS	5	2 to 5
KEYS	7	all
VS DIGITAL	5	slight in all
METAL FX	7	inharmonic, for textures

WK families	What they are
RESO LO, RESO HI, SOFT LP, NO FUND, FILTER	filters and resonance
SIN>SQR, SIN>SAW, PWM, PHASE SW, SYNC	from the sine to the classic shapes
VIBES, BELLS, BELL A, BELL B, GLASS, TINE, MALLET, CELESTE, HI PEAKS, HI COMB, HI FORCE, HI STRONG	bells and metal
VOWEL M, VOWEL F, FORM LOW, FORM HIGH, FORM HI2, FORM MIR, CHOIR	formants and voices
FM 1-1, FM 1-2, FM 1-3, FM 1-5, FM 1-7, EP DIG	FM spectra
ORGANS, REEDS, STRINGS, BRASS	organs, reeds, strings
RINGMID, RINGMID2, WILD, FUND+HI, ALT HI LO, ECHOES, ECHO COL, DREAM, COMB, CHIP	effects
SOFT	soft waves

User manual: the tables, page 65

FRAMES

The frames

FRAMES says how many waves of the table are played: 2, 4, 8 or 16 on OSC A, 2, 4 or 8 on OSC B. They are spread evenly over the table, and the strip shows them, each with its level.

WAVE swaps the selected frame for any other wave of the same origin, ◀ **MOVE** ▶ changes its place, **FRAME LVL** trims it by ±12 dB, and **AUTO LEVEL** brings every frame to the table's mean level, from the levels measured on the K2700.

FRAMES 2 is a morph between two waves, at two voices a note. It starts on the table's cleanest neighbouring pair; on HIGH PARTIALS and CHOIR + PAD the panel says NO CLEAN PAIR. An own table in 4 plays waves 1, 4, 5 and 8, so that neighbours still share no harmonic.

User manual: the frames, page 68

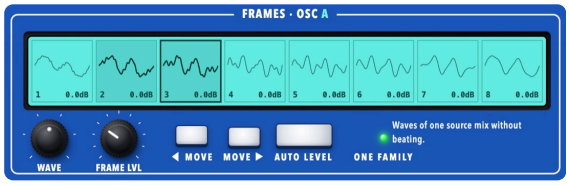


Fig. 13. The FRAMES strip of OSC A.

BETWEEN FRAMES

SMOOTH, STEP, PPG, and SHAPE

Three buttons on OSC A say what happens between two frames, in the MORPH engine. SHAPE is another engine: no table at all, one layer and the K2700's own shapers.

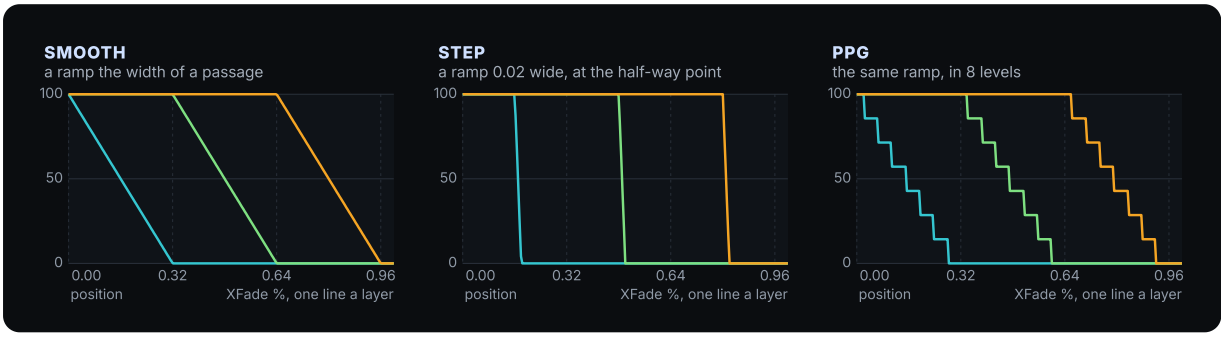


Fig. 14. As the compiler writes them for 4 frames, 0.32 apart: the XFade of each layer against the position. In SMOOTH each layer takes the whole of its passage, in STEP a ramp 0.02 wide at the half-way point, in PPG the same ramp as SMOOTH in 8 levels.

	Between two frames	Positions, 8 frames	What it needs
SMOOTH	a straight crossfade of the two neighbours	continuous	3 FUNs a layer
STEP	a jump at the half-way point, 0.02 of the position wide	8	3 FUNs a layer
PPG	8 levels across each passage: small jumps, not a blend	50 (10 frames: 64)	4 FUNs a layer, so one direct source only
SHAPE	not a table: a factory sine, saw or triangle through SHAPER or WRAP, its amount on the position	continuous	1 voice, no ramps



Fig. 15. OSC A, with VOWEL F in 8 frames.

User manual: engines and modes, page 72

PPG is the mode for the jump in small steps. With 8 frames it gives 50 places, each one a jump, with no extra voice. A jump on the K2700 takes 10 to 13 ms, where the original instrument's was immediate. The price is the FUN it spends, so it only takes a single direct source: RANDOM or a negative AMOUNT would need a fifth FUN, and the panel falls back to STEP. A SCORE in PPG plays its steps with no smoothing.

SHAPE drives a SHAPER (sine and triangle, 0.1 to 2.5 ×) or a WRAP (saw, −12 to +12 dB) with the position. One voice a note, so it is the cheapest way to move timbre, and it leaves all the polyphony for chords.

MOTION · POSITION

Every way to move the position

POSITION says where a sound sits in its table, and the motion moves it from there, by AMOUNT, up or down. Each source on the panel is a real K2700 control source, written into every layer.

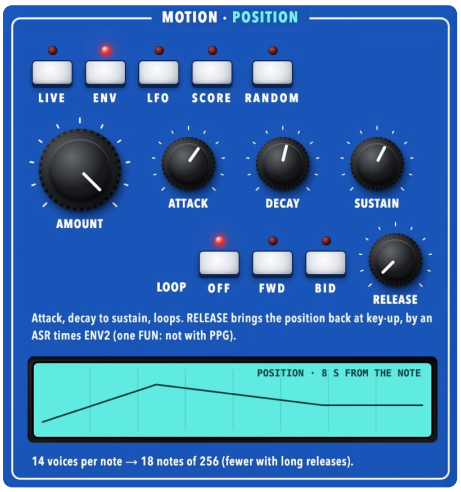


Fig. 16. MOTION, here on ENV. The curve is the position against time, and the last line says what it costs in voices.

On the panel	On the K2700	
LIVE · MOD WHEEL	MWheel	
LIVE · SLIDER (CC 20)	MIDI20, with the label WT Position	the display follows a K2700 control on CC 20
LIVE · PRESSURE	Press	
LIVE · BENDER	AbsPwl	either way counts as up
ENV	ENV2	ATTACK, DECAY, SUSTAIN, LOOP OFF, FWD or BID, and RELEASE
LFO	LFO1	RATE 0.02 to 8 Hz or SYNC to the tempo; +TRIANGLE, +SINE, +SAW, +SQUARE or RANDOM
SCORE	the CC sequencer on MIDI20	16 steps of 1/16 to 1 BAR, SMOOTH by a lowpass FUN
RANDOM	GRand2 held at the note's start	a new place on every note
VEL → POS, KEY → POS	AttVel, KeyNum	with the motion's AMOUNT at 0

LIVE writes no envelope and no LFO: the position simply is the control. On CC 20 the program also carries the PARAMS label **WT Position**, because a K2700 program only hears a CC it has a label for; without it, the slider does nothing in a stored program.

ENV can loop, forward or back and forth, for the slow tides of a pad. On the K2700 the release segment of ENV2 does not run, so **RELEASE** is built another way (see below). **POS ENV** in the filter uses this same ENV2 to open the cutoff, so timbre and brightness are one gesture.

SCORE runs on the K2700's own CC sequencer, but only in a stored program: the edit buffer does not carry a sequence. While you are linked, WAVEKRAFT plays the same 16 steps as CCs in time.

AMOUNT at 0 means no motion at all: the position sits where POSITION puts it, as constant XFades that use no FUN.

User manual: the motion, page 73

THE SECOND OSCILLATOR

OSC B follows, stays or goes its own way

OSC B is a whole second chain of layers after A's, with its own table, frames and level. It adds its frames to the voices of every note, and the panel says how many.

FOLLOW A moves B with A's position plus an offset: two tables travelling together. **OWN** parks it at its own POSITION, as constant XFades with no FUN at all. **ENV** gives it a sweep of its own: ASR1 in Norm mode, up in ATTACK and back in DECAY, once a note, by DEPTH, which can be negative.

INTERVAL (±24 semitones), **DETUNE** (±50 cents), **LEVEL** and **PAN** are on the panel. Each chain has its own filter and level, but one filter section sets both.

Measured on the K2700: with A on ENV2 up in 2 s and B on ASR1, up in 0.5 s and back in 1 s, each did its own thing: B was already home when A was at 71 %.

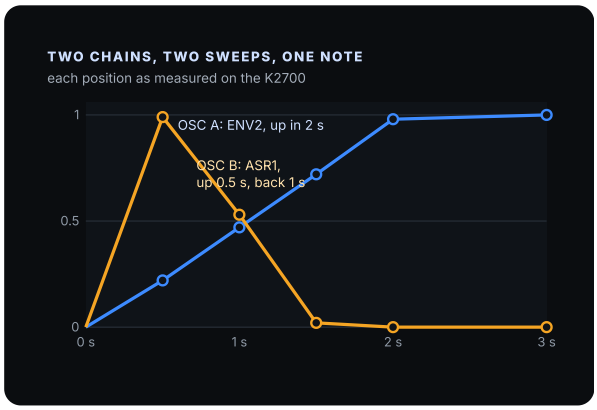


Fig. 17. OSC A on ENV2 and OSC B on ASR1, one note, each chain measured on its own waves.



Fig. 18. OSC B, on OWN, a fifth above.

User manual: OSC B, page 77

FILTER · AMP

A filter with character, and an amplifier

The filter sits after the cascade, on the sum of the waves. LP is two poles in the last layer; LP 24 takes a layer of its own. Two more controls take the sound towards the instruments that started all this.



Fig. 19. FILTER · AMP.

Control	Range	On the K2700
LP, HP, BP	two poles	2POLE LOWPASS, 2POLE HIPASS, BANDPASS, in the last layer
LP 24	four poles	4POLE MOGUE LP in a layer of its own, ALG 105
CUTOFF	40 Hz to 18 kHz	on the K2700's semitone grid, following KEY TRK
RESO	0 to 24 dB	on LP 24 mapped to −6 to +12 dB; on BP it narrows the band
FLT ENV	±48 semitones	ENV3 as Src1; or ENV2 with POS ENV
GRAIN	24 Hz	the envelope in steps: Sample B on A clocked by LFO2
DIGITAL	0 to 100 %	QUANTIZE in every voice, before the filter
AMP	attack to 10 s, decay to 30 s, release to 20 s	AMPENV, User, every layer the same
VEL	0 to 48 dB	the AMP's velocity tracking

GRAIN turns the filter's envelope into steps, as the slow control updates of the first instruments did. **DIGITAL** takes bits away, about one for every 12 %, in each voice on its own, so that notes of a chord do not cross. The numbers are in the section on filter layers below.

User manual: the filter, page 79

User manual: the amp, page 80

EFFECTS

One insert chain and a hall

The insert is WAVEKRAFT FX, a USER chain that the pack carries. The reverb is a factory chain. Each part is switched and set by a CC that is one of the K2700's own controls, and the program stores where each one starts.

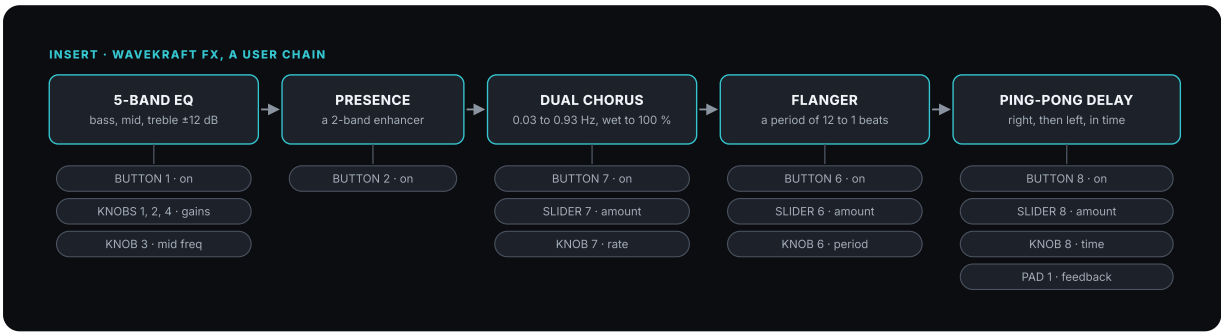


Fig. 20. WAVEKRAFT FX, each part with the K2700 controls that move it. The program stores them all as entry values, so a program opens as you left it, and you can play them live.

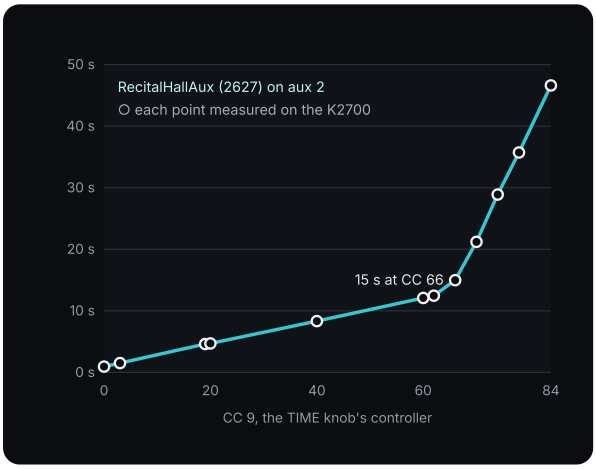


Fig. 21. The reverb's decay time against CC 9, measured on the K2700. WAVEKRAFT's TIME knob works in seconds and sends the CC that gives them.

WAVEKRAFT FX starts from a factory chain, with two changes. The Wet/Dry of the chorus reaches 100 % on CC 26, where the factory chain stops at 50 %. And its two LFOs are 8 and 6.5 cents deep, not 20 and 15: so deep and so wet, every held note beat against its own dry sound.

On by default: the chorus at 80 % wet and 0.10 Hz.

The reverb is RecitalHallAux on aux 2. As in the factory's programs, slider 9 sets how much, button 9 switches it, and knob 9 sets the time: the send is 100 % scaled by the mod Sld9&Sw9, the amount being the entry value of CC 28, labelled Reverb Amount. The panel's REVERB knob is that CC, in real time.

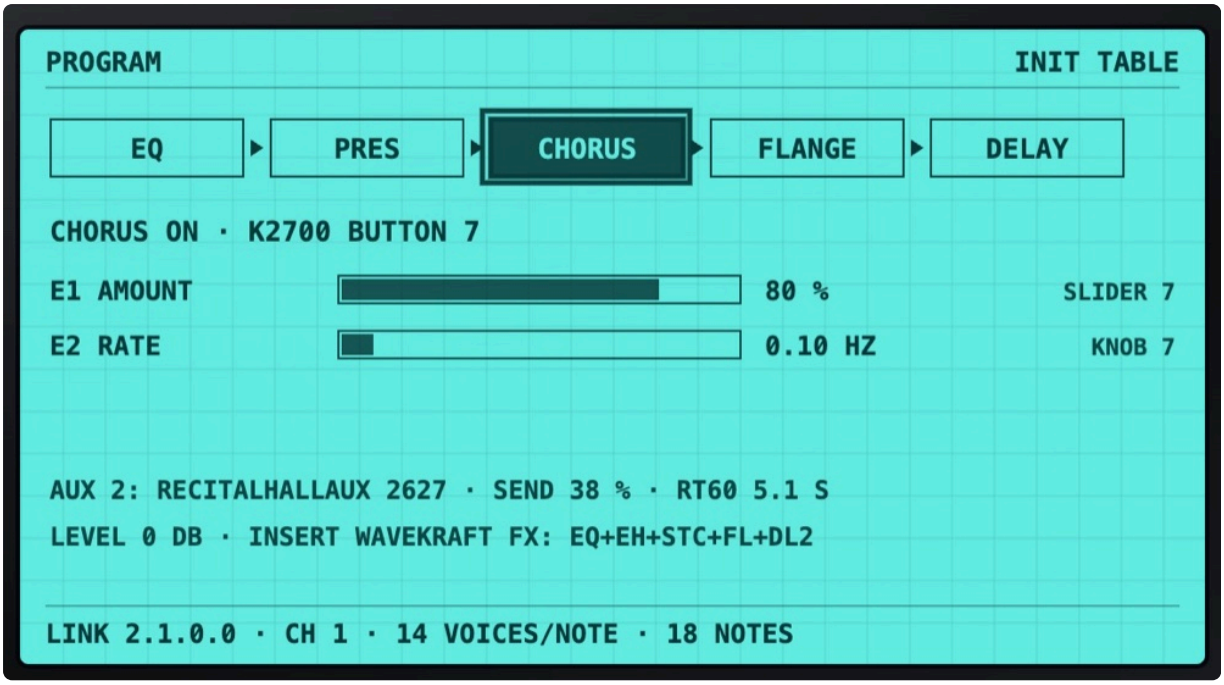


Fig. 22. The FX page. ◀ FX and FX ▶ pick the part, E1 to E3 set it, and the bottom line names the K2700 control.

User manual: the effects, page 81

LINK, SCAN, READ, STORE

No presets: what is on your K2700 is what you edit

WAVEKRAFT holds no presets and saves nothing on the computer. It lists the programs it finds on the K2700, and it writes only to the K2700. A .K27 file carries the waves, the programs and the chain from one K2700 to the next.

1

LINK

Finds the effect chain and the waves on your K2700 by name, then the SCAN runs by itself. Every change on the panel compiles the program again, and only what changed goes into the edit buffer.

2

SCAN

Reads every USER program from 4096 to 8191, marks WAVEKRAFT's own by the tag in their Info, and puts them in the PROGRAM ◀ ▶ list.

3

READ

Opens a WAVEKRAFT program in the panel, field by field, with what you changed on the K2700's own panel too.

4

STORE

Pressed twice, writes the program to its own ID or to one chosen on the programs page: an empty one or a WAVEKRAFT one, never another app's. It reads it back to check, then selects it.

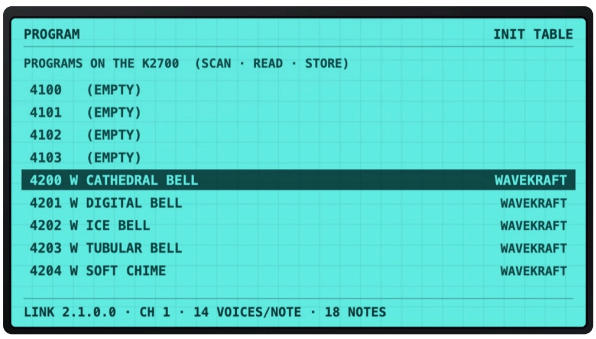


Fig. 23. The programs page after a SCAN.

PLAY plays a chord on the K2700 from the panel, on the chosen KEY with its VELOCITY, and **HOLD** keeps it down: you can edit with both hands free.

While you are linked, if the K2700 goes to another program WAVEKRAFT stops editing it and says so, and LINK sends the program again. Closing the page or the app sends note offs, All Notes Off and All Sound Off.

What cannot be done is refused before it gets anywhere: a program that would need more than 32 layers or more than 4 FUNs in a layer shows NOT ON THE K2700 on the display.

User manual: working with the K2700, page 85

410 PROGRAMS

Three banks, three ways of using a table

WAVEKRAFT keeps no presets of its own: the programs live on your K2700. They come as .K27 files, you load them with FILE > LOAD, and SCAN finds them.

WAVEKRAFT

100 programs on the K2700's ROM alone, with no samples to load. Pads that move once or very slowly over clean passages, and classic sounds that set their timbre at the strike and hold it.

WAVEKRAFT 2

100 more on the ROM, with more motion: tides, drifts, breathing, twin tables and slow scores that you hear from the first seconds of a chord.

WAVEKRAFT WAVES

210 simple sounds on the pack's 740 waves: bells, glass, mallets, digital keys, soft pads, voices, organs. Slow chorus and moderate reverb on all of them.

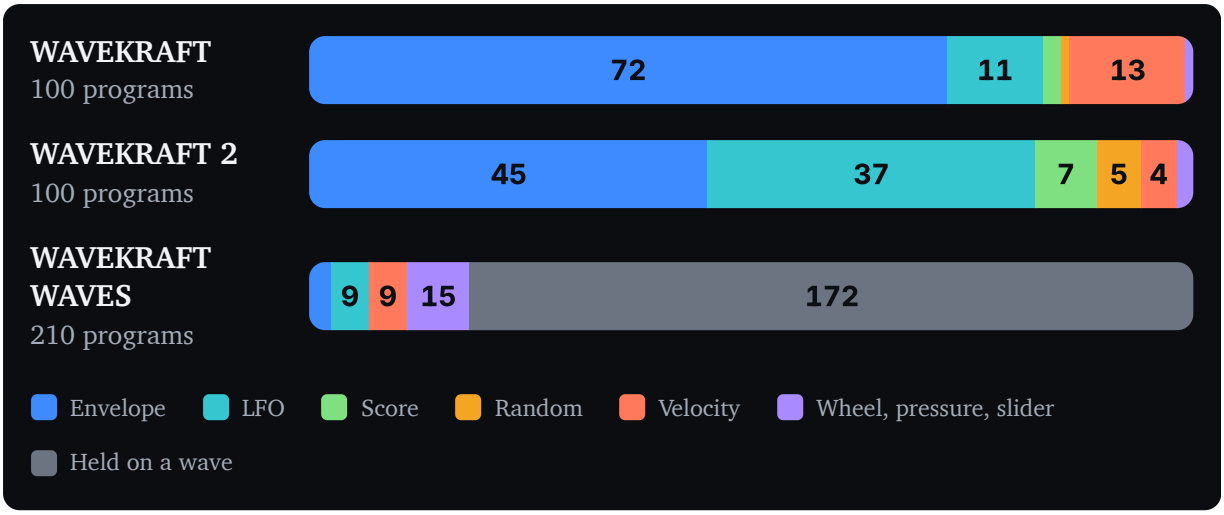


Fig. 24. What moves the position, program by program, in each bank.

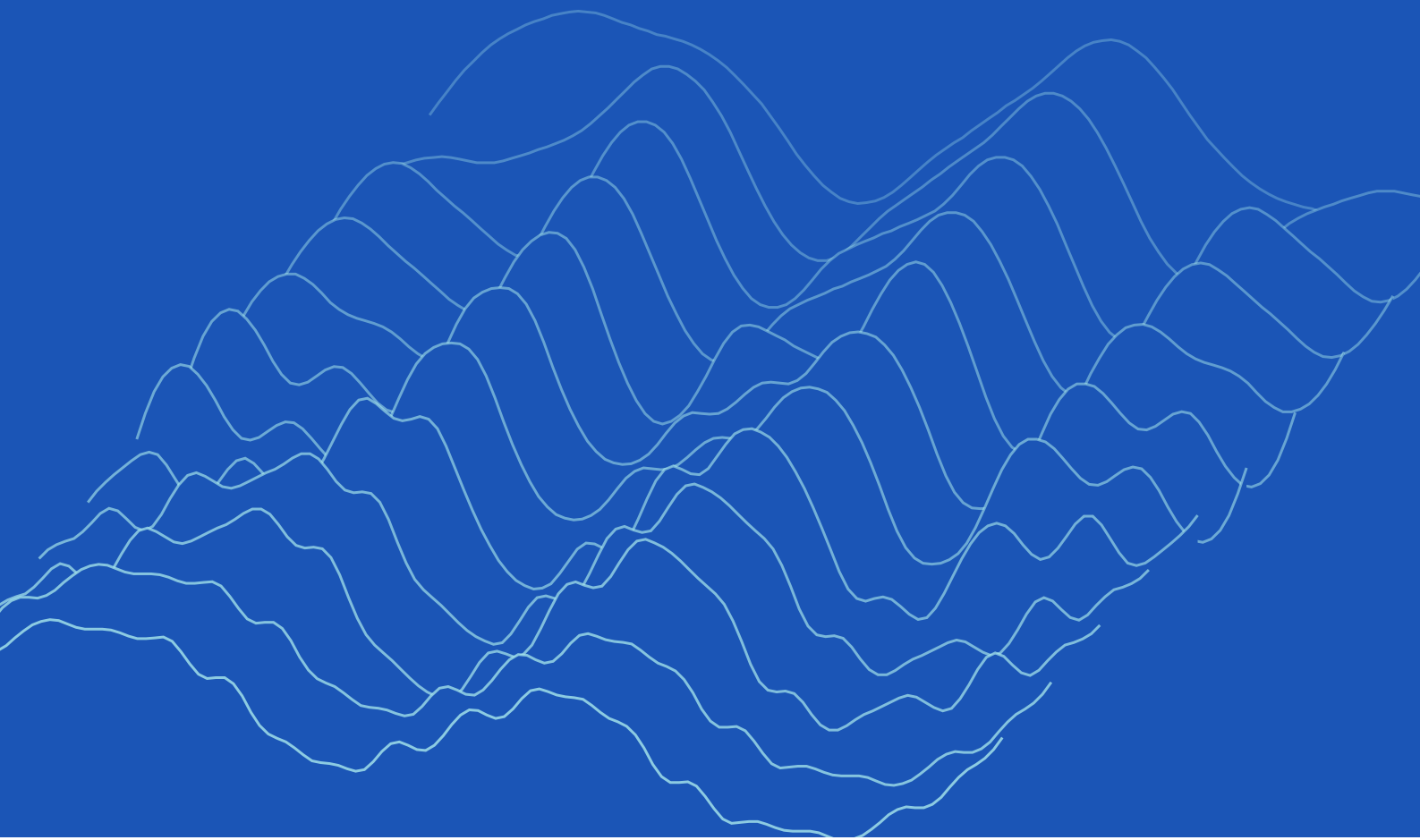
Category	WAVEKRAFT	WAVEKRAFT 2	WAVEKRAFT WAVES
Pads	18	22	26
Strings	10	8	14
Choirs, voices	6	6	14
Electric pianos, keys	12	10	20
Bells, mallets	8	8	38
Glass			14
Plucks	6	8	14
Organs	8	6	12
Brass, reeds	6	6	12
Winds, flutes	4	4	8
Basses	10	8	16
Leads	6	6	12
Sequences	3	4	
Textures, atmospheres	3	4	10

User manual: programs, page 83

PART FOUR

Building it on a Kurzweil

VAST has no wavetable oscillator. Here is how to make one from what it has, step by step, down to the numbers in every FUN: the same program WAVEKRAFT writes, explained well enough to write it by hand.



THE PLAN

What a wavetable needs, and what VAST gives you

A wavetable oscillator needs frames, a continuous position, a coherent blend between neighbours and something to move it. VAST has no such block, but it has layers that can be chained, and wiring algorithms that crossfade a layer's own keymap with the layer before it.

What a wavetable needs	What it is on the K2700	The limit
Frames	one layer per frame, on a keymap with a stored cycle at each root	2 to 16; a voice a note each
A blend between neighbours	the XFADE block in ALG 103 and ALG 123: the chain so far on input A, the layer's own keymap on B	linear, as measured
A position	any control source, read by ramps made of FUNs in each layer	4 FUNs a layer
Frames for every pitch	a keymap with a root in each octave	a root rises one octave at most
Motion	the layer's own ENV2, LFO1 and ASRs, the CC sequencer, wheel, pressure, bender	the same in every layer

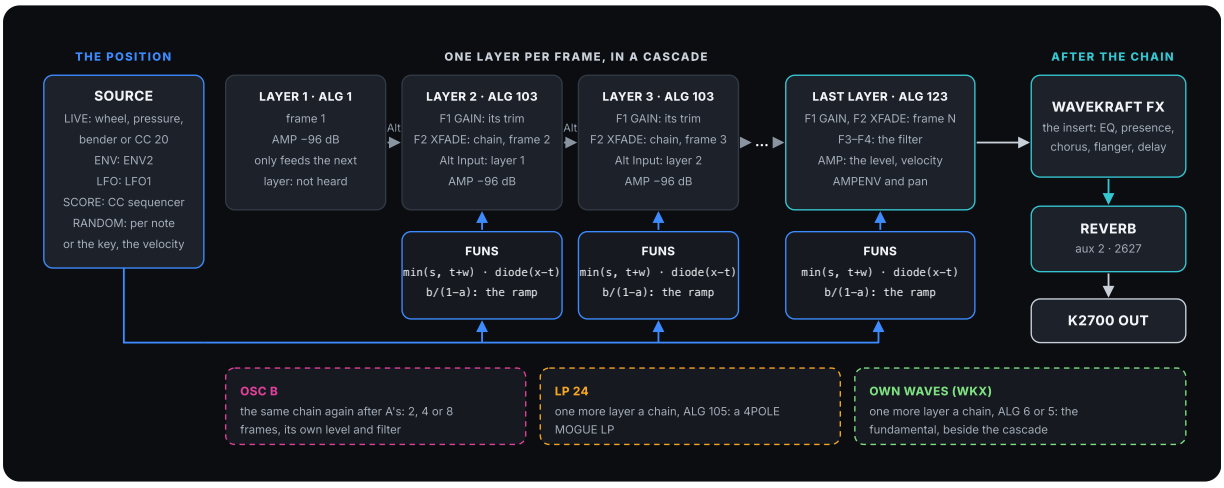


Fig. 25. The program WAVEKRAFT writes. Blue: where the position comes from, and the ramps. Each layer's XFADE takes the chain so far and its own frame; only the last layer is heard. Dashed: what can be added, and what it costs.

Only the last layer is heard
Every layer before it has its AMP at −96 dB and feeds the next through Alt Input. The last one has the AMP, the AMPENV and the pan for the whole chain.

Every layer reads the same
ENV2, ENV3, LFO1 and ASR2 are written the same way into every layer, and they all start with the note, so the ramps all read one position.

A program like any other
It opens, plays and can be edited on the K2700's own panel like a factory program. The editor builds it and sends it; from then on the K2700 does all of it, with no computer attached.

STEP 1

Find the waves

A frame is a layer playing a keymap in which every root is one cycle of the same wave. The ROM has many, and you can load your own.

In the ROM. Look for keymaps that hold a single cycle at every root: Sine Wave, Partials 1 2 3, Sawtooth Wave, Square Wave and their families. Inside a family the roots change on the same keys, so two keymaps stay in step across the keyboard. A long loop that evolves by itself is not a single cycle and will not blend.

Try every passage. Set up a morph between two candidates, hold it half way and play C2, C3 and C5. If a strong harmonic falls more than 9 dB below a clean crossfade, or the level falls more than 3.5 dB, the passage will hollow out when crossed slowly: keep it for attacks, or pick another wave. That is how WAVEKRAFT's 17 ROM tables came out of 110 candidate waves.

Or make your own. One cycle per root and a root in every octave, since a sample plays at most one octave above its root. Eight roots from F#0 to F#7 cover the keyboard, as in the table under aliasing. Keep all the waves at one RMS level and load them as keymaps in a .K27, which is what WAVEKRAFT's pack is.

Level them. Each frame's level is set where it enters the chain, in F1 GAIN of its own layer, as the difference from the frame before.

STEP 2

Each layer crossfades everything before it with its own wave

Two frames at most sound at any position. That follows from one block, the XFADE, and from where each layer's ramp starts and stops.

The XFADE, as measured on the K2700: 100 % plays input A, the chain; 0 % plays input B, the layer's own keymap; 50 % plays both, each at −6 dB; it is linear in between, and a value pushed below 0 holds at B. Its Pad is set to 0 in every layer.

A ramp to each layer. A layer's XFade rests at 100 %, the chain passes through, until the position reaches that layer's threshold. It then falls to 0 over one passage, when only its own frame is left. By then the next layer's ramp is starting.



Fig. 26. The compiler's arithmetic for eight frames with CC 20 at 47: each frame's XFade, its share of what comes out, and the FUNs of layer 3.

Layer	ALG	Blocks	AMP
1	ALG 1	none: the keymap only	−96 dB
2 to N − 1	ALG 103	F1 GAIN, F2 XFADE; Alt Input from the layer before	−96 dB
N, the last	ALG 123	F1 GAIN, F2 XFADE, then the 2-block filter or the QUANTIZE of DIGITAL	the oscillator's level, velocity
the filter, if it has a layer	ALG 105 or ALG 106	4POLE MOGUE LP, or a 2-block filter after DIGITAL; on the last frame's keymap, which it does not play	the oscillator's level, velocity
the own waves' fundamental	ALG 6, or ALG 5 with LP 24	the sine WKX SINE, with the chain's filter	a line in dB over the position
SHAPE, alone	ALG 7	F1 SHAPER or WRAP, the filter in F2–F3	the level

F1 GAIN carries the difference between the levels of two neighbouring frames, the panel's trims, so a frame's level is set where it enters the chain.

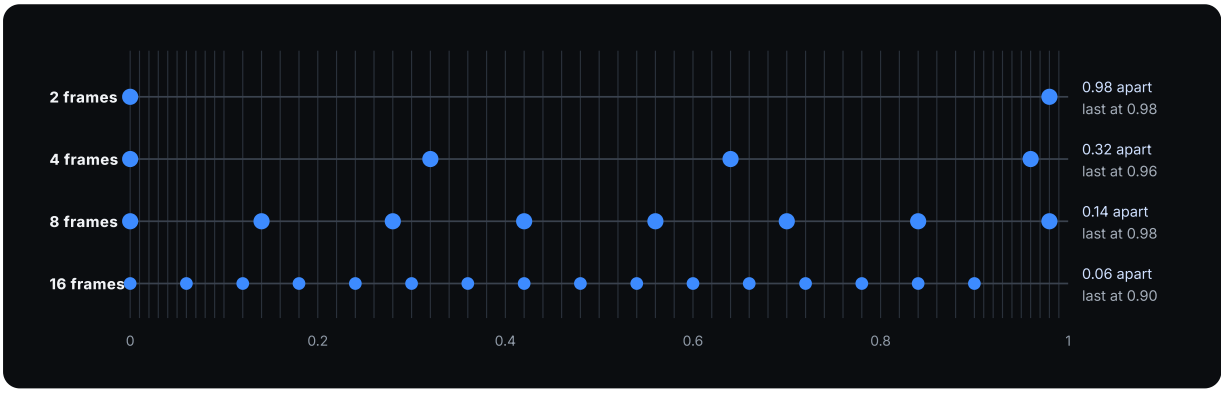


Fig. 27. Where the frames sit, as the compiler picks them: the widest spacing whose thresholds are all valid FUN constants on a 0.02 grid. Eight frames are 0.14 apart and end at 0.98, sixteen are 0.06 apart and end at 0.90.

STEP 3

A FUN does not stop at 1

The obvious ramp takes the threshold off the position in one FUN and multiplies by the slope in the next. On a K2700 it comes out as a sequence of waves in the wrong order, because of one thing FUNs do.

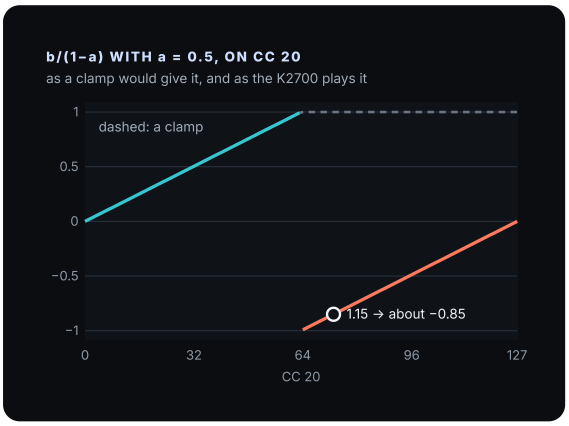


Fig. 28. b/(1−a) on the K2700: a = 0.5, CC 20 from 0 to 127. Up to CC 64 it does what it should. Past it, the output does not hold at 1: it wraps round.

Measured on b/(1−a), the FUN that gives a ramp its slope. With 1.15 asked of it the output came back as about −0.85. Adding a min() afterwards does not help, since by then it has already wrapped.

With the obvious ramp two things go wrong at once. Before a layer's turn, a−b goes negative and the XFade goes past 100 %, so its frame comes in early. After it, the slope passes 1, wraps, and the frame before comes back. At position 0, where only the first wave should sound, all four are heard.

The cure is to keep every FUN inside 0 to 1. The source is capped first, the threshold is taken off with a floor at 0, and only then is the slope applied. Amount and offset are folded into the constants t and w, so they use no FUN.

On the K2700	The obvious ramp	The safe ramp
Position at 0: only the first wave	all four waves: harmonic 3 at −15 dB, harmonics 5 to 11 at −21 dB, against the sine	only the sine, the rest below −120 dB
ENV2 over 20 s, 4 waves	harmonics coming and going in jumps of 8 to 22 dB	harmonics rising and falling in order, 0.1 dB every 50 ms



Fig. 29. Each layer's FUNs. t is where its passage begins and w is how wide it is, in the units of the source. The constants lie on a grid of 0.02, so that a READ gives them back unchanged.

THE BUDGET

Four FUNs a layer

A ramp takes three of a layer's four FUNs, so one is left. It can go to the PPG mode's Quantize, or to whatever a source needs before the ramp: the lowpass of a smoothed SCORE, the held value of RANDOM, a 1−s for a negative AMOUNT, or ENV2 × ASR2 for a release after a decay. One of those, and only one. The compiler counts them, and what would need a fifth is refused with NOT ON THE K2700. Global FUNs do not help, since with Globals on a layer keeps only two of its own.



Fig. 30. The FUNs of a layer in each case. In PPG mode with RANDOM or a negative AMOUNT the panel falls back to STEP.

STEP 4

Two waves on the K2700's own panel

You do not need WAVEKRAFT to try this. A morph between two waves takes two layers and three FUNs, and every field is on the front panel.

Start from any simple program in **PROGRAM**, then **EDIT**. Layer 1 plays the first wave and is never heard directly. Layer 2 plays the second and crossfades it with layer 1. **CHANNEL/LAYER** changes layer and the soft button **NEW LYR** adds one.

Layer	Page	Field	Value
1	KEYMAP	Keymap 1	Sine Wave
1	ALG	Algorithm	1
1	DSP CTL	AMP Adjust	−96 dB: it is heard only through layer 2
2	KEYMAP	Keymap 1	Partials 1 2 3
2	ALG	Algorithm	123
2	ALG	Alt Input	Layer 1
2	ALG	F2 and F3	XFADE and 2POLE LOWPASS
2	DSP CTL	XFade Adjust and Pad	100 % and 0
2	DSP MOD	XFade Src1	FUN3, depth −100 %
2	LFO+	FUN1	min(a,b), a = MIDI20, b = 0.98
2	LFO+	FUN2	diode(a-b), a = FUN1, b = 0.00
2	LFO+	FUN3	b/(1-a), a = 0.02, b = FUN2
2	DSP CTL	AMP Adjust	−6 dB
all	PARAMS	a row for MIDI20	label it WT Position: a program only hears a CC that has a label

Move CC 20 from 0 to 127 and the sine grows into a wave of three harmonics. Put **ENV2** in FUN1's a in place of MIDI20, and the same two layers are an envelope sweep.

N FRAMES

More waves

Each new frame is one more layer, each taking the layer before it as its Alt Input: ALG 103 in the middle and ALG 123 only on the last. Every ramp has the same three FUNs and only three numbers change. **FUN1 b** is where the ramp ends, **FUN2 b** is where it starts, and **FUN3 a** is one minus its width.

Layer	Keymap	ALG	FUN1 b	FUN2 b	FUN3 a
1	Sine Wave	1			
2	Partials 1 2 3	103	0.32	0.00	0.68
3	Partials 2 3 4	103	0.64	0.32	0.68
4	Partials 3 4	123	0.96	0.64	0.68

FUN constants come on a grid: steps of 0.01 up to 0.10, of 0.02 up to 0.90, and of 0.01 up to 0.99. That is why eight frames are 0.14 apart and end at 0.98.

Part of a table. A motion rarely crosses the whole table. To let the source reach only from place **s** to place **s + A**, divide: a ramp that starts at t and is w wide becomes (t − s) / A and w / A. With four waves, s = 0.16 and A = 0.48, layer 2 has FUN1 b = 0.32, FUN2 b = −0.34 and FUN3 a = 0.34, and layer 3 has 0.98, 0.32 and 0.34. Layer 4 is out of reach, so its XFade stays at 100 % and it uses no FUN at all.

STEP 5

Plug in the motion

The position is one field: the a of FUN1. Write the same thing in every layer. Each layer starts with the note, so they all read one position.

Gesture	What goes in	Where it is set
Wheel, pressure, bender, slider	MWheel, Press, AbsPwl, MIDI20	the source itself; a CC also needs its PARAMS label
ONCE, BLOOM, FADE	ENV2	ENV2 page: Attack and Decay, with the level that lands on a wave, Loop Off
TIDE	ENV2	the same, with Loop Seg1Bid
DRIFT, BREATH	LFO1	LFO+ page: +Sine or +Triangle, at the Rate
Velocity, key	AttVel, KeyNum	the source itself
RANDOM	FUN1 = Sample B on A, a = Note St, b = GRand2	the ramp moves up to FUN2, FUN3 and FUN4
SCORE	FUN1 = lowpass(f=a,b), a = 0.14, b = MIDI20	CC SEQ page: a lane on MIDI20 with 16 User steps; the ramp moves up to FUN2, FUN3 and FUN4
TWIN	the same source in a second chain of layers	the second chain has its own t and w

The ramp takes three of the four FUNs of a layer, so a source can use only one more. Envelopes and LFOs are written the same way in every layer, because each layer's ENV2 and LFO1 are its own.

STEP 6

Bringing the position back when the key goes up

In a program of this kind the K2700 does not run the release of ENV2: the position would stay where the key-up found it. WAVEKRAFT's RELEASE knob uses an ASR instead.

When the position's envelope only rises, it is written as ASR2 in Hold mode on Note St: the ASR's attack is the envelope's and its release is the knob's, with no FUN at all. With a decay or a loop it is ENV2 × ASR2 in FUN1, and the filter can follow it. That FUN is the spare one, so PPG mode does not combine with it.

Measured on the K2700: with an ASR release of 1 s the position was still at 90 % after 0.18 s and down to 10 % after 0.98 s; it starts to answer 0.1 to 0.2 s after the key goes up. In PPG mode it goes back down through its steps.

STEP 7

The layers of a cascade do not arrive together

Measured on the K2700: the layers of a XFADE cascade reach each other a few samples apart, 7 to 37 at 48 kHz, in steps of about 7.5, and the figure changes from note to note. It happens with ROM waves and with samples alike, and no fixed offset can correct it.

Played alone, a wave does not show it. Half way through a passage, anything the two waves share goes through a comb filter: a harmonic can fall by 8 to 10 dB on one note and not on the next. **More frames do not help**: the more alike two neighbours are, the more they have in common, and the

deeper the comb.

The answer is to have them share nothing the comb can reach. Above about 450 Hz one wave holds harmonics 1, 2, 5, 6, 9, 10… and the next 3, 4, 7, 8, 11, 12…; each harmonic is in only one of the two, and a delay has nothing to cancel. Those that leave are given back in level, × √2. The fundamental would cancel high on the keyboard, where it is nearly everything, so it plays in a layer of its own beside the cascade (WKX SINE): one voice more a note, and its level follows the position as a line in dB fitted to the waves.

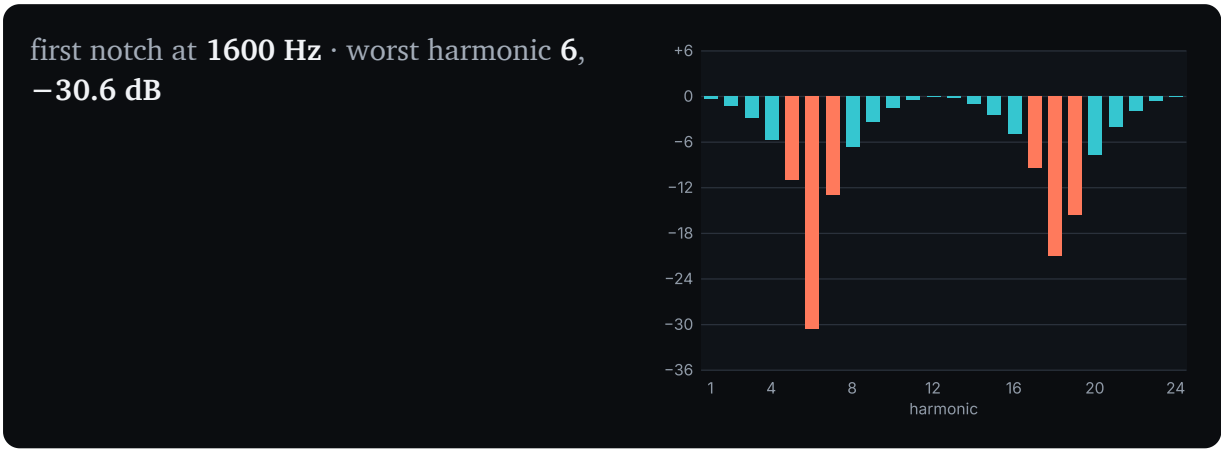


Fig. 31. Two layers 15 samples apart at C4, in the middle of a passage, on waves that share their harmonics. Each bar is a harmonic against its level alone.

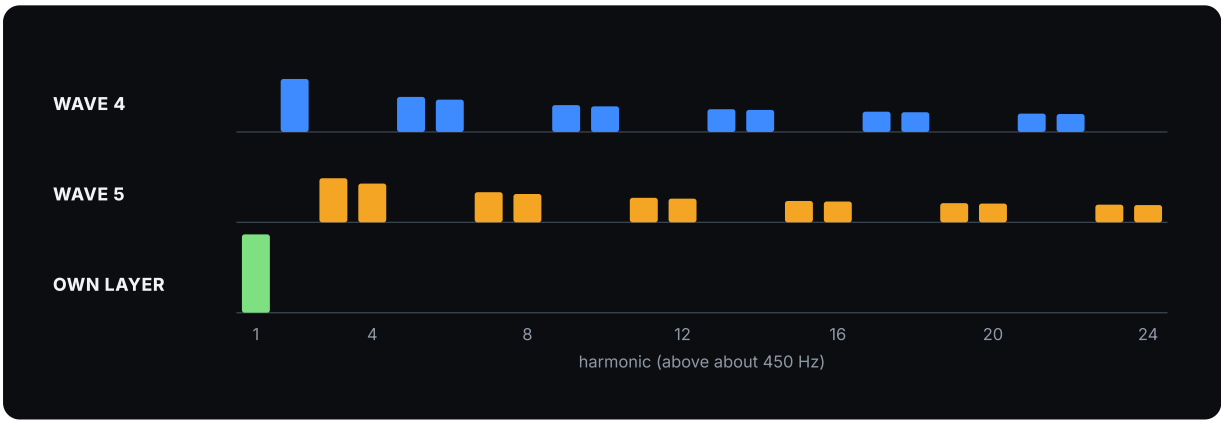


Fig. 32. How the own waves (WKX) are woven: two neighbours and the layer of the fundamental. An illustration: the real heights are each wave's own.

On the K2700	Note	Worst hole	Level drop
VOWEL M, wave 4 to 5	C3	1.0 dB	1.0 dB
FM 1-1, wave 6 to 7	C3	0.9 dB	1.7 dB
FILTER, wave 3 to 4	C3	0.6 dB	1.3 dB
VOWEL M, wave 4 to 5	C5	0.9 dB	0.9 dB
FM 1-1, wave 6 to 7	C5	1.0 dB	1.8 dB
VOWEL M, wave 4 to 5	C6	0.9 dB	0.3 dB

Each row is 5 notes half way through a passage, every one within the limits used here: no hole above 9 dB on a strong harmonic and no level drop above 3 dB.

Two kinds of wave for two jobs. Woven waves (WKX) are made for travelling: neighbours alternate in weight, every note costs one voice more, and no passage hollows out. The 640 WK waves are whole, fundamental included, and made to be held still or crossed quickly: each plays alone and sounds like itself, which is why the pack's programs rest on them.

STEP 8

The last layer sets a gain on the whole chain

A four-pole filter takes four blocks and the XFADE takes one of the same layer's, so LP 24 goes in a layer of its own after the last frame. That layer has to be put on the right keymap, for a reason that applies to any cascade.

LP 24 is a 4POLE MOGUE LP in ALG 105. The panel's RESO (0 to 24 dB) is mapped to this filter's own range, −6 to +12 dB. Compared on the K2700 with a W/SEP four-pole, MOGUE keeps a more gradual knee from the cutoff, like a ladder, where W/SEP is flat to the cutoff and falls abruptly. So MOGUE it is.

On the K2700, saw in C2, cutoff 523 Hz	Slope above the cutoff	Down 6 dB at	Peak over the passband
2 poles	−12.4 dB/octave	785 Hz	+0.9 dB
MOGUE, RESO 0 (−6 dB)	−20.9 dB/octave	523 Hz	none
W/SEP, 0 dB	−23.1 dB/octave	654 Hz	+1.2 dB
MOGUE, RESO 16 (+6 dB)	−21.7 dB/octave	719 Hz	+6.5 dB at 458 Hz
W/SEP, +12 dB	−23.0 dB/octave	719 Hz	+12.0 dB at 523 Hz

A fact about any cascade on the K2700. With the filter layer on the keymap Silence, its level against the 2 poles came out different from one table to the next: it did not depend on the cutoff or on the number of waves, only on which wave came last. The last layer of a cascade applies to the whole chain a gain that goes with its keymap, whether it plays it or not. So the filter's layer now sits on the last frame's keymap, which it never plays, and no compensating gain is written anywhere.

Filter in its own layer, on the last frame's keymap, against the 2 poles	Difference
Saw and triangle, 2 waves, LP 24	0.0 dB
ROM ANALOG, 2, 4 and 8 waves, LP 24	0.0 dB
ROM ANALOG, 4 waves, 2 poles after DIGITAL	0.0 dB
Own waves, 2, 4 and 8 waves, LP 24	0.0 dB
Own waves, 8 waves, 2 poles after DIGITAL	0.0 dB

AS MEASURED

GRAIN and DIGITAL

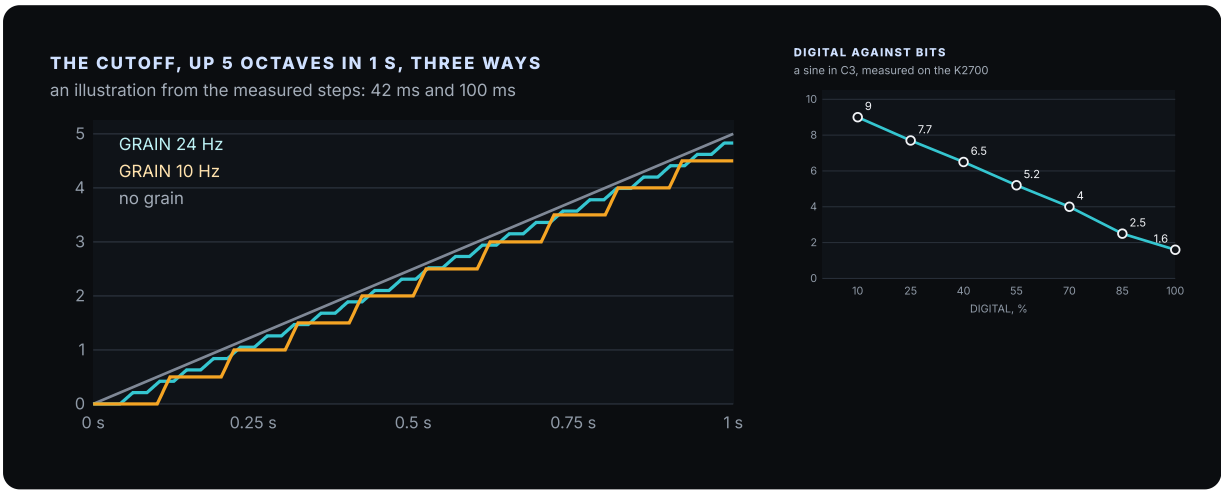


Fig. 33. Left: the filter's sweep with no grain and with GRAIN, drawn from the measured steps. Right: DIGITAL against the bits it leaves, as measured on a sine in C3.

GRAIN catches the filter's envelope with a FUN Sample B on A, clocked by LFO2 as a +Square at 24 Hz, the fastest a K2700 LFO goes and close to the 26 Hz of the original control updates. Measured: a step every 42 ms, each softened by about 20 ms, which is the K2700's own smoothing. At 10 Hz the steps are sharp; at 24 Hz the cutoff is moving for half the time, so the grain is softer. It needs a free FUN: with LP 24 there is always one, and with two poles in PPG mode there is none, so the panel asks for LP 24.

DIGITAL is the QUANTIZE block, voice by voice, after the waves and before the filter, as the original's converters came before its filter. It costs the filter's place, so a 2-block filter moves to a layer of its own, ALG 106, one voice more a chain. Measured on a sine: 9 bits at 10 %, 7.7 at 25 %, 1.6 at 100 %; the level barely moves, 0 dB up to 55 %. Two notes a tritone apart at 70 % give cross-products 18 to 36 dB under their own harmonics, so a chord does not turn to mush, which is what a bit-reduction in the effects would do.

STEP 9

N voices a note leaves 256 ÷ N notes

Every layer plays one voice for every note, even the layers you do not hear. A K2700 has 256 voices, so the number of frames is a choice between richness and polyphony.



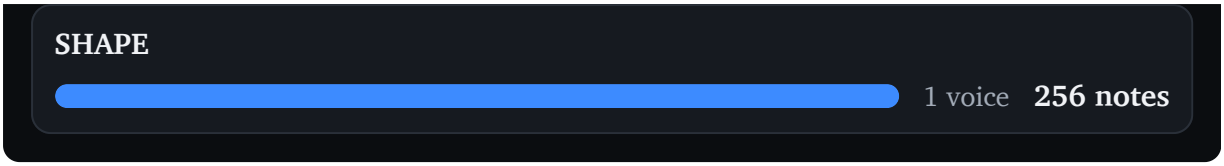


Fig. 34. Voices a note and the notes they leave of 256, in typical patches. The bar is on a scale of octaves. Long releases keep their voices, so a pad plays fewer notes than the figure.

The display shows this all the time, in the line under the position: 8 VOICES/NOTE · 32 NOTES. Most of the programs in the pack use two waves an oscillator, which is why they stay playable as chords.

User manual: voices and notes, page 82

A VARIATION

Another way to travel: eight levels across a passage

The PPG mode is the SMOOTH ramp with a fourth FUN after it. Quantize B to A with a = 0.88 turns the ramp from 0 to 1 into eight levels, so N frames give $7 \times (N - 1) + 1$ places.

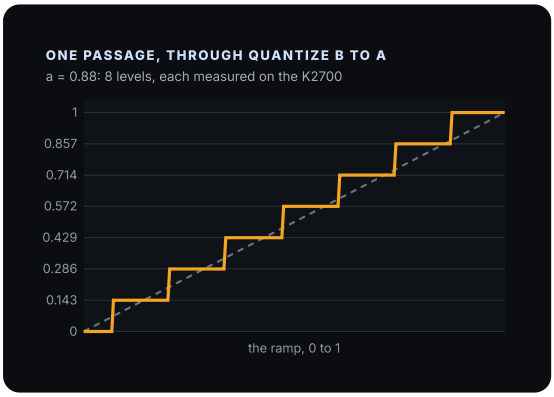


Fig. 35. A passage through the Quantize. The levels on the left are the ones measured on the K2700.

Measured with a full layer and 3 waves: 15 places, always rising, with no wrapping and no wave coming back. The steps are nearly equal; the top level arrives a little early, so each key wave lasts about one and a half times as long as a step in between.

A jump is not instantaneous. It takes 10 to 13 ms on the K2700, in 3 ticks of about 6 ms. When the jump is made by an LFO edge the times are 4.8 ms one way and 21 ms the other.

On the original instrument the jump happens from one sample to the next. Here each is a small mix of two neighbouring levels: very short, and very close to each other, since each step is 1/7 of a passage.

Frames	2	4	5	8	10	16
Places	8	22	29	50	64	106
Voices a note	2	4	5	8	10	16

WAVEKRAFT WAVES.K27

One file, and everything is found by name

The waves, the programs and the effect chain are in one .K27. Loading a file onto the K2700 gives every object an ID the K2700 chooses, so WAVEKRAFT cannot rely on IDs. It looks for everything by name.

740 waves

640 whole WK waves in 50 families and 100 woven WKX waves: 12 tables of 8 and four classic shapes. Every wave has eight roots.

210 programs and a chain

210 programs in 14 categories and the chain WAVEKRAFT FX. About 24 MB in all.

Made here

Every wave is computed from a formula. No wave is taken from another instrument.

How the waves are made. Every wave is a sum of sines, odd about its middle, rounded to 8 bits and held k samples a word at the low roots. Most families are fixed in harmonic number, like a stored wave; vowels and FILTER are redrawn at every root, so formants stay put in Hz across the keyboard. Classic shapes have positive signs, and the others a fixed sign pattern that lowers the peak, the same for a whole family, so neighbours do not oppose each other. All have the same RMS, −13.1 to −13.2 dBFS, so swapping a wave does not jump in level. 453 of the 640 are more than 3 dB (rms over harmonics 1 to 63) from every wave before them; the rest are the gentle steps within a family that make a passage continuous.

1

LOAD

The .K27 goes on with FILE > LOAD, FILL. Each object takes the first free USER ID, and references between them are kept.

2

The chain

At LINK on WAVEKRAFT looks for WAVEKRAFT FX by name: first at 5100, then in the USER chains from 4096 up until it is found or 512 IDs in a row are empty. If it is missing it asks before writing it, never over another object.

3

The waves

It goes through the USER keymaps and takes every one whose name starts with WK or WKX. A WK wave it does not know becomes a table of its own, named after it.

4

The programs

SCAN finds WAVEKRAFT's by the tag WKRAFT1 in their Info. Inside the app everything has fixed numbers; what goes to the K2700 carries the K2700's IDs, and READ maps them back.

Renaming a wave on the K2700 makes WAVEKRAFT lose it. Without the pack on the K2700, the tables that need it show NOT LOADED and cannot be picked.

User manual: why the K2700 chooses the IDs, page 63

WHAT GOES TO THE K2700

One program holds all of it

Everything WAVEKRAFT does ends up in one K2700 program, which the LINK sends and STORE writes.

Part	What WAVEKRAFT writes
Program	the name (16 characters), category Synth, keyword wavekraft, bend ±2 semitones, poly; the panel's LEVEL as the program's Out Gain, −30 to +24 dB
Layers	as in the table above, across the whole keyboard, C0 to G9
Motion	ENV2, ENV3, LFO1, ASR2 in every layer, ASR1 on OSC B's; SCORE: the CC sequencer and the program's tempo
Effects	the insert WAVEKRAFT FX; the reverb, factory chain 2627 on aux 2, send 100 %, mod Sld9&Sw9
Entry values	the 18 controls of the insert, the reverb's time on CC 9, its amount on CC 28, its switch on CC 90, and CC 20 with LIVE or SCORE
PARAMS labels	WT Position (LIVE and SCORE on CC 20), Reverb Amount, Reverb Enable
Info	WKRAFT1 and the table's name: how SCAN knows it

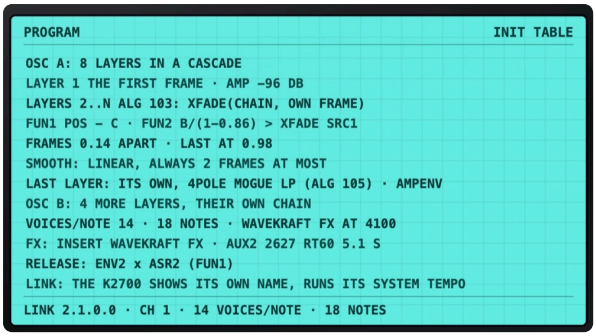


Fig. 36. The K2700 page of the display: what the program will be, in the K2700's terms.

Every patch the panel can make goes through one compiler, and READ brings it back the same, so what you see on the panel is what the K2700 holds.

A patch that would not fit, with more than 32 layers or more than 4 FUNs in a layer, is refused on the display before anything is sent.

THE WHOLE FAMILY

One editor for the K2700, K2088, K2061 and PC4

WAVEKRAFT's LINK recognises your keyboard by itself and shows its name. The programs, the waves and the effect chain are compatible with all four, and everything in Part four applies to them: the same layers, the same FUNs, the same ROM waves.

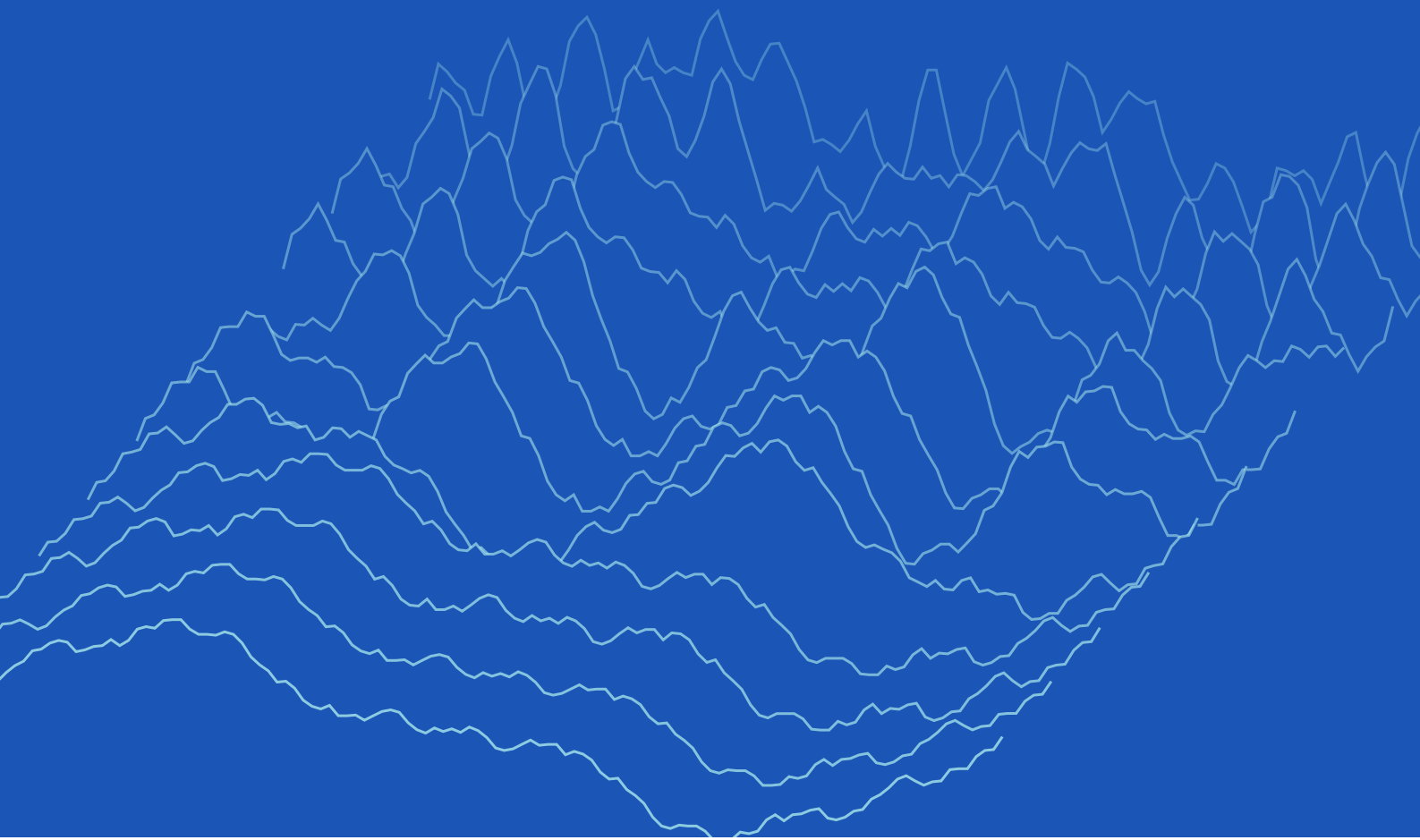
	K2700	K2088, K2061	PC4
The LINK: every knob in real time, SCAN, READ and STORE	yes	yes	yes
The programs of the three banks	yes	yes	yes
The waves and the chain in the .K27 files	yes	yes	yes
ALGs 1, 5, 6, 7, 103, 105, 106, 123	yes	yes	yes
The 111 ROM waves the panel offers	yes	yes	yes
Reverb chain 2627, and the chain WAVEKRAFT FX starts from	yes	yes	yes

On a PC4, STORE writes each program in that keyboard's own format, and READ and SCAN bring it back, so the panel works the same on all four.

PART FIVE

User manual

Every control, message and workflow of the editor, section by section.



Welcome

WAVEKRAFT is a wavetable editor for the Kurzweil K2700. A wavetable is a row of single-cycle waves, and a position that travels along the row: as it moves, the sound moves from one wave to the next. WAVEKRAFT sets up the row, what moves the position, and the filter, envelopes and effects around it.

WAVEKRAFT makes no sound of its own. Every patch becomes a real K2700 program: each wave is one VAST layer, and the layers are crossfaded inside the instrument, voice by voice. The app sends every change to the K2700 over USB as you make it, stores finished programs on it and reads them back. It keeps nothing itself: the programs live on the K2700, and a stored program plays on the instrument with no computer attached.

- **79 tables.** 17 from the K2700's own ROM, and 62 more (740 waves) that the pack `WAVEKRAFT WAVES.K27` puts on your K2700.
- **Two oscillators.** OSC A and OSC B, each with its own table, frames, tune, level and pan. OSC B can follow A's position, stay at a position of its own, or sweep on its own envelope.
- **Three ways through the frames.** SMOOTH blends, STEP jumps from frame to frame, PPG moves in small hard jumps. SHAPE is a separate engine that needs one voice a note.
- **Eight position sources.** The mod wheel, pressure, the bender, CC 20, an envelope, an LFO, a 16-step score and a random value at each note, and also velocity and the key.
- **Filter.** LP, LP 24, HP and BP, a stepped filter envelope (GRAIN) and a bit-reduction colour (DIGITAL).
- **Effects.** One insert chain (EQ, presence, chorus, flanger, delay) and a hall reverb, each on the K2700's own buttons, sliders and knobs.
- **210 programs in 14 categories** in the pack. They live on the K2700: the app has none of its own.

Getting started

What you need

- A Mac with macOS 12 or later.
- A Kurzweil K2700 and a USB cable to its USB COMPUTER port. WAVEKRAFT needs it: without the K2700 there is no sound.
- The pack `WAVEKRAFT WAVES.K27` on a USB stick (about 24 MB). It holds 740 waves, 210 programs and the effect chain WAVEKRAFT FX.

Loading the pack on the K2700

You do this once. On the K2700:

1. Press **GLOBAL**, then **FILE**, then **LOAD**, and choose `WAVEKRAFT WAVES.K27` on the USB stick.
2. Press **FILL**. The K2700 asks which ID to fill from; accept it (or choose one), then press **FILL** again.
3. Wait until the K2700 has finished. Nothing that was on it has been replaced: FILL only uses free IDs.

> **Keep what you have.** Use FILL. **OVWRITE** deletes every USER object on the K2700 first. A **Hard Reset** deletes every USER object too, this pack and anything you have stored included. Before either, save everything to a USB stick with GLOBAL > FILE > STORE > ALL.

Why the K2700 chooses the IDs

The K2700's LOAD puts each object in the first free ID it finds and corrects the references between them. So the programs, waves and chain land at IDs that depend on what your K2700 already holds. WAVEKRAFT does not need to know them in advance: at LINK on it finds the chain and the waves by name and the programs by a tag in their Info text. Two things follow:

- The numbers in this manual's bank list are places in the list, not K2700 IDs. Find a program by its name.
- If you rename a wave on the K2700, WAVEKRAFT stops recognising it. Rename programs as you like.

First sounds

1. Connect the K2700, switch it on, put it in Program mode and select MIDI channel 1 on it.
2. Open WAVEKRAFT. It starts on **INIT TABLE**, and the header says `NOT LINKED`.
3. Press **LINK** (top right). Its light blinks while it connects and stays on once the K2700 answers. The header then reads `LINK`, the K2700's version and `CH 1`.
4. WAVEKRAFT now finds the effect chain and the waves by name, then scans every USER program on the K2700. The display's bottom line counts through them (`LOADING THE K2700'S PROGRAMS: 4512 OF 8191 · SCAN: STOP`). Every WAVEKRAFT program goes into the **PROGRAM** list, and the first one opens.
5. Play the K2700's keyboard, or press **PLAY** in the middle of the panel: it plays a chord on the K2700 and runs the position on the display.
6. Step through the programs with **PROGRAM** ◀ ▶. The K2700 changes to each one too.
7. Change something. Every change goes to the K2700's edit buffer at once.
8. To keep it, press **STORE** (see Programs). Nothing is kept until you do.

> If the chain is not on the K2700, WAVEKRAFT asks before writing it (see EFFECTS ON THE K2700). The 17 ROM tables work without the pack; the 62 others say `NOT LOADED` until the pack is on the K2700.
>
> The reverb is heard once the K2700 is on a WAVEKRAFT program stored on it, with channel 1 selected on its panel (see Which effects you hear). **PROGRAM** ◀ ▶ and **STORE** both put it there.

The panel at a glance

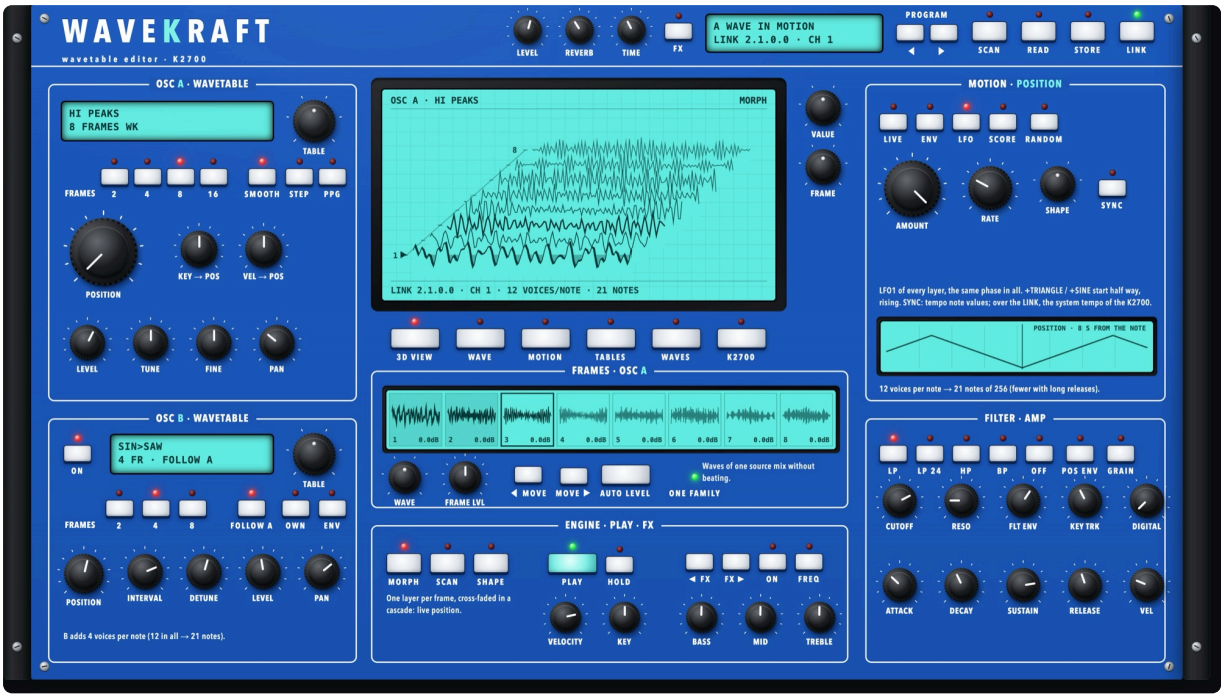


Fig. 37. Eight frames of the HI PEAKS table on OSC A, an LFO moving the position, and OSC B following it.

Area	What it holds
Header	The program's **LEVEL**, the **REVERB** and its **TIME**, **FX**, the program's name and the LINK's state, **PROGRAM ◀ ▶**, **SCAN**, **READ**, **STORE** and **LINK**.
OSC A	The main table: frames, position, tune, level, pan (see OSC A).
OSC B	A second table with its own frames (see OSC B).
The display	Six pages on the soft keys below it, and the **VALUE** and **FRAME** encoders beside it (see The display).
FRAMES	The oscillator's frames in a row: choose one, change its wave, its level, its place (see The FRAMES strip).
ENGINE · PLAY · FX	**MORPH**, **SCAN**, **SHAPE** (see Engines and modes); **PLAY** and **HOLD** (see PLAY and HOLD); the insert chain's controls (see Level and effects).
MOTION · POSITION	What moves the position, its curve and the voice count (see Motion).
FILTER · AMP	The filter on the top row, the amplifier's envelope on the bottom row (see Filter and Amp).

Using the controls

- **Knobs.** Drag up or down, or use the mouse wheel. Hold `Shift` for fine steps. Double-click to return a knob to the value it had when the panel opened. The new value shows for a moment on the display's top line.
- **Endless knobs** (the ones with a dot: **TABLE**, **VALUE**, **FRAME**, **WAVE**, **CONTROL**, **SHAPE**, **STEP**) move one step at a time.
- **Which oscillator the display shows.** Click anywhere inside OSC A or OSC B. The display and the FRAMES strip then show that oscillator (OSC B only while it is on).

Tables, frames and position

Three words carry the whole instrument.

- A **table** is a family of waves that belong together: a filter opening, a row of vowels, a set of bells.
- A **frame** is one wave of the table that the patch actually plays. Each frame takes one layer of the program and one K2700 voice per note, so you choose how many (see Voices and notes). The frames are spread evenly over the table, and the first and the last are always kept.
- The **position** says where along the frames the sound is, from 0 % (the first frame) to 100 % (the last).

The 79 tables

The display's **TABLES** page shows each table with its size and source, and the oscillator's small display shows its source after the frame count: `8 FRAMES WK`.

Source	Tables	What they are
ROM	17	The K2700's own factory keymaps: every K2700 has them, and they need no pack. 4 to 10 frames each, from a library of 110 waves. Each wave's level is known to the panel, for AUTO LEVEL.
OWN	12	From the pack, 8 waves each. Woven so that two neighbours share no harmonics, which keeps a long passage between them even; the fundamental plays in one more layer beside them, at one more voice per note.
WK	50	From the pack, 640 whole waves, fundamental included, 16 or 8 to a table. Made for still waves and short moves; all at the same level, so frames can be swapped without jumps.

ROM tables

Table	Frames	Table	Frames
HARMONIC RISE	10	PULSE WIDTH	4
ADDITIVE	5	OB WAVES	4
DRAWBARS	4	ORGAN WAVES	4
HOLLOW ODD	4	VOWELS	5
EVEN SPECTRUM	4	CHOIR + PAD	4
HIGH PARTIALS	4	BELLS + GLASS	5
ANALOG	8	KEYS	7
SAW BRIGHTEN	5	VS DIGITAL	5
METAL FX	7		

METAL FX is inharmonic, for textures.

OWN tables

VOWEL M, VOWEL F, FM 1-1, FM 1-2, FM 1-5, FILTER, PWM, SYNC, ORGAN, BELLS, CHIP and COMB, 8 waves each. Their waves are named `WKX` on the K2700.

WK tables

Their waves are named `WK` on the K2700. Sixteen waves each, except those marked (8).

Group	Tables
Filters and resonance	RESO LO, RESO HI, SOFT LP, NO FUND, FILTER (8)
From sine to classic shapes	SIN>SQR, SIN>SAW, PWM, PHASE SW, SYNC (8)
Bells and metals	VIBES, HI PEAKS, HI COMB, HI FORCE, HI STRONG, BELLS (8), BELL A (8), BELL B (8), GLASS (8), TINE (8), MALLET (8), CELESTE (8)
Formants and voices	FORM LOW, FORM HIGH, FORM HI2, FORM MIR, CHOIR, VOWEL M (8), VOWEL F (8)
FM	FM 1-1 (8), FM 1-2 (8), FM 1-3 (8), FM 1-5 (8), FM 1-7 (8), EP DIG (8)
Organs, reeds, strings	ORGANS, REEDS, STRINGS, BRASS
Effects	RINGMID, RINGMID2, WILD, FUND+HI, ALT HI LO, ECHOES, ECHO COL, DREAM, COMB (8), CHIP (8)
Soft	SOFT (8)

A wave named `WK` that this version of WAVEKRAFT does not know makes a table of its own, grouped by the name without its last number: `WK NEW 01` and `WK NEW 02` make the table **NEW**. It needs at least two waves, is listed last and has no drawing on the display.

> **Moving between waves.** A passage between two frames that share harmonics can sound hollow for a moment, and the effect changes from note to note. Where the position stops, you hear the wave itself. Pass quickly, stop on a frame, or use an OWN table when you want a long, slow passage.

OSC A



Fig. 38. OSC A on eight frames of HI PEAKS, SMOOTH lit.

Control	Range	What it does
TABLE	the 79 tables	An endless knob. Tables not on this K2700 are passed over. In SHAPE it chooses the shape instead.
FRAMES	2, 4, 8, 16	How many of the table's waves the patch plays (MORPH only). A table smaller than the number pressed says so: `ANALOG HAS 8 WAVES`. See How many frames.
SMOOTH, STEP, PPG		How the position crosses from one frame to the next (see Engines and modes). OSC B takes the same mode.
POSITION	0 … 100 %	Where the position starts, or stands (see What POSITION and AMOUNT do). In SHAPE, the amount of shaping.
KEY → POS	−100 … +100 %	The key played moves the position. At +100 % the whole MIDI key range covers the table (C4 is about half way). Only with MOTION's AMOUNT at 0.
VEL → POS	−100 … +100 %	How hard you play moves the position. Only with MOTION's AMOUNT at 0, and it takes precedence over KEY → POS.
LEVEL	−24 … +6 dB	The oscillator's level.
TUNE	−24 … +24 semitones	
FINE	−50 … +50 cents	

PAN	L 64 ... CENTRE ... R 64

How many frames

- **16** is only for the WK tables of 16 waves. It costs 16 voices a note.
- **8** needs a table of 8 waves or more.
- **4** is available on every table.
- **2** is a single passage between two waves, at 2 voices a note. On a ROM table it starts at the table's cleanest pair of neighbours. On **HIGH PARTIALS** and **CHOIR + PAD** no pair is clean, and the display says `NO CLEAN PAIR`: the two waves will partly cancel half way. You can still use them, or choose other waves with **WAVE**. After you choose waves by hand the panel no longer warns about the pair: trust your ears.

If you step to a table with fewer waves than the current count, the patch takes all of them and no FRAMES light stays on (a table of 5, for example, plays its 5).

The FRAMES strip

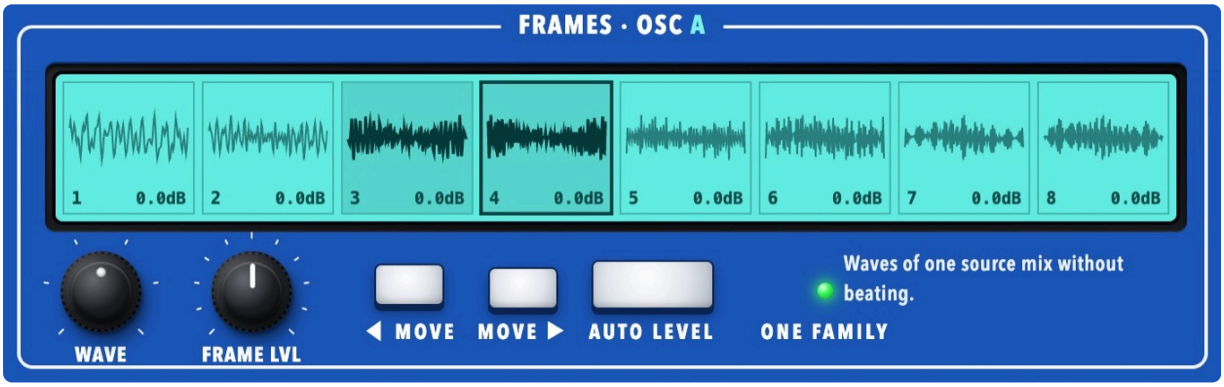


Fig. 39. Frame 4 chosen, and the position between frames 4 and 5 (the two that light up).

The strip shows the frames of the oscillator in focus. The title says which: `FRAMES · OSC A`. Click a frame to choose it, or turn **FRAME** beside the display. The frames the position is on light up.

Control	Range	What it does
WAVE	the table's source	Changes the chosen frame's wave and opens the WAVES page. A frame of a ROM table can take any of the 110 ROM waves, a frame of a WK table any of the 640 WK waves. A frame of an OWN table takes only waves of the same harmonic set, so that neighbours keep alternating.
FRAME LVL	−12 ... +12 dB, in 0.5 dB steps	The chosen frame's level against the others. It shows under each frame.
◀ MOVE, MOVE ▶		Moves the chosen frame one place. Not on OWN tables, where the order must stay.
AUTO LEVEL		Sets every frame to the mean level of the frames, so the sound does not jump as the position moves. A ROM table is levelled by itself when you choose it. WK and OWN waves are already level with each other.

ONE FAMILY / MIXED	A light: green when all the frames come from one source (ROM, OWN or WK), amber when they do not. Waves from different sources beat slowly in the mix, so a mixed passage is a little less even.

WAVE, FRAME LVL, MOVE and AUTO LEVEL work in MORPH only.

The display

The top line shows the oscillator in focus, its table and the engine, or the control you just touched. The bottom line shows the position and the voices (`POS 0.34 · FRAME 3›4 · 8 VOICES/NOTE · 32 NOTES`), or, with the LINK on, the LINK's state and the voices (see Messages). Six soft keys below it choose the page.

Control	What it does
VALUE	On TABLES it steps the table, on WAVES the wave, on the programs page the row. On any other page it moves POSITION by 1 %.
FRAME	Chooses the frame, as a click on the strip does.

3D VIEW

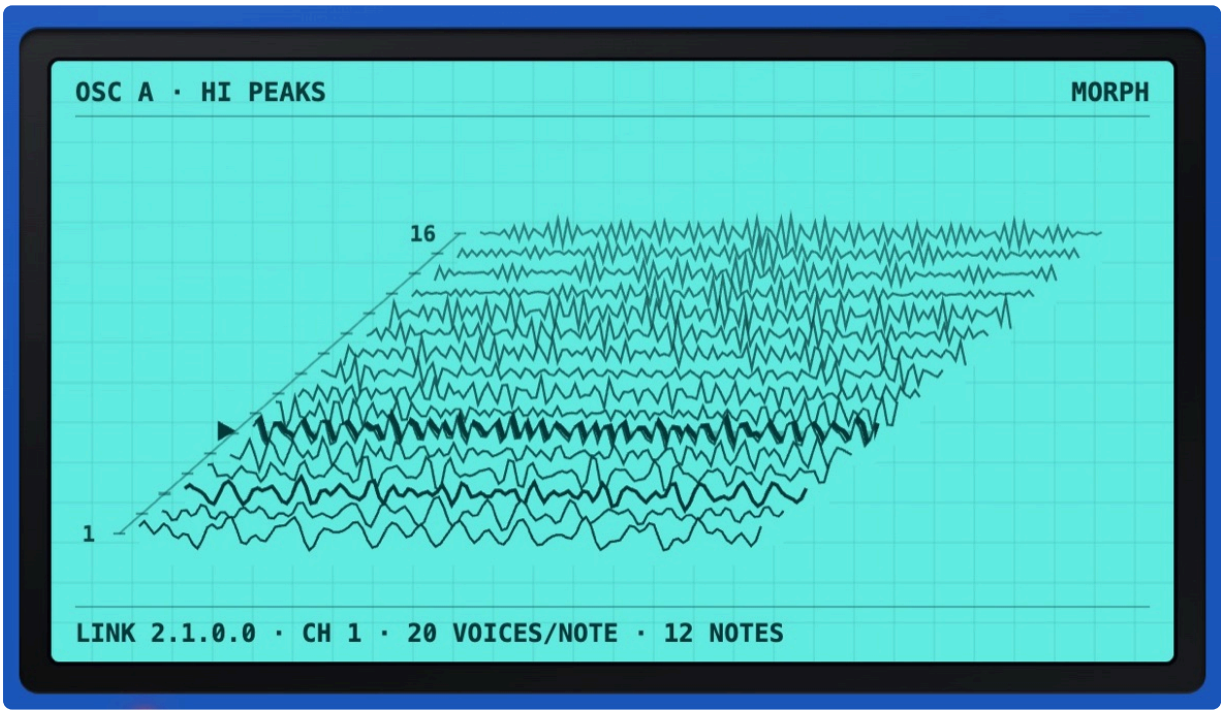


Fig. 40. Sixteen frames: the first in front, the last at the back, the arrow and the bold wave at the position.

The frames in depth. The bold wave is the sound at the position now, and the chosen frame is drawn a little darker. Click on the picture to set POSITION (OSC A).

WAVE

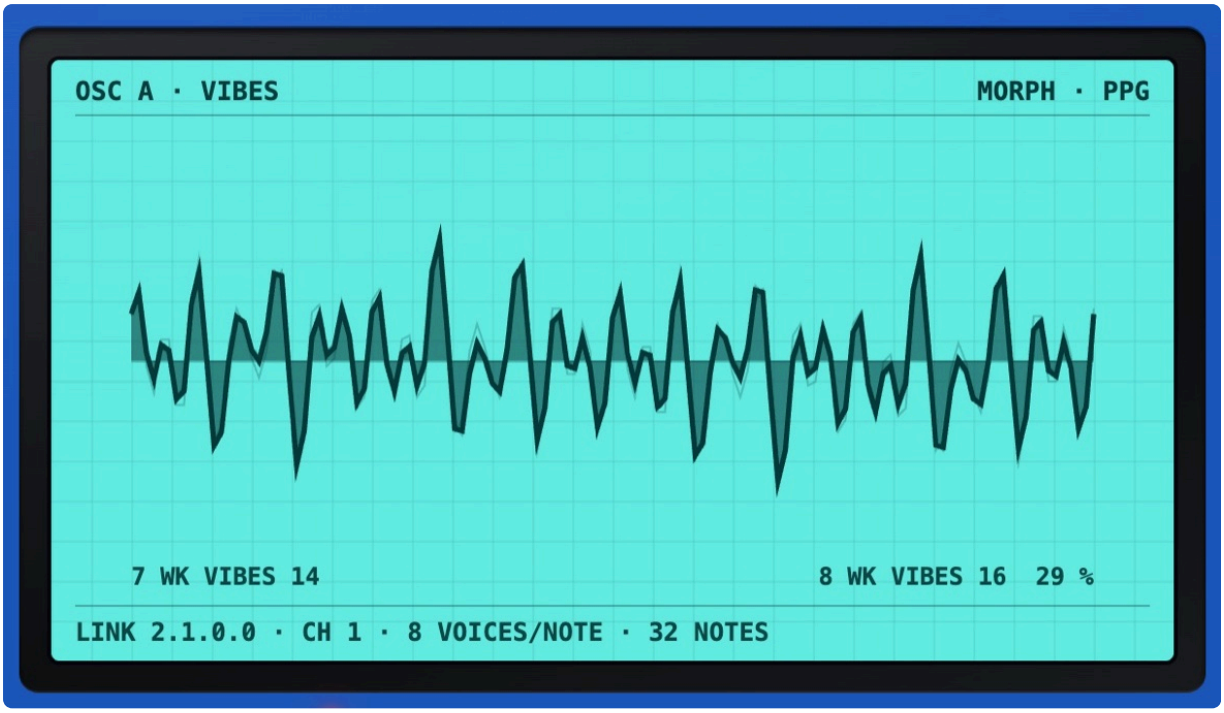


Fig. 41. The wave at the position, here in PPG mode, 29 % of the way between frames 7 and 8.

One large cycle of the wave at the position. Between two frames it also draws both of them faintly, and it names them and says how far along it is. Click on it to set POSITION.

MOTION

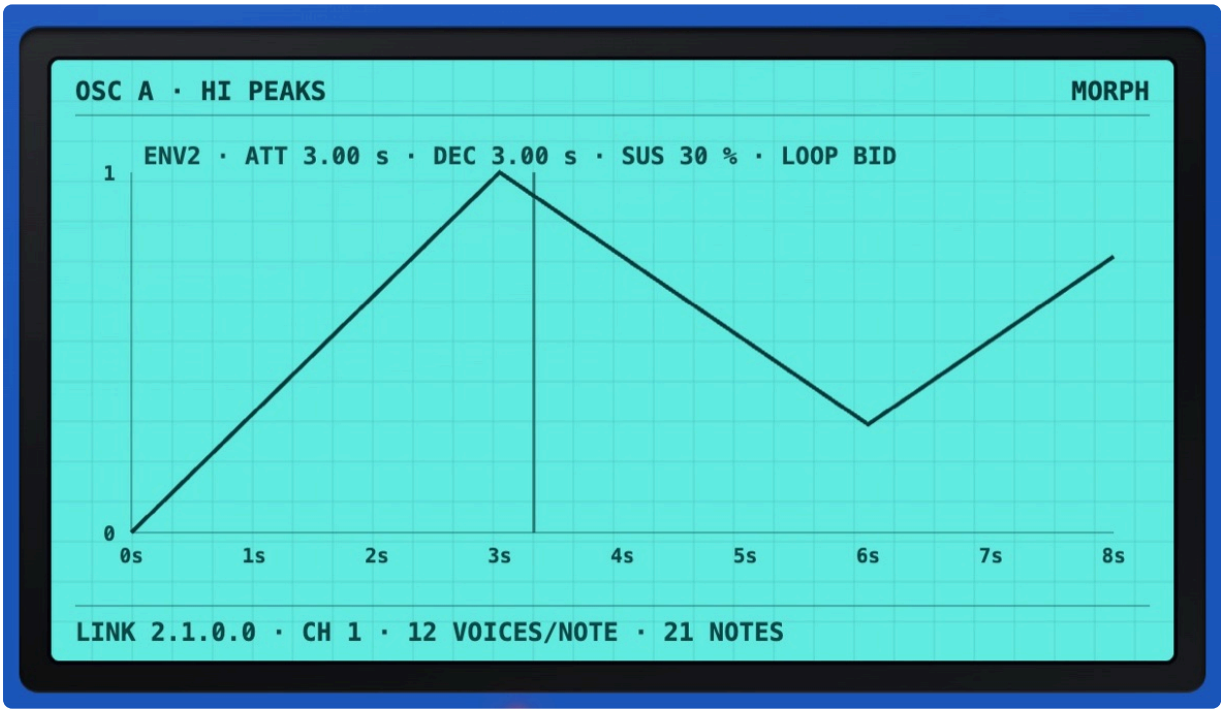


Fig. 42. The position over 8 seconds from the note, with its source and values above the curve.

Pressing one of MOTION's source buttons opens this page. While PLAY runs, a line travels along the curve.

TABLES

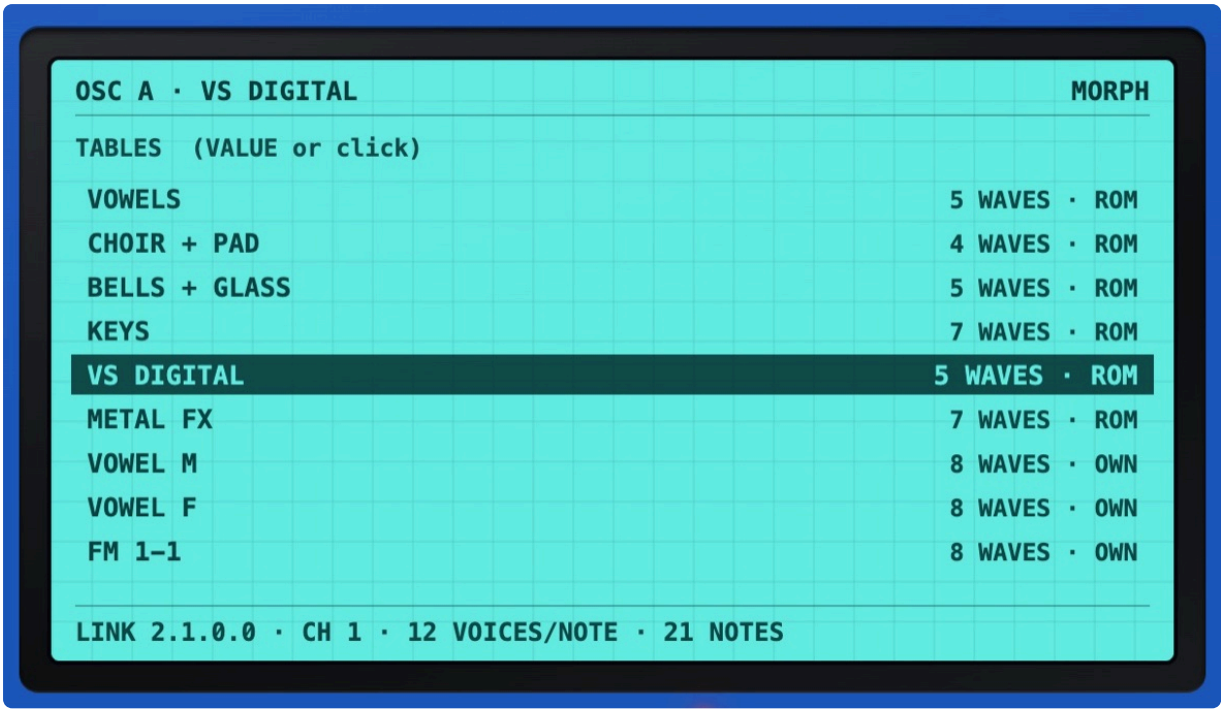


Fig. 43. Each table with its size and source.

Turn **VALUE** or click a row to choose a table for the oscillator in focus. A table whose waves are not on this K2700 says `NOT LOADED`.

WAVES

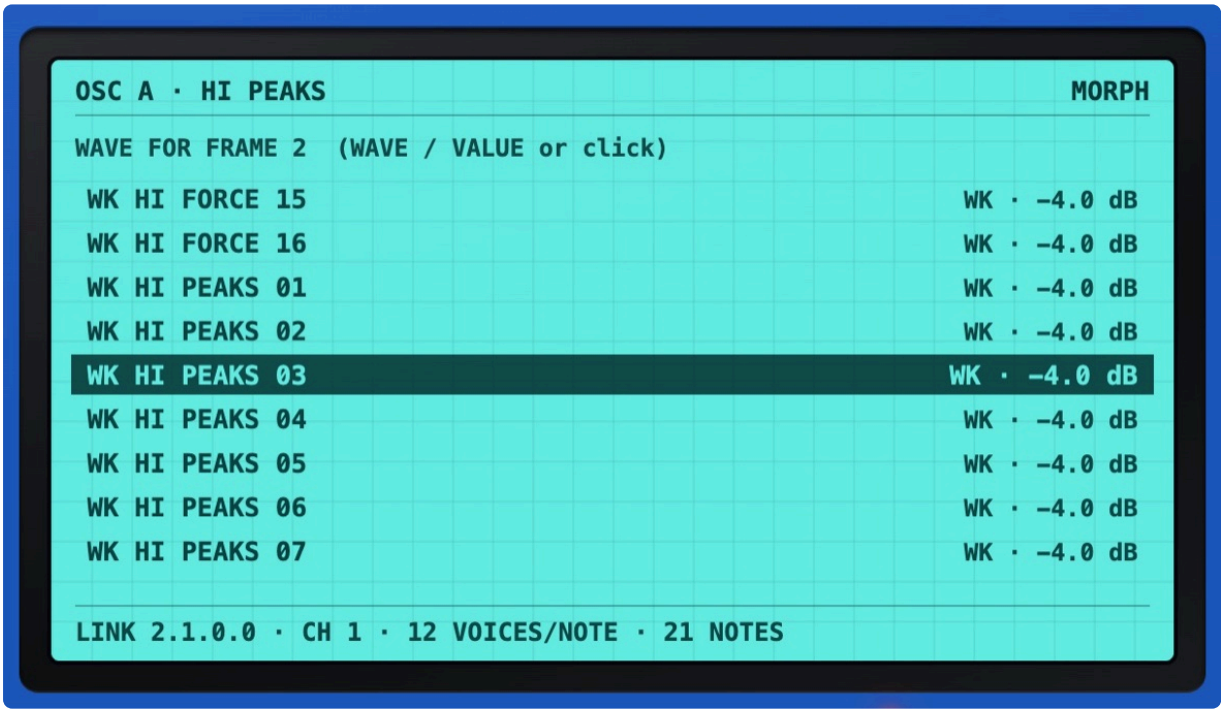


Fig. 44. The waves the chosen frame can take.

Turn **VALUE** or **WAVE**, or click a row, to change the wave of the chosen frame.

K2700

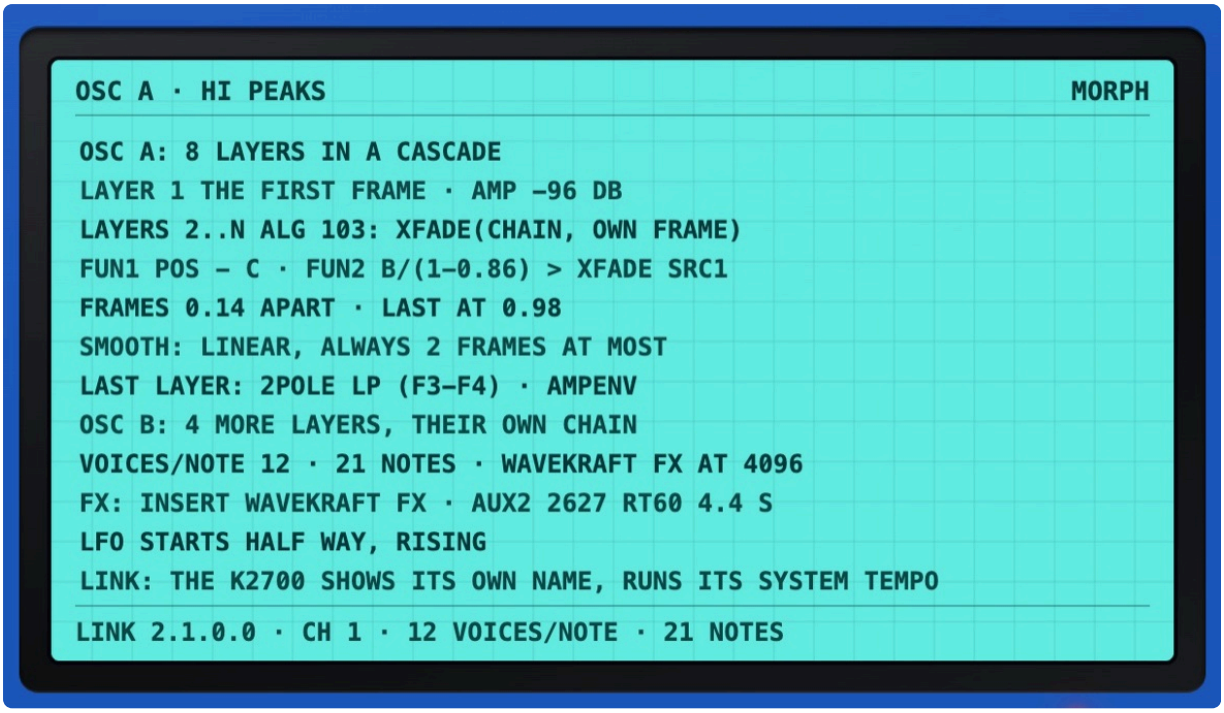


Fig. 45. What the program is on the K2700, in its own terms.

How the patch is built as a K2700 program: its layers, how the frames are spaced, the filter's place, the voices, the effect chain and where it was found on your K2700 (`WAVEKRAFT FX AT 4096`) or that it is missing. It explains; nothing here is edited.

Other pages

FX in the header opens the effects page (see Level and effects), and **SCAN**, **READ** or **STORE** open the programs page (see Programs). Any soft key leaves them.

Engines and modes



Fig. 46. The engine on the left, PLAY in the middle, the effects' controls on the right.

MORPH

The main engine. One layer for each frame, crossfaded in a chain inside the K2700, so the position works live, note by note. At any position at most two frames are sounding. Three modes, on OSC A's buttons, say how the frames are crossed:

Mode	What you hear	Positions
SMOOTH	A linear blend from one frame to the next.	Continuous
STEP	No blend: it jumps straight to the next frame at the half-way point. Good for hard, sequenced changes.	One per frame
PPG	The stepped sound of the classic early-80s wavetable instruments: each passage is cut into 8 levels and the position jumps between them, never blending.	7 × (frames − 1) + 1: 8 at 2 frames, 22 at 4, 50 at 8, 106 at 16

PPG uses the last function generator each layer has, so only one direct source can drive it. RANDOM, a negative AMOUNT, a RELEASE with a decay or a loop, and OSC B's ENV with a negative DEPTH do not fit: the display says `ONE DIRECT SOURCE ONLY`, and if one of these is set later the mode falls back to STEP. A SCORE plays its steps with no smoothing in this mode. See What the K2700 can play.

SHAPE

One layer, one voice per note. No frames: the K2700's own processing bends a simple wave, and the position sets how much. **TABLE** chooses among three shapes:

Shape	What the position does
SINE › SHAPER	From a sine to a bright, folded wave (shaper amount 0.1 to 2.5 ×).
SAW › WRAP	A sawtooth wrapped around more and more as the position rises (−12 to +12 dB).
TRI › SHAPER	From a triangle to a bright, folded wave (shaper amount 0.1 to 2.5 ×).

In SHAPE there is no OSC B, no 24 dB filter (LP 24 plays as LP) and no DIGITAL. The strip draws the shape's steps. It is useful for big chords and long releases, where a frame chain would use up the K2700's voices.

SCAN

The button is there for sweeps recorded as long samples. The ROM tables and the pack have none, so the display says `SCAN: NO SWEEPS IN THE ROM TABLES` and the panel stays where it was. Do not confuse it with **SCAN** in the header, which reads the K2700's programs.

Motion

Five buttons choose what moves the position. Each brings up its own knobs and opens the MOTION page. The curve at the bottom draws the position over the 8 seconds after a note, and the line under it counts the voices.

What POSITION and AMOUNT do

AMOUNT runs from −100 to +100 %. Negative values run the source backwards.

Source	POSITION	AMOUNT
LIVE on CC 20	not used: the CC is the position	not used
LIVE on the wheel, pressure or bender	the starting point	how far the control takes it
ENV, LFO	the starting point	how far the motion takes it
SCORE, RANDOM	not used	not used

With AMOUNT at 0, the position stands still at POSITION on ENV, LFO and the wheel, pressure or bender. That is also the only setting in which **VEL → POS** and **KEY → POS** count (velocity first): the two then decide the position, over POSITION as a starting point.

LIVE

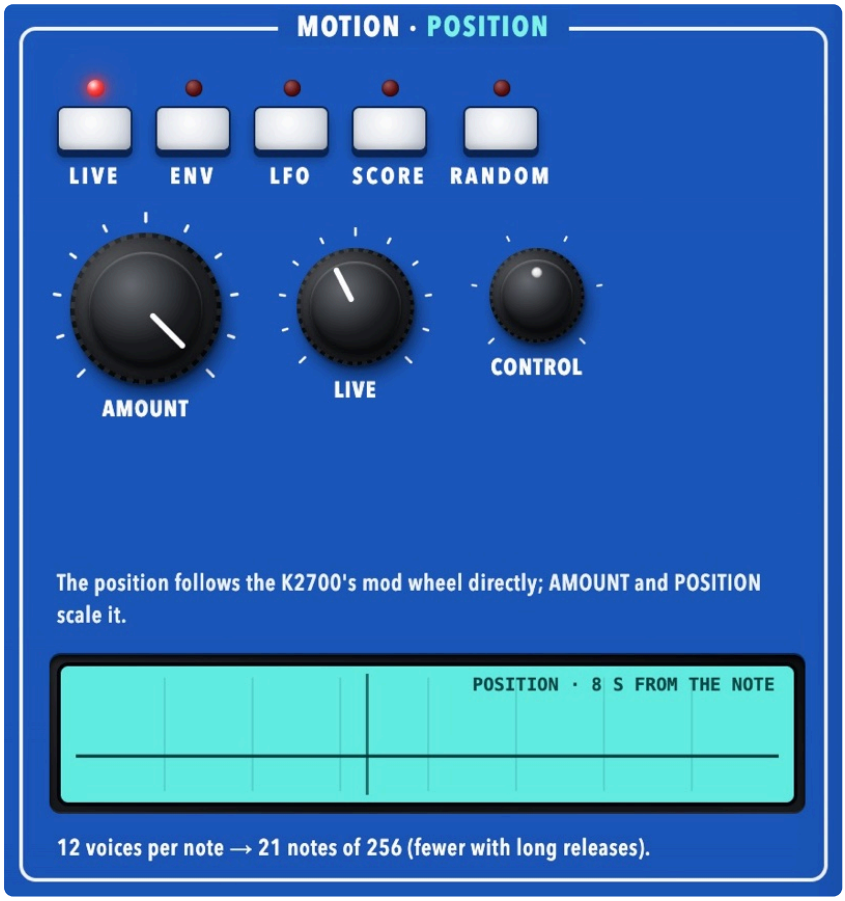


Fig. 47. LIVE with the mod wheel as the control.

Control	Range	What it does
CONTROL	MOD WHEEL, SLIDER (CC 20), PRESSURE, BENDER	Which K2700 control moves the position, with no function generator in between. With BENDER, either direction counts as up.
LIVE	CC 0 … 127	With SLIDER (CC 20): the position itself, stored as the program's starting value and sent to the K2700 as CC 20 while the LINK is on.

With LIVE on CC 20 and the knob at 0 you have a still wave: the first frame. Most of the 210 programs are made that way. Which K2700 controls can move it is in The K2700's own controls.

ENV

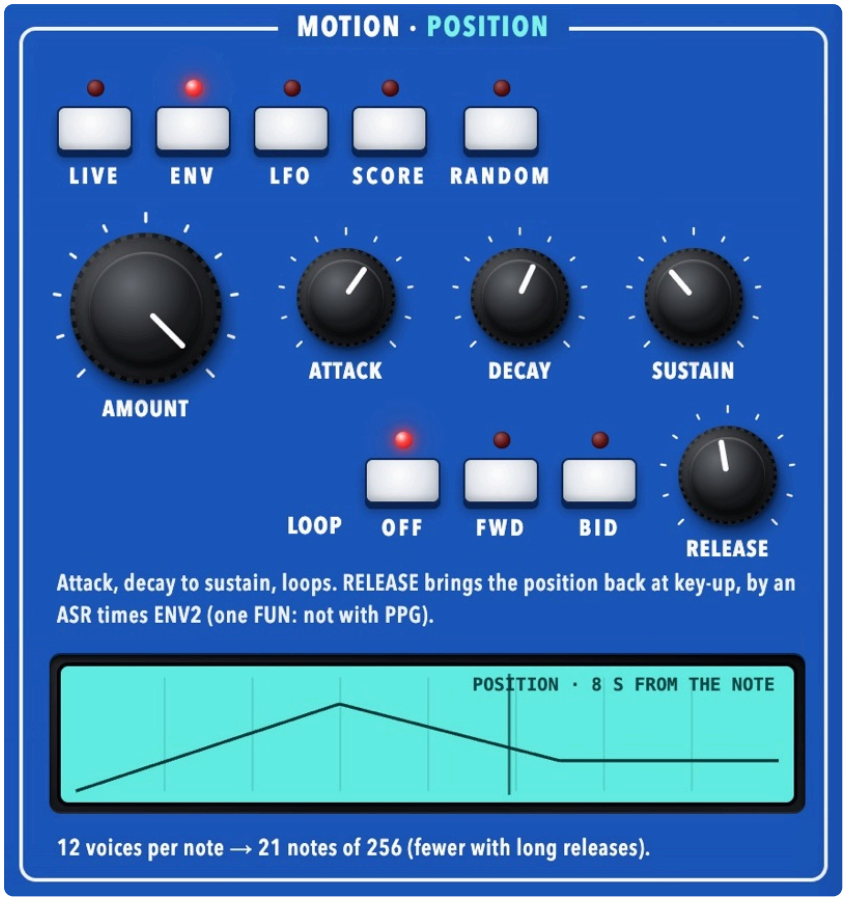


Fig. 48. An envelope drawn over 8 seconds.

Control	Range	What it does
ATTACK	0 … 12 s	The time up to the peak, with each note.
DECAY	0 … 12 s	The time down to SUSTAIN.
SUSTAIN	0 … 100 %	Where the position stays while the key is down.
LOOP	OFF, FWD, BID	**FWD** repeats attack and decay while the key is held; **BID** goes back and forth over them.
RELEASE	OFF … 12 s	Brings the position back at key-up.

The envelope is the K2700's ENV2, the same in every layer. Times are stored on the K2700's own envelope steps.

The K2700 runs no release on this envelope, so with RELEASE **OFF** the position stays where the key-up finds it. RELEASE works in MORPH only, by an extra envelope:

- An envelope that only rises (no loop, and DECAY at 0 or SUSTAIN at 100 %) needs no function generator.
- With a decay or a loop it takes one: it then does not fit with PPG, and AMOUNT must be above 0 (the display says `NOT ON THE K2700: RELEASE WITH A DECAY: AMOUNT ABOVE 0`).

Press **POS ENV** in the filter to make this same envelope open the filter (see Filter).

LFO

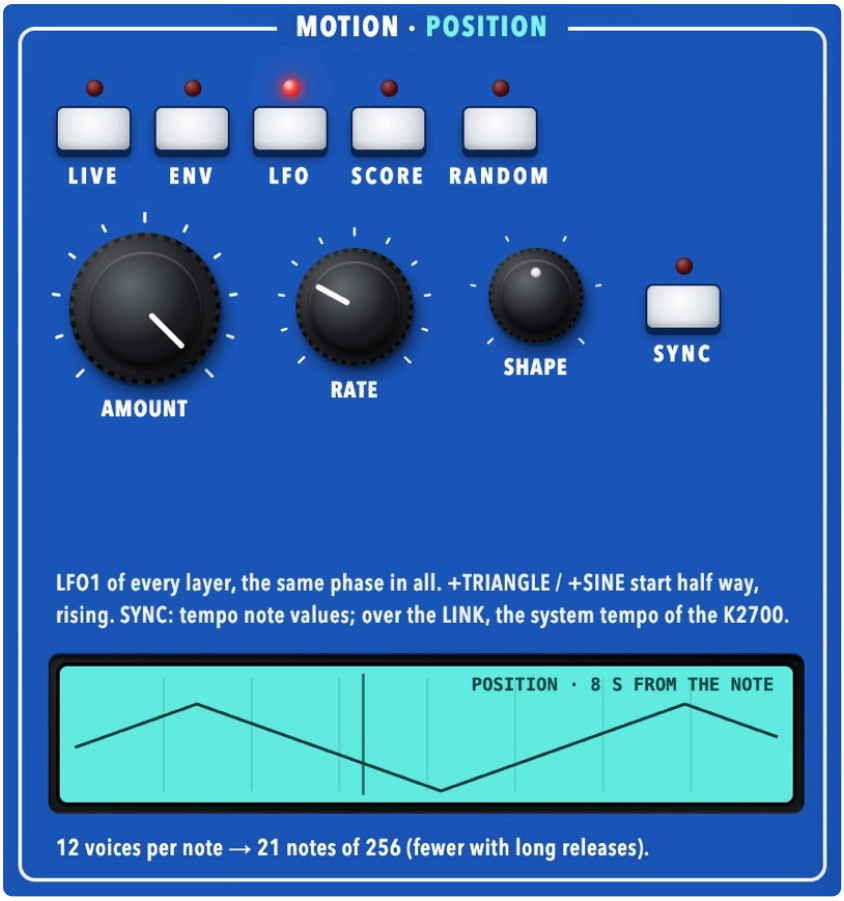


Fig. 49. A slow triangle LFO over 8 seconds.

Control	Range	What it does
RATE	0.02 … 8 Hz	
SHAPE	+TRIANGLE, +SINE, +RISE SAW, +SQUARE, S&H	All unipolar, so the position only moves up from POSITION.
SYNC	OFF, 1/4, 1/8, 1/8T, 1/16	Each press takes the next value. The rate then follows the K2700's tempo: over the LINK, its system tempo.

It is the K2700's LFO 1, the same phase in every layer, so the frames stay together. +TRIANGLE and +SINE start half way up, rising. The LFO starts with each note: two notes played apart are not in step.

SCORE

Control	Range	What it does
STEP	1/16, 1/8, 1/4, 1/2, 1/1	The length of each of the 16 steps, at the program's tempo of 120 BPM.
SMOOTH	0 … 100 %	How much the steps are smoothed into one line. In PPG mode there is no smoothing.

A rising and falling gesture of 16 steps, played by the K2700's own CC sequencer. The panel has no editor for the steps: a program READ from the K2700 keeps its own, and a new one uses the panel's.

The K2700's edit buffer does not carry the CC sequencer. While you edit with the LINK on, the app sends the 16 steps to the K2700 itself as CC 20, but only while **PLAY** is playing: notes played on the keyboard do not start them. Once the program is stored, the K2700 plays them on its own, and starts again when you play after every key has been released.

RANDOM

A new position at each note, held for the whole note and the same in every layer. It does not fit with PPG. The **GLIDE** knob does not change the program in this version.

OSC B



Fig. 50. OSC B on its own sweep: ATTACK, DECAY and DEPTH appear when ENV is on.

A second chain of frames after A's, with the same filter and the same amp envelope. It works in MORPH only, and adds its frames to the voices.

Control	Range	What it does
ON		Switches the oscillator on.
TABLE	the 79 tables	As on OSC A.
FRAMES	2, 4, 8	No 16 here.

FOLLOW A		B's position is A's plus **POSITION** as an offset.
OWN		B stays at **POSITION**, a fixed wave, whatever A does. Not to be confused with the OWN tables.
ENV		B has a sweep of its own, up and back once with each note (below).
POSITION	−100 … +100 %	The offset in FOLLOW A. Where B stands in OWN (negative counts as 0). Where the sweep starts in ENV.
INTERVAL	−24 … +24 semitones	Added to A's TUNE.
DETUNE	−50 … +50 cents	Added to A's FINE.
LEVEL	−24 … +6 dB	
PAN	L 64 … CENTRE … R 64	A panned one way and B the other opens the stereo.

B's own sweep (ENV)

Control	Range	What it does
ATTACK	0 … 12 s	The time up to the top of the sweep.
DECAY	0 … 12 s	The time back down.
DEPTH	−100 … +100 %	How far it travels from POSITION. Negative runs downward, costs one function generator and does not fit with PPG.

The sweep leaves the filter's envelope free, so A, B and the filter can each move differently.

Filter



Fig. 51. LP 24 with GRAIN and DIGITAL on.

One filter setting serves both oscillators, each with its own filter, after the crossfades.

Control	Range	What it does
LP		A 2-pole lowpass.
LP 24		A 4-pole lowpass, 24 dB an octave. It needs a layer of its own: one more voice per note for each oscillator. MORPH only: in SHAPE it plays as LP.
HP		A 2-pole highpass.
BP		A bandpass.
OFF		No filter.
CUTOFF	40 Hz … 18 kHz	Stored on the nearest semitone, as the K2700 keeps it.
RESO	0 … 24 dB	Resonance. On LP 24 the knob covers that filter's whole range, −6 to +12 dB. On BP it sets the band's width instead: 2.8 octaves at 0, down to half an octave.
FLT ENV	−48 … +48 semitones	How far the envelope moves the cutoff, up or down (four octaves).
KEY TRK	0 … 100 %	How far the cutoff follows the keyboard. 100 % follows it fully, one semitone a key.

DIGITAL	0 … 100 %	Reduces the bits of the sound voice by voice, before the filter: about one bit lost every 12 %, about 8 bits at 25 %. The knob shows the equivalent (`25 % · ~8 BITS`). With a filter on it takes one more voice per note for each oscillator. Not in SHAPE.
POS ENV	on, off	The filter follows MOTION's envelope instead of its own, by the amount FLT ENV sets (MORPH, with MOTION on ENV and AMOUNT not at 0; otherwise the display says `NEEDS MOTION ENV`).
GRAIN	on, off	The filter's envelope moves in steps, 24 a second, giving a slightly stepped sweep. It only acts when FLT ENV is not 0.

The filter's envelope

Without POS ENV, the filter has an envelope of its own:

- A new patch's filter envelope follows the AMP section: its ATTACK, DECAY (50 ms at least, or 1 s if DECAY is 0) and SUSTAIN.
- A program read from the K2700 keeps the filter envelope it was stored with, including those of the 210 programs, whatever the AMP knobs do. To get a short filter sweep over a long sound, start from a program that has one.

GRAIN and the function generators

GRAIN needs a free function generator in the layer that holds the filter. On LP 24, or with DIGITAL on, it always has one. On LP, HP and BP it does not fit with PPG, SCORE, RANDOM, a negative AMOUNT or a RELEASE with a decay: the display says `NO FREE FUN: USE LP 24`, and GRAIN switches itself off if such a setting comes later.

Amp

The bottom row of FILTER · AMP, the same for both oscillators.

Control	Range	What it does
ATTACK	0 … 10 s	
DECAY	0 … 30 s	
SUSTAIN	0 … 100 %	
RELEASE	0 … 20 s	Long releases keep voices busy: see Voices and notes.
VEL	0 … 48 dB	How much velocity changes the level. 0 is an organ, 18 a touch-sensitive key.

Times are stored on the K2700's envelope steps.

Level and effects

In the header



Fig. 52. The header.

Control	Range	What it does
LEVEL	−30 … +24 dB	The whole program's output gain. The K2700's VOLUME slider stays the master volume.
REVERB	0 … 100 %	The mix of the hall reverb: 50 % is half dry, half reverb. It is the starting value of the K2700's Slider 9, and goes to the K2700 as you turn it.
TIME	0.95 … 46.6 s	The reverb's decay, shown in seconds and as the value of the K2700's Knob 9.
FX		Opens and closes the effects page.

The insert chain

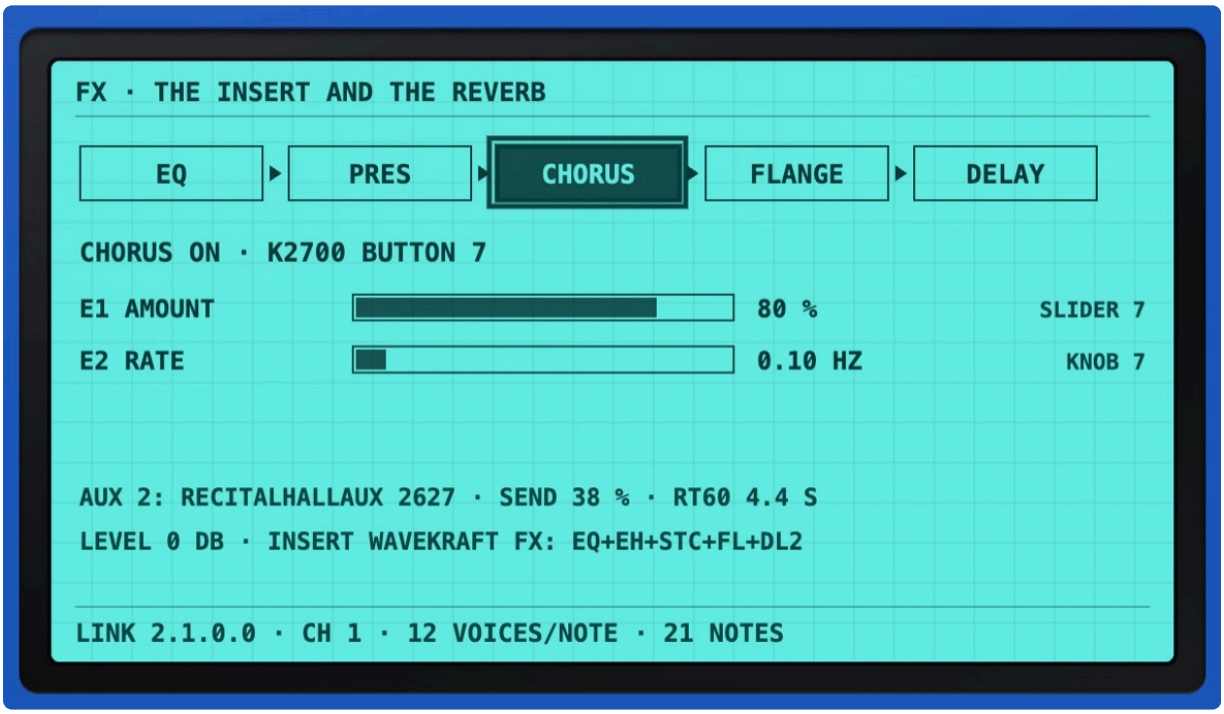


Fig. 53. The chorus chosen: each value with the K2700 control that moves it.

Every program has the chain WAVEKRAFT FX in its insert: a 5-band EQ, a presence enhancer, a dual chorus, a flanger and a ping-pong delay, in that order. A part is filled in on the page while it is on. A new patch opens with the chorus on at 80 % and 0.10 Hz, and the reverb at 50 %.

- ◄ **FX** and **FX** ► choose a part (or click it on the page).
- **ON** switches that part on or off.
- The three encoders set its values; their labels change with the part.

- On the EQ, **FREQ** swaps the three gains for the three frequencies. On the other parts the same button is **BYPASS**, which takes the whole chain out of this program.

Part	On / off	Values (encoders), range and K2700 control
EQ	Button 1	BASS Knob 1, MID Knob 2, TREBLE Knob 4 (each ±12 dB). FREQ: BASS FREQ CC 70 (131 ... 524 Hz), MID FREQ Knob 3 (311 ... 1759 Hz), TREB FREQ CC 78 (1.57 ... 11.2 kHz)
PRES	Button 2	On or off only
CHORUS	Button 7	AMOUNT Slider 7 (0 ... 100 %), RATE Knob 7 (0.03 ... 0.93 Hz)
FLANGE	Button 6	AMOUNT Slider 6 (0 ... 100 %), PERIOD Knob 6 (12 ... 1 beats)
DELAY	Button 8	AMOUNT Slider 8 (0 ... 50 %), TIME Knob 8 (right 0.04 ... 4.04 beats, left twice that), FEEDBACK Pad 1 (0 ... 90 %)

The flanger's period and the delay's times follow the tempo the K2700 runs at. STORE keeps every value in the program; no other program is affected.

PLAY and HOLD

Control	Range	What it does
PLAY		While held, plays a chord on the K2700 (the key, a fifth and a major tenth above it) and runs the position on the display. Without the LINK only the display moves.
HOLD	on, off	PLAY latches: press once to start, again to stop.
VELOCITY	1 ... 127	The chord's velocity.
KEY	C1 ... C7	The chord's lowest note.

Voices and notes

The K2700 has 256 voices. A WAVEKRAFT note uses one voice for each layer it plays, so a patch with N voices per note can sound **256 ÷ N** notes at once. The display's bottom line and the line under MOTION show the count as you work.

What you choose	Voices per note
OSC A in MORPH	its frames
OSC B on	plus its frames
LP 24, or DIGITAL with a filter on	plus 1 for each oscillator
A table of OWN waves	plus 1 for each oscillator on one
SHAPE	1

Patch	Voices per note	Notes
2 frames	2	128
4 frames	4	64
2 + OSC B on 2	4	64
8 frames	8	32
8 + OSC B on 4	12	21
8 + OSC B on 4, LP 24	14	18
16 frames	16	16
16 + OSC B on 8, LP 24	26	9

Notes still sounding in their release count too, and the sustain pedal holds them longer. When the K2700 runs out of voices, it has to cut notes.

Spending them well

- A still wave needs only 2 frames. The 210 programs all use 2 frames an oscillator: 2 to 6 voices a note.
- A pad that moves slowly often sounds as good on 4 frames as on 8.
- Big chords and long releases: fewer frames, and OSC B on 2.
- LP 24 and DIGITAL cost one voice per oscillator each time the filter is in its own layer: on a sound with OSC B that is 2 voices per note.

Programs



Fig. 54. The K2700's USER programs: W marks WAVEKRAFT's own, o another program.

PROGRAM ◀ ▶

Steps through **INIT TABLE**, a plain patch to start from, and every WAVEKRAFT program the SCAN found on your K2700. Loading one replaces the panel, so anything not stored is lost. The K2700 changes to that program too, and it goes whole to the K2700's edit buffer; the row on the programs page follows. Until the LINK is on there is only INIT TABLE.

SCAN

Reads every USER program on the K2700, 4096 to 8191, and opens the programs page. It lists each program it found: `W` and `WAVEKRAFT` for one of ours, `o` and `OTHER` for any other program; and the first 8 free IDs, as `(EMPTY)`, where STORE can write. Choose a row with **VALUE** or a click. The SCAN happens by itself at LINK on, and it fills the PROGRAM list.

Press **SCAN** again to stop it. What it found stays, and the programs of the list it had not yet reached are left as they were.

READ

Opens the chosen WAVEKRAFT program on the panel, field by field, as it is now on the K2700: what you changed on the K2700's own panel comes back with it. Times and frequencies come back on the K2700's own steps.

STORE

Writes the program as the panel has it on the K2700. It always takes two presses within 3 seconds. The display asks first: `OVERWRITE 4152?` or `STORE TO 4152?`, with `PRESS STORE AGAIN`.

- **A program from the list** stores to its own ID unless you are on the programs page.
- **On the programs page** it stores to the chosen row: an empty ID or a WAVEKRAFT program. Press SCAN first if the page is empty.
- **A new patch** (from INIT TABLE) goes through the programs page: choose an empty ID.
- WAVEKRAFT will not write over another app's program: `4097 IS ANOTHER APP'S PROGRAM`.

WAVEKRAFT reads the program back to check it, then selects it on the K2700 on channel 1, so the K2700 plays it with its own reverb. The display says `STORED 4152` and `SELECTED ON CH 1`. If the chain was missing, STORE writes it first: `STORED 4152 + FX CHAIN AT 5100`.

> **The name.** The panel has no field for the name: a program keeps the name of the one you started from, and a program built from INIT TABLE is stored as INIT TABLE. Rename it on the K2700. READ then brings the new name back.

Programs of other apps

Programs that WAVEKRAFT did not make are listed as OTHER. They can't be read (`NOT A WAVEKRAFT PROGRAM`) or written over. They stay as they are.

Old programs

A WAVEKRAFT program whose waves the panel can't find on this K2700 is marked `WAVEKRAFT (OLD)` and left out of the PROGRAM list, and the SCAN says `12 OLD ONES LEFT OUT`. That happens to a program on the pack's waves when those waves have been deleted from the K2700, or to one from an earlier bank built on waves that are no longer there. READ says `AN OLD PROGRAM`.

Working with the K2700

The LINK

Press **LINK** to connect, and again to disconnect. WAVEKRAFT finds the K2700's USB MIDI port by its name. It plays on MIDI channel 1: select channel 1 on the K2700. With the LINK on, the patch plays in the K2700's edit buffer and every change is sent as you make it; only the parts that changed travel. Disconnecting first releases any notes it was playing.

- **What the K2700 shows.** The K2700's screen keeps the name of the program it entered, and it runs its system tempo: the edit buffer carries neither a name nor a tempo. PROGRAM ◀ ▶ and STORE move the K2700 to the program itself.
- **K2700 ELSEWHERE: LINK.** If you select another program on the K2700, WAVEKRAFT stops sending. Press LINK to send the patch to the K2700 again.
- **What travels with a stored program.** The motion, the filter, the effects and the K2700 controls all go with it. A stored program plays and moves on the K2700 alone.
- **What the app plays while you edit.** LIVE's CC 20 and the SCORE's steps (with PLAY).

EFFECTS ON THE K2700

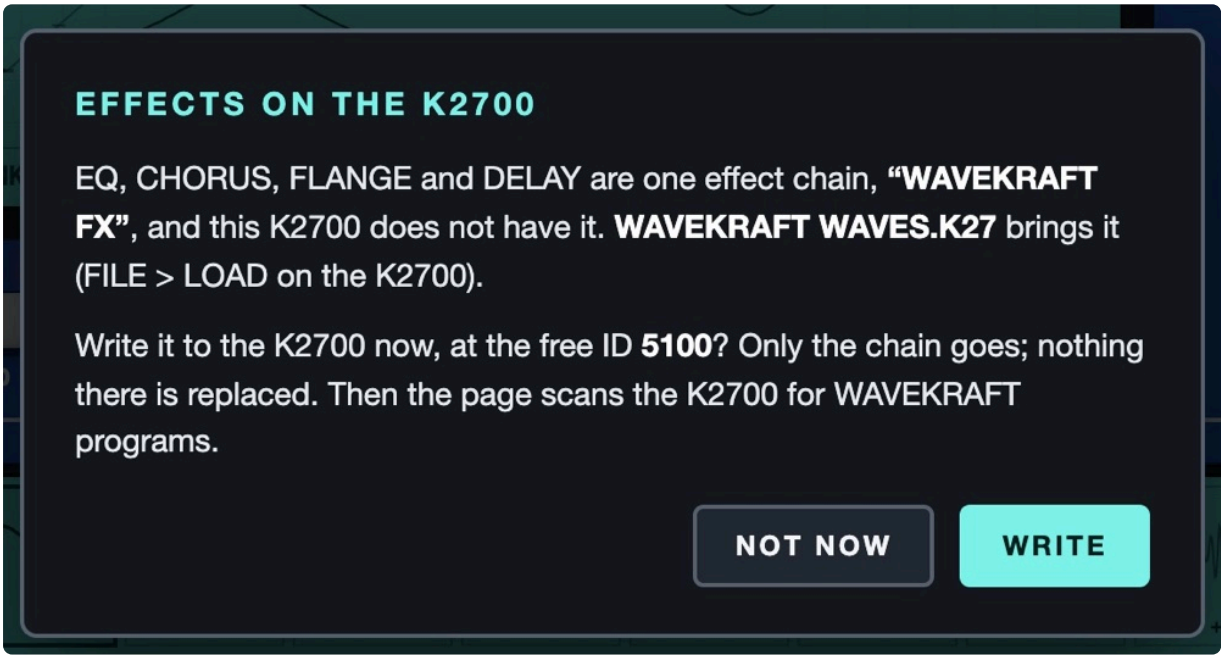


Fig. 55. What you see if the chain is not on the K2700.

The insert effects are one USER chain, WAVEKRAFT FX, that the pack brings. At LINK on WAVEKRAFT looks for it by name. If it is missing, it asks:

- **WRITE** puts only the chain on the K2700, at the free ID shown. Nothing there is replaced.
- **NOT NOW** leaves it. The insert effects are not heard, the bottom line ends in `FX CHAIN MISSING`, and the first STORE writes it before the program.

Which effects you hear

The insert chain plays as you edit, but the reverb sits on the K2700's aux 2, and the K2700 loads its aux effects only when it enters a program. While you edit, it plays the aux effects of the program it was on, and only those of the channel selected on its front panel. So WAVEKRAFT's reverb is heard when:

- **the K2700's panel is on channel 1**, the LINK's channel;
- **the K2700 is on a WAVEKRAFT program stored on it.** PROGRAM ◀ ▶ selects the program on the K2700, and STORE selects the one it writes; or select one of your WAVEKRAFT programs on the K2700 and press LINK to send the patch into it.

When another program's effects are playing, the display's bottom line alternates with `FX OF 4097 …`, and the chain on its aux 2.

What the K2700 can play

Every layer on the K2700 has four function generators (FUNs). WAVEKRAFT's crossfades use three of them in every frame after the first, which leaves one. So some settings exclude others:

Choice	It takes	What it means
PPG	the last FUN	One direct source: no RANDOM, no negative AMOUNT, no RELEASE with a decay or a loop, no OSC B ENV with negative DEPTH
RANDOM	1 FUN	Not with PPG
SCORE's smoothing	1 FUN	In PPG mode the steps play with no smoothing
A negative AMOUNT	1 FUN	Not with PPG
RELEASE with a decay or a loop	1 FUN	Not with PPG; AMOUNT above 0
OSC B ENV with negative DEPTH	1 FUN	Not with PPG
GRAIN on LP, HP or BP	1 FUN	A FUN free in the last frame: use LP 24 if not

A program can also have 32 layers at most. No combination on the panel reaches that, and any change that would not fit is refused with `NOT ON THE K2700: …` on the bottom line.

The K2700's own controls

A stored program answers the K2700's panel, so it can be played without the app.

K2700	Moves
Slider 9	The reverb's amount (CC 28). It starts where REVERB left it.
Button 9	The reverb on or off (CC 90). It starts on.
Knob 9	The reverb's time (CC 9).
Mod wheel	The position, in a program on LIVE with CONTROL at MOD WHEEL
Pressure	The position, on LIVE with CONTROL at PRESSURE

Pitch wheel	The position, on LIVE with CONTROL at BENDER (either direction counts as up). It also bends the pitch, ±2 semitones.
CC 20	The position, on LIVE with CONTROL at SLIDER (CC 20)
Buttons 1, 2, 6, 7, 8	EQ, presence, flanger, chorus and delay on or off
Sliders 6, 7, 8	The flanger's, chorus's and delay's amounts
Knobs 1 … 4	The EQ's bass, mid and treble gains and its mid frequency
Knobs 6, 7, 8	The flanger's period, the chorus's rate, the delay's time
Pad 1	The delay's feedback

CC 20

On a program on LIVE at SLIDER (CC 20), CC 20 is the wave's position, and the program shows it on the K2700's PARAMS page as `WT Position`, with the value you stored as its starting value. The K2700's own knobs and sliders do not send CC 20 in Program mode. To play it by hand:

- send CC 20 on channel 1 from another controller, or assign a slider to CC 20 in a zone of a Multi on the K2700;
- or choose MOD WHEEL, PRESSURE or BENDER as CONTROL before you store, if you want it under your hand on the K2700 itself.

With the LINK on, a K2700 control or another controller sending CC 20 on channel 1 also moves the panel's LIVE knob.

Messages

What the panel says, and what to do about it. Short messages appear for a moment on the display's top line; the state of the LINK stays in the header and on the bottom line.

The LINK

Message	Meaning and what to do
`NOT LINKED`	The LINK is off. Press LINK.
`LINK: CONNECTING`	Waiting for the K2700 to answer. The LINK light blinks.
`NO K2700 ON MIDI` (a dialog)	No MIDI port is named K2700. Switch it on, connect it by USB and press LINK again. The dialog lists the ports it can see.
`LINK FAILED: …`	The reason follows. Check the cable and press LINK.
`THE K2700 WENT AWAY, THE LINK IS OFF`	The K2700 was unplugged or switched off. Connect it and press LINK.
`LINK OFF: …`	The K2700 stopped answering. Check the cable and press LINK.
`ALLOW MIDI, MIDI IS BLOCKED, MIDI NOT ALLOWED`	In a browser only (see In your browser): the page needs MIDI with SysEx. Allow it for this site, using the icon left of the address, and press LINK again.
`NO WEB MIDI, THIS PAGE IS NOT SECURE`	In a browser only: use Chrome or Edge on a Mac or a PC, on the page's https address.

`K2700 ELSEWHERE: LINK`	Another program was selected on the K2700, and WAVEKRAFT has stopped sending. Press LINK: `LINK: THE PROGRAM SENT AGAIN`.
`FX OF 4097 …`	You are hearing the aux effects of that program. See Which effects you hear.
`THE COMPILER IS STILL LOADING`	The panel has just opened. Try LINK again in a moment.

The effect chain and the waves

Message	Meaning and what to do
`EFFECTS ON THE K2700` (a question)	The chain is missing. WRITE puts it on the K2700; NOT NOW leaves it for the first STORE. See EFFECTS ON THE K2700.
`WRITTEN: WAVEKRAFT FX AT 5100`	The chain is on the K2700. Nothing was replaced.
`FX CHAIN NOT WRITTEN`	You answered NOT NOW (`STORE WRITES IT TOO`), or the K2700 refused it: the reason follows.
`FX CHAIN MISSING` (end of the bottom line)	The insert effects are not heard. Load the pack, or let STORE write the chain.
`FX CHAIN MISSING: NO FREE ID`	The K2700 has no free USER chain ID. Delete a chain you do not need there.
`FX CHAIN: NOT LOOKED FOR`	The K2700 did not answer the question. Switch the LINK off and on.
`WK WAVES NOT LOADED` (end of the bottom line), `WK WAVES NOT ON THIS K2700`	The pack is not on this K2700, so its 62 tables can't be used; the oscillator goes back to the first table. Load `WAVEKRAFT WAVES.K27` with FILL, then switch the LINK off and on.
`NOT LOADED` on the TABLES page	The same, for that table.

SCAN, READ, STORE

Message	Meaning and what to do
`210 WAVEKRAFT PROGRAMS LOADED`	The SCAN finished. They are in the PROGRAM list.
`12 OLD ONES LEFT OUT`	See Old programs.
`NO WAVEKRAFT PROGRAMS ON THE K2700`, `LOAD WAVEKRAFT WAVES.K27`	Load the pack with FILL, or store your own.
`SCAN STOPPED AT 5012`	You pressed SCAN while it ran. Press it again for a full scan.
`SCAN: LINK FIRST` (also READ and STORE)	The programs are on the K2700: press LINK.
`THE PROGRAMS ARE ON THE K2700`, `LINK TO LOAD THEM`	PROGRAM ◀ ▶ has only INIT TABLE so far. Press LINK.
`LOADING THE K2700 PROGRAMS`	The SCAN is still running. Wait a moment.
`SCAN FIRST`	READ or STORE on the programs page with nothing listed.
`NOT A WAVEKRAFT PROGRAM`	READ only opens WAVEKRAFT's own.
`AN EMPTY ID`	READ on a free ID.
`READ 4152: AN OLD PROGRAM`	See Old programs.
`OVERWRITE 4152?`, `STORE TO 4152?`	Press STORE again within 3 seconds.
`4097 IS ANOTHER APP'S PROGRAM`	Choose an empty ID or a WAVEKRAFT program.

`STORED 4152, SELECTED ON CH 1`	Written, checked and selected.
`NOT SELECTED: LINK`	Written, but not selected on the K2700. Press LINK.
`4152: NOT SELECTED`	The K2700 did not change to the program PROGRAM ◀ ▶ opened. Press LINK.
`STORE 4152 FAILED`	The reason follows. `THE PROGRAM READ BACK IS NOT THE ONE WRITTEN`: try again, and SCAN to see what is at that ID.

The panel

Message	Meaning and what to do
`NOT ON THE K2700: …`	This combination does not fit (see What the K2700 can play). Undo the last change.
`ONE DIRECT SOURCE ONLY`	PPG does not fit with the current motion. Use a positive AMOUNT, leave RANDOM, or use STEP.
`NO FREE FUN: USE LP 24`	GRAIN doesn't fit on this filter with this motion.
`NEEDS MOTION ENV`	POS ENV is on, but MOTION is not on ENV.
`NO CLEAN PAIR`	This table has no pair of neighbours that blends cleanly (see How many frames).
`ANALOG HAS 8 WAVES`	The table is smaller than the FRAMES pressed.
`MORPH ONLY, SHAPE: 1 VOICE`	SHAPE has no frames.
`THE ORDER STAYS: NEIGHBOURS ALTERNATE`	The frames of an OWN table can't be moved.
`SCAN: NO SWEEPS IN THE ROM TABLES`	The SCAN engine has nothing to play. MORPH or SHAPE.

The 210 programs

The pack holds 210 programs in 14 categories, mostly simple sounds: two waves an oscillator, 2 to 6 voices a note. The number below is only the program's place in this list. On your K2700 each one has the ID the LOAD gave it, so find it by name; the SCAN puts them all in the PROGRAM list.

The first list of waves is OSC A, then, after the plus, OSC B with its interval, detune and level. **Fixed** means the wave stands still: that is LIVE at 0, and CC 20 moves it. The chorus is on in all of them, slowly (0.22 to 0.40 Hz), and the reverb is on Slider 9 (see The K2700's own controls).

Bells (24)

Immediate attack, no sustain, a long tail; the filter opens and closes with the note; a big reverb.

#	Name	Waves	Motion	Voices
1	CATHEDRAL BELL	BELL B 3 + GLASS 5 (+12 st, −10 dB)	Fixed	4
2	DIGITAL BELL	BELL A 5 + BELL A 6 (+4 ct, −5 dB)	Fixed	4
3	ICE BELL	GLASS 4 + BELL A 7 (+12 st, −12 dB)	Fixed	4

4	TUBULAR BELL	BELL B 6 + BELL B 7 (+4 ct, −5 dB)	Fixed	4
5	SOFT CHIME	BELLS 3 + BELLS 4 (+4 ct, −5 dB)	Fixed	4
6	MUSIC BOX	CELESTE 4 + BELL A 6 (+24 st, −16 dB)	Fixed	4
7	CELESTA SOFT	CELESTE 2 + CELESTE 3 (+4 ct, −5 dB)	Velocity to CELESTE 3	4
8	WIND CHIMES	GLASS 7 + BELL B 8 (+12 st, +4 ct, −12 dB)	Fixed	4
9	TEMPLE BELL	VIBES 9 + FM 1–7 3 (−12 st, −10 dB)	Fixed	4
10	FM BELL	FM 1–7 5 + FM 1–7 6 (+4 ct, −5 dB)	Envelope to FM 1-7 6	4
11	FM GLOCK	FM 1–5 6 + FM 1–5 7 (+4 ct, −5 dB) · +12 st	Fixed	4
12	DX CHIME	TINE 6 + FM 1–7 4 (+12 st, −12 dB)	Fixed	4
13	CRYSTAL BOWL	GLASS 2 + GLASS 3 (+4 ct, −5 dB)	Fixed	4
14	BRIGHT BELL	HI PEAKS 4 + HI PEAKS 5 (+4 ct, −5 dB)	Fixed	4
15	FAR BELL	BELLS 6 + BELLS 7 (+4 ct, −5 dB)	Fixed	4
16	ECHO BELL	ECHOES 6 + ECHOES 7 (+4 ct, −5 dB)	Fixed	4
17	TWIN BELL	BELL A 4 + BELL A 6 (+7 ct, −6 dB)	Fixed	4
18	DREAM BELL	DREAM 5 + DREAM 6 (+4 ct, −5 dB)	Fixed	4
19	GAMELAN	FM 1–5 4 + ALT HI LO 9 (+7 st, −14 dB)	Fixed	4
20	THIN BELL	FUND+HI 10 + FUND+HI 11 (+4 ct, −5 dB)	Fixed	4
21	BELL PAD	BELL B 4 + SOFT 4 (−12 st, −8 dB)	Fixed	4
22	SWEET BELL	BELLS 2 + BELLS 3 (+4 ct, −5 dB)	Fixed	4
23	METAL BELL	HI STRONG 6 + FM 1–5 7 (+12 st, −12 dB)	Fixed	4
24	8-BIT BELL	BELL A 6 + BELL A 7 (+4 ct, −5 dB)	Fixed	6

Glass (14)

Fine brilliance and high harmonics; highpass and bandpass filters.

#	Name	Waves	Motion	Voices
25	GLASS KEYS	GLASS 3 + GLASS 4 (+5 ct, −5 dB)	Velocity to GLASS 4	4
26	CRYSTAL KEYS	GLASS 5 + CELESTE 3 (+12 st, −12 dB)	Fixed	4
27	GLASS PAD	GLASS 4 + GLASS 5 (+5 ct, −5 dB)	Fixed	4
28	THIN ICE	GLASS 8 + GLASS 7 (+5 ct, −5 dB)	Fixed	4
29	PRISM	HI PEAKS 6 + GLASS 2 (+12 st, +5 ct, −10 dB)	Fixed	4
30	FROZEN LAKE	HI COMB 5 + HI COMB 6 (+5 ct, −5 dB)	Fixed	4
31	CRYSTAL RAIN	GLASS 6 + GLASS 7 (+5 ct, −5 dB)	Fixed	4
32	SOFT SHARD	HI COMB 3 + HI COMB 4 (+5 ct, −5 dB)	Fixed	4
33	FROST	HI FORCE 6 + HI FORCE 7 (+5 ct, −5 dB)	Fixed	4
34	CLEAR WATER	FM 1–7 2 + FM 1–7 3 (+5 ct, −5 dB)	Fixed	4
35	SPARKLE	DREAM 9 + GLASS 7 (+24 st, −14 dB)	Fixed	4
36	CRYSTAL TINE	TINE 5 + GLASS 3 (+12 st, −14 dB)	Fixed	4

37	AIRY GLASS	HI STRONG 3 + HI STRONG 4 (+5 ct, −5 dB)	Fixed	4
38	MIRROR	FORM MIR 12 + FORM MIR 5 (+6 ct, −6 dB)	Fixed	4

Mallets (14)

Short and round; velocity opens the filter or changes the wave; little reverb.

#	Name	Waves	Motion	Voices
39	MARIMBA	MALLET 2	Velocity to MALLET 3	2
40	SOFT MARIMBA	MALLET 1	Fixed	2
41	VIBES	VIBES 5	Fixed	2
42	SOFT VIBES	VIBES 3	Fixed	2
43	XYLO	MALLET 5 · +12 st	Fixed	2
44	KALIMBA	MALLET 4 + TINE 3 (+12 st, −14 dB)	Fixed	4
45	WOOD TAP	MALLET 6	Fixed	2
46	STEEL DRUM	FM 1−2 5	Fixed	2
47	BALI MALLET	FM 1−5 3 + MALLET 3 (−12 st, −8 dB)	Fixed	4
48	LOG DRUM	NO FUND 4 · −12 st	Fixed	2
49	GLOCK	BELL A 3 · +24 st	Fixed	2
50	TOY PIANO	CELESTE 5	Fixed	3
51	FELT MALLET	SOFT 6	Fixed	2
52	BALAFON	FM 1−3 3	Fixed	2

Digital keys (20)

Digital electric pianos and keys: a falling sustain, medium chorus, very sensitive to velocity.

#	Name	Waves	Motion	Voices
53	DIGITAL EP	EP DIG 4 + EP DIG 5 (+5 ct, −5 dB)	Velocity to EP DIG 5	4
54	SOFT EP	EP DIG 2 + EP DIG 3 (+5 ct, −5 dB)	Fixed	4
55	BRIGHT EP	EP DIG 7 + TINE 5 (+12 st, −14 dB)	Fixed	4
56	TINE EP	TINE 4 + TINE 5 (+5 ct, −5 dB)	Velocity to TINE 5	4
57	FM RHODES	FM 1−1 3 + TINE 4 (−10 dB)	Fixed	4
58	SUITCASE	EP DIG 3 + EP DIG 4 (+5 ct, −5 dB)	Fixed	4
59	STEREO EP	EP DIG 5 + EP DIG 3 (+7 ct, −6 dB)	Fixed	4
60	REED EP	FM 1−2 3 + FM 1−2 4 (+5 ct, −5 dB)	Fixed	4
61	CLAVI	PWM 7	Fixed	2
62	SOFT CLAV	PWM 5	Fixed	2
63	HARPSI	SYNC 3 + HI STRONG 2 (+12 st, −14 dB)	Fixed	4
64	DIGI PIANO	STRINGS 5 + BELL A 2 (+12 st, −16 dB)	Fixed	4
65	GLASS EP	GLASS 3 + EP DIG 3 (−4 dB)	Fixed	4

66	MELLOW KEYS	SOFT 4 + EP DIG 2 (−8 dB)	Fixed	4
67	PLUCK EP	EP DIG 6 + EP DIG 7 (+5 ct, −5 dB)	Fixed	4
68	BELL EP	BELL A 3 + EP DIG 3 (−6 dB)	Fixed	4
69	DREAM EP	EP DIG 4 + DREAM 3 (+12 st, −16 dB)	Fixed	4
70	FELT KEYS	SOFT LP 7 + SOFT LP 8 (+5 ct, −5 dB)	Fixed	4
71	RETRO KEYS	CHIP 3 + CHIP 4 (+5 ct, −5 dB)	Fixed	6
72	SOFT STAB	FM 1–1 5 + FM 1–1 6 (+5 ct, −5 dB)	Fixed	4

Soft pads (26)

A slow entry, A and B detuned and spread in the stereo; a low filter; generous chorus and reverb.

#	Name	Waves	Motion	Voices
73	WARM PAD	SOFT 5 + SOFT LP 9 (+8 ct, −6 dB)	Fixed	4
74	SILK PAD	RESO LO 6 + RESO LO 8 (+6 ct, −6 dB)	Fixed	4
75	VELVET	SOFT LP 8 + SOFT LP 9 (+8 ct, −5 dB)	Fixed	6
76	CLOUD PAD	FORM LOW 5 + SOFT 3 (+12 st, −10 dB)	Fixed	4
77	SOFT SAW PAD	SIN>SAW 9 + SIN>SAW 9 (+9 ct, −5 dB)	Fixed	4
78	HOLLOW PAD	SIN>SQR 8 + PHASE SW 6 (+7 ct, −8 dB)	Fixed	4
79	AIR PAD	FORM HIGH 4 + FORM HIGH 5 (+8 ct, −5 dB)	Fixed	4
80	EVENING PAD	SOFT LP 11 + VOWEL M 2 (+12 st, −14 dB)	Fixed	4
81	SUNRISE	RESO LO 4 + RESO LO 5 (+8 ct, −5 dB)	Fixed	6
82	SUNSET	RESO LO 12 + RESO LO 13 (+8 ct, −5 dB)	Fixed	4
83	STRING HAZE	STRINGS 4 + STRINGS 7 (+9 ct, −6 dB)	Fixed	4
84	CHOIR HAZE	VOWEL F 3 + VOWEL M 4 (−12 st, +5 ct, −8 dB)	Fixed	4
85	DIGITAL MIST	ECHOES 4 + ECHOES 5 (+8 ct, −5 dB)	Fixed	4
86	SOFT ORGAN PAD	ORGANS 4 + ORGANS 5 (+8 ct, −5 dB)	Fixed	4
87	BELL HALO	SOFT 3 + BELL B 4 (+12 st, −14 dB)	Fixed	4
88	GLASS HALO	SOFT LP 6 + GLASS 5 (+24 st, −18 dB)	Fixed	4
89	SLOW WAVE	RESO HI 3 + RESO HI 4 (+8 ct, −5 dB)	LFO 0.09 Hz	4
90	BREATHING PAD	VOWEL M 3 + VOWEL M 4 (+8 ct, −5 dB)	Envelope to VOWEL M 4	4
91	WARM SYNC PAD	SYNC 2 + SOFT 5 (−12 st, −6 dB)	Fixed	4
92	SOFT PWM PAD	PWM 4 + PWM 6 (+8 ct, −5 dB)	Fixed	4
93	DEEP PAD	NO FUND 7 + SOFT 2 (−12 st, −4 dB)	Fixed	6
94	QUIET ROOM	SOFT 4 + SOFT 5 (+8 ct, −5 dB)	Fixed	4
95	WIDE STRINGS	PHASE SW 8 + PHASE SW 11 (+11 ct, −5 dB)	Fixed	4
96	8-BIT PAD	CHIP 4 + SOFT 3 (+6 ct, −6 dB)	Fixed	6
97	VOWEL DRIFT	VOWEL F 5 + VOWEL F 6 (+8 ct, −5 dB)	LFO 0.07 Hz	4
98	SOFT RESO PAD	SIN>SAW 11 + SIN>SAW 12 (+8 ct, −5 dB)	Fixed	6

Digital strings (14)

A soft or phased saw, a medium entry, a wide chorus, a lowpass with a slow envelope.

#	Name	Waves	Motion	Voices
99	DIGITAL STRINGS	STRINGS 6 + STRINGS 9 (+8 ct, −6 dB)	Fixed	4
100	WARM STRINGS	STRINGS 3 + STRINGS 4 (+8 ct, −5 dB)	Fixed	4
101	BRIGHT STRINGS	STRINGS 13 + STRINGS 14 (+8 ct, −5 dB)	Fixed	4
102	ENSEMBLE	PHASE SW 7 + PHASE SW 10 (+10 ct, −5 dB)	Fixed	4
103	SOFT ENSEMBLE	SIN>SAW 10 + SIN>SAW 10 (+10 ct, −5 dB)	Fixed	4
104	CHAMBER	STRINGS 8 + STRINGS 9 (+8 ct, −5 dB)	Fixed	4
105	CELLO LINE	STRINGS 5 · −12 st	Fixed	2
106	VIOLIN LINE	STRINGS 11	Pressure to STRINGS 12	2
107	PIZZICATO	STRINGS 7	Fixed	2
108	TREMOLO STR	STRINGS 9 + STRINGS 10 (+8 ct, −5 dB)	LFO 5 Hz	4
109	SLOW STRINGS	STRINGS 4 + STRINGS 5 (+8 ct, −5 dB)	Fixed	4
110	OCTAVE STRINGS	STRINGS 6 + STRINGS 10 (+12 st, −8 dB)	Fixed	4
111	STRING MACHINE	PHASE SW 5 + SIN>SQR 10 (+8 ct, −7 dB)	Fixed	4
112	GLASS STRINGS	STRINGS 7 + GLASS 3 (+12 st, −16 dB)	Fixed	4

Voices (14)

Fixed formants; the mod wheel or a slow envelope changes the vowel; a wide choir.

#	Name	Waves	Motion	Voices
113	AH CHOIR	VOWEL M 1 + VOWEL F 3 (+12 st, +5 ct, −8 dB)	Fixed	4
114	OH CHOIR	VOWEL M 6 + VOWEL F 6 (+12 st, +5 ct, −8 dB)	Fixed	4
115	EE VOICE	VOWEL F 1	Fixed	2
116	OO VOICE	VOWEL M 8	Fixed	2
117	VOWEL WHEEL	VOWEL M 1	Mod wheel to VOWEL M 6	2
118	FEMALE VOX	VOWEL F 3	Pressure to VOWEL F 4	2
119	MALE VOX	VOWEL M 2 · −12 st	Fixed	2
120	SOFT CHOIR	CHOIR 3 + CHOIR 4 (+5 ct, −5 dB)	Fixed	4
121	ANGEL CHOIR	CHOIR 8 + VOWEL F 2 (+12 st, −12 dB)	Fixed	4
122	FORMANT PAD	FORM LOW 8 + FORM LOW 11 (+7 ct, −6 dB)	Fixed	4
123	WHISPER	FORM HIGH 2 + FORM HIGH 3 (+5 ct, −5 dB)	Fixed	4
124	GHOST VOICE	FORM HI2 4 + FORM HI2 5 (+5 ct, −5 dB)	Fixed	4
125	DIGITAL VOX	VOWEL M 4	Fixed	3
126	VOCAL SWELL	VOWEL F 2	Envelope to VOWEL F 5	2

Organs (12)

No filter envelope, a short attack, a constant sound; flanger or chorus for the movement.

#	Name	Waves	Motion	Voices
127	TONEWHEEL	ORGANS 7	Fixed	2
128	SOFT TONE	ORGANS 2	Fixed	2
129	JAZZ ORGAN	ORGANS 5	Fixed	2
130	FULL ORGAN	ORGANS 12	Fixed	2
131	CHURCH	ORGANS 16 + ORGANS 10 (−12 st, −6 dB)	Fixed	4
132	FLUTE STOP	ORGANS 1	Fixed	2
133	REED STOP	REEDS 6	Fixed	2
134	HOLLOW ORGAN	SIN>SQR 7	Fixed	2
135	DIGITAL ORGAN	ORGANS 9	Fixed	3
136	SOFT PERC	ORGANS 4 + ORGANS 3 (+12 st, −8 dB)	Fixed	4
137	COMBO ORGAN	PWM 3	Fixed	2
138	AIR ORGAN	ORGANS 14	Fixed	2

Brass and reeds (12)

The filter opening on the attack, like a breath; soft attacks.

#	Name	Waves	Motion	Voices
139	SOFT BRASS	BRASS 4 + BRASS 6 (+7 ct, −6 dB)	Fixed	4
140	WARM HORNS	BRASS 2 + BRASS 3 (+5 ct, −5 dB)	Fixed	6
141	DIGITAL BRASS	SYNC 5 + SYNC 6 (+5 ct, −5 dB)	Velocity to SYNC 6	4
142	SAX LINE	REEDS 9	Pressure to REEDS 10	2
143	CLARINET SOFT	SIN>SQR 9	Fixed	2
144	OBOE SOFT	REEDS 6	Fixed	2
145	HARMONIUM	REEDS 3	Fixed	2
146	ACCORDION	REEDS 12 + REEDS 12 (+9 ct, −5 dB)	Fixed	4
147	HARMONICA	REEDS 8	Pressure to REEDS 9	2
148	BRASS PAD	BRASS 5 + BRASS 6 (+5 ct, −5 dB)	Fixed	6
149	BRIGHT STAB	BRASS 8 + BRASS 9 (+5 ct, −5 dB)	Fixed	4
150	SOFT TRUMPET	BRASS 3	Pressure to BRASS 4	2

Flutes (8)

Almost a sine, breath by velocity and pressure, a room reverb.

#	Name	Waves	Motion	Voices
151	SOFT FLUTE	RESO LO 3	Pressure to RESO LO 4	2
152	PAN FLUTE	RESO LO 5 + FORM HIGH 3 (+12 st, −22 dB)	Fixed	4

153	RECORDER	SIN>SQR 4	Fixed	2
154	OCARINA	SOFT 2	Fixed	2
155	BREATH FLUTE	SOFT LP 4 + HI COMB 4 (−24 dB)	Velocity to SOFT LP 5	4
156	AIR WHISTLE	RESO LO 2 · +12 st	Fixed	2
157	WOOD FLUTE	SIN>SQR 3	Fixed	2
158	SOFT LEAD FLUTE	RESO LO 7	Mod wheel to RESO LO 8	2

Basses (16)

Low and centred, few effects, a filter with a short envelope.

#	Name	Waves	Motion	Voices
159	ROUND BASS	SOFT 3 · −12 st	Fixed	2
160	SOFT SAW BASS	SIN>SAW 8 · −12 st	Fixed	3
161	SUB BASS	RESO LO 2 · −12 st	Fixed	2
162	DIGITAL BASS	SYNC 4 · −12 st	Fixed	3
163	FM BASS	FM 1−1 4 · −12 st	Velocity to FM 1-1 5	2
164	PLUCK BASS	PWM 3 · −12 st	Fixed	2
165	RESO BASS	SIN>SAW 12 · −12 st	Fixed	3
166	FRETLESS	RESO LO 5 · −12 st	Fixed	2
167	PICKED BASS	FM 1−2 3 · −12 st	Fixed	2
168	HOLLOW BASS	SIN>SQR 6 · −12 st	Fixed	3
169	WARM BASS	SOFT LP 8 + RESO LO 1 (−12 st, −6 dB) · −12 st	Fixed	4
170	8-BIT BASS	CHIP 5 · −12 st	Fixed	3
171	VOWEL BASS	VOWEL M 3 · −12 st	Fixed	3
172	ORGAN BASS	ORGANS 2 · −12 st	Fixed	2
173	SLAP SOFT	FM 1−3 3 · −12 st	Velocity to FM 1-3 4	2
174	SOFT SYNTH BASS	BRASS 3 · −12 st	Fixed	3

Soft leads (12)

Monophonic in spirit, the wheel or pressure on the wave, a discreet delay.

#	Name	Waves	Motion	Voices
175	SOFT LEAD	SOFT LP 11	Mod wheel to SOFT LP 12	2
176	SINE LEAD	RESO LO 3	Mod wheel to RESO LO 4	2
177	WARM LEAD	SIN>SAW 9	Fixed	3
178	SQUARE LEAD	SIN>SQR 11	Pressure to SIN>SQR 12	3
179	HOLLOW LEAD	PHASE SW 9 + RESO LO 2 (+12 st, −14 dB)	Fixed	4
180	VOWEL LEAD	VOWEL M 2	Mod wheel to VOWEL M 6	2
181	GLASS LEAD	GLASS 2 + SOFT 3 (−6 dB)	Fixed	4

182	FM LEAD	FM 1–1 2	Pressure to FM 1-1 5	2
183	SYNC LEAD SOFT	SYNC 3	Mod wheel to SYNC 6	2
184	DIGITAL WHISTLE	RESO HI 2 · +12 st	Fixed	2
185	REED LEAD	REEDS 7	Pressure to REEDS 8	2
186	8-BIT LEAD	PWM 2	Fixed	3

Plucks (14)

A dry attack, the filter closing quickly; the delay gives the space.

#	Name	Waves	Motion	Voices
187	SOFT PLUCK	SOFT LP 9 + SOFT LP 10 (+5 ct, −5 dB)	Fixed	4
188	DIGITAL PLUCK	SIN>SAW 12 + SIN>SAW 13 (+5 ct, −5 dB)	Fixed	4
189	HARP	RESO HI 3 + RESO HI 4 (+5 ct, −5 dB)	Fixed	4
190	KOTO	FM 1–3 4	Fixed	2
191	GUITAR SOFT	STRINGS 6 + STRINGS 7 (+5 ct, −5 dB)	Fixed	4
192	NYLON	SIN>SAW 6	Fixed	2
193	SITAR SOFT	ALT HI LO 5 + SYNC 3 (−10 dB)	Fixed	4
194	WATER DROP	RESO LO 7 + RESO LO 8 (+5 ct, −5 dB)	Fixed	4
195	STEREO PLUCK	PWM 4 + PWM 6 (+6 ct, −5 dB)	Fixed	4
196	GLASS PLUCK	GLASS 3 + GLASS 4 (+5 ct, −5 dB)	Fixed	4
197	BELL PLUCK	BELL A 4 + BELL A 5 (+5 ct, −5 dB)	Fixed	4
198	MUTED PLUCK	SOFT 5 + SOFT 6 (+5 ct, −5 dB)	Fixed	4
199	UKULELE	SIN>SAW 5 · +12 st	Fixed	2
200	8-BIT PLUCK	CHIP 6 + CHIP 7 (+5 ct, −5 dB)	Fixed	6

Atmospheres (10)

The only ones with visible motion, always slow and between two waves.

#	Name	Waves	Motion	Voices
201	DEEP SPACE	NO FUND 3 + SOFT 2 (−12 st, −8 dB)	LFO 0.06 Hz	4
202	SLOW TIDE	RESO LO 6 + RESO LO 7 (+10 ct, −5 dB)	LFO 0.05 Hz	4
203	FROZEN AIR	HI COMB 4 + HI COMB 5 (+10 ct, −5 dB)	LFO 0.08 Hz	4
204	NIGHT FOREST	FORM LOW 3 + FORM LOW 4 (+10 ct, −5 dB)	Envelope to FORM LOW 9	4
205	FAR VOICES	CHOIR 6 + CHOIR 7 (+10 ct, −5 dB)	LFO 0.07 Hz	4
206	GLASS HORIZON	GLASS 2 + GLASS 3 (+10 ct, −5 dB)	LFO 0.05 Hz	4
207	OLD MACHINE	WILD 5 + WILD 6 (+10 ct, −5 dB)	LFO 0.06 Hz	6
208	SOFT RAIN	ECHO COL 2 + ECHO COL 3 (+10 ct, −5 dB)	Fixed	4
209	DARK WATER	RINGMID 3 + RINGMID 4 (+10 ct, −5 dB)	Fixed	6
210	LAST LIGHT	DREAM 3 + DREAM 4 (+10 ct, −5 dB)	Envelope to DREAM 7	4

Recipes

Each starts from **INIT TABLE** (**PROGRAM** ◀ until the header shows it) with the LINK on, and ends with STORE. Values are starting points: move them.

A pad that moves on its own

1. **OSC A:** TABLE on SOFT LP (the WK one), FRAMES 8.
2. **MOTION:** LFO. RATE 0.09 Hz, SHAPE +SINE, AMOUNT +60 %, POSITION 0 %.
3. **OSC B:** ON. TABLE on RESO LO, FRAMES 4, FOLLOW A, DETUNE +8, LEVEL −5 dB, PAN R 40. On OSC A, PAN L 40.
4. **FILTER:** LP, CUTOFF 4.5 kHz, RESO 0, KEY TRK 30 %.
5. **AMP:** ATTACK 900 ms, DECAY 2 s, SUSTAIN 85 %, RELEASE 2.2 s, VEL 6 dB.
6. **FX:** on CHORUS, AMOUNT 55 %, RATE 0.22 Hz. REVERB 38 %, TIME 4.5 s.
7. The display shows 12 voices a note, 21 notes. If chords run out of voices, go to FRAMES 4 on A and 2 on B: 6 voices, 42 notes.

A sweep in steps (PPG)

1. **OSC A:** TABLE on HI PEAKS, FRAMES 8, then **PPG** (50 positions).
2. **MOTION:** ENV. ATTACK 0, DECAY 2.5 s, SUSTAIN 0 %, LOOP OFF, RELEASE OFF, AMOUNT +100 %, POSITION 0 %. The position falls through the table in steps.
3. **FILTER:** LP 24, CUTOFF 2 kHz, RESO 8 dB, FLT ENV +24, POS ENV on, GRAIN on, DIGITAL 25 %.
4. **AMP:** ATTACK 2 ms, DECAY 3 s, SUSTAIN 60 %, RELEASE 800 ms, VEL 12 dB.
5. 9 voices a note, 28 notes.

A bass

1. **OSC A:** TABLE on SIN>SAW, FRAMES 2. Choose frame 1 and turn WAVE to `WK SIN>SAW 12`. TUNE −12.
2. **MOTION:** LIVE, CONTROL on SLIDER (CC 20), LIVE at 0: a still wave.
3. **FILTER:** LP 24, CUTOFF 600 Hz, RESO 6 dB, FLT ENV +30, KEY TRK 30 %.
4. **AMP:** ATTACK 2 ms, DECAY 300 ms, SUSTAIN 40 %, RELEASE 140 ms, VEL 14 dB. In a new patch the filter's envelope follows these.
5. **REVERB** 5 %, TIME 0.95 s. On CHORUS, AMOUNT about 12 %.

The bank's RESO BASS and ROUND BASS have a shorter filter envelope of their own: start from one of them to keep it.

A bell

1. **OSC A:** TABLE on BELL B, FRAMES 2, PAN L 12.
2. **MOTION:** LIVE, CONTROL on SLIDER (CC 20), LIVE at 0.
3. **OSC B:** ON, TABLE on GLASS, FRAMES 2, OWN, POSITION 0 %, INTERVAL +12, LEVEL −10 dB, PAN R 18.
4. **FILTER:** LP, CUTOFF 11 kHz, KEY TRK 60 %, FLT ENV +14.
5. **AMP:** ATTACK 2 ms, DECAY 7 s, SUSTAIN 0 %, RELEASE 6 s, VEL 12 dB.

6. **FX:** on CHORUS, AMOUNT 35 %, RATE 0.22 Hz. REVERB 33 %, TIME 5 s.

A vowel on the mod wheel

1. **OSC A:** TABLE on VOWEL M (the WK one), FRAMES 8.
2. **MOTION:** LIVE, CONTROL on MOD WHEEL, AMOUNT +100 %, POSITION 0 %.
3. **FILTER:** LP, CUTOFF 7 kHz, KEY TRK 30 %.
4. **AMP:** ATTACK 400 ms, DECAY 1.5 s, SUSTAIN 90 %, RELEASE 1.5 s, VEL 6 dB.
5. STORE it: on the K2700 alone, the wheel moves the vowels.

Velocity changes the wave

1. **OSC A:** TABLE on EP DIG, FRAMES 2.
2. **MOTION:** stay on ENV and set AMOUNT to 0 %. On OSC A, **VEL → POS** +70 %.
3. **FILTER:** LP, CUTOFF 8 kHz, KEY TRK 60 %, FLT ENV +10.
4. **AMP:** ATTACK 2 ms, DECAY 3 s, SUSTAIN 20 %, RELEASE 600 ms, VEL 18 dB.

A program made this way shows ENV lit and AMOUNT at 0 when you read it back: the velocity is in VEL → POS.

Every note different

1. **OSC A:** TABLE on HI COMB, FRAMES 8. **RANDOM** in MOTION.
2. **FILTER:** LP, CUTOFF 6 kHz, KEY TRK 40 %, FLT ENV +10.
3. **AMP:** ATTACK 1 ms, DECAY 1.2 s, SUSTAIN 0 %, RELEASE 800 ms, VEL 16 dB.
4. **FX:** on DELAY, press ON, AMOUNT about 25 %.

A gesture in time

1. **OSC A:** TABLE on PHASE SW, FRAMES 8.
2. **MOTION:** SCORE, STEP 1/8, SMOOTH 30 %.
3. Press **HOLD**, then **PLAY**, to hear the 16 steps while you edit. STORE it to hear them from the keyboard.

One voice a note

1. **ENGINE:** SHAPE, TABLE on SAW › WRAP.
2. **MOTION:** ENV. ATTACK 0, DECAY 2 s, SUSTAIN 20 %, AMOUNT +100 %, POSITION 10 %.
3. **FILTER:** LP, CUTOFF 3 kHz, RESO 3 dB, KEY TRK 60 %.
4. 256 notes: chords and long releases cost next to nothing.

A second oscillator with its own sweep

1. **OSC A:** TABLE on SOFT, FRAMES 2.
2. **MOTION:** LIVE, CONTROL on SLIDER (CC 20), LIVE at 0.
3. **OSC B:** ON, TABLE on HI FORCE, FRAMES 8, **ENV**. ATTACK 0, DECAY 1.5 s, DEPTH +100 %, POSITION 0 %, INTERVAL +12, LEVEL −9 dB.
4. Each note opens with a bright sweep on B over A's steady tone.

On the Mac

The Mac app is the panel in a window of its own, with the compiler and the LINK inside it: no browser is needed.

- **No sound, no files.** The app opens no audio output and keeps nothing on the Mac: the K2700 plays and keeps every program. STORE is the only save.
- **MIDI menu.** Chooses the MIDI inputs that reach the panel, so that a control on CC 20 moves LIVE while the LINK is on. **All Sound Off** (`⌘.`) releases the notes the app played and sends All Notes Off and All Sound Off to the K2700.
- **Quitting** does the same and switches the LINK off.

In your browser

WAVEKRAFT in your browser is the same panel, compiler and LINK, with nothing to install. It has no programs of its own: at LINK on it finds your K2700, scans it and loads every WAVEKRAFT program there. It needs Chrome or Edge on a Mac or a PC and the K2700 on USB: the page reaches it through Web MIDI, and the browser asks once to allow MIDI with SysEx. Safari and every browser on the iPhone and iPad have no Web MIDI.

- **The K2700 keeps your programs.** The page keeps nothing: STORE puts a program on the K2700, READ opens it again.
- **All Sound Off** (`⌘.` or `Ctrl .`) releases the notes the page played.
- **Closing the page** or switching the LINK off sends note offs, All Notes Off and All Sound Off, so no note is left hanging.

Troubleshooting

Symptom	Check
No sound at all	WAVEKRAFT plays through the K2700: the LINK must be on (its light steady) and the K2700 on MIDI channel 1, in Program mode. Check the K2700's VOLUME slider.
The LINK does not connect	The USB cable in the K2700's USB COMPUTER port and the K2700 switched on. The display says why it failed.
The PROGRAM list has only INIT TABLE	The SCAN found no WAVEKRAFT programs. Load the pack with FILL, then press SCAN.
Most tables say NOT LOADED	The pack is not on the K2700, or it was loaded while the LINK was on. Load `WAVEKRAFT WAVES.K27` with FILL, and switch the LINK off and on.
A wave I renamed has disappeared	WAVEKRAFT finds its waves by name. Give it back its name on the K2700, or load the pack again.

The pack did not fit	It needs 740 free keymap IDs, 740 free sample IDs, 210 free program IDs and a free chain ID. With the Global setting Load Fill Limit on Continue, a crowded K2700 can take programs whose waves did not fit. The Fill from ID page's MAP shows the IDs in use. Make room and load it again.
A hollow sound half way between two waves	Two waves that share harmonics partly cancel in a passage. Stop on a frame, pass more quickly, or use an OWN table (see Tables, frames and position).
Chords lose notes	Too many voices per note: read the count on the display and spend fewer (see Voices and notes).
No reverb, or the wrong effects	The K2700 plays the aux effects of the program it is on, and only on the channel its front panel has selected. Select channel 1, and put it on a WAVEKRAFT program stored on it (see Which effects you hear).
No chorus, delay or EQ	The chain is missing (`FX CHAIN MISSING`), or BYPASS is on, or that part is off (see Level and effects).
Too much reverb	REVERB is a mix: 50 % is half dry, half reverb. On the K2700, Slider 9 moves it.
A program is too loud or too quiet	LEVEL in the header, then STORE.
The position does not move	AMOUNT at 0, or LIVE waiting for its control. LIVE on CC 20 needs CC 20 (see The K2700's own controls).
VEL → POS or KEY → POS does nothing	They count only with MOTION's AMOUNT at 0, and not on LIVE with CC 20. VEL → POS comes first.
POSITION does nothing	On LIVE with CC 20, SCORE and RANDOM it is not used.
The position stays where it is when I let go	That is the K2700 with RELEASE off. Set RELEASE in MOTION, in MORPH.
A SCORE program stands still	While editing, only PLAY runs its steps. A stored program runs them by itself, from the first note after all keys are up.
The panel left PPG by itself	A setting that doesn't fit with it came in, and it fell back to STEP (see What the K2700 can play).
GRAIN switched itself off	The same: it needs a free function generator. Use LP 24.
GRAIN or POS ENV has no effect	Both need FLT ENV not at 0. POS ENV also needs MOTION on ENV, in MORPH.
OSC B does nothing	It is on only in MORPH. Check ON and its LEVEL.
The delay or flanger runs at the wrong speed	They follow the K2700's tempo.
K2700 ELSEWHERE: LINK	Another program was selected on the K2700. Press LINK.
STORE does not write	It takes two presses within 3 seconds. A new patch needs an ID: choose one on the programs page.
Everything is called INIT TABLE	The panel has no name field. Rename the program on the K2700.
Notes keep sounding	Switch the LINK off and on, or use All Sound Off (⌘.).

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