OPERATION MANUAL

XERXES MK2

8-VOICE POLYPHONIC SYNTHESIZER
BY BLACK CORPORATION

1.1.1

FCC COMPLIANCE STATEMENT

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

EUROPEAN UNION REGULATION COMPLIANCE STATEMENT

This product complies with the Low Voltage Directive 2006/95/EC and the Electromagnetic Compatibility Directive 2004/108/EC. The product meets the requirements of RoHS 2 Directive 2011/65/EU.

This product must be disposed of properly according to local laws and regulations.

IMPORTANT SAFETY INSTRUCTIONS

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of a polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped

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INTRODUCTION

XERXES is an 8-voice polyphonic synthesizer with two numerically controlled analog oscillators per voice. Its analog voice architecture is inspired by the Elka Synthex. While XERXES can produce very similar sounds, its sonic palette and capabilities have been significantly enhanced. It has additional modulation options such as oscillator sync with variable phase control, pulse amplitude cross modulation (PAM), two independent, MIDI syncable LFOs with added waveforms, greatly extended fundamental frequency range, and compatibility with polyphonic aftertouch and MIDI polyphonic expression (MPE) controllers. XERXES has 16 stable numerically-controlled analog oscillators which can be independently and precisely controlled to always stay in tune without needing to be tuned or calibrated.

The convenient desktop format can also be converted into a 4U rack-mounted unit with included rack ears and screws.

PACKAGE CONTENTS

When unpacking your XERXES, check to make sure all of the following contents are present, and nothing has been lost or damaged in shipping. It may be helpful to save the packaging to protect the unit when transporting it. If you have any questions, feel free to contact us at support@black-corporation.com.

XERXES ships with the following items:
- XERXES Desktop Synthesizer
- 12.0V 2.5A 30W wall wart power supply with US/JP, UK, EU, and AU local adapters.
- Rack Ears and Mounting Screws (Caution: Use the screws provided in the bag or you could damage your unit!)
- 4 Self-Adhesive Felt Pads
- Black Corporation Logo Stickers

It is a good idea to hold on to your packaging if you would like to transport XERXES safely.

FEATURES AND SPECIFICATIONS

Polyphony:	8 voices
Voice Layers:	1 (monotimbral)
Oscillators:	16 (2 per voice)
Oscillator Type:	Hybrid digitally controlled analog oscillators
Oscillator Frequency Range:	0.1Hz to 20kHz
Oscillator Waveforms:	Triangle, Saw, Square, Pulse with additional modulations
Oscillator Controls:	Octave (1'-16'), Transpose, Pulse Width, Volume
Oscillator Modulations:	Pulse Width (PWM), Pulse Amplitude (PAM), Ring Mod
Low Frequency Oscillators (LFO):	2 independent LFOs with Frequency synchronization
LFO Waveforms:	Sine, Triangle, Saw, Ramp, Square, Random
LFO Destinations:	Osc 1/2 pitch, Filter, Amplifier, Pulse Width 1/2, Osc 2 Sync Phase
LFO Controls:	Frequency (independent or synced), Depth, Delay, Aftertouch
Filter:	1 multi-mode filter per voice
Filter Options:	24db/oct Low Pass, 6db/oct Band Pass, 12db/oct Band Pass, 12db/oct High Pass selections
Filter Modulations:	LFO 1 and 2, Velocity, Aftertouch, Envelope, Keyboard tracking
Preset Memory:	1320 Total – 128 in Factory Bank, 40 in Vintage Bank, 9 User Banks of 128 Patches each
Keyboard Touch Response:	Velocity, Aftertouch (Channel and Polyphonic), MPE
Connections:	MIDI IN/OUT/THRU, AUDIO L+R, USB (isolated), Headphones
Power:	+12VDC, 2.5A
Dimensions:	440 W, 180 H, 70 D (mm)

INITIAL SETUP

XERXES requires an external MIDI controller to produce sounds. It may be necessary to adjust settings appropriately to match the synthesizer to the type of MIDI controller used. Modify the following global settings as needed. To enter Settings, press SHIFT + BACK. Use the Encoder to select an item in the list, press the Enter button or Encoder knob to enter a submenu or save a new setting, and then press the Back button to navigate out from the menu tree. All other options in the Settings menu are explained in more detail towards the end of this document, but here are the MIDI settings to get you started.

MIDI CHANNEL:

- MIDI > CHANNEL (1-16, ALL)

MIDI AFTERTOUCH MODE:

- MIDI > MODE >
- POLY AFTERTOUCH: MIDI keyboard with polyphonic aftertouch
- MPE: Midi Polyphonic Expression capable keyboard

MIDI CC# 74 DESTINATION (MPE MODE ONLY):

- MIDI > CC74 REPLACE >
- NONE, LFO FREQ, LFO DEPTH, OSC2 SYNC, VCF FREQ, VCF RESO

ENABLE MIDI CONTINUOUS CONTROLLER MESSAGES:

- MIDI > CC RECEIVE (ON/OFF)

KNOB RESPONSE MODE:

- MIDI > KNOBS >
- PICK UP: Knob value must reach saved value first before it takes effect
- MERGE: Knob value gradually reaches saved value
- INSTANT: Knob responds instantly from saved value (recommended)

GLOBAL TRANSPOSE:

This setting is used to map the range of the external MIDI keyboard to the internal octaves. The default is 0, which equals to the pipe organ standard of 8' length corresponding to A=440Hz above the middle C.

- MIDI > TRANSPOSE (-24 to +24 semitones)

PANEL LAYOUT
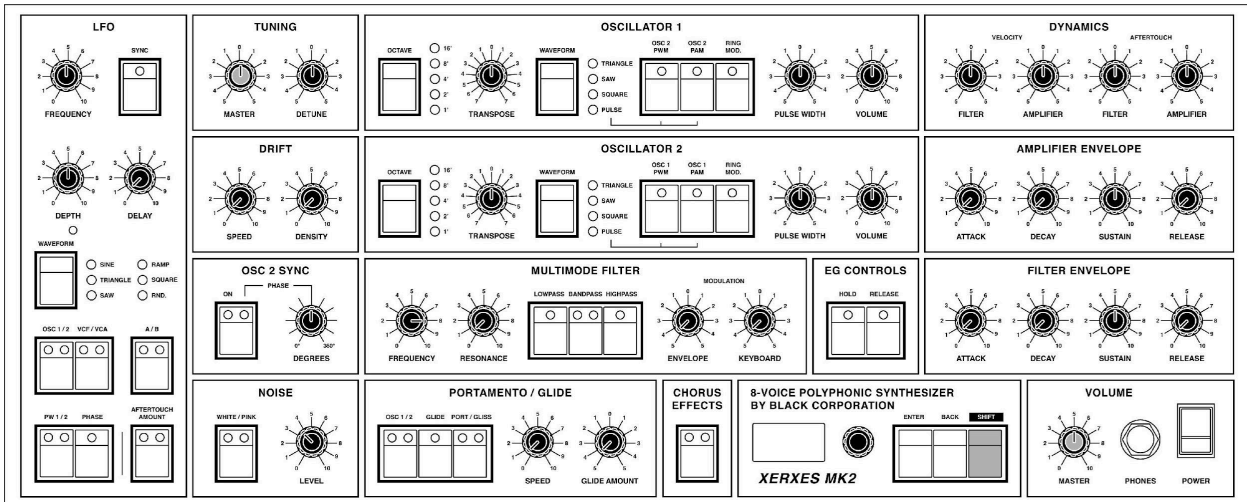
XERXES is designed to be intuitive and straightforward. Most of the functionality can be easily controlled in real time using the buttons and knobs on the front panel. For some buttons, the current selection is indicated with a row of lights next to the button. Others serve multiple functions as indicated by a combination of lights on that button. Pressing the same button multiple times will cycle thru the available combinations. The functionality for each control is described in the following sections.

The panel controls are grouped together into sections:

- **LFO:** Controls the Low Frequency Oscillator, which is used to slowly change various parameters in the oscillator and filters. There are two independent LFOs selected by the A/B switch, and their frequencies can be either independent or synchronized with the Sync button. They can also be synced to an incoming MIDI clock.

- **TUNING:** Adjusts tuning of the entire instrument and detune of oscillator 2.

- **DRIFT:** Introduces very small changes to the oscillator frequencies over time to add warmth.

- **OSC 2 SYNC:** Synchronizes oscillator 2 to oscillator 1, with separate phase control.

- **NOISE:** Allows white or pink noise to be added to the oscillators before the filter circuit.

- **OSCILLATOR 1 and 2:** Selects the frequencies, waveforms, modulations, and volume for oscillators.

- **MULTIMODE FILTER:** Selects the type of filter, controls its frequency, resonance, and modulation.

- **EG CONTROLS:** Enables/disables note hold and release envelope functions.

- **PORTAMENTO / GLIDE:** Controls note pitch movement at the beginning or from note to note.

- **CHORUS EFFECTS:** Selects 3 different types of chorus effects that are applied to the audio output.

- **DYNAMICS:** Controls how note velocity and aftertouch affect the volume and filter settings.

- **AMPLIFIER ENVELOPE:** Controls attack, decay, sustain, and release parameters for volume envelope.

- **FILTER ENVELOPE:** Controls attack, decay, sustain, and release parameters for filter envelope.

- **OLED DISPLAY:** Displays status, allows access to patch memory, settings, and additional parameters.

- **VOLUME:** Contains the master volume control, headphones output, and a power switch.

SYSTEM MEMORY AND CONTROL PANEL

This section allows patch saving and recall, system settings changes, setup, and calibration functions. The Enter, Back, and Shift buttons together with the encoder knob allow for easy navigation. Depending on function, the display will show the current functionality for each button as applicable.
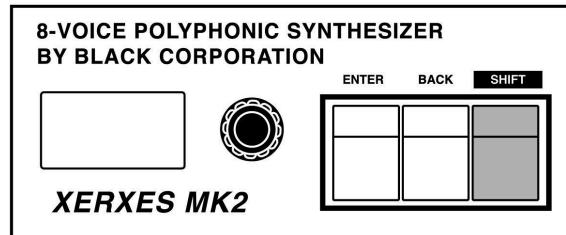
PANEL MODE

Panel Mode produces sound based on all the currently selected panel knob and switch positions. This is indicated with **PNL** on the display. To toggle Panel Mode on or off, press the encoder knob.

SELECTING BANKS

XERXES has 11 built-in memory banks. 10 banks have 128 patch locations each, and a special Vintage Bank has 40 patches. To select a new bank, press and hold Shift and turn the Encoder knob. Alternatively, you can also hold Shift and press the Enter key repeatedly (shows BANK on the display button image). Each press cycles to the next bank. The selected bank is shown on the display directly above the patch number. After the desired bank is selected, rotate the scroll knob to select a patch from this bank. Only the user banks 1-9 are editable.

- **FCTR** – Factory bank, patches numbered 1-128 (read only)
- **VNT** – Vintage bank, patches numbered 10-49 (read only)
- **BNKx** – User banks 1 to 9, each holding patches numbered 1-128

NOTE: The Vintage Bank contains sounds closely modeled after Elka Synthex factory patches. Due to tuning differences of individual vintage synthesizers, the patches may sound slightly different from the original. To compensate for these tuning differences, the Detune knob can be used to make the vintage patch to match better with the original's tuning variations.

RECALLING PATCHES

To select a patch in the selected bank, turn the encoder. The selected patch number is shown in the display.

To select a certain patch without scrolling thru all patches, press the Back button (shows LOAD on the display button image), use the scroll wheel to select the patch, and then press the Back button again.

SAVING PATCHES

To save a patch to the currently selected patch number, press the Enter button TWICE.

To save a patch to a different location within the same bank, press the Enter button ONCE, use the scroll wheel to select the target patch number, and then press the Enter button again. Note that this will permanently overwrite any previously saved sound in that location.

To save the current sound to a different bank, first select the target bank as described above. *At this point DO NOT turn the scroll knob or the current sound is lost!* Next, press the Enter button ONCE, use the scroll wheel to select a target patch number, and then press the Enter button again. Note that this will permanently overwrite any previously saved sound in that location.

OSCILLATOR 1 AND 2
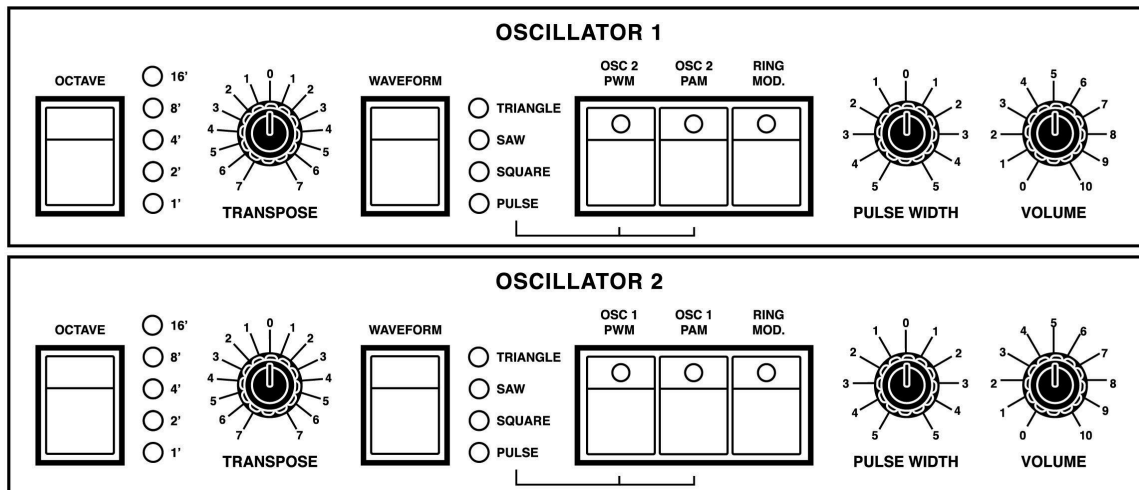
XERXES contains 16 advanced digitally controlled analog oscillators, two of which are used for each played note. The oscillator waveforms are always free-running, but oscillator 2 can also be synchronized to oscillator 1 frequency when the oscillator 2 sync option is turned on. The individual oscillator frequencies can be very precisely controlled with sub-milliHertz precision when using microtuning tables that can be uploaded to the instrument via MIDI or when used with mictrotuning software such as the Oddsound MTS software. The frequencies

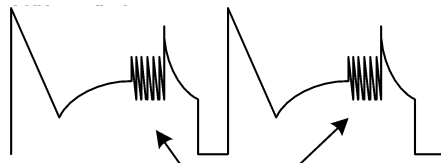can also slightly drift with the Drift feature and modulated with LFO, portamento, and glide features.

> **NOTE:** When detune, microtuning, LFO, or drift features are not used, the oscillator 1 and 2 phase relationship may stay locked, causing each voice to sound slightly different with a different phase. One solution to this is to use at least one these features to slightly detune the oscillators from each other.
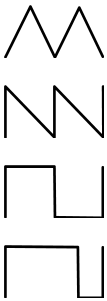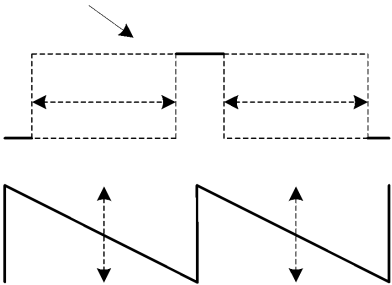
For each voice, the two oscillators can have different waveform shapes, and these shapes can be further combined in various ways thru cross modulation, providing a large number of possible waveforms. Unlike traditional Digitally Controlled Oscillators (DCOs), the waveforms in XERXES follow fast frequency changes just like traditional voltage-controlled oscillators (VCOs) by morphing the waveform shape to precisely match the cycle for a particular frequency. This is illustrated in the following diagram. Notice how the sawtooth ramp waveform changes shape with a rapidly changing frequency:
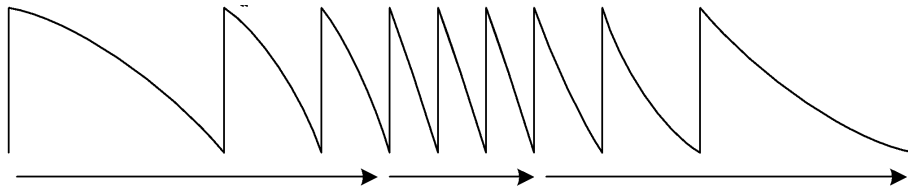
Certain cross-modulation combinations can also cause self-resonance when additional high frequency components are generated within a single waveform cycle via electronic feedback in the oscillator circuit, not in the filter. Oscillator self-resonance, created purely in analog hardware, is one of the unique features responsible for the special sound of this instrument.
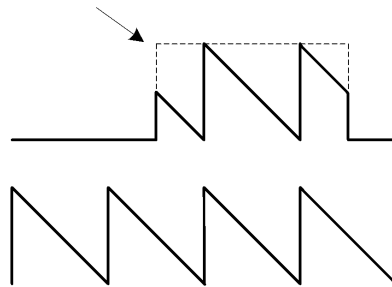

The following is a description of oscillator section panel controls:

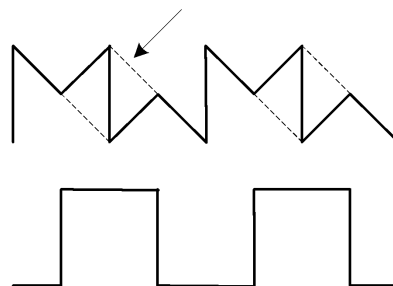| OCTAVE	Selects the octave in feet (16', 8', 4', 2', 1'), which transposes the keyboard up or down in octaves. The smaller the number the higher the pitch on the keyboard.
TRANSPOSE	Transposes the oscillator pitch from -7 (down) to +7 (up) in semitone steps, allowing for quick interval changes between the oscillators. A setting of 0 is neutral and does not transpose the pitch.
WAVEFORM	Selects the oscillator waveform. Each waveform has a different timbre, which depends on the harmonic content in the waveform: ● **Triangle** wave contains very few odd harmonics, containing a very pure sound with few overtones. ● **Sawtooth** wave contains all the integer harmonics (both even and odd), making it useful for producing tones that are very rich in overtones. ● **Square** wave only contains odd harmonics. It can produce flute-like sounds with certain oscillator frequency combinations. ● **Pulse** wave contains harmonics that are dependent on the selected pulse width. Pulse width can be controlled with the Pulse Width knob, and it can also change at audio rates when Pulse Width Modulation (PWM) is enabled. Pulse amplitude can vary at audio rates when Pulse Amplitude Modulation (PAM) is enabled.
OSC x PWM	Selects Pulse Width Cross-Modulation, where the pulse width of the current oscillator is modulated by the waveform amplitude of the other oscillator. If this button is pressed, Pulse waveform is automatically selected. PWM can produce very rapid change in overtones that depends on the frequency and waveform settings on the other oscillator. In this modulation setting the pulse width can still be adjusted using the Pulse Width knob. LFO can also automatically vary the pulse width when selected.

| **OSC x PAM**	Pulse Amplitude Modulation (PAM) is a unique feature to the XERXES synthesizer. The pulse amplitude (height) of the current oscillator is modulated by the waveform amplitude of the other oscillator. If this button is pressed, Pulse waveform is automatically selected. PAM can "clean up" a waveform, making it more defined at the upper frequency ranges, and giving it more pronounced low frequency content at lower ranges depending on the frequency and waveform settings on the other oscillator. In this modulation setting the pulse width can still be adjusted using the Pulse Width knob, and PWM can also be used at the same time to produce very rich textures of sound. **NOTE:** Turning on PAM for both oscillators at the same time is not recommended. It will generally produce silence from both oscillators, or if there is any sound, the volume from each voice card may not be consistent. There may be sound present on lower frequency range only, or only on some cross-modulation combinations.
RING MOD.	Selects Ring Modulation, which inverts the waveform of the current oscillator with the amplitude of the other oscillator. This is especially useful when used in combination with the Oscillator 2 Sync and Glide functions where it can generate sounds with harsh overtones that vary over time, such as metallic, laser, and bell-like sounds.

|	**NOTE:** Turning on Ring Mod for both oscillators at the same time, or when combined with PWM or PAM settings, can produce harsh distortion-like noise that may not track the keyboard very well from note to note. Use the Pulse Width knobs to fine tune the resulting sound in this case and test each note before using.
PULSE WIDTH	Adjusts the pulse width from 0% to 100% of the currently selected Pulse waveform only. It has no function for other waveforms. At 50% the waveform is a square wave with only odd harmonics, with more harmonic content being added towards the extremes. Pulse width can be controlled automatically at audio rates from the other oscillator by either the Pulse Width Cross-Modulation (PWM) setting, or with the Low Frequency Oscillator (LFO) which can be used to change the timbre slowly over time. **NOTE:** When PWM is not active, there is no sound at either extreme of the knob setting, at 0% and 100%.
VOLUME	Adjusts the output volume of the oscillator before it's mixed with the other oscillator and sent to the filter circuit. It's recommended that the volume is used in the middle setting (4-6) unless the patch itself has lower than normal volume. Using it at the maximum 10 setting may produce distortion at the output on some modulation settings, especially when using chords.

MULTIMODE FILTER
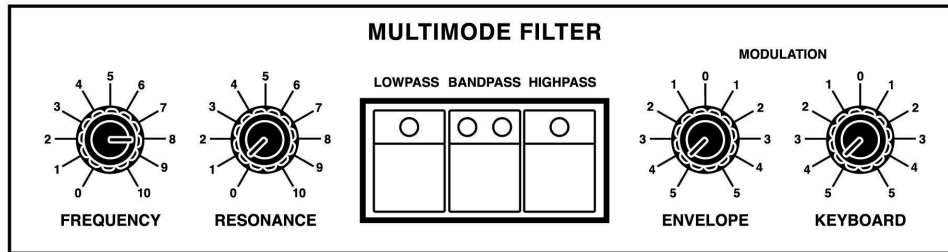
The filter controls the harmonic content of the raw audio output from the oscillators by changing the frequency ranges of the audio signal. XERXES' filter has four modes that define which frequency bands are being controlled. Additionally, the note envelope and keyboard tracking can be changed dynamically based on velocity and keyboard position.

FREQUENCY	Adjusts the filter cutoff point across the frequency spectrum. The lower the knob setting, the lower the cutoff point.
RESONANCE	Resonance amplifies a narrow range of frequencies at the filter cutoff point. When increasing the resonance knob, it intensifies the effect up to about 7, at which point the filter starts oscillating independently with a feedback frequency that is not related to the oscillator output. This can produce sound effects when used with a frequency envelope.
FILTER TYPES	● **Lowpass:** Allows lower frequencies to pass below the filter cutoff point. Frequencies above the cutoff point are filtered at a rate of 24db/octave. ● **Bandpass 1:** When left LED is on, only a narrow band of frequencies close to the filter cutoff point are passing the filter. Frequencies above and below the cutoff are attenuated at a rate of 6dB/octave. ● **Bandpass 2:** When right LED is on, only a narrow band of frequencies close to the filter cutoff point are passing the filter. Frequencies above and below the cutoff are attenuated at a rate of 12dB/octave. BP2 filter band is narrower than BP1. ● **Highpass:** Allows higher frequencies to pass above the filter cutoff point. Frequencies below the cutoff point are filtered at a rate of 12db/octave.
ENVELOPE	Envelope knob adjusts the amount a filter envelope will modify the filter cutoff point at the beginning of each note. Turning the envelope clockwise from 0 causes the filter envelope to increase the filter cutoff point, resulting in a brighter attack. Turning it counter-clockwise from 0 has the opposite effect – the filter envelope decreases the filter cutoff point, resulting in a more muted attack at the beginning of the note. Modify the Envelope Amount together with the filter cutoff point to find the best balance for a desired effect.

KEYBOARD	Keyboard knob allows the filter cutoff to track the note's pitch played on the keyboard. When it is turned clockwise from 0, higher pitches have a higher cutoff frequency, and lower pitches have lower cutoff. This results in higher notes on the keyboard having a brighter timbre than lower notes. When it is turned counter-clockwise from 0, the filter cutoff tracks the keyboard position in reverse – lower notes on the keyboard will have brighter timbre than higher notes.

LFO
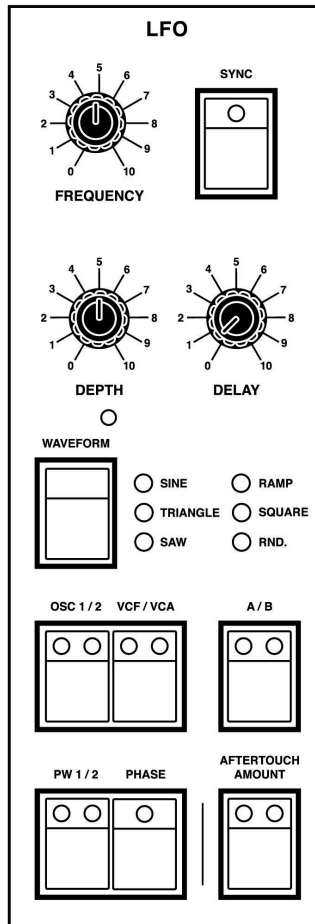
Low Frequency Oscillator is used to change various parameters such as pitch, filter, amplifier, pulse width, and oscillator 2 sync phase with adjustable speed, intensity, and delay. There are two independent LFOs selected by the A/B switch, and their frequencies can be either independent or synchronized with the Sync button. Aftertouch can also be used to control the intensity of the LFO Amount.

FREQUENCY	Adjusts the speed for the selected LFO A or B from about 0.02Hz to 40Hz. When SYNC is selected, frequency adjusts both A and B LFO at the same time.
SYNC	When enabled, the frequency for both A and B LFO is the same, and the Frequency knob will affect both at the same time regardless if LFO A or B is selected.
DEPTH	Adjusts the intensity (amplitude) of the waveform for a selected LFO A or B. Depth control remains independent for each LFO even if SYNC is enabled. Depth can also be modulated by Aftertouch Amount setting. NOTE: When the LFO Amount Mode is set to Individual in settings, the Depth can be applied individually to each destination. To make individual adjustments, hold down the destination button while adjusting the Depth knob.
DELAY	Adjusts the delay for the LFO effect, during which the LFO depth is gradually increased to each note up to the depth set by the DEPTH knob. When Delay is 0, the modulation is applied immediately. When Delay is 10, there is an 8-second delay, after which the LFO depth is slowly increased over a 30 second interval. If Delay is higher than 1, the first note also restarts the LFO wave; from 0-1 the wave is not restarted. When used with Saw or Ramp LFO waveforms, a short delay will cause a quick ramp-up to the maximum depth value, which sounds like an attack envelope being applied, or glide if the LFO destination is an oscillator.
WAVEFORM	Selects a waveform for the selected LFO A or B: ● **SINE:** Sinusoidal waveform ● **TRIANGLE:** Wave ramps up and down ● **SAW:** Wave ramps down and resets to high level ● **RAMP:** Wave ramps up and resets to low level ● **SQUARE:** Oscillates between two levels only ● **RND.:** Oscillates among random levels
A/B	Selects which LFO, A or B, is currently selected for the panel controls. All controls and switches are independent for each LFO, except for Frequency control if the SYNC button is enabled. Both LFOs can be active at the same time, modulating the same destinations.
OSC 1/2	Selects which oscillator pitch the selected LFO modulates. Select none, 1, 2, or both oscillators. Depth is applied polyphonically and affects each note independently when being controlled with polyphonic aftertouch.

| VCF/VCA	Selects whether the selected LFO modulates the Filter (VCF) or Amplifier (VCA, Volume) for the voice. Select none, VCF, VCA, or both. This effect is polyphonic and applies to each note independently with polyphonic aftertouch.
PW 1/2	Selects which oscillator's pulse width the selected LFO modulates. Pulse Waveform must be turned on for the oscillator for this to have any effect. Select none, 1, 2, or both oscillators.
PHASE	Selects whether the selected LFO modulates the oscillator 2 sync phase. Phase control must be enabled in OSC 2 SYNC section for this to have any effect.
AFTERTOUCH AMOUNT	Keyboard aftertouch (either channel or polyphonic) can be used to control the Depth of the currently selected LFO A or B. There are 3 levels of control (left LED, right LED, and both on), and an OFF setting when both LEDs are off. A setting of 1 will increase the Depth control by about 5% from the Depth knob's current position to the knob's maximum with a full range of aftertouch data. A setting of 2 increases Depth by about 25% of the maximum, and a setting of 3 by about 50% of the maximum. If the Depth knob is already at maximum then aftertouch will have no additional effect. When polyphonic aftertouch is enabled, this effect is polyphonic when applied to the oscillator's pitch or VCF. If VCA, PW 1/2, or Phase is selected, the note with the largest received polyphonic aftertouch data value will control the effect.

TUNING
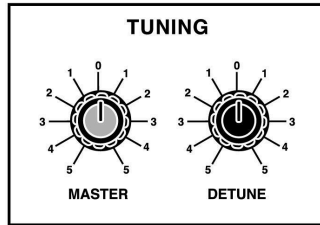
Tuning section is used to control the master tuning for the entire instrument.

| MASTER	Adjusts the global tuning for the entire instrument with a continuous range of 2 semitones up or down, with 0 setting representing a perfectly tuned instrument where A4 = 440Hz thanks to its digitally controlled oscillators. Master tune is not memorized in any saved patch memory; it always reflects the current panel knob setting. If the instrument is out of tune with the 0 setting, ensure that the knobs are calibrated to their center positions (described later in Calibration section).
DETUNE	Adjusts the pitch of oscillator 2 apart from oscillator 1 with a continuous range of 1 semitone up or down. When Detune is 0, both oscillators maintain the same frequency multiple indefinitely. Since the oscillators are always free-running (unless oscillator 2 sync is turned on), this can result in different voice cards having the oscillator frequencies locked at different phases that do not change, which will make each voice sound consistently different. To remedy that, turn the Detune button ever so slightly to make the oscillators slightly beating, or use the Drift functionality described below.

DRIFT
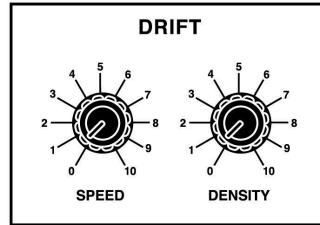
This feature is unique to the XERXES synthesizer. While the XERXES synthesizer is using analog oscillators, the pitch is controlled digitally, and they never drift or go out of tune. While this is certainly an advantage when producing sharp or metallic sounds, it can also be a disadvantage as the tone can sound too static with some patches, and using the LFO can sound too regular. The controls in the Drift section can be used to simulate pure analog oscillators by introducing tiny amounts of random but continuous pitch changes independently to each oscillator. This functions like a separate, random LFO for every oscillator slightly affecting the note's pitch randomly like a vintage voltage controlled analog oscillator. Note that both Speed and Density must be higher than 0 to have any effect.

| SPEED	Adjusts how fast the frequency changes are being applied to each note as the note is held down. There is no correction with 0 setting. At 10, the random changes become more audible and are applied more often at 2 times per second.
DENSITY	Adjusts how far apart each individual note is being detuned, in cents. With a setting of 0 there is no detune and the note frequencies are extremely precise. With a setting of 10 the notes are being detuned to a random value from 0 up to 20 cents maximum with a regularity selected with the Speed knob.

OSC 2 SYNC
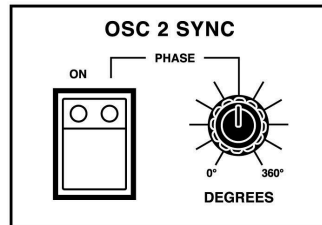
The controls in this section can be used to precisely synchronize oscillator 2 with oscillator 1. When enabled, oscillator 2 waveform will restart at a precise time when oscillator 1 waveform is restarting. Variable phase control is a unique feature to the XERXES synthesizer. It allows adjusting the phase of the oscillator 2 waveform against oscillator 1 by introducing a delay to the oscillator 2 phase starting point with respect to oscillator 1. Phase control is most effective if both oscillators are using the same octave settings; if the octaves are further apart it will have a smaller effect. When the LFO is set modulate the phase, it can be used to produce small pitch changes to oscillator 2 without changing the actual pitch of the oscillator.

|	
SYNC ON	When set to ON (left LED), oscillator 2 is precisely synchronized with oscillator 1, at 0 degrees phase difference. Oscillator 2 waveform always restarts every time oscillator 1 waveform is restarting, regardless of what waveform or modulation is selected.
PHASE	When set to PHASE (left and right LEDs on), oscillator 2 is synchronized with oscillator 1, but the synchronization phase can be adjusted using the DEGREES knob. This can also be modulated by the LFO Phase destination. This can produce phaser-like sound textures, especially when combined with other LFO modulation settings. When Sync is OFF, oscillator 2 is always free-running with respect to oscillator 1.
DEGREES	When PHASE is enabled, the Degrees knob adjusts the oscillator 2 synchronization to a specific phase in oscillator 1 waveform over a range from 0 degrees to almost 360 degrees. If both oscillators are using the same frequency, a mid-point in the knob represents the oscillator frequencies 180 degrees out of phase. **NOTE:** When the knob is set close to minimum 0, or maximum 360 degrees, the oscillator will lose the synchronization lock until the knob is turned back slightly. This is also more pronounced in upper keyboard ranges, so test the entire keyboard range when designing sounds. This feature can be used to produce interesting sound textures when an LFO is set to control the phase, as oscillator 2 will sync and lose sync periodically with the LFO frequency, making it sound like a delay or trill effect.

NOISE
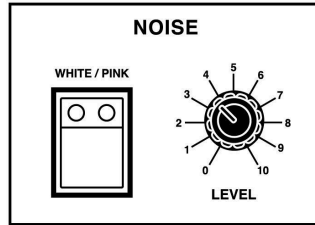
Noise can be added and mixed with the oscillator outputs before they are mixed and routed into the filter section. Two types of noise are available with a level control.

WHITE/PINK	Selects the type of noise. White noise contains a full spectrum from lowest to highest audible frequencies. Pink noise is filtered slightly with a low pass filter and does not sound as "bright." Noise is turned off when no LEDs are lit.
LEVEL	Adjusts the level of noise being routed into the filter.

EG CONTROLS
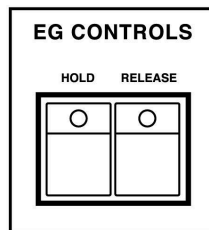
This section allows the user to override the note envelope generator stages. It is used to hold a note or turn on/off the release tail of the note.

HOLD	Selecting this will cause all notes to be held indefinitely with envelopes at the sustain level until the Hold button is turned off. This can be used to hold the notes in memory and then play with the panel controls using both hands.
RELEASE	Enables the release envelope to function normally when selected. If this button is turned off, release section of the note's envelope does not function, and the sound is turned off immediately when a note is released regardless of the Release knob setting in the Amplifier Envelope section.

PORTAMENTO / GLIDE
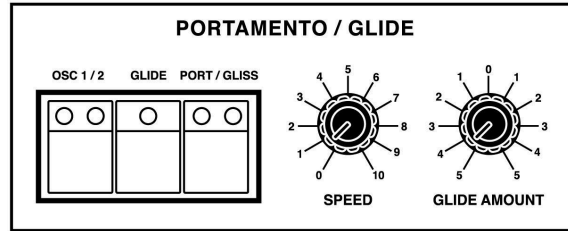
This section assigns glide, portamento, and glissando functionality to one or both oscillators.

| OSC 1/2	Selects the oscillator(s) that will be affected by Glide, Portamento, or Glissando. Select OFF, Oscillator 1, Oscillator 2, or both 1 and 2.
GLIDE	Selects the Glide effect. When enabled, each note starts the pitch higher or lower, smoothly reaching the actual note pitch. The position and speed of the glide is controlled by Speed and Glide Amount knobs.
PORT (left LED)	Selects the Portamento effect. When enabled, the oscillator pitch moves smoothly from note to note.
GLISS (right LED)	Selects the Glissando effect. When enabled, the oscillator pitch moves from note to note in discrete semitone steps.
SPEED	Controls the rate for the Glide, Portamento, or Glissando effect. **NOTE:** In Performance Legato mode (in Mono mode only), this controls the slowest rate when notes are played with minimum velocity in legato. When played with maximum velocity, the speed is instantaneous.
GLIDE AMOUNT	Selects the interval where the pitch starts the glide from. The range is -32 to +31 semitones. Turning the knob counterclockwise starts the glide from below the note, clockwise starts from above. If the knob is set to center (0) there is no glide effect as the note starts with the actual pitch. This knob has no effect on Portamento or Glissando, which start the pitch from the last played note.

CHORUS EFFECTS
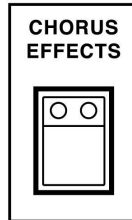
The XERXES synthesizer has a stereo analog Bucket Brigade Device (BBD) chorus circuit built-in with 3 different fixed chorus settings. When enabled, this effect is added to the sound before the final output. A single button controls all 3 settings, plus an OFF setting when both LEDs are off. The stereo effect is accomplished with 3 analog BBD delay lines, with two lines routed independently to L and R channels.

|	
No LEDs lit	No chorus effect is active. Sound is unchanged from the filter section.
Left LED on	Chorus effect 1: Two slightly delayed sounds are added to the original sound, one with a smaller amplitude, adding a slight interference, producing a slow chorus effect.
Right LED on	Chorus effect 2: Two slightly delayed sounds with higher amplitude are added to the original sound, adding a slow choral effect to the sound. This sounds more "wet" with a wider stereo image.
Both LEDs on	Chorus effect 3: Two slightly delayed sounds with a faster frequency are added to the original sound, creating a string ensemble effect with a wider stereo image.

DYNAMICS
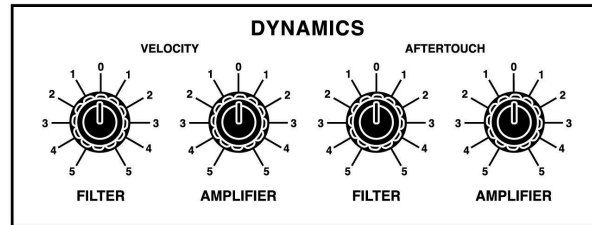
Dynamics knobs adjust the effect of note velocity and aftertouch on the oscillator volume and filter settings. If the synthesizer is in polyphonic aftertouch or MPE mode, all of these effects are applied polyphonically, affecting both oscillator volume and filter frequency for individual notes. If channel aftertouch is used, the effect is being applied to all notes simultaneously. All knobs are bipolar, meaning that the effect can be either positive or negative depending on the knob's direction from the center.

VELOCITY FILTER	Adjusts how note velocity affects the filter envelope. Turning the knob clockwise from 0 will produce a positive effect; when note is struck faster it causes the filter envelope to have a sharper, brighter tone than slower notes. Turning the knob counterclockwise from 0 will have the opposite effect; notes pressed slower cause the filter envelope to have a sharper, brighter tone than notes pressed faster.
VELOCITY AMPLIFIER	Adjusts how note velocity affects oscillator volume. Turning the knob clockwise from 0 causes a note struck faster to make it louder and slower notes softer. Turning it counterclockwise from 0 will have the opposite effect. **NOTE:** The default volume level that applies to MIDI velocity data=64 is set in Voice > VCA LEVEL in settings menu. If this is set to 100%, volume will not increase if MIDI velocity data of higher than 64 is received. For velocity to have any effect on volume, reduce the VCA LEVEL to less than 100%.
AFTERTOUCH FILTER	Adjusts how aftertouch data affects filter cutoff. Turning the knob clockwise from 0 will produce a positive effect; when note is pressed harder it causes the filter cutoff to increase, making the note brighter. Turning the knob counterclockwise from 0 will have the opposite effect; notes pressed harder cause the filter cutoff to decrease, making the note more muted.
AFTERTOUCH AMPLIFIER	Adjusts how aftertouch data affects oscillator volume. Turning the knob clockwise from 0 causes a note pressed harder to make it louder. Turning it counterclockwise from 0 will have the opposite effect. NOTE: The default volume level that applies to minimum MIDI aftertouch data is set in VOICE > VCA LEVEL in settings menu. If this is set to 100%, volume will not increase further with aftertouch. For aftertouch to have any effect on volume, reduce the VCA LEVEL to less than 100%.

AMPLIFIER ENVELOPE
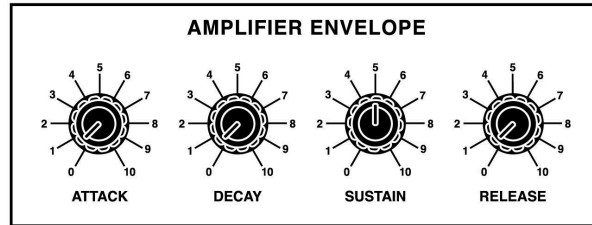
Amplifier Envelope knobs adjust the amplitude and timing of individual sections of the volume curve from the moment each note is played.
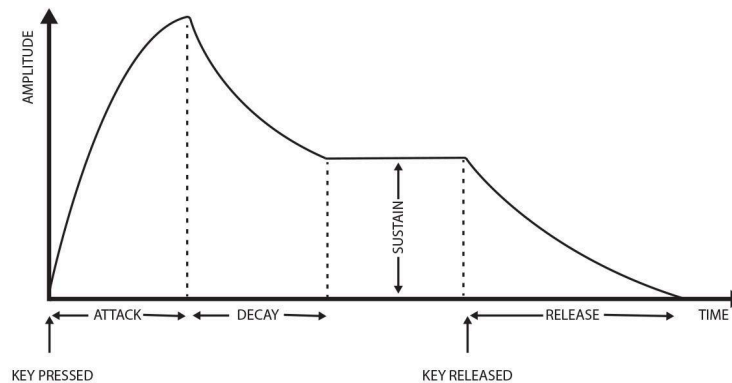
ATTACK	Adjusts the time it takes for the note's volume to reach a full level after a note is struck. A setting of 10 takes about 7 seconds.
DECAY	Adjusts the time it takes for the note's volume to drop from maximum level to a level set by the sustain knob. A setting of 10 takes about 23 seconds.
SUSTAIN	Adjusts the level to which the note's decay stops if the key is being held or the Hold button is ON in the EG Controls section. Clockwise rotation of the knob increases the level from 0 to 100% of full level.
RELEASE	Adjusts the time it takes for the note's volume to drop from sustain level to zero after a note is released. A setting of 10 takes about 10 seconds. This knob is active only if the Hold button is OFF and the Release button is ON in the EG Controls section.

FILTER ENVELOPE

Similar to the Amplifier Envelope section, the Filter Envelope knobs adjust the filter cutoff and timing of individual sections of the filter cutoff curve from the moment each note is played.

ATTACK	Adjusts the time it takes for the note's filter cutoff frequency to reach maximum after a note is struck. A setting of 10 takes about 7 seconds.
DECAY	Adjusts the time it takes for the note's filter cutoff frequency to drop from maximum to a setting set by the sustain knob. A setting of 10 takes about 23 seconds.
SUSTAIN	Adjusts the filter cutoff frequency to which the note's decay stops if the key is being held or the Hold button is ON in the EG Controls section. Clockwise rotation of the knob increases the filter cutoff frequency from 0 to 100% to a level set by the Frequency knob in the Multimode Filter section.
RELEASE	Adjusts the time it takes for the note's filter cutoff frequency to drop from sustain level to minimum after a note is released. A setting of 10 takes about 10 seconds. This knob is active only if the Hold button is OFF and the Release button is ON in the EG Controls section.

VOLUME

The Volume section contains Master volume control, headphones jack, and a power switch.
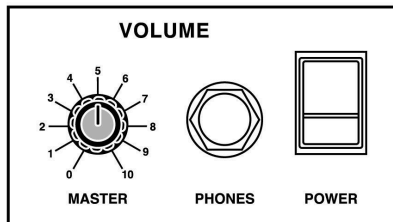
SPECIAL VOICE MODES

POLYPHONY MODE

There are 3 different modes that select the polyphonic and monophonic voice modes. These are selected under VOICE > MODE in Settings.

- MONOPHONIC: Only one voice is active at all times, effectively turning it into a monosynth
- POLYPHONIC: All 8 voices are independently active for each note
- UNISON: All 8 voices are simultaneously active for every note

VOICE LAYERING

Several voices can be layered that are triggered under a single note. 1, 2, or 4 simultaneous voices per note can be selected under VOICE > CARDS PER VOICE in Settings. Increasing voices per note decreases available polyphony.

VCA LEVEL

This setting is used to give more headroom for velocity and aftertouch control. A setting of 100% has a maximum volume with minimal additional volume used for velocity and aftertouch. By lowering the VCA Level, the overall patch volume is reduced, allowing velocity and aftertouch to have greater increase to volume. This can be changed under VOICE > VCA LEVEL menu.

PRESET VOLUME

This setting sets the overall volume for the preset. It can be used to decrease or increase the volume as needed if the volume is too low or high due to certain filter or modulation settings. This can be changed under PRESET VOLUME menu, and can be adjusted from -6 to +6 dB. The default is 0 dB.

LFO DEPTH AMOUNT MODE

The AMOUNT MODE setting selects how the LFO Depth knob affects the selected destinations.

- COMMON: The Depth control affects all selected destinations equally at the same time.

- INDIVIDUAL: LFO Depth can be customized for each LFO destination individually by holding down the destination button while adjusting the LFO Depth knob.

LFO POLYPHONY MODE

This setting allows the LFO to affect the destinations either monophonically or polyphonically (for oscillator pitch or filter only). This can be selected under TIME > LFO MODE setting.

- MONO: LFO waveform controls all selected destinations at the same time for all voices

- POLY: LFO waveform controls oscillator pitch and filter polyphonically, which restarts a different LFO waveform asynchronously for each note. Other destinations (VCA, PW 1&2, and Phase) are still affected monophonically, synchronized with the first note played in the chord.

SPECIAL PERFORMANCE MODES

XERXES synthesizer includes several special performance modes that do not have dedicated panel buttons. They can be used to fine-tune the synthesizer's responsiveness to external MIDI controllers and to allow more intuitive control, which are especially useful when performing live. These performance modes can be changed in Settings (see next section for details how to enter and use the Settings menu).

FILTER VELOCITY

This selects how velocity affects the filter. This setting is found under VOICE > FILTER VELOCITY.

- FREQUENCY: Velocity modulates the filter's Frequency parameter, making the sound duller or brighter overall based on note's velocity.

- ENVELOPE: Velocity modulates the filter's ADSR envelope, making it possible for velocity to affect only the Attack/Decay portion of the envelope, depending on how the Envelope knob and the filter ADSR controls are set. This can make the note's attack and decay more natural.

Note that the depth (strength) of how much velocity affects each note is controlled with the Filter knob in the DYNAMICS panel section under VELOCITY.

KEY ASSIGNER MODES

There are 3 different key assigner modes in XERXES, found under VOICE > PLAYBACK menu. The first two are inherited from the Deckard's Dream synthesizer that replicates the Yamaha CS-80 functionality. The third is a XERXES-only mode that is functionally similar to Synthex.

- SUSTAIN I: In this mode, all voices are assigned to new notes sequentially, regardless if they are played in legato or staccato (disconnected), or are repeated. In this mode, if a note has a long release tail and it is triggered again, a new voice will play the repeated note, causing two voices of the same note to play in unison.

- SUSTAIN II: This is a special CS-80 mode, which assigns the same voice to disconnected notes and then retriggers the new note's envelope from the previous note's release level. This makes it possible to hold a chord with one hand and play a solo with the other hand similar to a monosynth. This is mostly effective with patches having a longer release tail.

- SUSTAIN III: In this mode, voices are assigned to the notes randomly, but they do not change when the note is repeated, unless more than 8 different notes have been played, in which case a new voice is assigned to the newest note. The main difference between Sustain-I and III modes is that Sustain-III does not assign a new voice to each note unless it's needed. Repeated note with a long release tail will trigger the same voice again, similar to a monosynth. This mode replicates Synthex key assigner.

MONOPHONIC MODES

XERXES synthesizer has 3 different monophonic modes. These modes control how note transitions affect the ADSR envelope when playing connected notes (legato). They are only available if the voice mode is set to Monophonic. The 3 modes can be changed under VOICE > MONO MODE setting.

- LEGATO: ADSR envelope does not retrigger on connected notes (when played legato).

- STACCATO: ADSR envelope always retriggers with every note.

- PERF LEGATO: Performance Legato – ADSR envelope does not retrigger when played legato. Glide, Portamento, or Glissando speed, when enabled, is based on new note's velocity value when played in legato. When played softly, the pitch glides more slowly, and vice versa. This makes it possible to control note transitions naturally when playing live on the keyboard. In this mode, disconnected notes will not trigger Glide, Portamento, or Glissando.

LEGATO NOTE PRIORITY SETTINGS

Legato note priority can be further refined with VOICE > LEGATO SETTINGS > NOTE PRIORITY menu.

- NO: Only the newest or a last active note will play (recommended)

- LOW: Only lowest note in a chord will play

- HIGH: Only highest note in a chord will play

SETTINGS MENU

XERXES synthesizer contains internal settings which are accessible via the settings menu. These contain MIDI settings, additional settings for voices that are not available on the panel, system setup and calibration functions, and system reset and firmware upgrade functionality.

To enter the Settings, press and hold the Shift button and press the Back button (shows STNG on the display button image). Use the scroll wheel to select an item in the list, press the Enter button to save a new setting, and then press the Back button to navigate out from the menu tree.

MENU STRUCTURE

MIDI	
MODE	● POLY AFTERTOUCH ● MPE
CHANNEL	● ALL, 1-16
CC RECEIVE	● ON ● OFF
CC 74 REPLACE*	● NONE ● LFO A FREQ ● LFO A DEPTH ● LFO B FREQ ● LFO B DEPTH ● OSC 2 SYNC ● VCF FREQ ● VCF RESO ● VCA
KNOBS	● PICK UP ● MERGE ● INSTANT
CC	● PICK UP ● MERGE ● INSTANT

MODWHEEL DESTINATION*	- LFO A SPEED - LFO A DEPTH - LFO B SPEED - LFO B DEPTH - FILTER FREQ - FILTER RESO - PULSE WIDTH 1 - PULSE WIDTH 2 - OCTAVE 1 - OCTAVE 2 - SYNC PHASE - GLIDE SPEED - AMP+FILTER - NONE
MODWHEEL POLARITY*	- POSITIVE - NEGATIVE

PITCHBEND RANGE*	1-99 SEMITONES
KBRD TRACKING CENTER*	48-72
TRANSPOSE	1-24 SEMITONES
VELOCITY CURVE	- LINEAR - LOGARITHMIC - EXPONENTIAL - STYPE - NTYPE
AFTERTOUCH CURVE	- LINEAR - LOGARITHMIC - EXPONENTIAL - STYPE - NTYPE

VOICES	
MODE*	- MONOPHONIC - POLYPHONIC - UNISON
CARDS PER VOICE*	1-4
NUMBER OF VOICES	8-1
VCA LEVEL*	10-100%
FILTER VELOCITY*	- FREQUENCY - ENVELOPE
FILTER AFTERTOUCH*	- FREQUENCY - ENVELOPE
PLAYBACK*	- SUSTAIN I - SUSTAIN II - SUSTAIN III

PRESSET VOLUME*	● -6 DB - +6DB

LFO*	
LFO MAX	● 1-100 HZ
LFO MIN	● 0.01-0.10 HZ
LFO 1 SYNC	● OFF ● ON
LFO 2 SYNC	● OFF ● ON
AMOUNT MODE	● COMMON ● INDIVIDUAL
LFO MODE	● MONO ● POLY
RETRIG	● ON ● OFF

MICROTUNING*	
STATE	● OFF ● ON
PROGRAM	● 1-128
SAVE SCALE	● 1-128
DELETE ALL PROGRAMS	

CALIBRATION	
KNOBS	

FILTERS	● TUNE ALL VOICES ● TUNE VOICE 1-8

TIME*	
GLIDE MAX TIME	● 1-10 S/OCT
ADSR MULT	● X1-4

SCREENSAVER	● NEVER ● 5 MINUTES ● 10 MINUTES ● 30 MINUTES ● 1 HOUR

ABOUT	● DISPLAYS SYSTEM INFORMATION

* **NOTE:** Settings that are saved with each patch are marked with an asterisk

MIDI CC CHART

	CHANNEL 1
CC40	POT_LFO_FREQ
CC41	POT_OSC2SYNC_DEGREES
CC42	POT_GLIDE_AMOUNT
CC43	POT_DINAMIC_VELO_AMPLIFIER
CC44	POT_VCF_ENV_ATTACK
CC45	POT_DINAMIC_AFTER_FILTER
CC46	POT_VCF_ENV_DECAY
CC47	POT_DINAMIC_AFTER_AMPLIFIER
CC48	POT_VCFENV_SUSTAIN
CC49	POT_OSC2_VOLUME
CC50	POT_VCF_ENV_RELEASE
CC51	POT_MMF_MODULATION_ENV
CC52	POT_VCAENV_ATTACK
CC53	POT_MASTER_VOLUME
CC54	POT_MMF_MODULATION_KBRD
CC55	POT_VCA_ENV_DECAY
CC56	POT_TUNING_DETUNE
CC57	POT_LFO_DEPTH
CC58	POT_NOISE_LEVEL
CC59	POT_OSC2_PW
CC60	POT_LFO2_FREQ
CC61	POT_LFO2_DEPTH

CC62	POT_LFO2_DELAY
CC65	POT_LFO_DELAY
CC66	POT_OSC2_TRANSPOSE
CC67	POT_OSC1_PW
CC68	POT_TUNING_MASTER
CC69	POT_MMF_FREQ
CC70	POT_VCAENV_SUSTAIN
CC71	POT_DRIFT_DENSITY
CC72	POT_MMF_RESO
CC73	POT_OSC1_VOLUME
CC75	POT_VCAENV_RELEASE
CC76	POT_DRIFT_SPEED
CC77	POT_GLIDE_SPEED
CC78	POT_DINAMIC_FILTER
CC79	POT_OSC1_TRANSPOSE
CC80	POT_LFO2_DEPTH
CC81	POT_LFO2_FREQ
CC82	POT_LFO2_DELAY
CC83	POT_GLIDE2_SPEED
CC84	POT_GLIDE2_AMOUNT

	CHANNEL 2
CC40	BUTTON_LFO_SYN C
CC41	BUTTON_LFO_WA VEFORM
CC42	BUTTON_LFO_OS C12
CC43	BUTTON_LFO_VCF VCA
CC44	BUTTON_LFO_AB
CC45	BUTTON_LFO_PW 12
CC46	BUTTON_LFO_PHASE
CC47	BUTTON_LFO_AFT ERTOUCH
CC48	BUTTON_OSC2_S YNC
CC49	BUTTON_NOISE
CC50	BUTTON_OSC1_O CTAVE
CC51	BUTTON_OSC2_O CTAVE
CC52	BUTTON_OSC1_W AVEFORM
CC53	BUTTON_OSC2_W AVEFORM
CC54	BUTTON_OSC2_P WM
CC55	BUTTON_OSC2_PA M
CC56	BUTTON_OSC1_RI NGMOD
CC57	BUTTON_OSC1_P WM
CC58	BUTTON_OSC1_PA M
CC59	BUTTON_OSC2_RI NGMOD
CC60	BUTTON_MMF_LO WPASS
CC61	BUTTON_MMF_BA NDPASS
CC62	BUTTON_MMF_HI GHPASS
CC65	BUTTON_GLIDE_O SC
CC66	BUTTON_GLIDE_O NOFF
CC67	BUTTON_GLIDE_P ORT_GLISS

Roman Filippov
Bob Akber
Ando Pilve
Aleksandr Kholenko