



# USER GUIDE OVERVIEW





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# ACXEL2

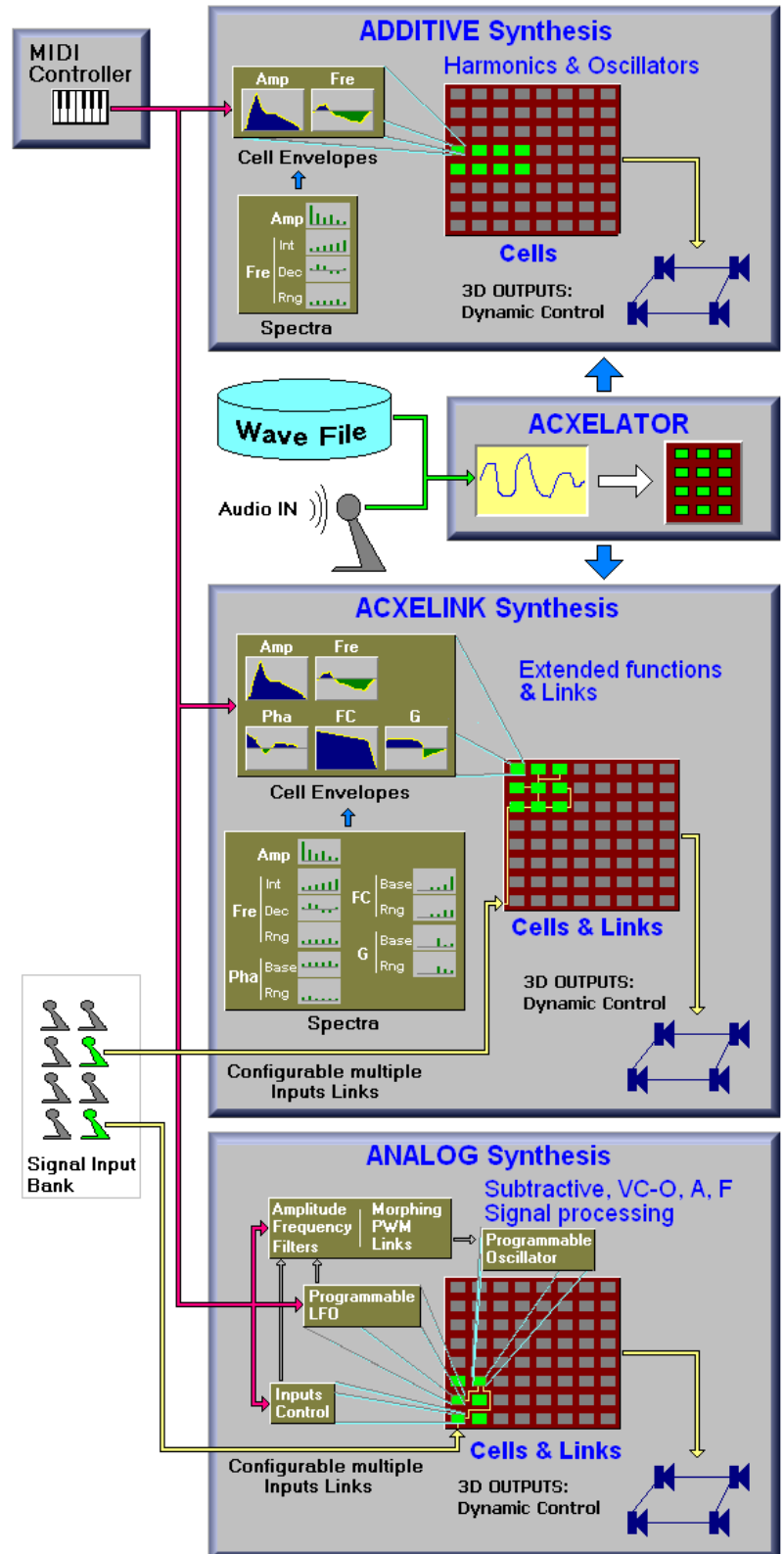
## The « F1 » of synthesizers

Taking advantage of the Acxel<sup>1</sup> legacy and revolutionary new processor technology<sup>2</sup>, with the Acxel2, IDARCA-AUDIO introduces a new evolutionary multisynthesis and multitimbral Modular synthesizer. The Acxel2 has become a new reference standard for synthesis and audio processing in the music industry.

The Acxel2 proposes 3 synthesis modes, including 2 standards: Additive Synthesis (including Re-synthesis) and Analog Synthesis.

On top of it, the Acxel2 introduces its native synthesis mode, the **Acxlink** (with re-synthesis). This synthesis is built from cell elements organized in a dynamic matrix architecture network that offers full open access to the sound internal structure thru a very intuitive user interface.

The flexibility of the Acxel2 based on specific configurations of the Acxlink synthesis, naturally enables the introduction of new sound creation models with the introduction of macros and new synthesis modes through continuous software upgrades.



<sup>1</sup> The **Acxel** is a ReSynthesizer developed in the turning of the 90's, invented by Pierre Guilmette, actual founder and President of Idarca-Audio Inc.

<sup>2</sup> At the heart of the Acxel2 system is a massively parallel dynamically reconfigurable processor, the RPP with signal synthesis embedded capabilities and ultra low granularity parallel calculator. RPP is based on an array of interdependent intelligent elements so called cells. This architecture enables flexibility that is not accessible with standard single or multiple DSP technology available today.



## OVERVIEW

### 1- Real Time Editing

The 3 basic Synthesis-Processing Modes available with the Acxel2 are dedicated to real time control and editing features with a unique approach and no compromise performance but still simple to use:

- Additive Synthesis Module
- Analog Synthesis Module
- Acxelink Synthesis & Processing Module

Other modes will be available later on.

#### The Acxel2 common Real Time Editing Features

The sound elements structures are implemented with 2 different elements: the Elements Synthesis Waveforms and Elements Processing States. The sound elements dynamics and real-time articulation are expressed with the envelopes and MIDI controls.

Elements Structure:

Elements Synthesis waveforms: with elements set as sound generator (All modes):

- Sine
- Square
- Sawtooth (ascending, descending)
- Triangle
- Noise generator
- Programmable drawn waveform

Elements Processing states: with elements set as processing elements (Acxelink mode only):

- Signal multiple Inputs (3) Recorder with memory size configurable for each element
- Wave Player with memory size and loop points configurable for each element
- Capture on Signal Inputs (3) no memorization for external direct control

#### MIDI Controls ON SOUND STRUCTURE:

Parameter on each element or global level can independently be modulated from any selected MIDI Controller. Each element parameter has base value level (corresponding to a spectrum element) and the envelope itself giving the variation of this value. MIDI is assigned to one or the other, depending on the user preference. As an example, to control element amplitude, the MIDI controller can be designated to affect its base value or its envelope.

The way MIDI is assigned to parameter is, by convention, the MIDI-Minimum and the MIDI-Maximum values; all controllable data is doubled for MIDI response.

- MIDI Min: For a specific parameter is the value when its assigned MIDI-control is at minimum value (ex: Lowest velocity).
- MIDI-Max: For a specific parameter the MIDI-Max term is the value when its assigned MIDI-control is at maximum value, at intermediate control value the parameter is proportionally interpolated between the min and max terms.

The MIDI-Min/Max applies for base values and envelopes at users choice. Each MIDI controller assigned to specific parameter is entirely user definable. Extensive selections of control curves are available.

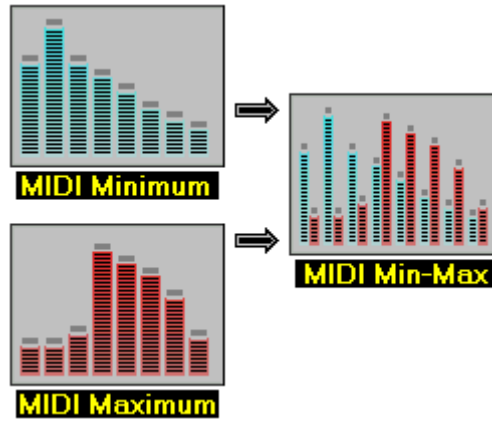
### SPECTRA (Element Base Values):

Each Spectrum is a representation of a specific element-cell parameter (ex.: base amplitude, etc.)

Each Spectrum is represented on MIDI Min (turquoise) and MIDI Max (red). Both can also be displayed together with each bars representing associated cell.

Main Parameters are:

- Amplitude
- Frequency: Base (integer, decimal), Range
- Optional Parameters (on Acxellink Mode only):
- Phase: Base, Range
- Filter: Base
- G (multiple: Symmetry or Morphing): Base, Range



### ENVELOPES:

The envelopes are accessible in 2 different representations:

- ADSR with loop points shapes
- Point-to-Point

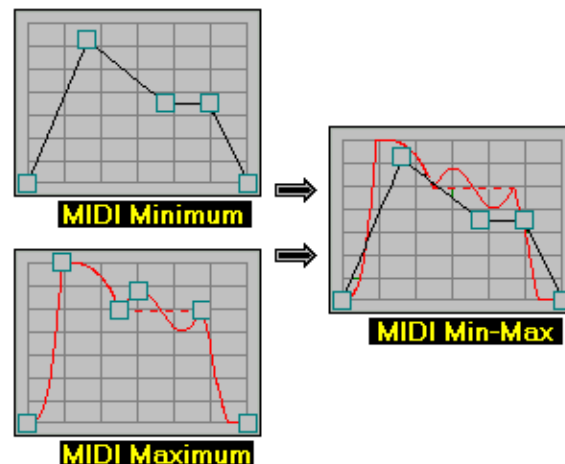
Each parameter has envelopes attached to each element. On each spectrum the corresponding bar of a selected element (Cell) gives the Base value and/or Envelope Variation Range for envelopes.

Each parameter envelope is represented for MIDI Min (turquoise) and MIDI Max (red). Both can also be displayed together. Each MIDI-Min/Max envelope has its own user defined Loop points.

#### ADSR Envelope type:

The envelopes are defined with Time and Level parameters, with Slope types definitions for each section (selection of Linear, Logarithmic or exponential), and sustain variation predefined Shapes independently for Midi-min/max :

- Attack time, level and slope type
- Decay time, level and slope type
- Sustain level, time and shape (Flat, Sine, triangle, sawtooth, pulse width); the sustain level can be adjusted from static to variable, with modulation
- Release time and slope type



### Point-to-Point Envelope type:

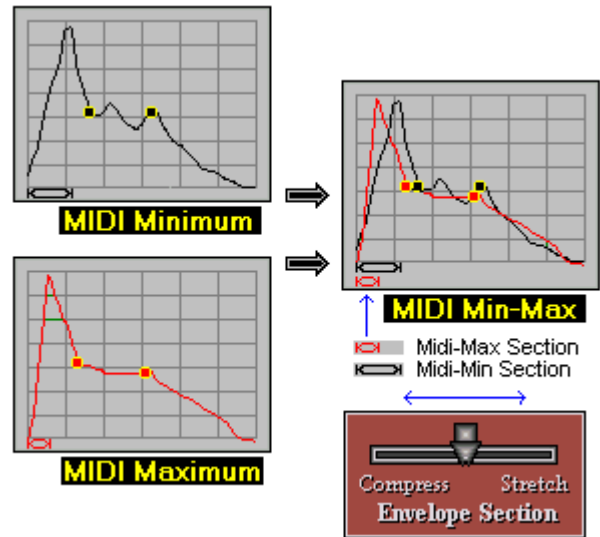
The envelopes are drawn directly in a general non recursive shape. No rise/fall time and level are defined; instead, the vertical points position to time on horizontal axis correspond to values in time-segments.

On time domain, whole envelope duration time and with Variation Range level are defined. It is also possible to compress/expand an envelope section (ex: attack).

There are 2 different editing facilities available for Point-to-Point envelopes:

- ❑ Selected time section Compression-Expansion with cursor control on each envelope
- ❑ Global Attack (time to first peak point) proportional Compression-Expansion for all envelopes with a single cursor

The Loop points are directly drawn (start – stop). On envelopes, a defined section (example: attack section) can be compress/expand independently for each envelope (small block down left, black or red). This function allows to rapidly and easily changing the dynamics while keeping the high definition of the point-to-point envelope original shape.



## **2- SYNTHESIS STRUCTURE:**

For each Synthesis module, the structure is based on 2 hierarchical levels of resources from base - Module to high - Instrument:

Module – Specific to each Synthesis module (can be combined with different synthesis modes within an Instrument).

- ❑ **Cells:** Multiple mode elements that are defined by user as Oscillators, Sampler, Controller.
- ❑ Parameters: Amplitude, Frequency
- ❑ Parameters (**Acxlink** mode only): Phase, Filter, Symmetry/Morphing (dual waveshape)
- ❑ Midi-Min (Base) & Midi-Max (Max control) Envelope on each Parameter,
- ❑ Controls (**Acxlink** mode only): Control input on cell's parameters
- ❑ Spectra & Envelopes: Pattern for each parameter
- ❑ Waveform (as generator) or type – Generator, Capture, Recorder
- ❑ Size (on sampler-recorder type), loops points.
- ❑ Module relative tuning (related to Instrument pitch)

Instrument – The top level assigned to a MIDI channel, it contains a user-specified number of Synthesis Modules .

- ❑ MIDI Channel Selection
- ❑ Number of Modules



#### □ Parameters

- Volume - Selected on Envelopes (ADSR):
  - Volume reference Value
  - Midi-Min & Midi-Max Envelope,
  - Optional LFO control,
- Pitch (Selected on Envelopes (ADSR) base or Static):
  - Tuning reference Value
  - Midi-Min & Midi-Max Envelope,
  - Optional LFO control,
- Filter:
  - Cut-off Frequency reference value
  - Reference frequency response: Fix, tracking
  - Midi-Min & Midi-Max Envelope,
  - Type Selection: Low Pass, High Pass, Band Pass,
  - Slope: 6 to 24 db per Octave,
  - Resonance Factor: 0 to 127,
  - Optional LFO control with Injection Level Factor,
- OUTPUTS Control - Selected on Envelopes (ADSR) :
  - Midi-Min & Midi-Max Envelopes,
  - Envelopes (with 2 outputs): Left-Right,
  - Envelopes (with 8 outputs option) Front-Back, Top-Bottom.



## SYNTHESIS MODES

### 1- Acxlink

Think about a Synthesis mode so powerful and complete that it can emulate most of the known synthesis modes available today and introduces new ones as well. Modes that can be combined. This ultimately gives the musician access to **an open world of Sound Synthesis / Processing**, with all micro-elements controllable in Real Time giving access to infinite Articulation Palette.

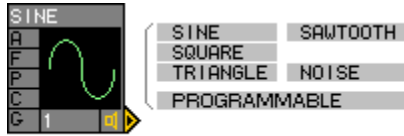
This Synthesis mode contents can be initiated from the Acxelator. All of this is already yet included with Acxlink Synthesis.

#### Acxlink Synthesis & Processing Module

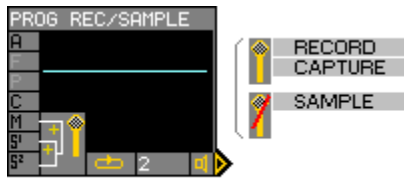
This mode is the native Acxel2 synthesis mode. The Acxelator can create the basic sound to be editable directly in Acxlink form, and then use its extremely rich palette of Real-Time controls, articulations and unique functions.

Spectral elements so called Cells are the extended sound elements for the Acxlink synthesis. Those have 5 basic parameters, and introduce an open structure where each parameter driven by Midi-Min/Max Envelope can also be controlled from any source - another cell, an instrument, an external signal input.

It is possible to define cells to behave as multiple input recorder-player with their own user defined wave area and loops. The Acxlink synthesis can be used for real time multiple signal Input Instrument (or any external sound source) processing to create unique effects.



CELL as a Sound Generator



CELL as a Signal Processor

### CELLS:

The Acxellink Synthesis basic element is the **cell**, where each one can be configured as **generator** or as **signal processor**.

The left figure represents waveforms available on 4 **generator** preset waveforms, one noise and one programmable waveform (that can be drawn or recorded from an external source, with configurable recording size and loop points).

In **processing** mode, a cell can access memory (with configurable size and loop points) to record (microphone ON) and-or playback (microphone OFF) a signal. The Capture mode is equivalent to Record but with no memory, it is defined to integrate and assign external signal to the **Acxel2** structure.

### SPECTRA & ENVELOPES :

With Acxellink mode, each Cell integrates 5 available parameters through 10 types of data accessible in dual-Spectra representation, with MIDI-Min-max.

Also, each Cell's parameter (5) is dynamically driven from related dual-envelope, with Midi-Min-max.

If the Acxelator is used to set the initial sound configuration, it will create a number of sinewave cells with correlated Amplitude and Frequency spectra and envelopes based on sound structure. Once done, the musician has complete access to the 5 parameters dual-spectra and dual-envelopes for editing.

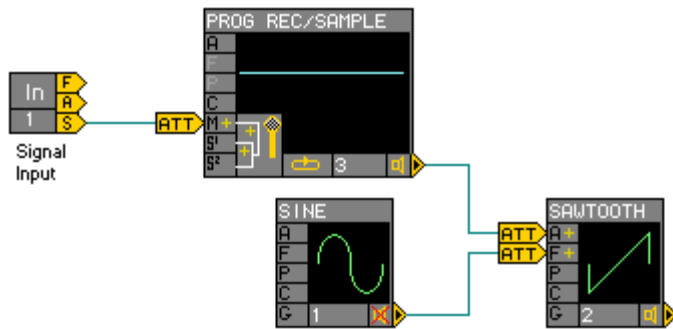
AMPLITUDE	FILTER - BASE
FRE - BASE INTEGER	FILTER - RANGE
FRE - BASE DECIMAL	G - BASE
FRE - RANGE	G - RANGE
PHASE - BASE	
PHASE - RANGE	

ACXELINK MODE SPECTRA

AMPLITUDE
FREQUENCY
PHASE
FILTER
G

ACXELINK MODE ENVELOPES

### ACXELINK CELL LINKS:



ACXELINK - CELLS typical Links

#### ENVELOPES CONTROLS

A	Amplitude
F	Frequency
P	Phase
C	Filter
G	G (Pwm,morphing,F. Slope)

#### CELLS SIGNAL INPUTS

M	INPUT Main
S¹	INPUT #1 Secondary
S²	INPUT #2 Secondary

#### LINK TYPES

ATT	Link Attenuation
+	Additive Link
x	Multiplicative Link



With the Links concept, each **Cell** acts as specific sound element generator and/or processor, the cells can then be combined and related using links.

For each **Generator-Cell** (like cells #1, #2 on figure), any source (Cells, external signal Inputs or an entire Instrument) can control-modulate any of its parameters thru its control input. This means that a specified source can modulate any cell parameter – Amplitude, Frequency, Phase, Filter Cutoff, G (PWM, morphing, Filter Slope), there is no restriction on links numbers or types. Each cell has 5 control inputs (to related parameters). A control input on parameter can be attenuated (including inversion); in fact a single source can control different destinations with specific attenuation factors. Each control effect can independently be defined to be additive or multiplicative on each related parameter.

Example:

In the preceding figure a SINE cell (#1) controls (+ indicates that the control is additive) the Frequency parameter of sawtooth cell (#2) and a RECORDING cell (#3) controls the Amplitude (A) parameter of sawtooth cell (#2).

For each **Signal Processing-Cell** (like cell #3 on figure), any of its parameters or multiple signal inputs can be controlled or driven from a source (Cells, device signal Inputs or an entire Instrument). As on the Generator Cells, the specified source can modulate any of the Cell Envelopes. Also a source can be directed to any of the 3 available Inputs on a specified cell, these Inputs (Main, Secondaries 1 and 2) can be combined together in additive or multiplicative manner. Each Control or Signal Input can be attenuated (including inverted). Control Inputs can independently be applied to be additive or multiplicative on related envelope.

Example:

In the previous figure the Signal Input #1 is directed to the Main Input (M) of the RECORDING Cell (#3).

In the preceding figure, an example of combination of **Generator-Cells** and **Processing-Cell** is represented in a very simple application of **Acxellink** Mode. The cells #1 and #2 are Generator cells with defined waveform, with controls. The #3 cell is a Signal Processor which can be combined to synthesis cell, more of that - this cell can act as a sound processor to operate various effects on connected Instruments (ex: Guitar, etc.). The **Acxel2** is capable to implement many functions normally executed with different devices, simultaneously without constraints:

- ❑ Multi-Timbral and Multi-Mode Synthesizer and/or Resynthesizer (with Acxelator)
- ❑ Multiple Effects Processor: Phasing, Delaying, Reverb, Filtering, Spatialization, etc.
- ❑ Multi-Sampler (up to 16 available signal inputs)
- ❑ Mixing Console (up to 16 available signal inputs)
- ❑ Spatialization Outputs controller

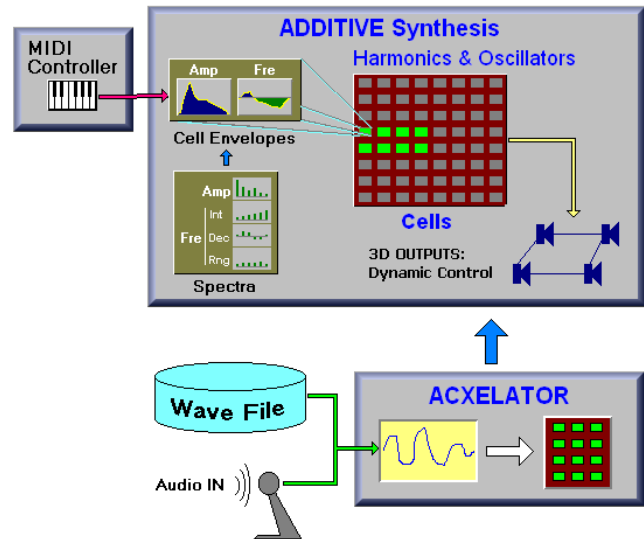
Again the structure can be initially set with the Acxelator module.

## 2- Additive

Additive Synthesis accesses sound elements as naturally structured, and real time controls and articulations to make it come alive and natural.

Additive Synthesis mode (an Acxlink preset) becomes a natural solution to create and edit timbre and to apply MIDI controls to selected sound elements. Sound can be created from the **Acxelator** (from pre-recorded sound or wavefile) or created from scratch.

A large selection of parameters is accessible through the graphic interface. Using this interface, the sound can be modified or made structurally different with independently assigned MIDI controls. As an example, you can automatically build 2 different sounds and use MIDI control to gradually morph from one sound to the other. These modifications apply to all sound parameters, including envelopes and dynamic expression.



### SPECTRA AND ENVELOPES:

In Additive mode, each **Cell** has 2 base value parameters through 4 types of data accessible in **Spectrum** representation, with MIDI-Min & MIDI-max.

Moreover, 2 related dual-envelopes, with MIDI-Min & MIDI-max. drive each **Cell** dynamics.

If the **Acxelator** is used to set the initial sound configuration, it will create a number of sinewave elements with sound definition Amplitude and Frequency spectra and envelopes. Once created, this gives the musician full access to the 2 parameters spectra and envelopes for editing.

AMPLITUDE  
FRE - BASE INTEGER  
FRE - BASE DECIMAL  
FRE - RANGE

ADDITIVE MODE SPECTRA

AMPLITUDE  
FREQUENCY

ADDITIVE MODE ENVELOPES

The default element waveform on Additive Synthesis Mode is the **Sinewave**, it can be changed to other shapes: Square, Sawtooth (ascending, descending), Triangle or a user defined shape.

Full MIDI control on structural elements (Cells parameters) or on global parameters.

The envelopes may optionally be represented as shown point-to-point envelopes (Default using the **Acxelator**), or ADSR with dynamic loop (Default if built from scratch).

Within the Additive Mode Synthesis, the sound elements parameters (frequencies, amplitudes) are dynamically drive with combination of Spectra (base values) and Envelopes (dynamics), each Waveform can be selected individually.

### 3- Analog

By taking advantage of the versatility of the Acxlink Synthesis, the Acxel2 offers an analog module with unique features.

#### The Analog Synthesis Module

This module is a simplified preset of Acxlink Synthesis using a reduce number of elements: with 4 Oscillators, 4 LFO's, Access to Signal Inputs for controls, Output Dynamic Configurable Filter and Spatial Outputs per synthesis module.

The accessible parameters on Oscillator/LFO are their Amplitude - Frequency envelopes, Shape (with morphing capability on both Oscillators and LFOs). Each LFO and oscillator is controllable from MIDI, on Dual Envelopes related to MIDI-Min and MIDI-Max of the selected controller. ADSR dual Envelopes on each element: Frequency, amplitude.

Thanks to its open structure with its Signal Input accessibility to control the operations, the analog module allows a very wide sound synthesis and processing palette. Familiar analog type synth sounds with their VCO, VCA, VCF can be created using the Signal to Parameter control. Benefits of programmability on parameters and specific global controls offer unique functionalities.

Among these: the oscillators block detuning function opens access to spectacular effects just from a single controller; to simulate orchestral groups with many musicians playing at slightly different pitches. Such a feature cannot be achieved with the traditional Chorus effects, as the later applies to already mixed sounds.





## **4- Others Synthesis modes**

Thanks to the native Acxlink Synthesis & Processing the potential of Processing Capabilities is virtually unlimited, considering that it can emulate well known existing Synthesis techniques, create new ones or combine Modes, effects and Signal processing functions.

### **Supplementary Optional Synthesis & Processing Modules**

These Synthesis and Processing modules can operate in exclusive processes or combined with other base or optional modes.

#### **SYNTHESIS MODES:**

- Physical Modeling
- Wavelets
- FM
- Wave Table
- Vocoders
- Instrument emulation: Acoustical, Synthesizer
- Real Time Control Macro functions

#### **PROCESSING APPLICATIONS:**

- Dynamic Mixing Console
- Studio environment system
- Room emulation
- Effect Processing: Guitar, Voice, other instruments
  - Noise reduction
  - Graphic equalizer



## RE-SYNTHESIS

### 1 - CONCEPT

The Re-synthesis, is now made available to the Acxel2 by virtue of two newly developed technologies – the **RPP** processor and the **Acxelator** based on dedicated and high level sound analysis algorithms. Real Time Re-synthesis is here at last with a simple user interface that belies the underlying complex sound structure.

#### SAMPLING

Current day sampling technology contains inherent constraints that limit the uses as a creative and expressive tool. Any pitch changes will cause a proportional duration variation and timbre alteration, which limits the sonic reproduction.

Multisampling allows the musician to distribute many different sampled sounds along the keyboard, recorded at different pitches and intensities. The timbre expression is entirely dependent on the original sample.

The looping is unable to accurately represent the timbre dynamics. The expression is limited and articulation narrow based. The sampled sound editing is virtually inexistent.

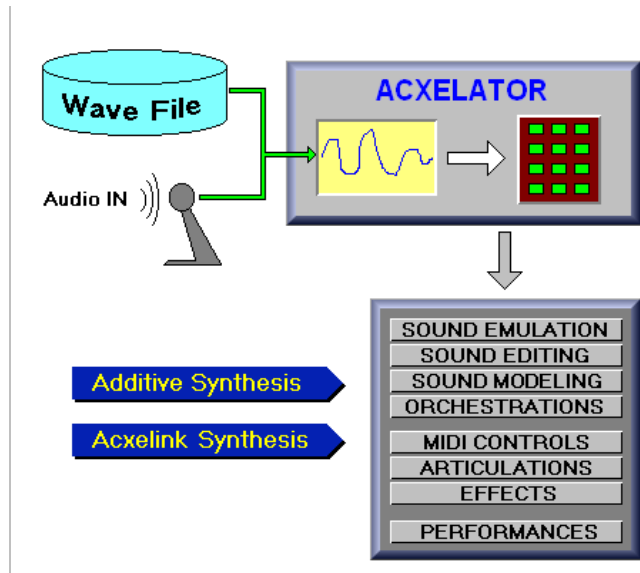
Also, the efforts involved to create a good sample library are enormous, considering that it requires a complex management, large data base and time consuming.

#### ACXEL2 RE-SYNTHESIS

**The Re-synthesis proceeds in a radically different manner**, which consists of analysing and decoding a sound and extracting the basic elements of the sound in their respective time domain. This process gives the musician access to all of the sound element parameters by means of the related independent envelopes.

In contrast with sampling, the spectral dynamic content remains constant throughout the entire range of the keyboard, maintaining intact the crucial sound musicality. In other words, the original harmonic envelopes are preserved with their specific properties across the entire range of the sound.

Another exciting result of this approach is that the timbre can be modified during playback, dynamically and in real time controls, by means of a large palette of modifications, including MIDI controls, as requested by the musician. Also, by assigning different parameters (Velocity min-max, Pan, LFO, etc.) on 2 or more of the basic components together, the musician is able to obtain a dynamic timbre variation, with very fine transitions in between the parameter groups. Furthermore, the attack and release sections of the sound are precisely and dynamically interpreted along all expressive levels. Consequently, no looping is necessary.



**Acxel2 re-synthesis** also enables a deep musical sense with each of the newly created sounds. The perspectives are infinite, as so many samples are available as a basis for. Each sample now becomes a foundation for the creation of an unlimited variety of dynamic timbres. No such physical modelling as in similarly named instruments is involved, making the **Acxel2** a really new concept.

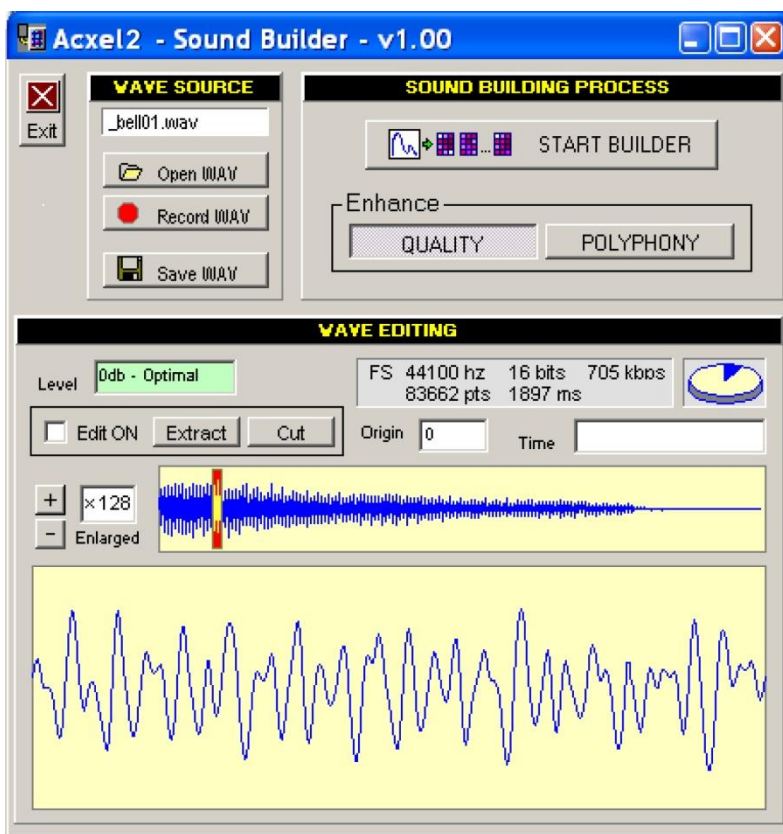
**Re-synthesised sound** can be combined within their structure to other sound elements, alternate synthesis modes, **always in Real Time**.



## 2 - The Acxelator™ – Sound Analyzer / Builder module

This module, called ACXELATOR, allows the musician to capture a signal from a .WAV file or from a system signal inputs. After the sound is loaded into the processor's memory, the program encodes it, extracts the elements and assigns required Re-synthesis resources.

The only user requirement is to specify the preference for an enhanced polyphony or an enhanced reproduction quality and the preferred synthesis mode (Acxlink, Additive). After the sound building is done, the musician has a complete access to the new sound structure. The sound can subsequently be modified and any selected element(s) can be controlled by MIDI in real time. The built sounds can also be combined to create timbral interpolation from MIDI control, etc..



### Acxelator processing Steps:

1. Select the origin sound from Input [Record WAV] or from a .WAV file [Open WAV]
2. RECORD or OPEN the file
3. EDIT the signal if necessary with selected section [cut/extract]
4. Select the preferred Building Mode: to prioritise [Polyphony] with fewer elements, or reproduction [Quality]
5. [START BUILDER]: on a 1 GHz Pentium 4 the building process takes about the same time as the recording time (example - a 2 second sound will take about 2 second to build).
6. Close the SOUND BUILDER Window.

### Uses of a newly Built Sound:

- Create original sound library with very low storage requirements, just parameters, no sample.
- Combine 2 original sounds into a new composite sound with dynamic MIDI interpolation.
- Create new sounds by editing them
- MIDI Control: can be applied on global or structural sound level, and as described before, with very rich and flexible control from subtle to large variations.

When the building is completed, the sound is ready to be played. **The resulting newly built sound is not a sample.**

For this reason, it can be **directly transposed** without affecting the duration or quality. For example, a 3 second violin note at 200 Hz transposed one octave lower will be heard as a 3 second Cello.

The Sound duration can be **stretched** or **compressed**. For example from 3 to 10 second without changing the original pitch. For example, a 0.3 second pizzicato violin at 220 Hz, extended to 5 second with its components detuned will be hear as a sort on organ AND the newly built sound can then be modified and controlled, using the preferred Synthesis Mode Interface - Acxlink or Additive mode.



## HARDWARE

### AXCEL2™ «CARD», AXCEL2™ «RACK», AXCEL2™ «STUDIO»

All Acxel2 products can be used with any DAW (Pro Tools, Cubase, Steinberg, Logic, etc.), can operate under Apple or Windows platform and can be used as "slave" or "master" with any audio or MIDI entry (keyboard, guitar, microphone, etc) . All our products incorporate the Acxel2 re-programmable microprocessor RPP renowned for its extreme reliability and execution speed, largely superior to any DSP chips currently available on the market.

**Acxel 2 «CARD»** is intended to be inserted into a computer (desktop or laptop) in a standard slot or into any "keyboard" that can receive a physical card.



**Acxel2 «RACK»** is an independent rack mounted unit in a standard 48 cm (19-inches 2U box) and can be inserted into a "rack" cabinet or used as a stand alone unit. For home studios, professional studios and stage musicians, all standard connections are present: midi, analog, USB2, mic / line / instrument. A 128 sounds library is included.



**Acxel 2 «STUDIO»** is our high performance independent unit, rack mounted in a prestigious black box (2U). For commercial professional recordings, production and post-production studios as well as the professional scene, it can be operated as a stand alone unit or into a "rack" cabinet. All standard connections are present (midi, audio analog, USB2 and Phantom power) including 8 inputs / outputs, a sampling rate, at 24-bits from 44.1 kHz to 192 kHz and 48 Khz to 192 Khz (384 Khz in Fall 2010), our complete extension system, an additional DSP co-processor, a 17-inch LCD touch screen panel or a LED matrix touch screen (LED available in 2010). The Analog (OpANA\_192) and Digital packages (OpDIG) and a 256 sounds library are included.





## Sounds Library

Acxel 2 «**SOUNDS LIBRARY**» is our original sound bank, developed in studios, on Acxel2, by experienced professionals. All the audio files files are compatible and can be modified and converted on any Acxel2 products. The sound bank can be purchased on CD or downloaded directly from our on-line store

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