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Fluid Control: Media Evolution in Water

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We have developed water based electronic elements which we built into electric circuits to control different parameters of electronic sound and video tools. As a result of our research we have constructed a complex controller whose main component is water. This tool makes it possible to control analog and software synthesizers as well as video software and other electronic devices, especially microcontroller based platforms like Arduino or Raspberry.

Introduction

Many traditional music instruments such as violins, guitars, timpani, pianos, and trumpets can give the musicians an immediate tactile response to their play. A strike on the timpani makes the mallets bounce back in a very specific manner, depending on the velocity, intensity, point, and angle of the beat. Plucking a guitar string, bowing a violin, sounding a trumpet or pushing a key on the piano not only requires overcoming a resistance but it also produces a kickback. On a piano for example, this kickback consists of the hammer falling back, an effect which the musician, upon touching the keys, can feel directly in his fingers. The nature and strength of this kickback response depend on both, the type of the action (plugging, beating, blowing, striking), and the strength, the sound quality, the pitch.

In electronic music the tactile feeling of the generated sound is absent. We cannot grab into the electric power and influence the sound quality with our hands in a direct manner. We cannot feel the swinging of an oscillating electric circuit consisting of transistors, resistors, and capacitors. Musicians have to play electronic instruments always in an indirect manner via interfaces.

These days the development of many industrially produced interfaces tends to avoid mechanical components as much as possible or to use only a minimum of mechanical parts. This leads to the fact that the input devices themselves do not create any music adequate resistance against the musician's acting. Moving a fader or potentiometer from point zero up to half (50%) requires the same force as moving it from half to the top (100%). If this tool is used to influence the volume or the amount of distortion of a sound, one would wish for a fader whose sanding resistance increases according to the distance. Certain attempts have been made at finding a solution but the results have not yet gone beyond the status of a dummy, i.e. they are not actually included in the work circle of the sound production.

The best known example of such a development are the weighted keys of a keyboard. They are supposed to imitate the feel of a traditional piano but are not actually linked to the sound production. However, these particularities of the electronic sound generation do not imply a lack because the listener is rewarded with an immense amount of sound possibilities, a wealth that hardly exists in music produced with traditional instruments. On the other hand we have to admit that these particularities clearly influence the aesthetic perception of the work. Especially in the beginning of electronic music people used to describe the sound as very mechanical.

Fluid Control

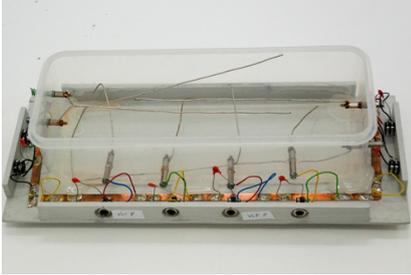


Fig. 1

The artist group “wechselstrom” has made an attempt to develop the potential: A first approach consisted of producing the movement of sounds in space with an interface that gives the musician a physically tangible reference to his actions. These movements are normally regulated with a pan knob or a joystick. We equipped the interior of a closable plastic box with metal wires that took over the function of inputs and outputs of a mixer. These wires were isolated from each other, i.e. they hung free-floating inside the plastic box (Fig. 1).

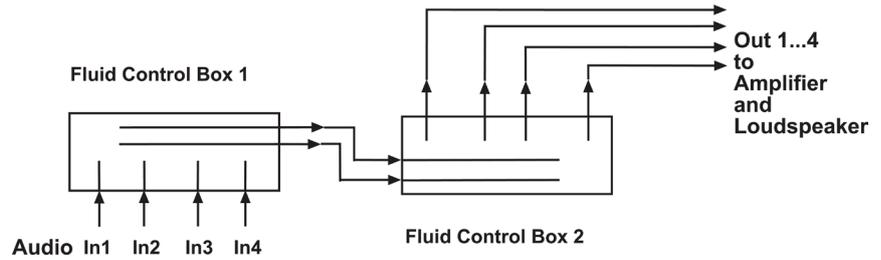
The moment when the box was filled with (tap) water a complex structure of potentiometers was created mutually influencing each other. The wires took over the function of electrodes and the water served as a variable resistor. Measurements showed that the electrical resistance between two electrodes was between 15 – 50 kohms, depending on the immersion depth and the degree of wetting. These values are also used in normal potentiometers in electric circuits.

We have called this new instrument the “Fluid Control” box. It has been our goal to use Fluid Control as a matrix mixer which combines the functions of controllers, switches, faders, panning regulators, and joysticks in one hand. The movement of the water inside the box, the sloshing of the liquid reveals not just an audible image of the movement of sounds in space. Furthermore, the player / musician can bring his own body into a tactile relationship with the shifting weight of the water. The body and the instrument can now get into a resonant interaction. This process is similar to the rhythms of a sand- or rice-filled egg shaker which sound most lively when one succeeds to synchronize the movement of the grains with the swinging movements of the hand and arm.

In summer 2012 (during the festival Sound Barrier) we set up two Fluid Control boxes, two CD players, which resulted in a total of four mono tracks, and a 4-channel sound system. The four mono tracks coming from two CD players were launched into the input side of the first Fluid Control box mixed together with the appropriate proportion of water and sound levels on two tracks. This mixture was fed into the second Fluid Control box and distributed dynamically to the four channels of the sound system (Fig. 2).

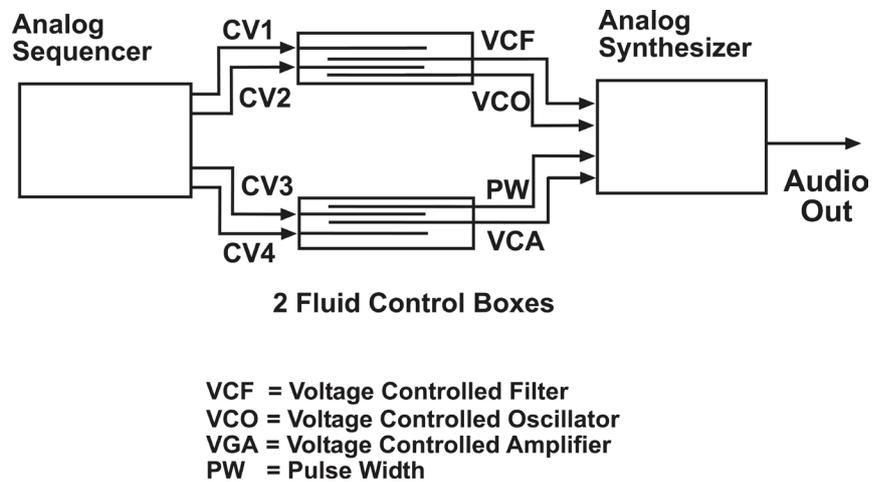
Following the golden rule “current is current is current” the next step was to modulate not only audio signals but also to modulate control voltages generated in analog synthesizers. These electronic devices have the advantage of providing multiple physical inputs and outputs that can be plugged in directly. We

Fig. 2



showed this second setting for the first time on Sept 15th 2012 in the Jazzschmiede in Düsseldorf. We used the possibilities offered by Fluid Control for influencing the control current that was produced by an analog sequencer in order to drive an analog synthesizer (Fig. 3).

Fig. 3



As a result of our research we have created a tool which makes it possible to control electronic sounds within the dispositive of preselected sequencer and synthesizer setups in a very fast, dizzy, sophisticated, and sometimes chaotic way. Developing this tool we intended to make the change of the sound parameters in electronic music physically tangible. We also wanted to give the player a resistor / a weight into his hand which enables him to react in a more immediate and body conscious way to changes in sound beyond the scope of what controllers and interfaces like buttons, faders, rotary potentiometers, and touch screens can do.

As the third we wanted to bring Fluid Control into the sphere of the digital world of computers, software synthesizers and, as a follow up, of video or any other multimedia software. All well-known software synthesizers like MAX, pd, Reaktor etc. and most video/graphic software (MAX/jitter, Resolume) use and understand MIDI specification to control various parameters. We used a MIDI box which provided MIDI inputs and outputs and was connected via USB or FireWire to the computer on the other side at the same time. For the creation of a reliable MIDI data stream we took

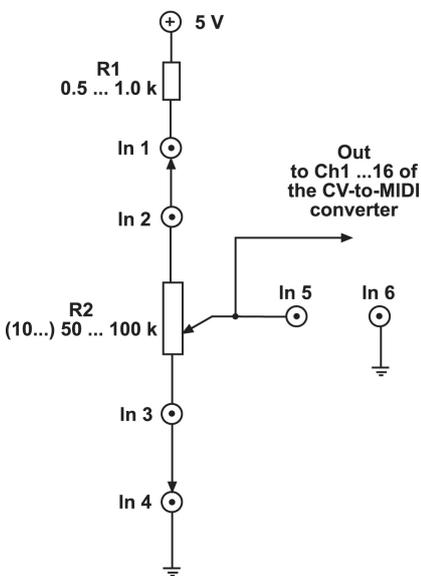


Fig. 4

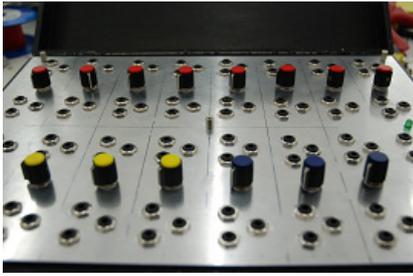
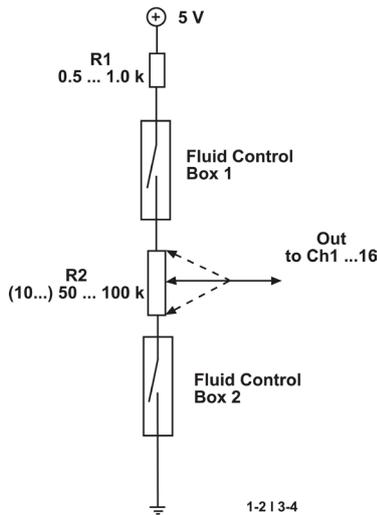


Fig. 5



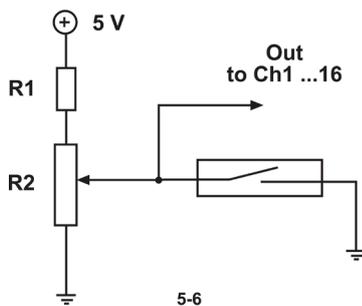
the +5 volt CV (Control Voltage) specification as an equivalent for the midi data value 0...127. We generated the corresponding data stream via a CV-to-MIDI converter. We modified the control voltage, which is often constructed with a single potentiometer, by adding the Fluid Control Box and by building it pre-, and/or post-fader or as a side channel into the electric circuit (Fig. 4).

“In1” and “In4” (socket symbol with arrow) are sockets with switching contacts, all other sockets are without switch. R1 is a resistor preventing a short circuit when sockets are connected in a wrong way (e.g. if you connect In1 to In6). The out goes to the input of one of the 16 channels provided by the CV-to-MIDI converter, which means that this circuit diagram was built 16 times (Fig. 5).

Connections can be made between all sockets, even between sockets of different channels. However, only the following connections produce an effect: In1-In2, In1-In5, In2-In5, In3-In4, In3-In5, In4-In5 and In5-In6.

Fig.6, 7, and 8 show the basic connections. In Fig.6 two Fluid Control boxes are looped in. Together with R2 they build a voltage divider. When the slider of R2 is in the upper position the first Fluid Control box has more influence than box nr.2 and vice versa. When for instance the second box is plugged out the remaining box achieves the highest effect with the slider of R2 being in the upper position. When the slider is in the down position the box is inactive because the slider is connected to ground, therefore the output voltage is zero. In Fig.7 and Fig.8 the box achieves its highest efficiency when the slider is in the center position.

Fig. 6

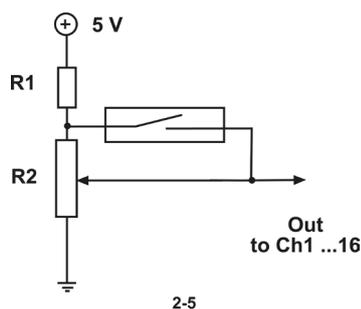


Obviously, Fluid Control can be connected to any microcontroller or computer. In this case a MIDI-translation is not necessary, the circuits shown in Fig.4 – Fig.8 can be directly plugged into the analog inputs of the Arduino or Raspberry.

Film clips illustrating the operation of this instrument are available under the following Internet links:

How it works: (search for “Fluid Control Essenz”) <https://www.youtube.com/watch?v=ed4JlMMNnyg> and “Fluid Control – The Installation” <https://www.youtube.com/watch?v=41uZi7bEdeI>

Fig. 7



wechselstrom

Christoph Theiler & Renate Pittroff

“wechselstrom” is a label owned by Renate Pittroff and Christoph Theiler. Based in Vienna, “wechselstrom” runs a so-called “off-space”, which offers room for exhibitions, media activism and all art forms on the fringe of culture.

Fig. 8

Selected works:

Piefkedenkmal – the construction of a monument for the musician Gottfried Piefke, who is also the namesake of the well-known Austrian derogatory name for Germans (2009 Gänserndorf)

Samenschleuder – a tool for environmentally conscious car driving (2009 Weinviertel, Lower Austria)

bm:dna – the government department for dna-analysis (2005 Vienna)

Tracker Dog – follow a (your) dog and track the route with a GPS, then print and distribute new walking maps (2008 Mostviertel, Lower Austria)

Community Game – a tool for distributing government grants using a mixed system of democratic vote and randomized control (2006 Vienna – distributing 125.000 Euro)

whispering bones – a theatre play asking for the whereabouts of A. Hitler's bones (2004 Vienna, rta-wind-channel)

Reply – mailing action: resending Mozart's begging letters under our own name to 270 people: to the 100 richest Germans and Austrians, to managers and artists of the classical music business, and all members of the Austrian government (2005/06 Vienna)

Re-Entry: Life in the Petri Dish-Opera for Oldenburg 2010

www.wechsel-strom.net, www.piefkedenkmal.at

www.samenschleuder.net, www.trackerdog.at