

# FLUID CONTROL – MEDIA EVOLUTION IN WATER

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## Abstract

We developed water based electronic elements. These elements are built into electronic circuits to control different parameters of electronic sound and video tools. As a result of our research we constructed a complex controller, with the main component of water. With this tool it is possible to control analog and software synthesizers as well as video-software and all kind of electronic devices especially microcontroller based platforms like Arduino or Raspberry.

## Keywords

controller, computer interface, water, electronic music, video, mass inertia, fluid, potentiometer, switch, fader,

## Introduction

Many traditional music instruments, such as violin, guitar, timpani, piano, trumpet have the quality to give the musicians an immediate, tactile noticeable 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 is connected not only with the overcoming of a resistance but also with the production of a kickback. On a piano for example this kickback consists in the action of the back falling hammer, which effect can be felt direct in the keys by the musicians finger. The nature and strength of this kickback response depends not only on the type of the action (plugging, beating, blowing, striking) but also on the strength, the sound quality and the pitch.

This, in addition to hearing the sound, direct tactile feeling of sound is absent in electronic music. We cannot grab into the electrical 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.

The development of many industrial produced interfaces moves up to now more in the direction to avoid mechanical components as much as possible, or to make it with a

minimum of mechanical parts. This leads to the fact, that the input devices themselves does not set any music adequate resistance against the musician's acting. A fader or potentiometer, which is moved from point zero up to half (50%) requires the same force as if it is moved from half point to top stop (100%). If this tool is used to influence the volume or the amount of distortion of a sound, one would wish a fader, whose sanding resistance increases with increasing distance. There are approaches, but they have generally the character of a dummy, i.e. they are not included in the work circle of the sound production. The best known example of such a development are the weighted keys of a keyboard, which should imitate the feel of a traditional piano, but have no causal link related to the sound production itself.

One does not have to evaluate these peculiarities of electronic sound generation as a lack, the listener is rewarded with an almost immense plenty of sound possibilities, a wealth that hardly exists in the music produced with traditional instruments. On the other hand we have to realize, that these peculiarities of electronic music generation clearly codetermine the aesthetic of the work. In the beginning of electronic music, the sound was always described as very mechanical.

## Fluid Control

The artist group „wechselstrom“ has now made an attempt to develop the potential: A first approach consisted in 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 freely floating inside the plastic box (see Fig. 1).

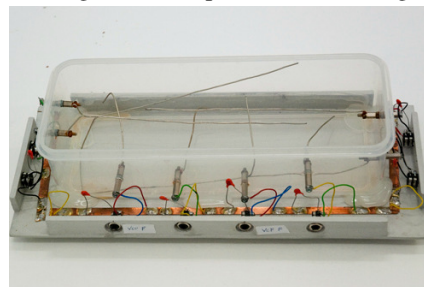


Fig. 1

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

We called this new instrument „Fluid Control Box“. Our aim was, to use Fluid Control as a matrix mixer, that combines the functions of controllers, switches, faders, panning regulators and joysticks in one hand. The movement of the water in the box, the sloshing of the liquid revealed not only an audible image of the movement of sounds in space, but the player / musician could also now bring his own body into tactile relationship to the shifting weight of the water. The body and the instrument could now come into resonance. A process, similar to the rhythms of a sand- or rice-filled egg, that sound most lively, if it succeeds to bring the movement of sand or rice grains in relationship with the swinging movements of the hand and the arm.

The setting, we realized in summer 2012 (during the festival Sound Barrier) consisted of two Fluid Control boxes, two CD players, which resulted a total of four mono tracks, and a 4-channel sound system. The four mono tracks coming from two CD players have been launched into the input side of the first Fluid Control box, there are mixed together with the use of water in their proportions 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)

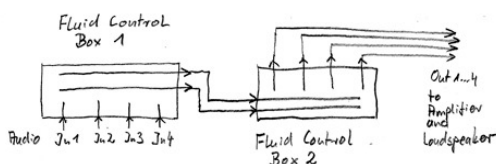


Fig. 2

Following the golden rule "current is current is current" the next step was to modulate not only audio signals but also control voltages, generated in analog synthesizers. These electronic devices have the advantage that they provide multiple physical inputs and outputs, you can plug directly. We showed this second setting first time on Sept 15th 2012 in Jazzschmiede in Düsseldorf. We used the possibilities of Fluid Control for influencing the control current that was produced by an analog sequencer in order to drive an analog synthesizer. (Fig. 3)

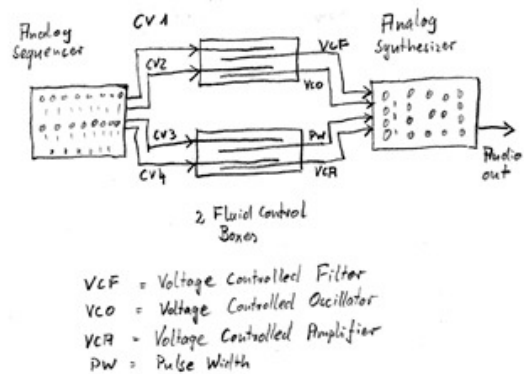


Fig. 3

Now we created a tool, which made 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. The aim of this development was to make the change of the sound parameters in electronic music available in form of a physically experience; to give the player a resistor / a weight into his hand, which makes it possible, to react in a more immediate and body conscious way to changes in sound - more possible, than classic controllers and interfaces like buttons, faders, rotary potentiometers, touch screens can do.

The third step was, to bring Fluid Control into the sphere of digital world, into the computer, into the world of digital software synthesizers and as a follow up into 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 on the one side MIDI inputs and outputs and was connected on the other side via USB or FireWire to the computer. For the creation of a reliable MIDI data stream, we took 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. The control voltage, often constructed with a single potentiometer, we extended the circuit by the Fluid Control Box that could be put in pre-, and/or post-fader or as a side channel. (Fig. 4)

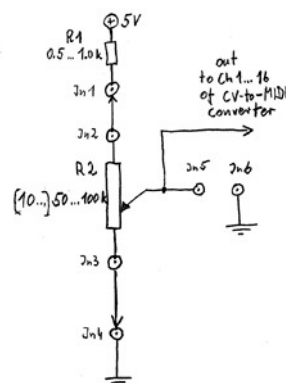


Fig. 4

“In 1” and “In 4” (socket symbol with arrow) are sockets with switching contacts, all other sockets are without switch. R1 is a resistor, which prevents a short circuit when sockets are connected in a wrong way (f.e. if you connect In1 to In6). The out goes to the input of one of the 16 channel, which the CV-to-MIDI converter provides, that means this circuit diagramm was built 16 times. (Fig. 5)



Fig. 5

Connections can be made between every socket, 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 shows the basic connections. In Fig.6 two Fluid Control boxes are looped in. Together with R2 they build a voltage divider. If the slider of R2 is in the upper position, first Fluid Control box has more influence, than box nr.2 and vice versa. If f. i. second box is plugged out, most effect of the remaining box is, when the slider of R2 is in the upper position. If the slider is in the down position, the box has no influence, because the slider is connected to ground, output voltage is zero. In Fig.7 and Fig.8 the box has most efficiency, when the slider is in the center position.

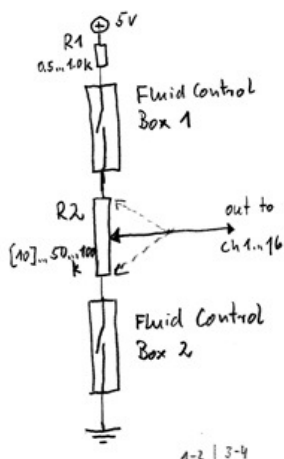


Fig. 6

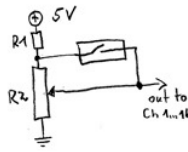


Fig. 7

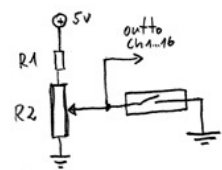


Fig. 8

Of course it is obvious, that FLUID CONTROL can be connected to any microcontroller or computer. In this case you don't need MIDI-translation, you can plug in the circuits shown in Fig.4 – Fig.8 direct into the analog inputs of the Arduino or Raspberry.

Film clips, which illustrate the mode of operation of this instrument are archived under the following internet links.

How it works: (search for “Fluid Control Essenz”)

<https://www.youtube.com/watch?v=ed4JIMMNnyg>

and “Fluid Control – The Installation”

<https://www.youtube.com/watch?v=41uZi7bEdeI>

## wechselstrom, Christoph Theiler & Renate Pittroff

wechselstrom is the label of Renate Pittroff and Christoph Theiler. Based in Vienna, they run an offspace, which is a room for exhibitions, media activism and all art forms on the fringe of culture.

Selection of Works:

Piefkedenkmal - construction of a monument for the musician Gottfried Piefke, who is also the name patron for the well known austrian dirty word for germans (2009 Gänserndorf)

Samenschleuder - tool for ecological sensitive car driving (2009 Weinviertel, lower austria)

bm:dna - ministry office for dna-analysis (2005 Vienna)

Tracker Dog - following a (your) dog and tracking the route with GPS-System, then printing and distributing new maps of walks (2008 Mostviertel, lower austria)

Community Game - tool for distributing gouvemnt grants using a mixed system of democratic voting and randomized control (2006 Vienna - distributing Euro 125.000,--)

whispering bones - theater play about the question, where A. Hitler's bones remain (2004 Vienna, rta-wind-channel)

Reply - mailing action: sending Mozart's begging letters again under own name to 270 people, the 100 richest germans and austrians, managers and artists of classical music business and all members of the austrian gouvemnt (2005/06 Vienna)

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

[www.wechsel-strom.net](http://www.wechsel-strom.net), [www.piefkedenkmal.at](http://www.piefkedenkmal.at)

[www.samenschleuder.net](http://www.samenschleuder.net), [www.trackerdog.at](http://www.trackerdog.at)