I-CubeX

A sensor toolkit for developing interactive media applications

by Axel Mulder

- About I-CubeX
- I-CubeX Hardware
- I-CubeX Software

http://icubex.com/support/I-CubeX.190325.pdf

http://ICubeX.com

Sensors, Interfaces & Software since 1995

I-CubeX examples

- Trigger sound in sync with physical action on stage (TouchMini, http://icubex.com/theatre)
- Create a basic control panel for QLab (TouchMiniOn)
- Rotate CG model of physical object in sync in interactive retail experience (Orient4D)
- Use heart beat to control tempo in musical performance (BioBeat)
- Detect hand position in laserbeam to trigger sound (ReachFar, https://youtu.be/BmWxUkhyedc?t=26)
- Trigger sound upon tap on the chest (Bang, https://www.youtube.com/watch?v=BmWxUkhyedc)
- Add control for sound effects on a trumpet (Push3D, https://www.youtube.com/watch?v=umBVBu6nFbI)

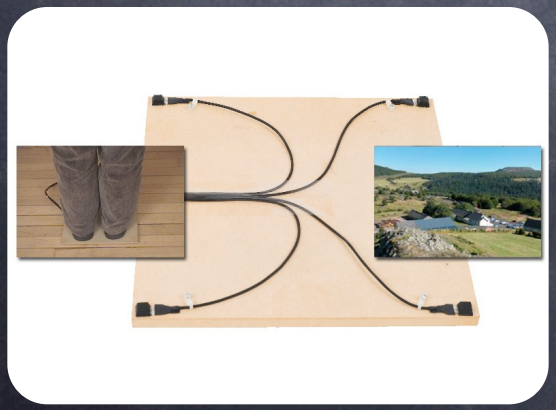
I-CubeX applications

Music

Dance

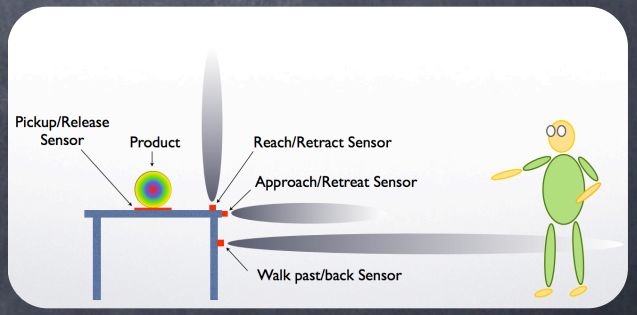
Installation Art

Exhibit Design



Game Dev

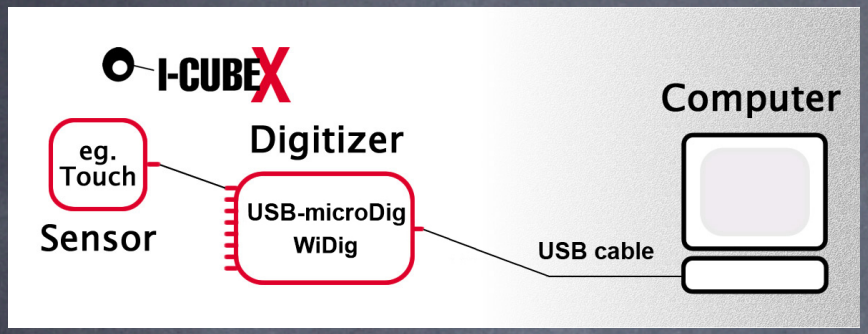
Biomechanics

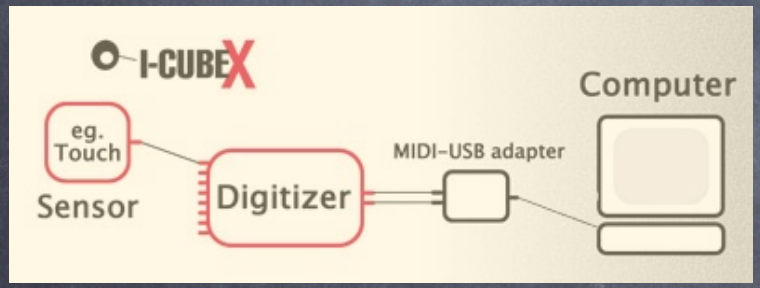


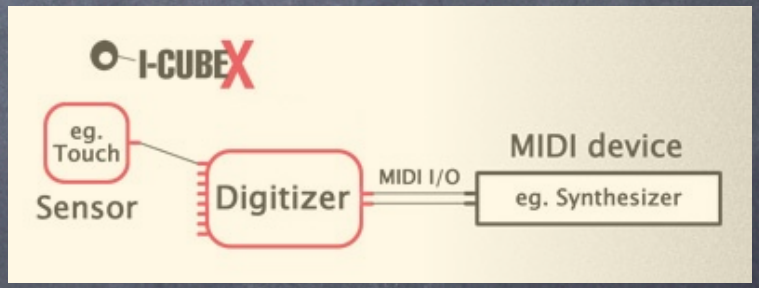
Behaviour Research

I-CubeX basics

http://icubex.com/about







Mode of operation

- Standalone mode: processed & mapped
- Host mode: raw

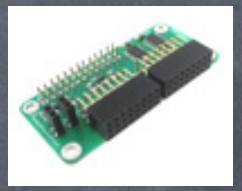
Sensor technologies

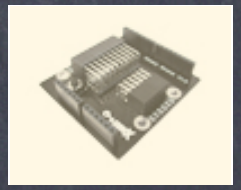
- Piezo-resistance (FSR, straingauge)
- Piezo-electricity (also PIR)
- Ultrasound TOF
- RF TOF (radar)
- Bio-potentials (EMG, EEG, EOG)
- Hall effect
- Electro-magnetic field (capacitance, inductance)
- Electro-optical (camera, LED)
- Microwave radiation

Interfaces

- WiDig: USB & WiFi or BLE, 8 i/o ports
- USB-microDig: USB, 8 i/o ports
- PiShield: for Raspberry-Pi, 8 + 4 ports
- Wi-microDig: Bluetooth, 8 inputs
- Digitizer: MIDI, 32 12bit inputs
- ArduinoShield: for Arduino

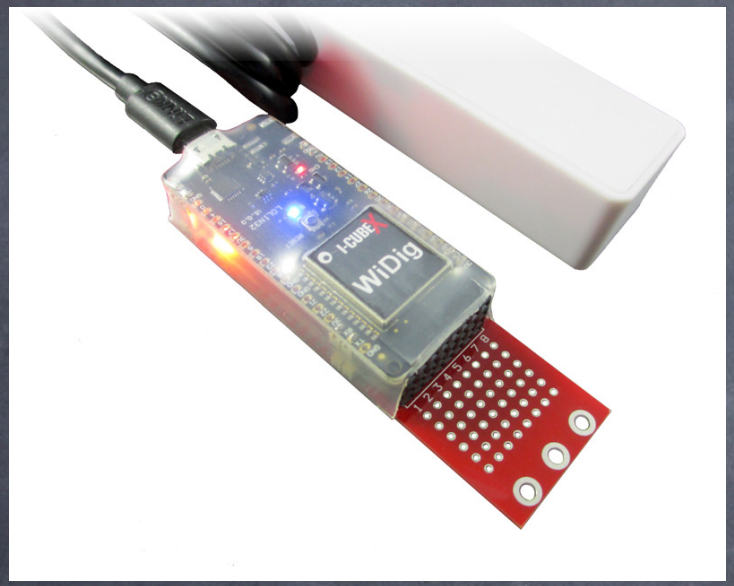


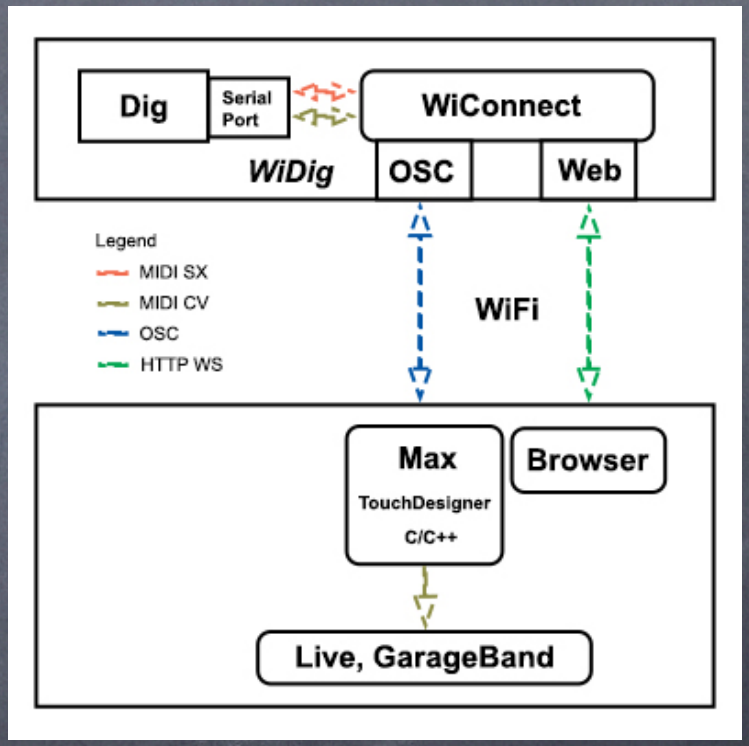


WiDig

Wireless & USB sensor interface





8 input/output ports: 10bit ADC, I²C, TTL, 5760 Hz sample rate (max)

USB serial (MIDI), BLE (MIDI), WiFi (OSC/HTTP/WS)

WiDig Firmware v8.1
- Sensors -

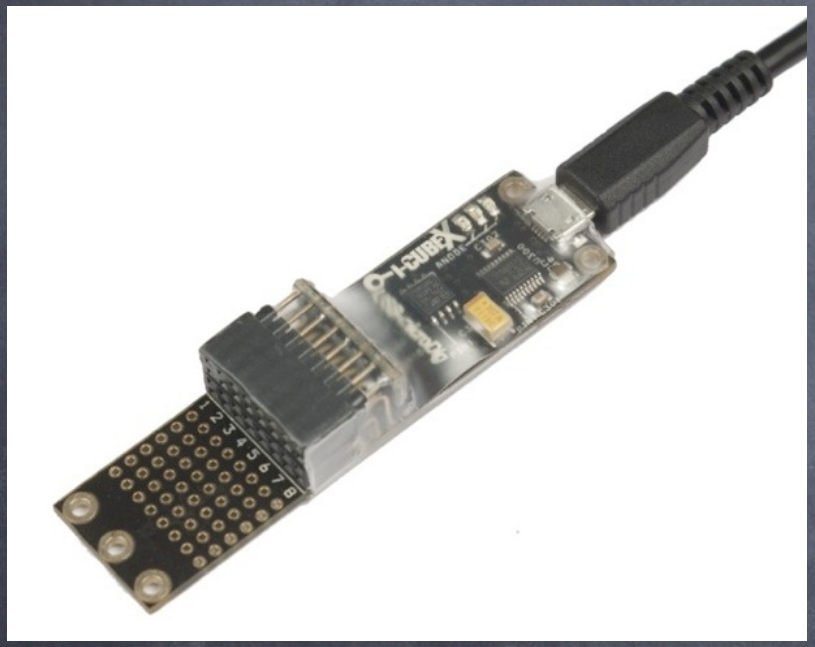
- Digital (I²C) sensor support: Air2D, AngleD, BioBeat3D, BioAirD, HotSpot2D, Light2D, Magnetic3D, Orient4D, ReachFarD, ReachID, ReachOnD, Swipe3D, ..
- Analog sensor signal processing: lookup tables, rectifying, smoothing, threshold/peak detection, peak-peak time/frequency measurement, ..

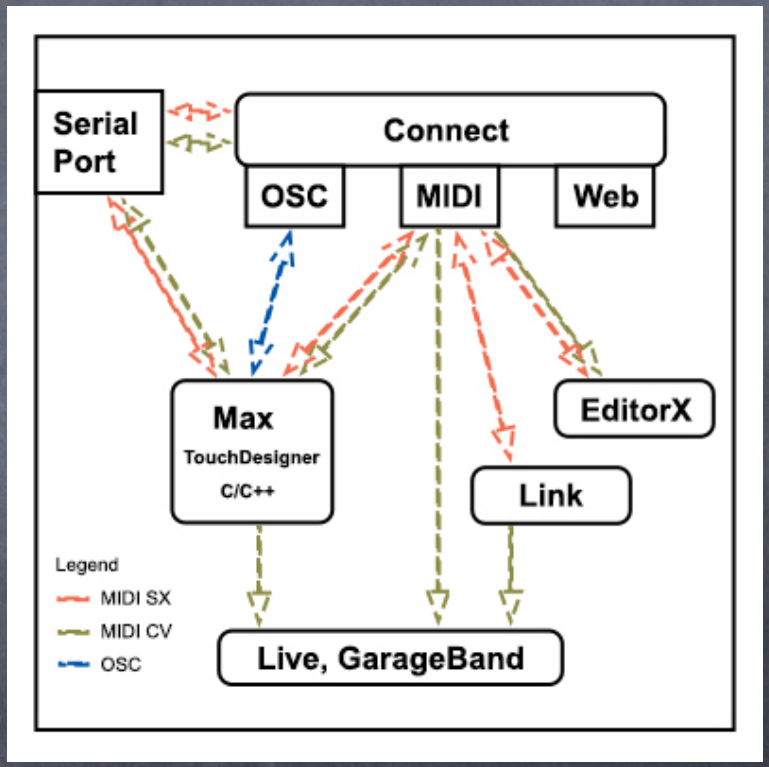
WiDig Firmware v8.1
- Actuators -

- Digital (I2C) actuator support: FeelVibe, SeeRGB
- PWM output: servo/motor control, dimming of LEDs, ...
- Binary (TTL) output: turn actuators on/off
- Map (multiple) sensor input(s) to an actuator output

USB-microDig

USB sensor interface



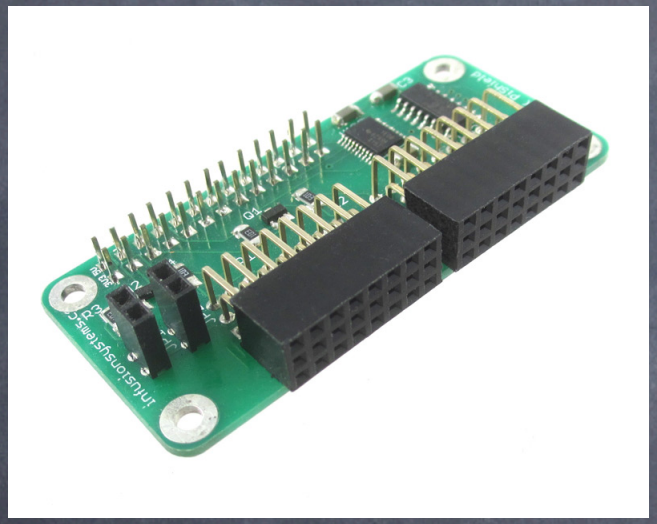


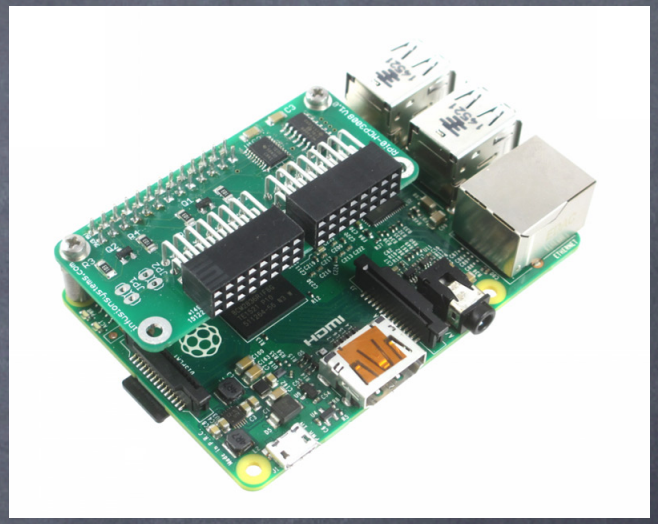
8 input/output ports: 10bit ADC, I²C, TTL, 6250 Hz sample rate (max)

USB serial (MIDI), MIDI (via USB-microMIDICable)

PiShield

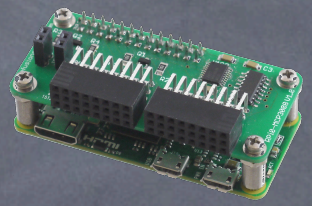
Adapter board for Raspberry-Pi

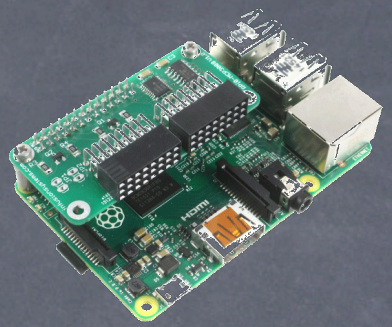




8 analog inputs, 4 digital I²C ports

SensePlay platform





- Embedded interactive media platform
- Raspberry-Pi: compact, low cost, standalone
- Hardware sensor interface + software system
- HD video, audio, sensor input
- Simple user interface: USB media-based content loading
- See also www.Sense-Play.com

Sensors

- Contactforce, Buttons
- Knobs, Sliders
- Distance, Position
- Acceleration, Orientation
- Biometric
- Environment

Orient4D

Orientation sensor

Use Wearability straps to mount on body.

Orientation in quaternions or Euler angles; acceleration, angular velocity, magnetic field strength, temperature

BioBeat3D

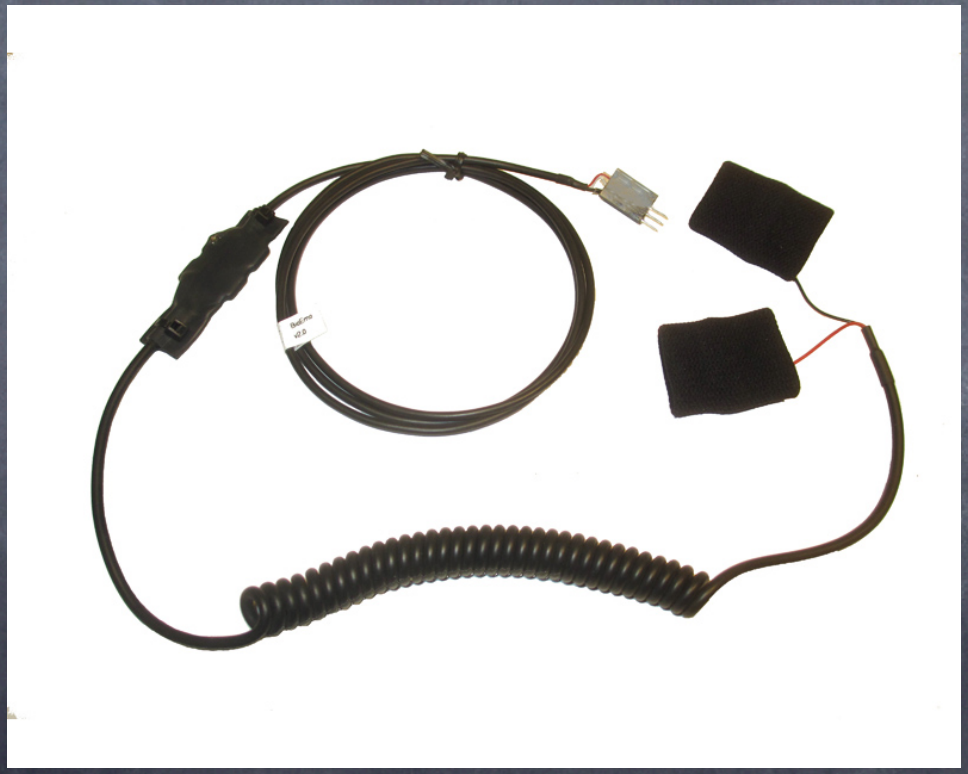
Heartbeat sensor

Heartbeat rate (BPM), pulse, blood oxygen (SpO2), temperature

Use straps to mount on finger.

BioEmo

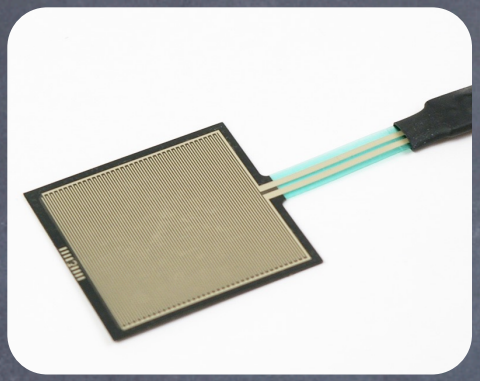
"mood" sensor



Touch

Force sensors

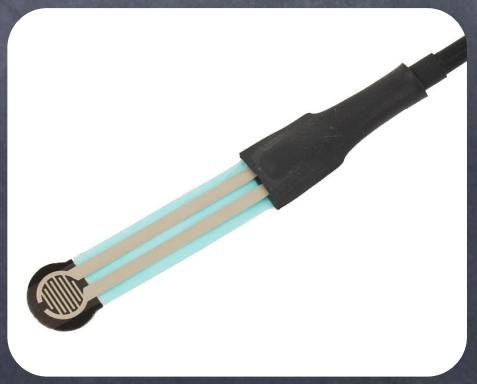
Touch



TouchMini

TouchMicro-10

TouchMicro-05



ReachCloseD, ReachFarD

Distance sensors

2 m range

max 50 Hz update rate

4 m range

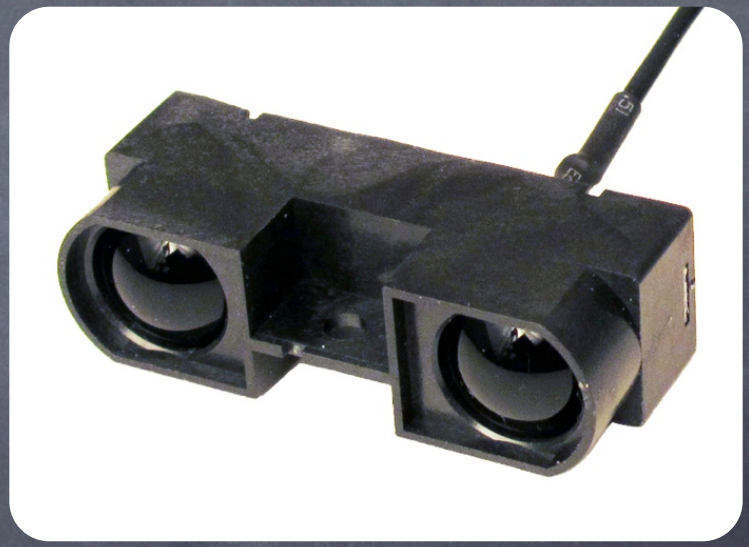
max 50 Hz update rate

ReachClose, ReachFar

Distance sensors

0.1 - 1.5 m range

approx. 50 Hz update rate



1.0 - 5.5 m range

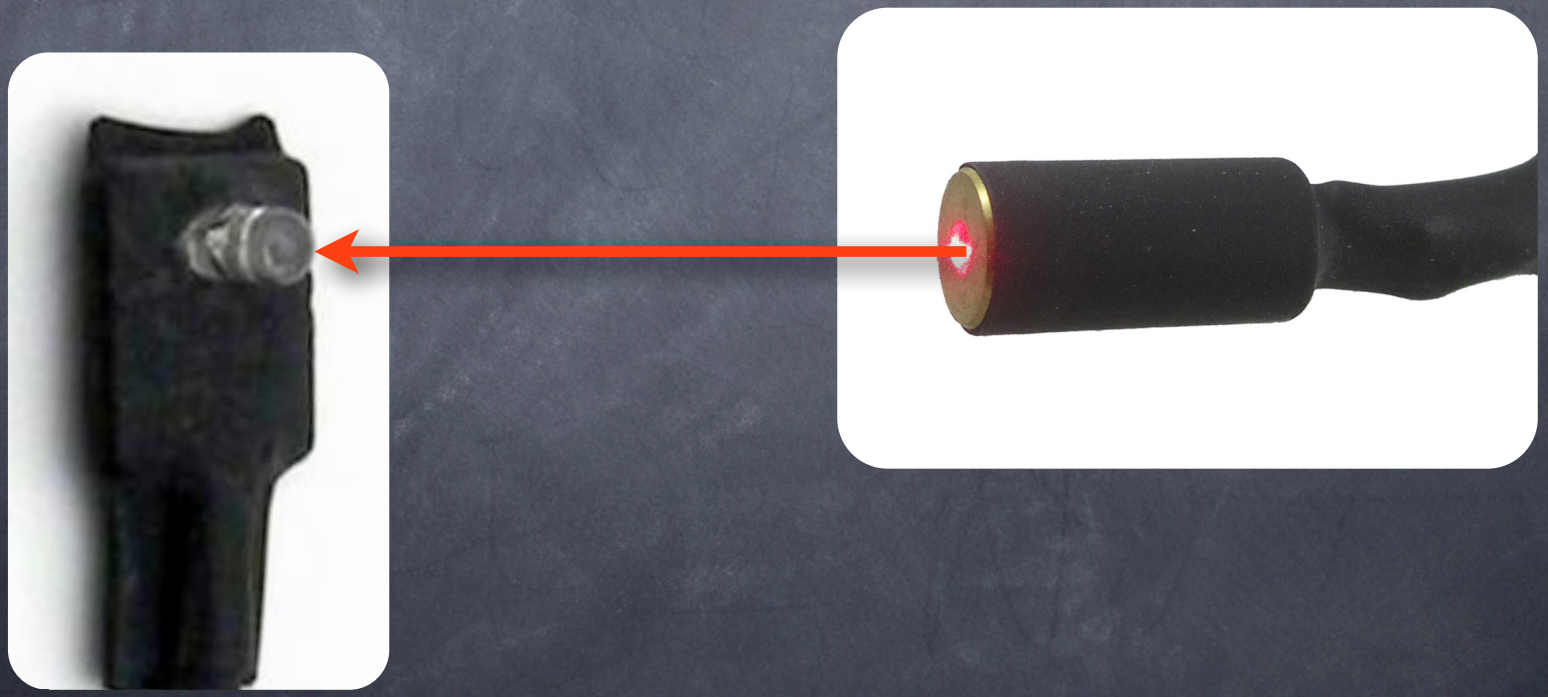
approx. 50 Hz update rate

Flash, SeeLaser

Trigger beam

Flash

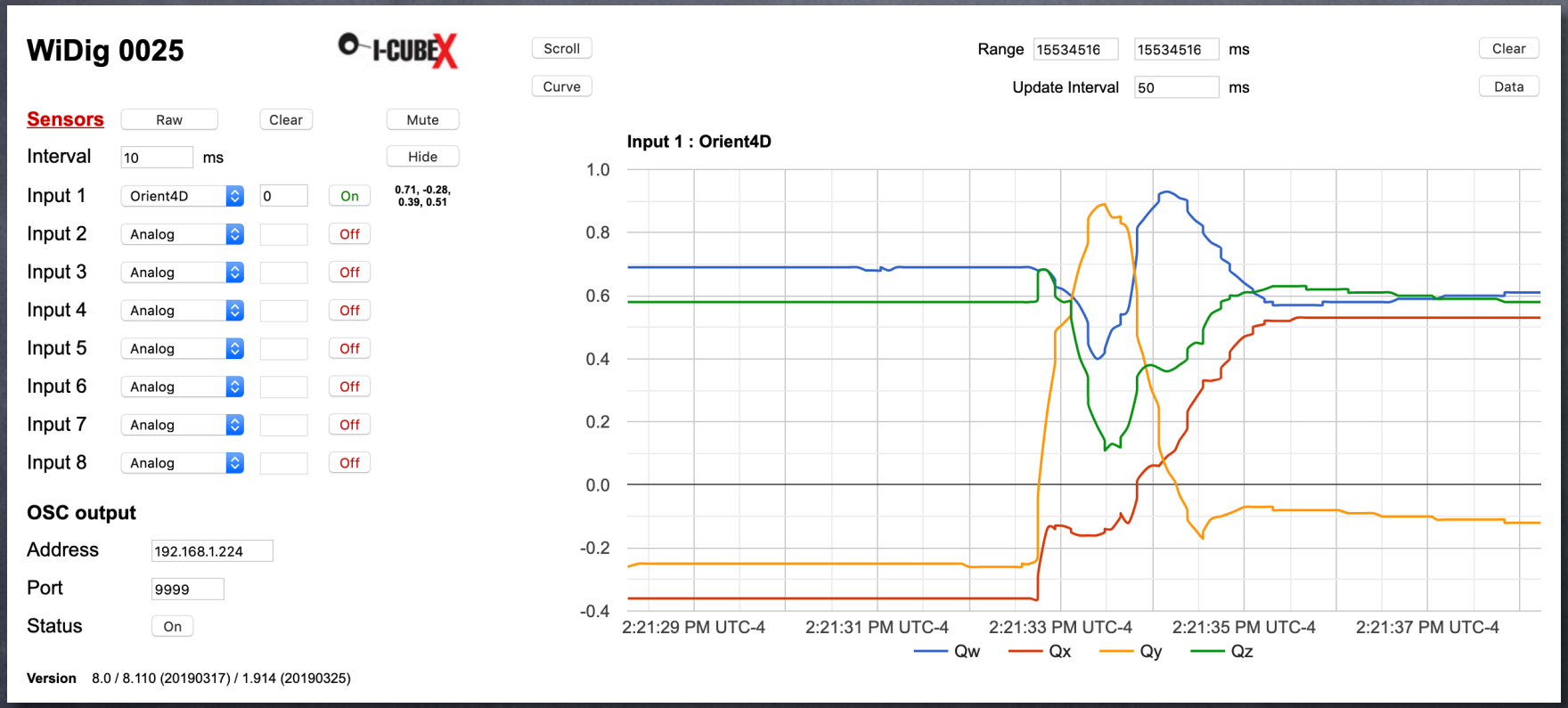
SeeLaser-Red



Software Apps

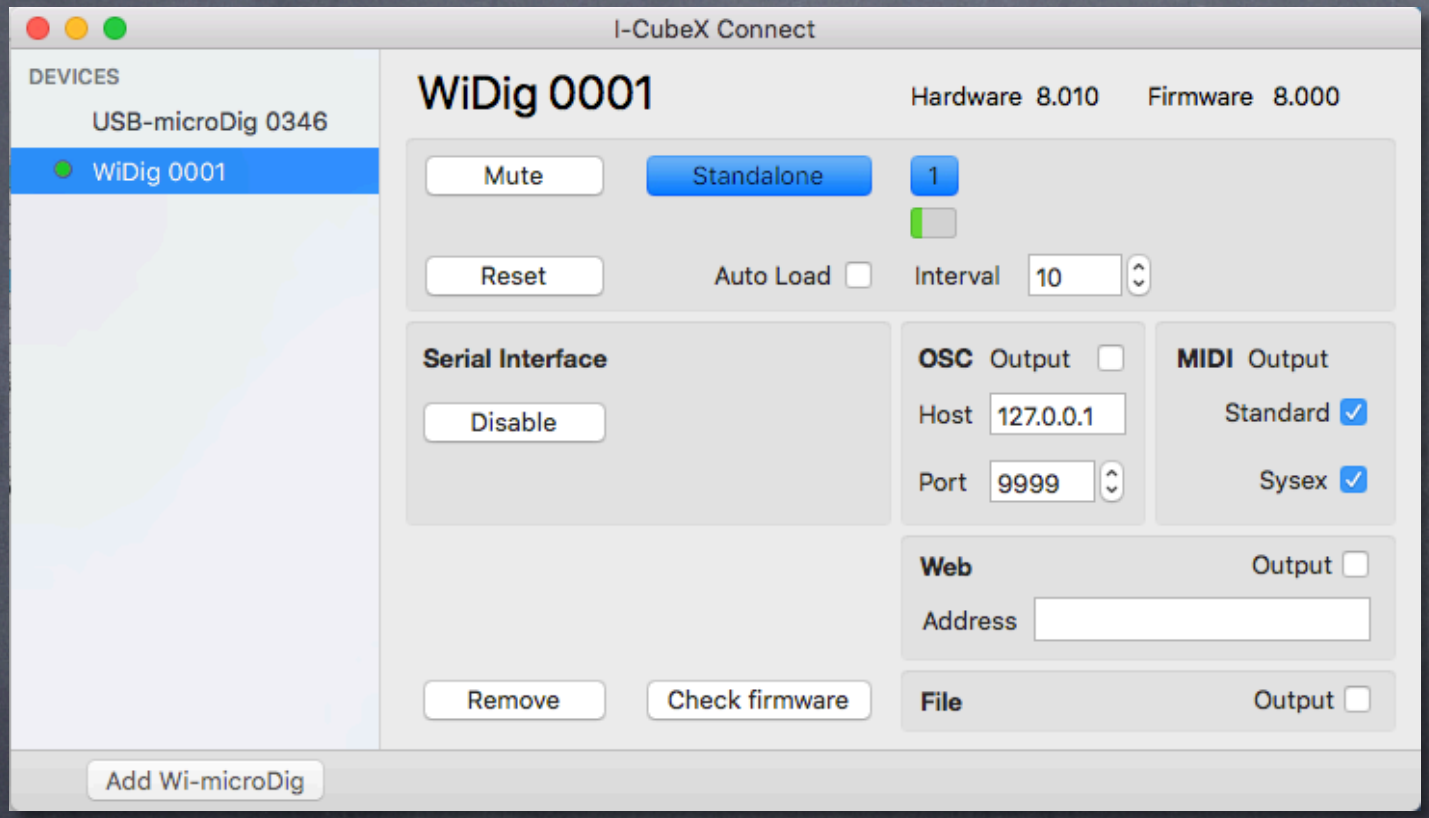
- WiConnect
- Connect
- EditorX
- Link
- SensePlay
- SensorX, BioBeat3D, BioEmo, MuscleTrainer, GForce3D-6, Orient4D, Air2D, Light2D, PitchColor, TouchGloves, HotSpot2D, ..

WiConnect



Web app for configuring a WiDig and viewing / saving data

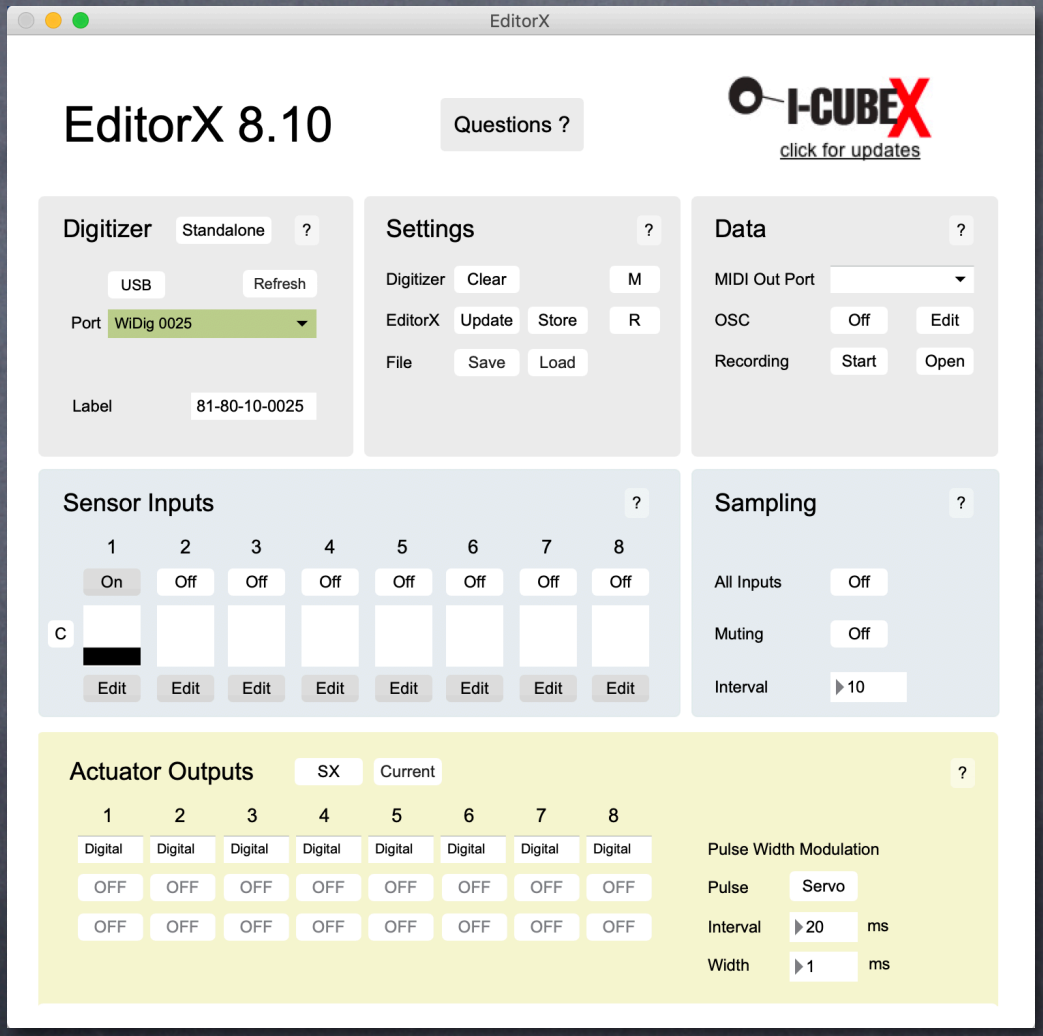
Connect



Serial to virtual MIDI / OSC / Webhook / file converter

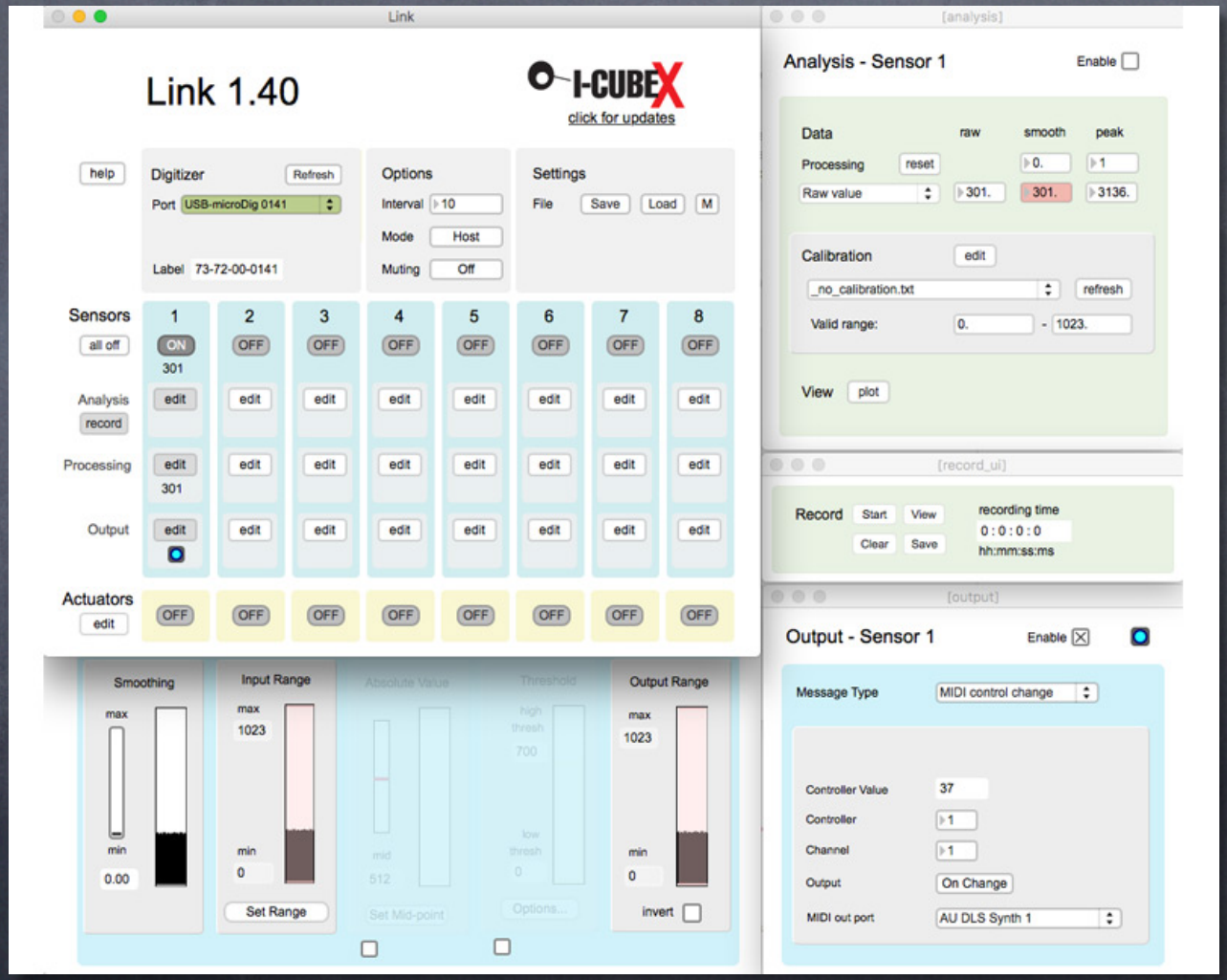
EditorX

Standalone mode editor

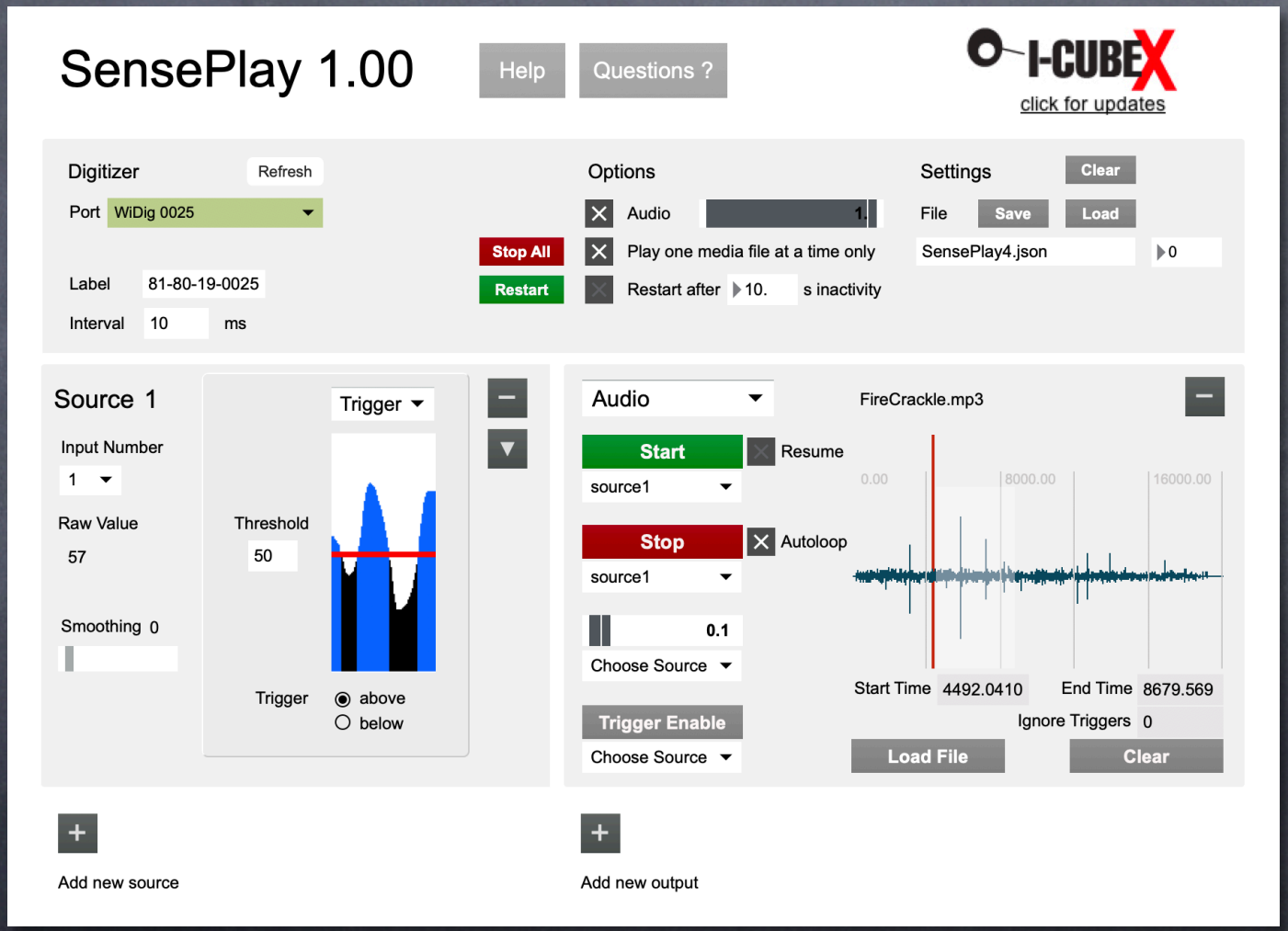


Link

Host mode editor

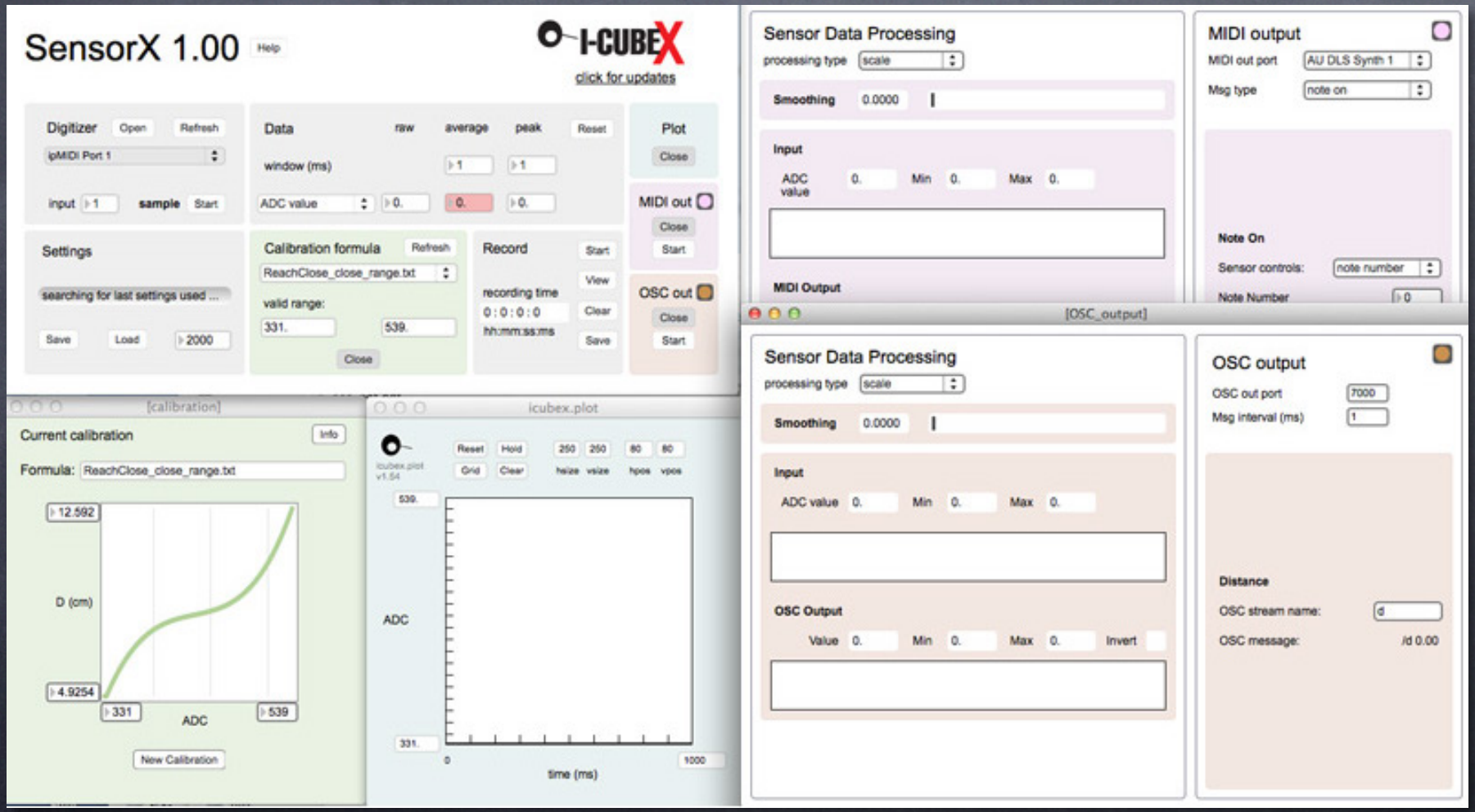


SensePlay Interactive Media player



SensorX

Analog sensor data processor / viewer

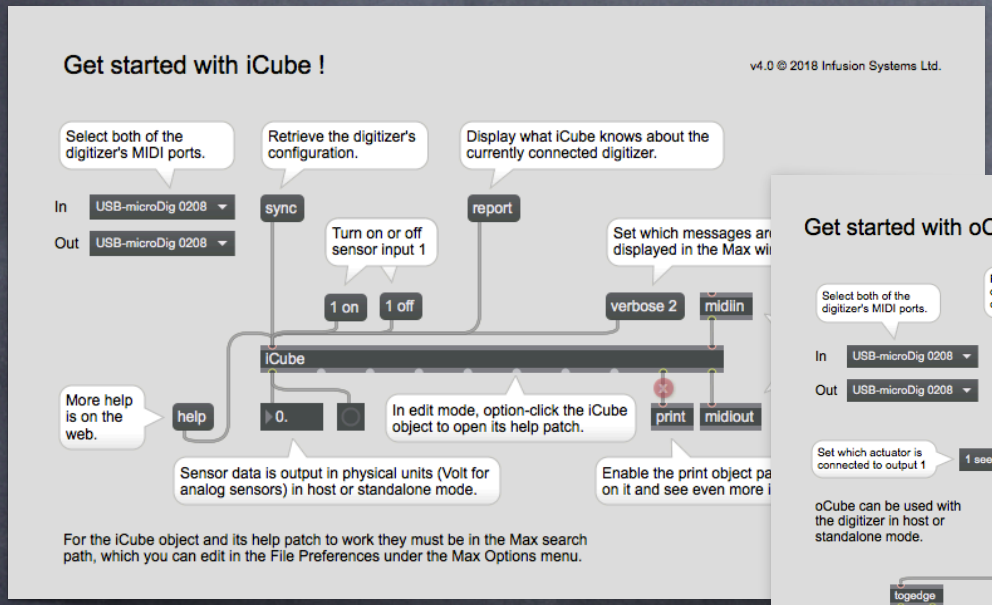


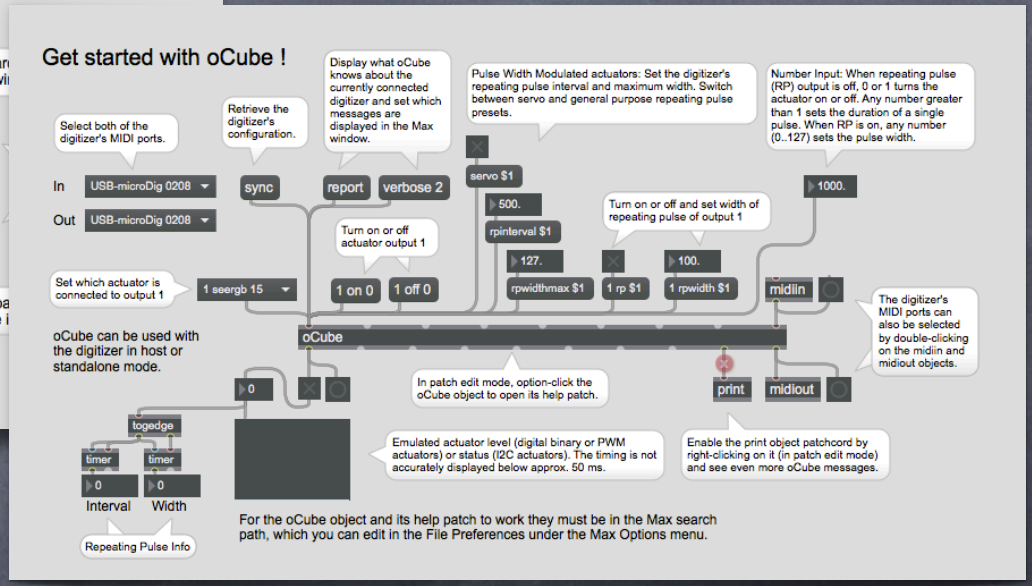
Software plugins

- Max plugins: iCube, oCube (MacOS/Windows/Linux), digitizer (MacOS, Windows)
- openFrameworks ofxICubeX addon (MacOS/Windows/Linux)
- C/C++ API (MacOS/Windows/Linux)
- Processing interface (MacOS/Windows/Linux)
- Ableton Live plugin: Dig4Live (MacOS/Windows)
- EyesWeb plugin (Windows)

iCube/oCube

I-CubeX plugins for Max





iCube

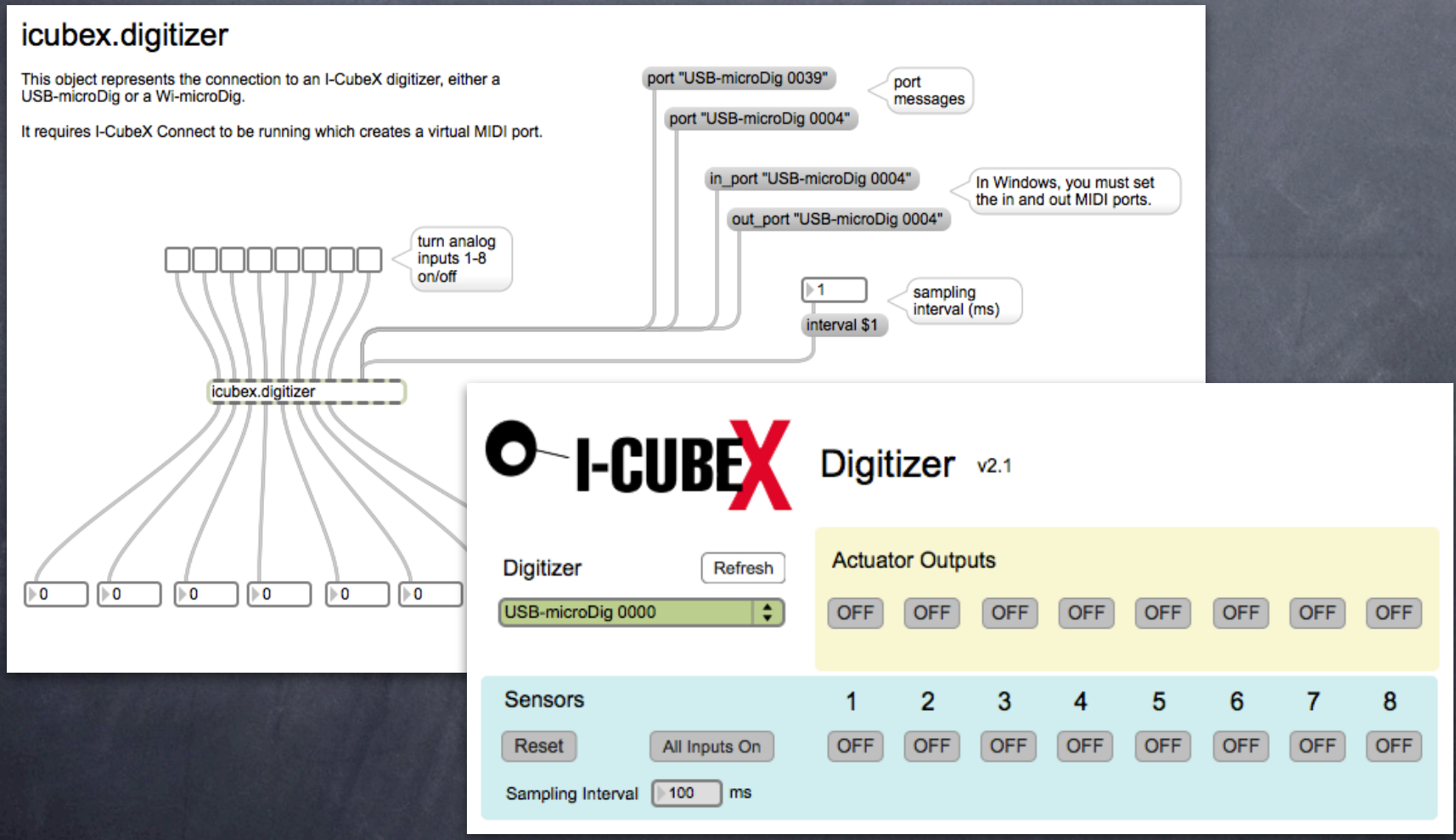
Max object for I-CubeX digitizer configuration and sensor data processing

oCube

Max object for I-CubeX digitizer configuration and actuator output control

icubex.digitizer

I-CubeX plugin
with UI for Max



I-CubeX API

- Open source C++ Library for interfacing with I-CubeX digitizers and sensors.
- Platform support for
  - Windows
  - Mac OS
  - iOS
  - Linux (desktop, raspberry Pi)
  - Android (experimental)

McGill

Input Devices and Music Interaction Laboratory (www.idmil.org)

ofxICubeX

- openFrameworks addon for I-CubeX
- allows "oF"-like access to API features

Application software

Software used in conjunction with I-CubeX:

- Max, Pd
- TouchDesigner
- QLab
- Matlab
- Unity
- Resolume
- Ableton Live
- Garageband