Teensy les 3

MIDI over USB

Teensy -> Max

Via seriële verbinding

byte voor byte doorsturen van informatie

> 1 byte = 8 bit

> getal tussen 0 en 255

Teensy -> Max

Via seriële verbinding

byte voor byte doorsturen van informatie

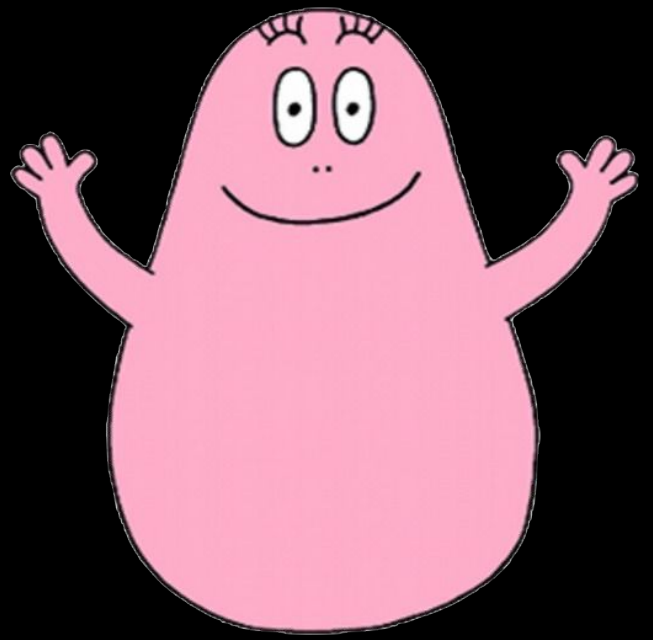
MIDI

> 1 bit gereserveerd voor status

> 7 bit over

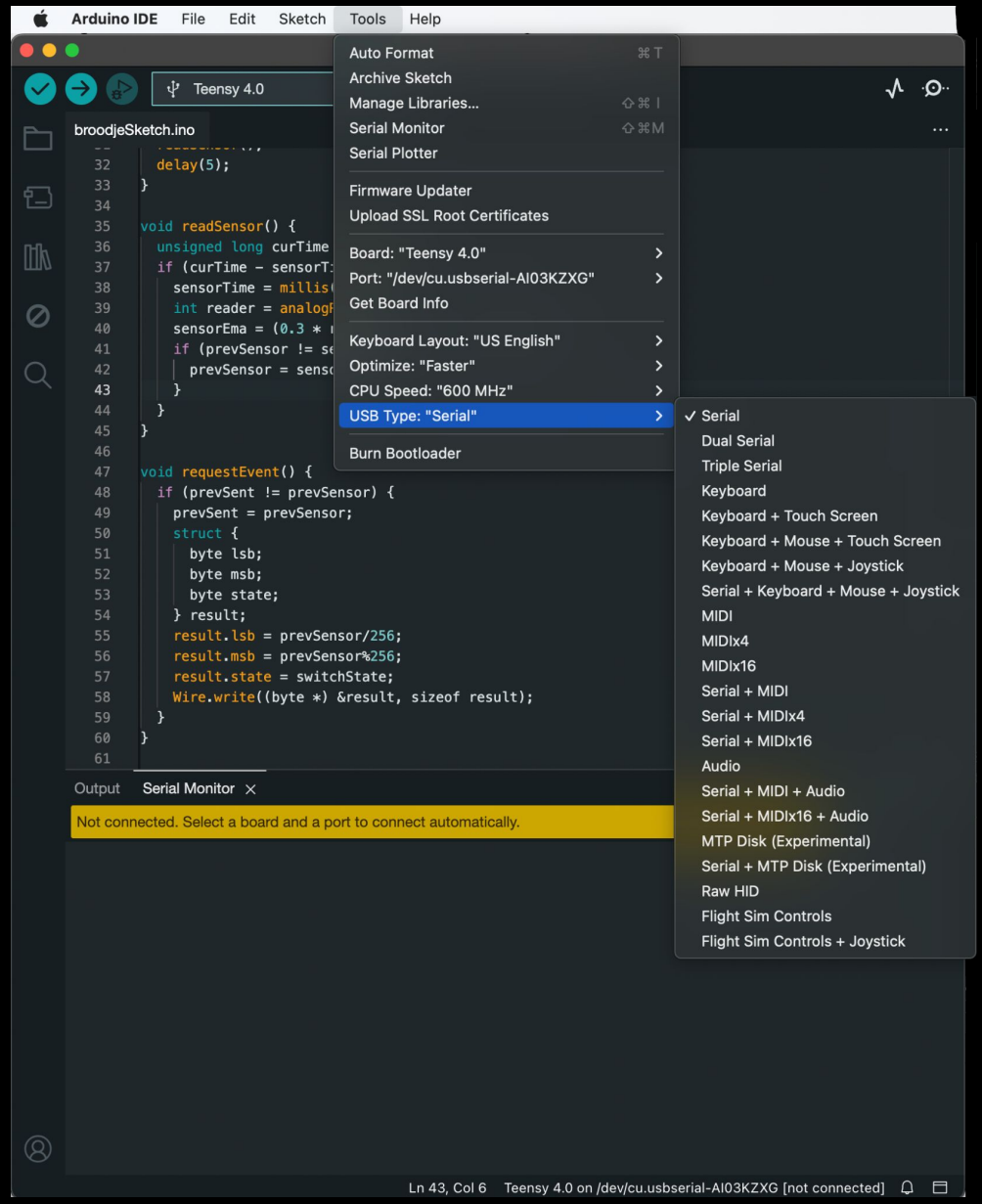
> getal tussen 0 en 127

=

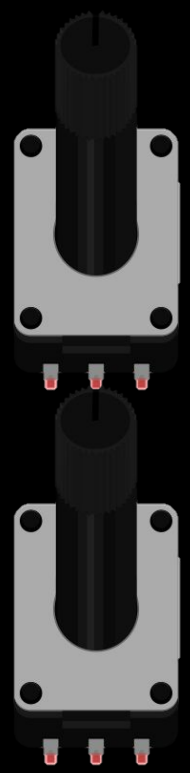


Kunnen wat ze willen worden

USB Types


Arduino IDE
File
Edit
Sketch
Tools
Help
Auto Format ⌘T
Archive Sketch
Manage Libraries... ⇧⌘I
Serial Monitor ⇧⌘M
Serial Plotter
Firmware Updater
Upload SSL Root Certificates
Board: "Teensy 4.0"
Port: "/dev/cu.usbserial-AI03KZXG"
Get Board Info
Keyboard Layout: "US English"
Optimize: "Faster"
CPU Speed: "600 MHz"
USB Type: "Serial"
Burn Bootloader
Serial
Dual Serial
Triple Serial
Keyboard
Keyboard + Touch Screen
Keyboard + Mouse + Touch Screen
Keyboard + Mouse + Joystick
Serial + Keyboard + Mouse + Joystick
MIDI
MIDIx4
MIDIx16
Serial + MIDI
Serial + MIDIx4
Serial + MIDIx16
Audio
Serial + MIDI + Audio
Serial + MIDIx16 + Audio
MTP Disk (Experimental)
Serial + MTP Disk (Experimental)
Raw HID
Flight Sim Controls
Flight Sim Controls + Joystick
Teensy 4.0
broodjeSketch.ino
Output
Serial Monitor
Not connected. Select a board and a port to connect automatically.
Ln 43, Col 6
Teensy 4.0 on /dev/cu.usbserial-AI03KZXG [not connected]

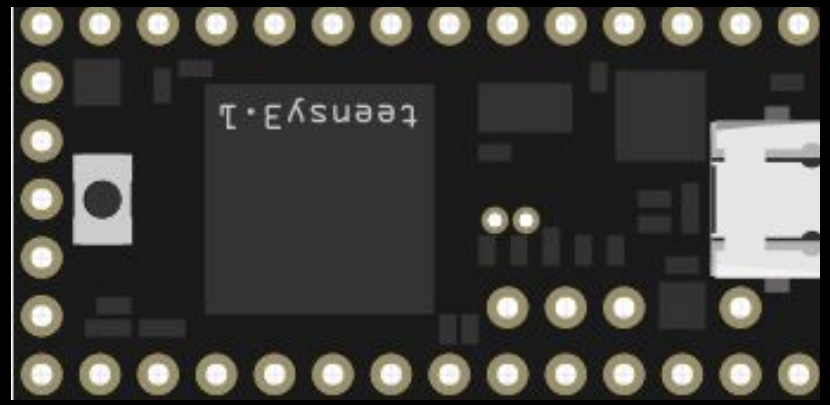
MIDI Controller



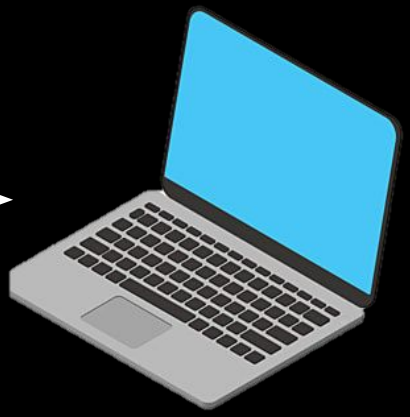
0v-3.3v

0v-3.3v

0 – 1023 (10 bit ADC)



USB MIDI CC
0 - 127



INPUT

TRANSFORMATIE

OUTPUT

MIDI-berichten

- **NoteOn**
- **NoteOff**
- **Control Change**

Extra:
- Program Change
- After Touch
- Pitch Bend
- SysEx
- Song Position
- Clock
- Etc (zie hier)

MIDI-berichten

Control Change op Teensy

```
usbMIDI.sendControlChange(control, value, channel);
```

```
Control     = index van controller (potmeter) (0 -127)
Value       = positie / waarde van potmeter (0 -127)
Channel     = MIDI kanaal van bericht (1 – 16)
```

MIDI-berichten

Midi-noten op Teensy

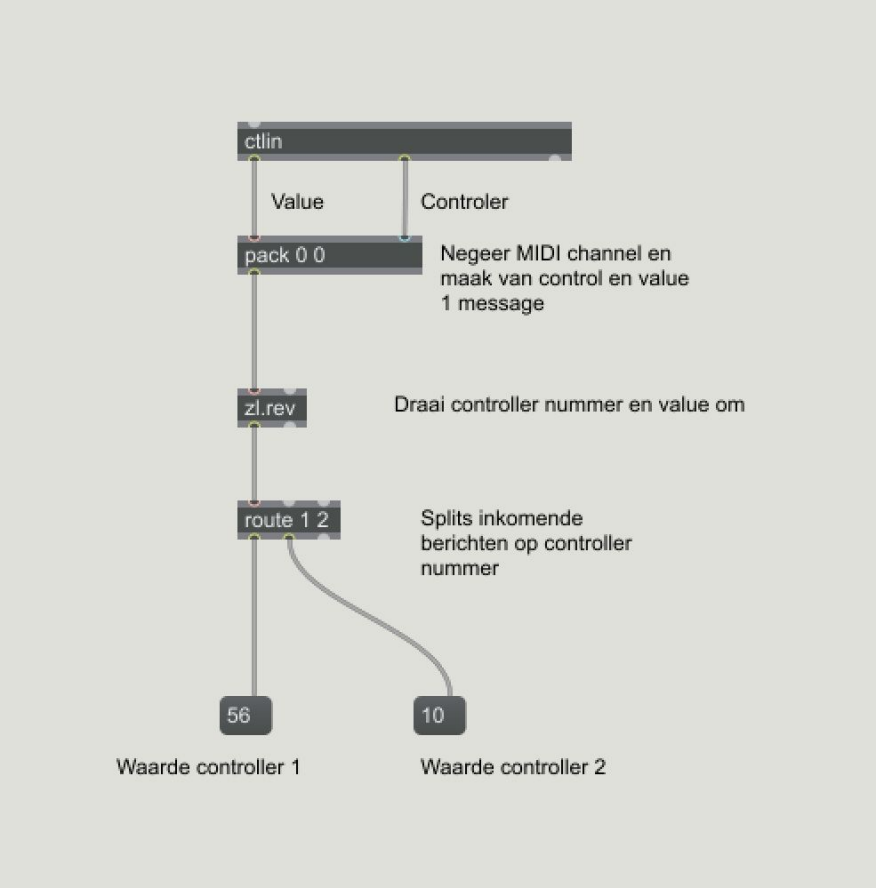
```
usbMIDI.sendNoteOn(pitch, velocity, channel);

usbMIDI.sendNoteOff(pitch, velocity, channel);
```

Ontvangen in Max

`ctlin`

- Familie van `notein`
- Volgorde van control, value omgedraaid

Ontvangen in Max



Maar FL Studio / Logic / Ableton / Reaper / Audacity / Cubase / Studio One / Reason / Bitwig / GarageBand / Mixcraft / Pro Tools / Cakewalk / een MIDI learn programma snapt hier niets van

Waarom?

Slimme MIDI sturen

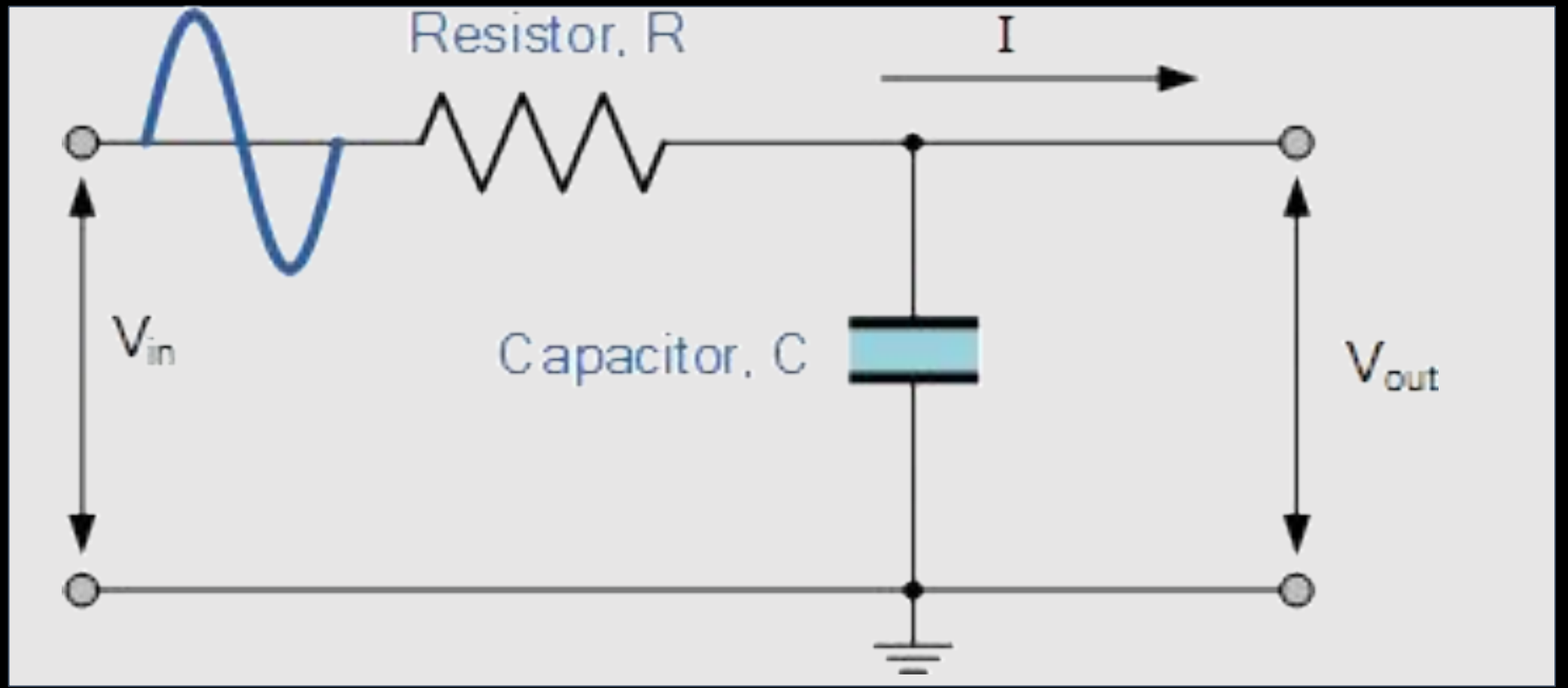
- Ruis filteren
- Niet altijd sturen

Analoge ruis

- Onontkoombaar
- USB voeding ruis
- Netstroom ruis
- Externe ruis

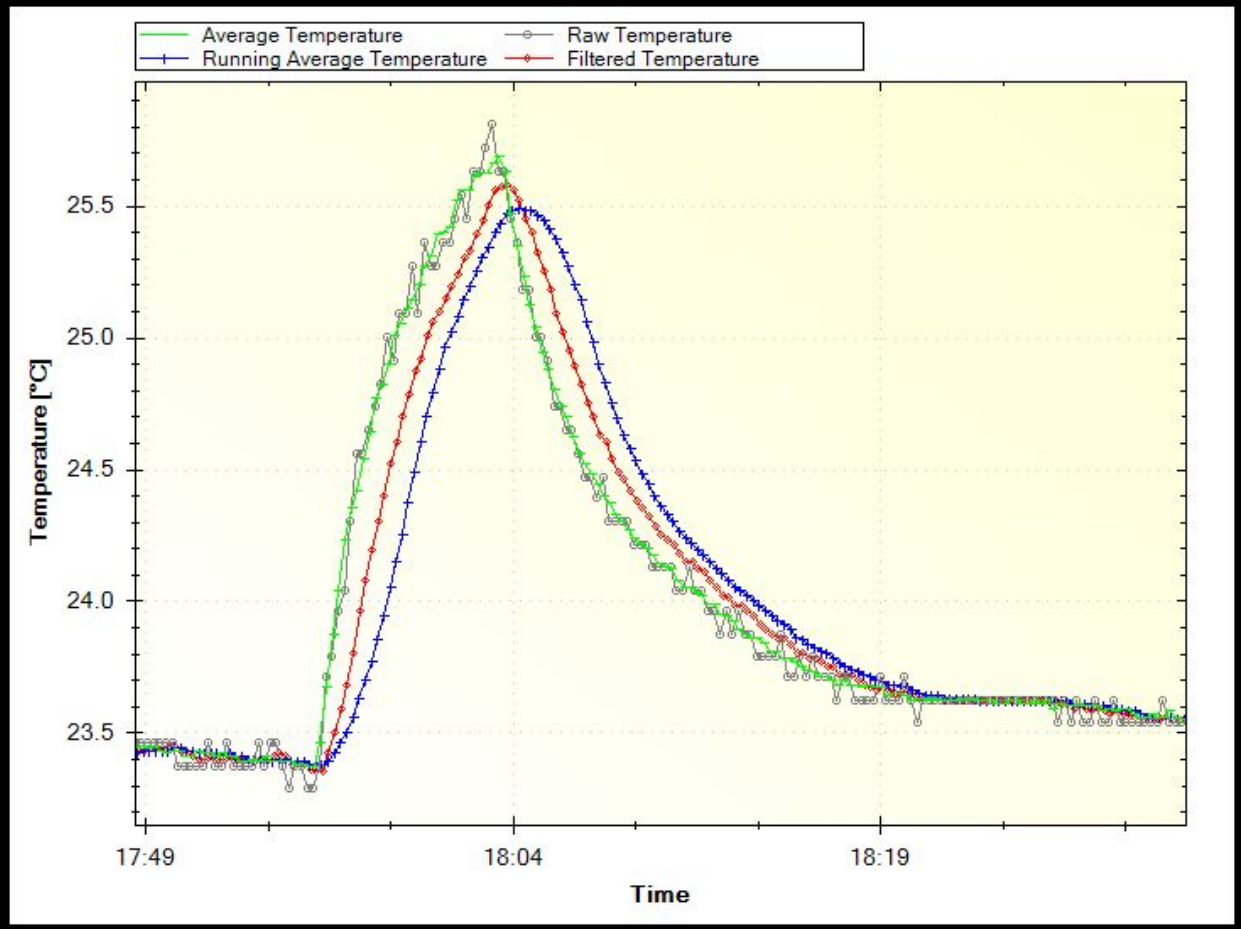
Analoge ruis (filteren)

- Analoog filteren:



Analoge ruis (filteren)

- Digitaal filteren (running average)



Analoog ruis (filteren 2)

- Running average:

```
1. int pot0Avg = 0;
2. void loop() {
3.    int pot0 = analogRead(A0);
4.    pot0Avg = (pot0 * 0.3) + (pot0Avg * 0.7);
5. }
```

Niet altijd sturen

Alleen MIDI sturen als de waarde verandert.

Niet altijd sturen

- Alleen MIDI sturen als MIDI waarde verandert

```
1.  int potAvg = 0;
2.  int prevPot = 0;
3.
4.  void setup() {
5.      pinMode(A0,INPUT);
6.      Serial.begin(9600);
7.  }
8.
9.  void loop() {
10.     int pot = analogRead(A0);
11.     potAvg = (pot * 0.3) + (potAvg * 0.7);
12.     if (abs(prevPot - potAvg) > 2) {
13.         usbMIDI.sendControlChange(1, potAvg/8, 1);
14.         prevPot = potAvg;
15.     }
16.     delay(1);
17. }
```

Demonstratie

Midi ontvangen

```
void setup() {
  usbMIDI.setHandleNoteOn(noteOnHandler);
  usbMIDI.setHandleControlChange(controlHandler);
  usbMIDI.setHandleNoteOff(noteOffHandler);
}

void loop() {
usbMIDI.read();
}
```

Midi ontvangen

```
void setup() {
  usbMIDI.setHandleControlChange(controlHandler);
}

void loop() {
 usbMIDI.read();
}

void controlHandler(byte channel, byte control, byte value)
{
  if (control == 1) {
    digitalWrite(13,value);
  }
}
```

Waar kan je naar luisteren op een Teensy?

```
usbMIDI.setHandleNoteOff(myNoteOff)
usbMIDI.setHandleNoteOn(myNoteOn)
usbMIDI.setHandleAfterTouchPoly(myAfterTouchPoly)
usbMIDI.setHandleControlChange(myControlChange)
usbMIDI.setHandleProgramChange(myProgramChange)
usbMIDI.setHandleAfterTouch(myAfterTouch)
usbMIDI.setHandlePitchChange(myPitchChange)
usbMIDI.setHandleSystemExclusive(mySystemExclusiveChunk);
usbMIDI.setHandleTimeCodeQuarterFrame(myTimeCodeQuarterFrame);
usbMIDI.setHandleSongPosition(mySongPosition);
usbMIDI.setHandleSongSelect(mySongSelect);
usbMIDI.setHandleTuneRequest(myTuneRequest);
usbMIDI.setHandleClock(myClock);
usbMIDI.setHandleStart(myStart);
usbMIDI.setHandleContinue(myContinue);
usbMIDI.setHandleStop(myStop);
usbMIDI.setHandleActiveSensing(myActiveSensing);
usbMIDI.setHandleSystemReset(mySystemReset);
usbMIDI.setHandleRealTimeSystem(myRealTimeSystem);
```

MIDI binnenkrijgen op Teensy

```
void setup() {
  Serial.begin(115200);
  usbMIDI.setHandleControlChange(myControlChange);
}

void loop() {
  usbMIDI.read();
}

void myControlChange(byte ch, byte cntl, byte val) {
  int channel = int(ch);
  int control = int(cntl);
  int value = int(val);
  Serial.println(“Channel ” + String(channel) + “ controller ” + String(control) + “ value: ” + String(value));
}
```

Arduino setup

in de seriële monitor:

pot1: 123

pot2: 251

```
void loop() {
  // put your main code here, to run repeatedly:
  int pot1Val = analogRead(A0);
  int pot2Val = analogRead(A1);
  Serial.print("pot1: ");
  Serial.println(pot1Val);
  Serial.print("pot2: ");
  Serial.println(pot2Val);
  delay(10);
}
```