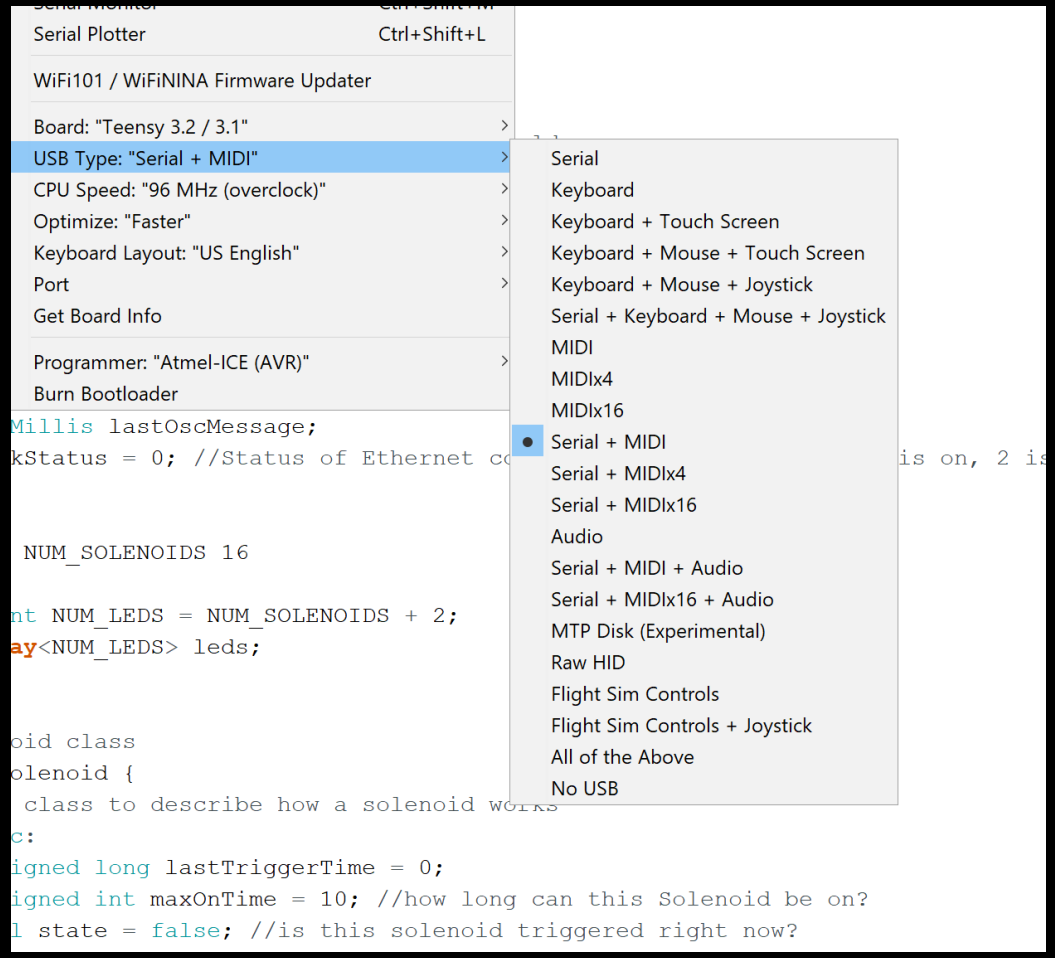
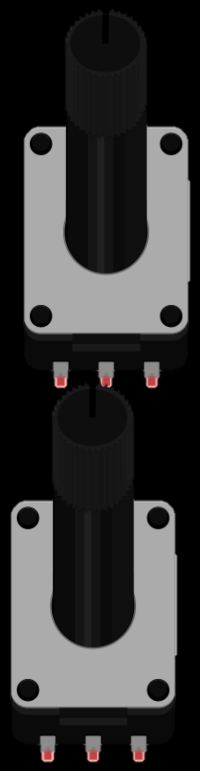
Hardware les 3 (of 4)

MIDI over USB

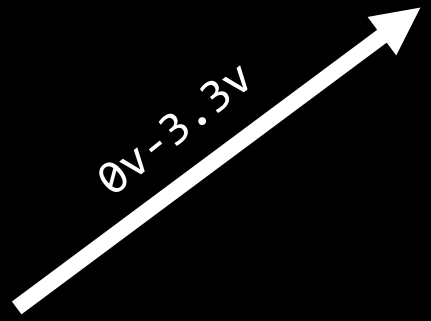
USB Types


Serial Plotter Ctrl+Shift+L
WiFi101 / WiFiNINA Firmware Updater
Board: "Teensy 3.2 / 3.1"
USB Type: "Serial + MIDI"
CPU Speed: "96 MHz (overclock)"
Optimize: "Faster"
Keyboard Layout: "US English"
Port
Get Board Info
Programmer: "Atmel-ICE (AVR)"
Burn Bootloader
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)
Raw HID
Flight Sim Controls
Flight Sim Controls + Joystick
All of the Above
No USB
Millis lastOscMessage;
kStatus = 0; //Status of Ethernet c
is on, 2 is
NUM_SOLENOIDS 16
nt NUM_LEDS = NUM_SOLENOIDS + 2;
ay<NUM_LEDS> leds;
oid class
olenoid {
class to describe how a solenoid works
c:
igned long lastTriggerTime = 0;
igned int maxOnTime = 10; //how long can this Solenoid be on?
l state = false; //is this solenoid triggered right now?

MIDI Controller

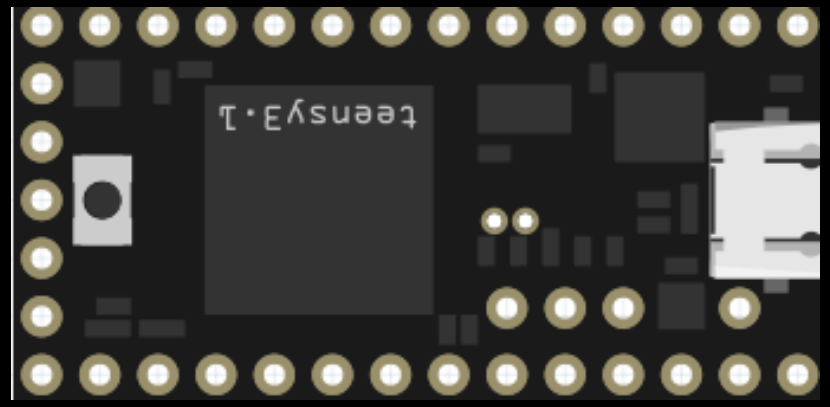


0v-3.3v

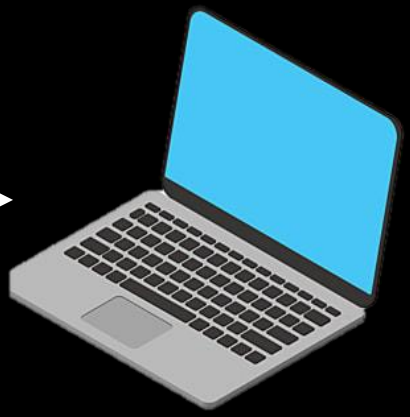


0v-3.3v

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);
```

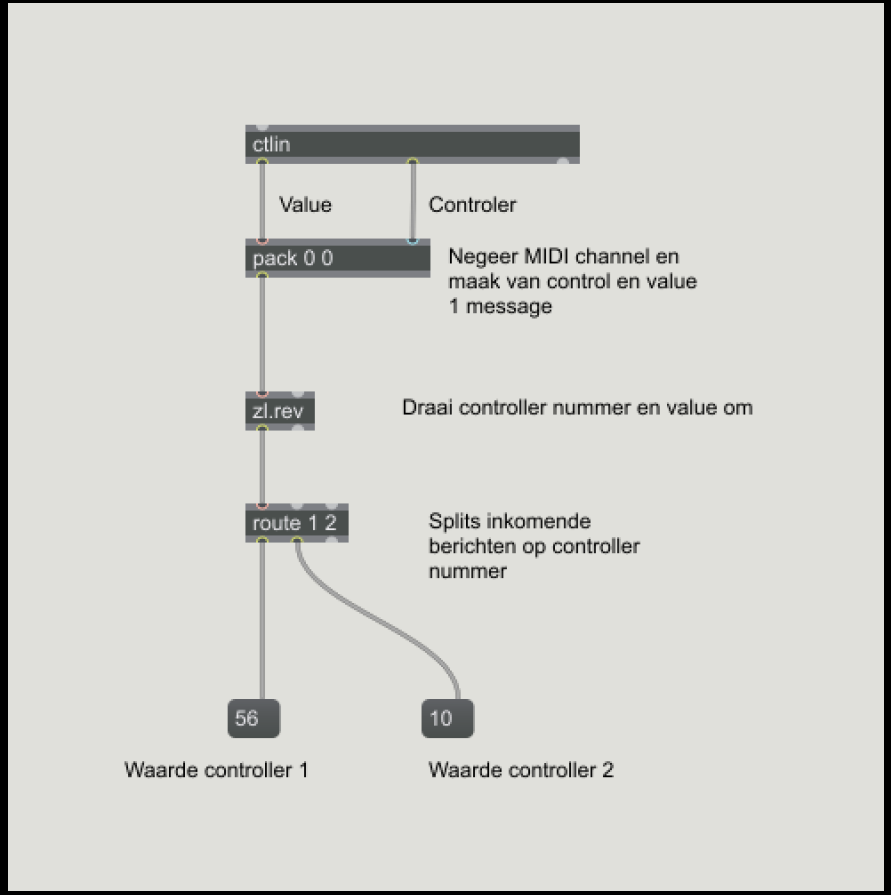
```
Control         = index van controller (potmeter)
Value           = positie / waarde van potmeter
Channel         = MIDI kanaal van bericht
```

Ontvangen in Max

`ctlin`

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

Ontangen 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

- Niet altijd sturen
- Ruis filteren
- Weinig latency behouden

Niet altijd sturen

- Alleen MIDI sturen als MIDI waarde verandert

Aan het einde van loop()

```
_potValue = potValue
```

In loop():

```
if (potValue != _potValue) {
    //als de huidige potValue anders is dan de
    vorige potValue, stuur dan een MIDI CC bericht
    usbMIDI.sendControlChange(1, potValue, 16);
}
```

Analoge ruis

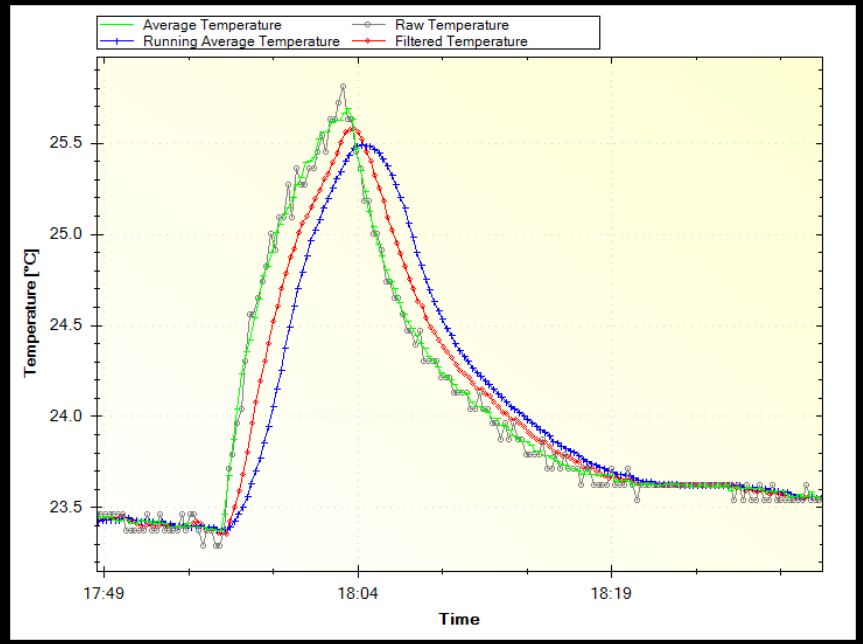
- Onontkoombaar
- USB voeding ruis
- Netstroom ruis
- Externe ruis

Analoge ruis (filteren)

- Analoog filteren is het beste
- Goedkoper en makkelijker is digitaal filteren

MAAR

digitaal filteren -> latency



Analoog ruis (filteren 2)

- Vooralsnog makkelijkst in Max op te lossen

- Anders lopend gemiddelde nemen of digitaal filter
- Zie hier voor meer info of hier

MIDI USB naam

- name.c maken in nieuw tabblad

```
// To give your project a unique name, this code must be
// placed into a .c file (its own tab).  It can not be in
// a .cpp file or your main sketch (the .ino file).

#include "usb_names.h"

// Edit these lines to create your own name.  The length must
// match the number of characters in your custom name.

#define MIDI_NAME   {'M','y',' ','M','I','D','I'}
#define MIDI_NAME_LEN  7

// Do not change this part.  This exact format is required by USB.

struct usb_string_descriptor_struct usb_string_product_name = {
        2 + MIDI_NAME_LEN * 2,
        3,
        MIDI_NAME
};
```

Demonstratie