senseBox

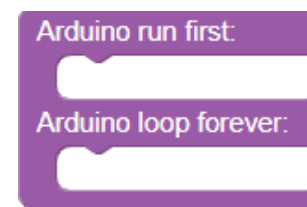## Step 1:

1. Open blockly.sensebox.de for programming

2. Our basic settings are created in the "Arduino run first".

   > **Arduino run first:**
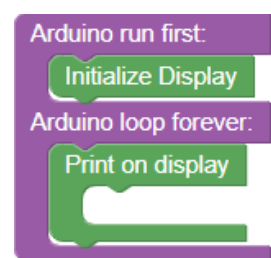   > **Arduino loop forever:**

3. The display must be recognized by the microcontroller. It must be initialized in the setup! Connect the "Initialize display" block with the purple "Arduino run first" block.
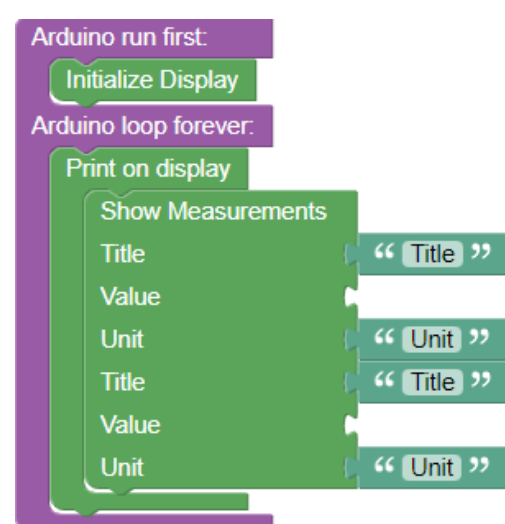
   > **Arduino run first:**
   > Initialize Display
   > **Arduino loop forever:**
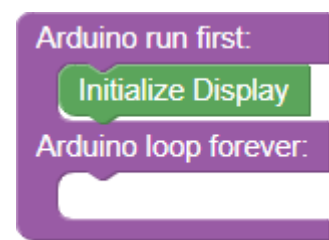
Step 2:

1. Something should be shown on the display. Connect the "Print on display" block with the infinite loop.

   > **Arduino run first:**
   > Initialize Display
   > **Arduino loop forever:**
   > Print on display

2. Now select the block to display measured values from sensors.

   > **Arduino run first:**
   > Initialize Display
   > **Arduino loop forever:**
   > Print on display
   > Show Measurements
   > Title   " Title "
   > Value
   > Unit   " Unit "
   > Title   " Title "
   > Value
   > Unit   " Unit "

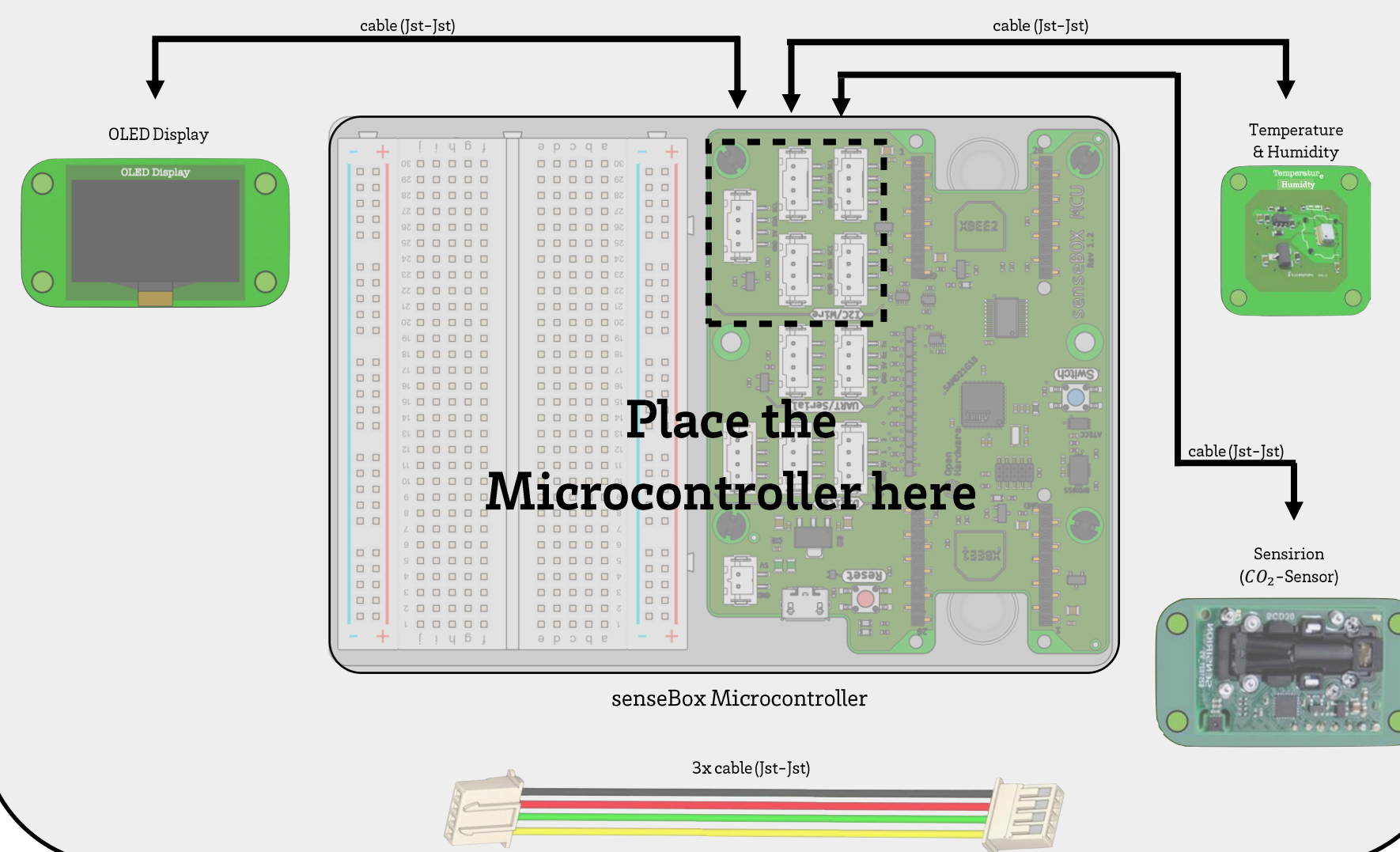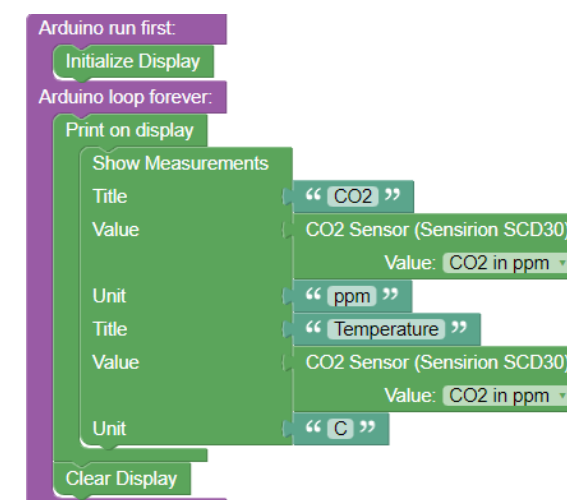## Task 1

Measure the air quality with the senseBox.

a) Connect the OLED display and the sensors to the microcontroller.

b) Create a program so that the measured values of the temperature and CO2 sensor are shown on the display. (see step 1–3)

Construction of the senseBox

cable (Jst-Jst)   cable (Jst-Jst)

OLED Display

Place the Microcontroller here

senseBox Microcontroller

Temperature & Humidity

cable (Jst-Jst)

Sensirion (CO_2-Sensor)

3x cable (Jst-Jst)

Step 3:

1. Now select the sensors whose values you want to display.
2. Also add 'Title' and 'Unit'.
3. Test your Code now!

   > **Arduino run first:**
   > Initialize Display
   > **Arduino loop forever:**
   > Print on display
   > Show Measurements
   > Title   " CO2 "
   > Value   CO2 Sensor (Sensirion SCD30)   Value: CO2 in ppm
   > Unit   " ppm "
   > Title   " Temperature "
   > Value   CO2 Sensor (Sensirion SCD30)   Value: CO2 in ppm
   > Unit   " C "
   > Clear Display

Time for testing!

1. Enter the values of temperature and CO2 concentration in the table every minute.

Time	Temperature	CO₂-Concentration

Place the sensor near a window and compare the measured values indoors and in the outdoor air.

2. Connect another sensor to the senseBox and record the measured values every minute.

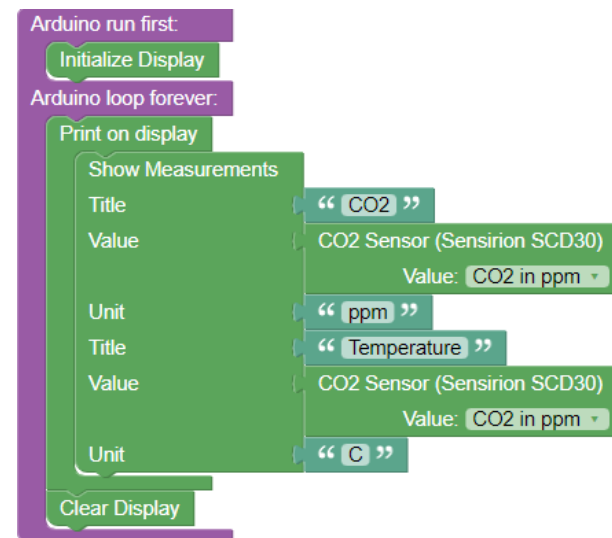| Time		

Information: CO_2-Sensor

The CO2 sensor has a measuring range between 400 ppm and 10 000 ppm.

The CO2 concentration in the air is given in parts per million (number of parts per million = ppm).
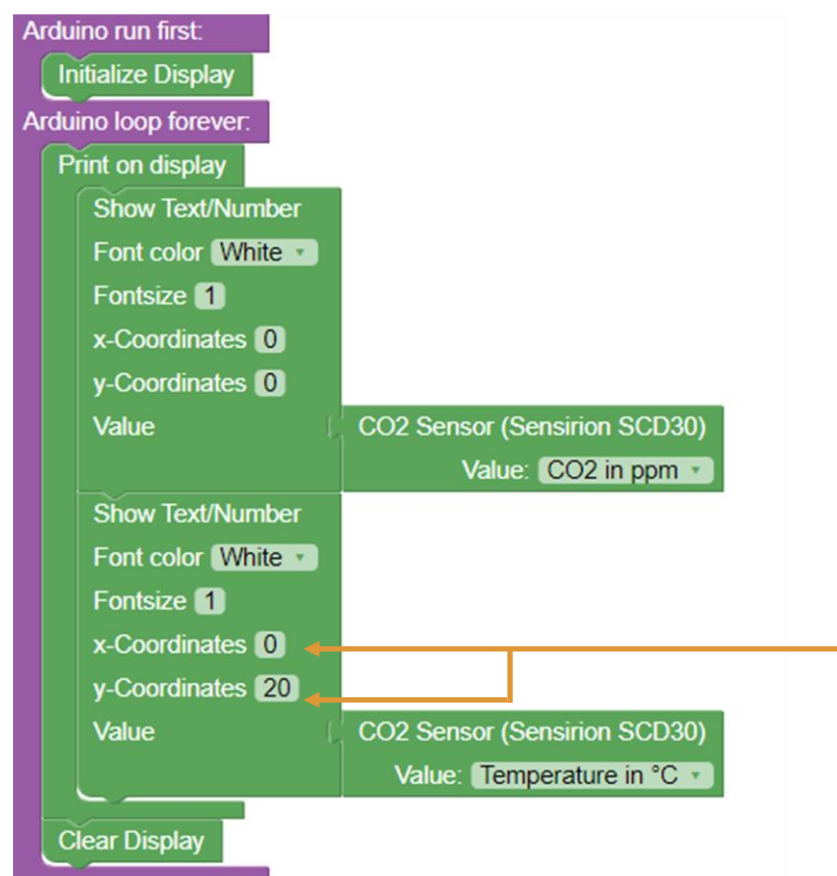
senseBox

Hint:

There are two ways to solve the task :

Option 1:


```
Arduino run first:
  Initialize Display
Arduino loop forever:
  Print on display
    Show Measurements
    Title         " CO2 "
    Value         CO2 Sensor (Sensirion SCD30)
                  Value: CO2 in ppm
    Unit          " ppm "
    Title         " Temperature "
    Value         CO2 Sensor (Sensirion SCD30)
                  Value: CO2 in ppm
    Unit          " C "
  Clear Display
```

Option 2:

```
Arduino run first:
  Initialize Display
Arduino loop forever:
  Print on display
    Show Text/Number
    Font color   White
    Fontsize     1
    x-Coordinates 0
    y-Coordinates 0
    Value        CO2 Sensor (Sensirion SCD30)
                 Value: CO2 in ppm
    Show Text/Number
    Font color   White
    Fontsize     1
    x-Coordinates 0
    y-Coordinates 20
    Value        CO2 Sensor (Sensirion SCD30)
                 Value: Temperature in °C
  Clear Display
```
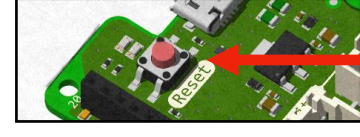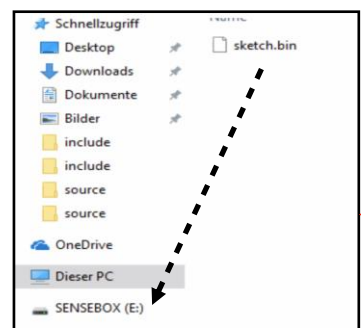
Attention: The x- and y- coordinates must be different for each measured value, otherwise the two measured values will overlap.
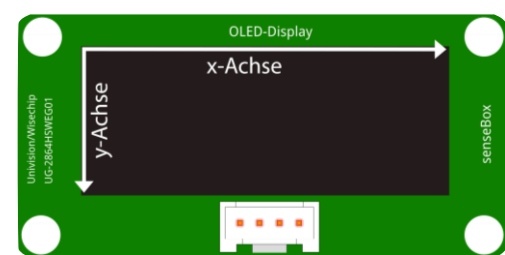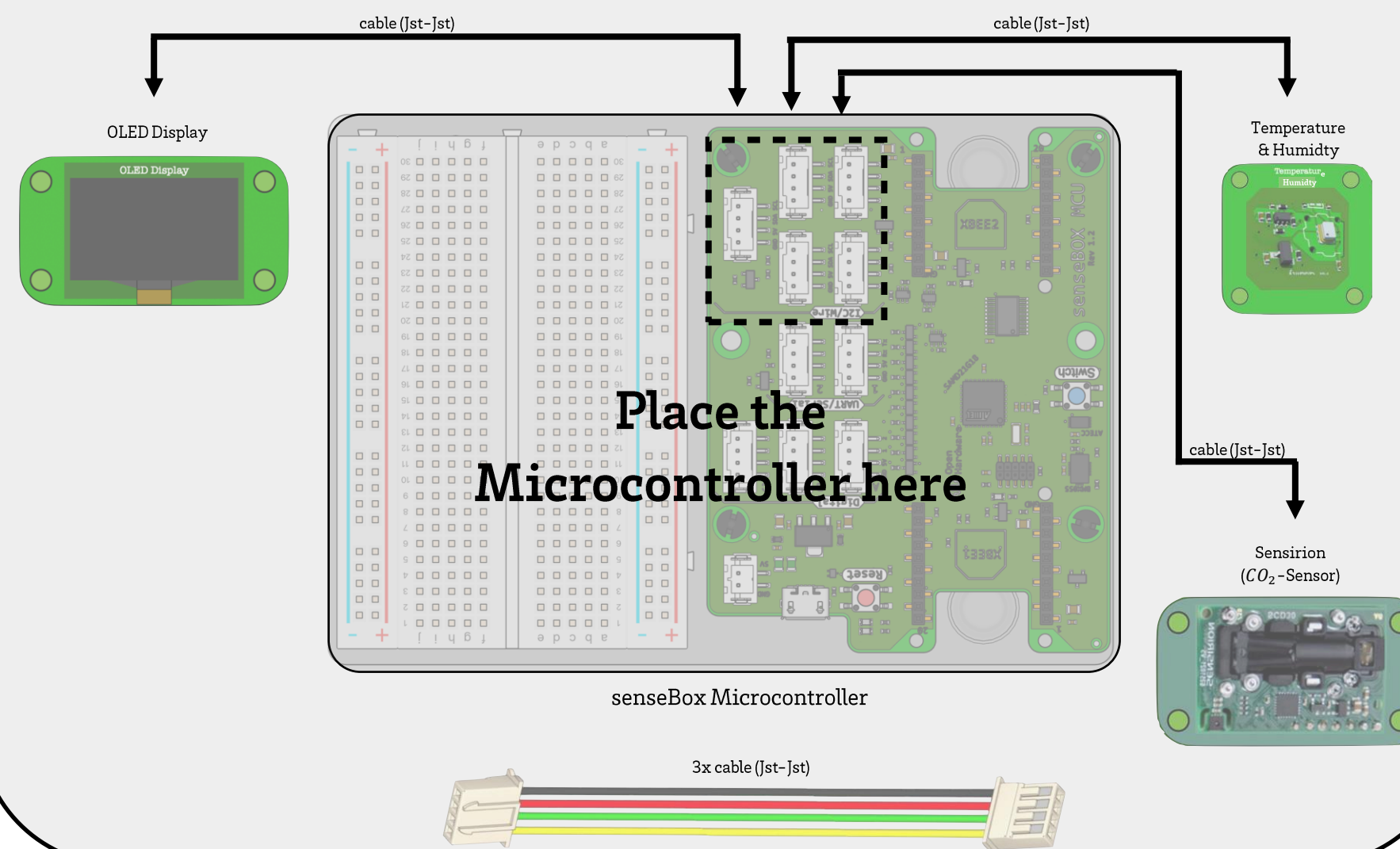

The display has a screen resolution of 128x64 pixels. That means 128 pixels in horizontal direction (x-axis) and 64 pixels in vertical direction (y-axis).

Transfer the code

1. Compile the code ✓

2. Press the Reset-Button twice ✓

3. Drag the code from the download folder to 'senseBox'. ✓

Construction oft the senseBox

OLED Display

Temperature & Humidty

cable (Jst-Jst)

cable (Jst-Jst)

Place the Microcontroller here

cable (Jst-Jst)

Sensirion (CO_2-Sensor)

senseBox Microcontroller

3x cable (Jst-Jst)

Debugging

- Check if you have reset the microcontroller (press the reset-button twice).
- Are your cables and wires connected exactly as shown in the pictures?
- Are your instruction blocks actually connected like little "puzzle pieces"?
- Are the x- and y-coordinates different (see hint)?
- Did you delete all blocks that are not connected to your main block?
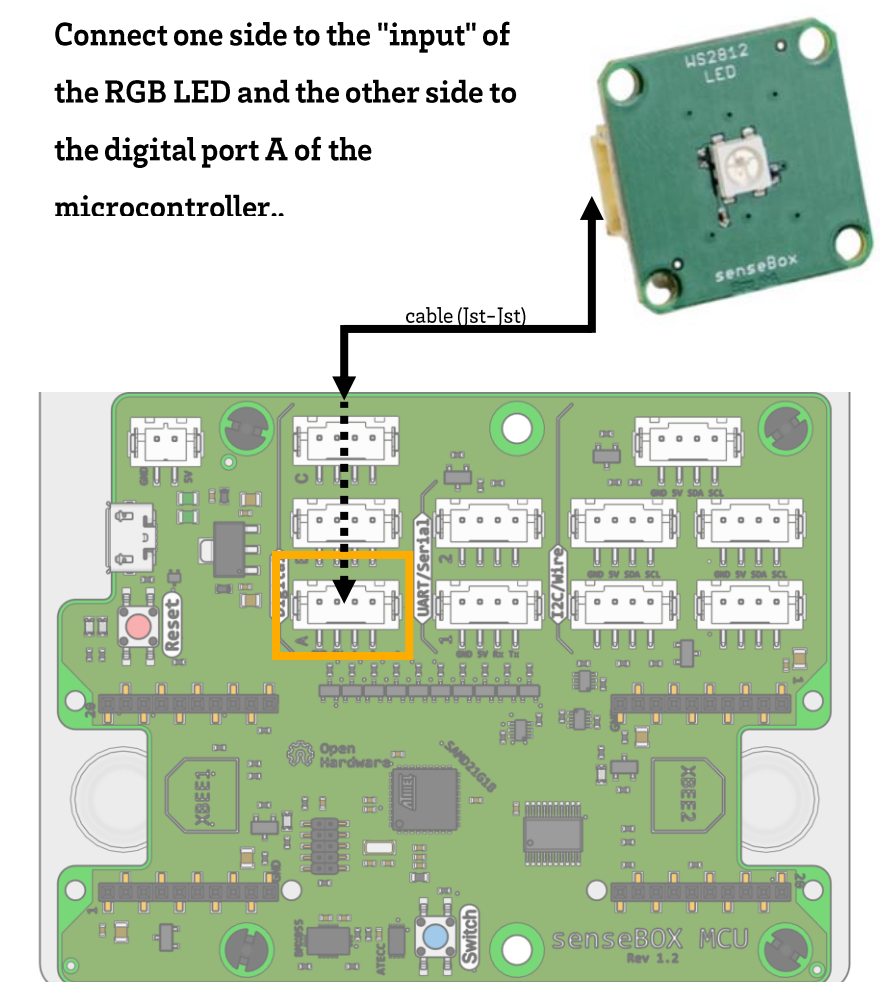
Still problems? Ask a teacher!

Hint: RGB-LED

Connect the RGB-LED to the microcontroller:
Therefore you need a JST-JST cable.
Connect one side to the "input" of the RGB LED and the other side to the digital port A of the microcontroller..

cable (Jst-Jst)

Create and test this code:

```
Arduino run first:
  Initialize Display
  Initialise RGB LED (WS2818)  Port: A
  Brightness                        30
  Number                            1
Arduino loop forever:
  Print on display
    Show Measurements
    Title        " CO2 "
    Value        CO2 Sensor (Sensirion SCD30)
                 Value: CO2 in ppm
    Unit         " ppm "
    Title        " Temperature "
    Value        CO2 Sensor (Sensirion SCD30)
                 Value: CO2 in ppm
    Unit         " C "
  Clear Display
  if    CO2 Sensor (Sensirion SCD30)    >    2000
        Value: CO2 in ppm
  do    Set RGB-LED at Port: A
        Position    0
        Color
  else  Set RGB-LED at Port: A
        Position    0
        Color
```