Hydro Hackers Turbidity Sensor

- Our turbidity sensor is a multi-purpose water quality sensor for natural water monitoring, irrigation systems, pools, industrial & municipal wastewater etc.
- It is suitable for professional use , for education and for hobbyists.
- The analog sensor is simple, robust, affordable and suitable to be used with commercial microcontrollers.

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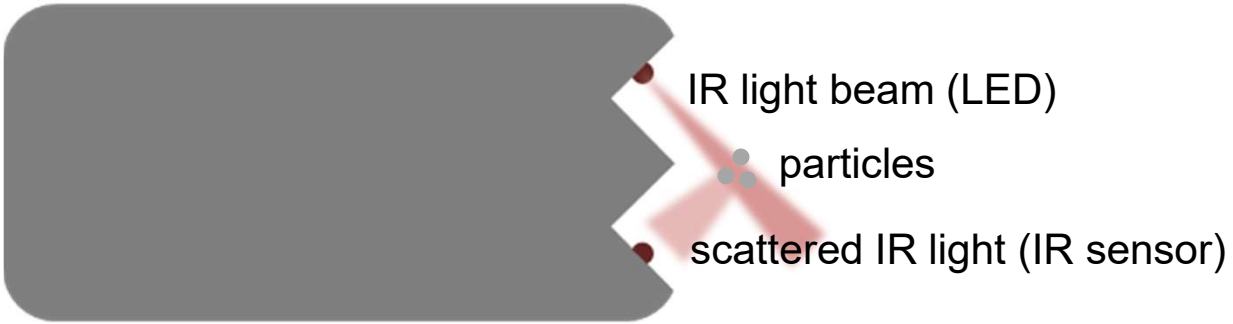
Principle

- IR light scattering effect (low-to-medium turbidities)
  - An IR LED emits IR light. Suspended particles in water scatter (reflect) light in all directions. The intensity of scattering depends on the concentration of particles.
  - An IR sensor detects scattered light at 90^{o} angle. The intensity of scattered light is proportional to turbidity of water.
- IR light attenuation effect (medium-to-high turbidities)
  - At certain turbidity the signal from scattered light reaches its maximum.
  - With increasing turbidity the suspended particles attenuate the IR light, which is seen as decreasing signal level.



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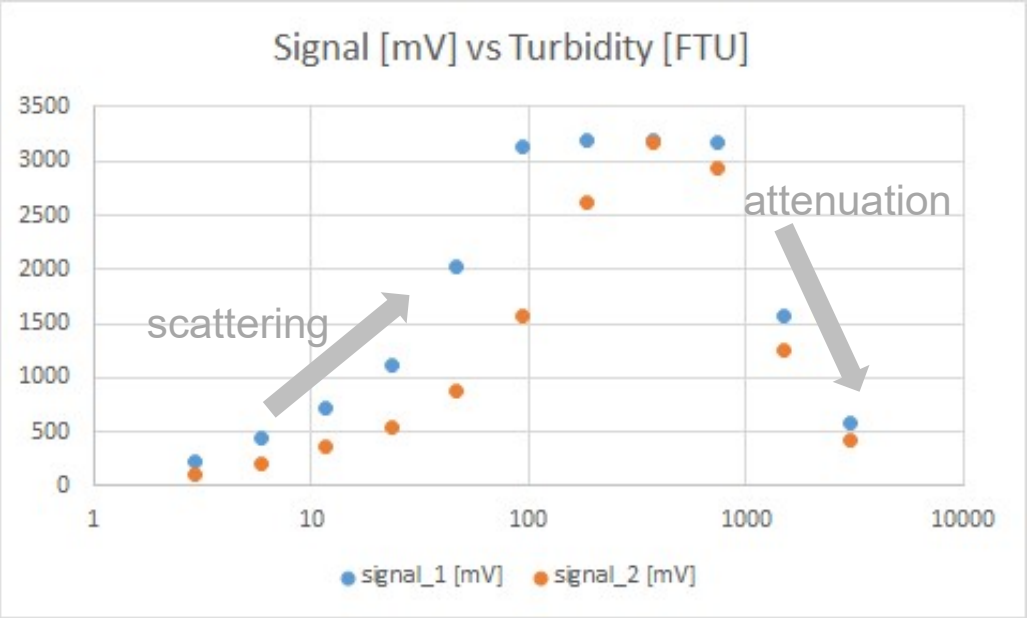
Performance

- Figure shows typical measurement curves, i.e. output signal as a function of turbidity. Please note that the signal level rises until it peaks, and then the signal decreases with increasing turbidity. This kind of measurement response is typical for side-scattering turbidity sensors; the rising part of the curve indicates light scattering, while decreasing of the signal level is due to signal attenuation.
- Both parts of the curve are useful, i.e the rising part of the curve is for low-to-medium turbidities, and the falling part for medium-to-high turbidities. As can be seen, the signal saturates quickly if the excitation voltage is too high.



measurements with 3.3V excitation (blue) and 2.5V excitation

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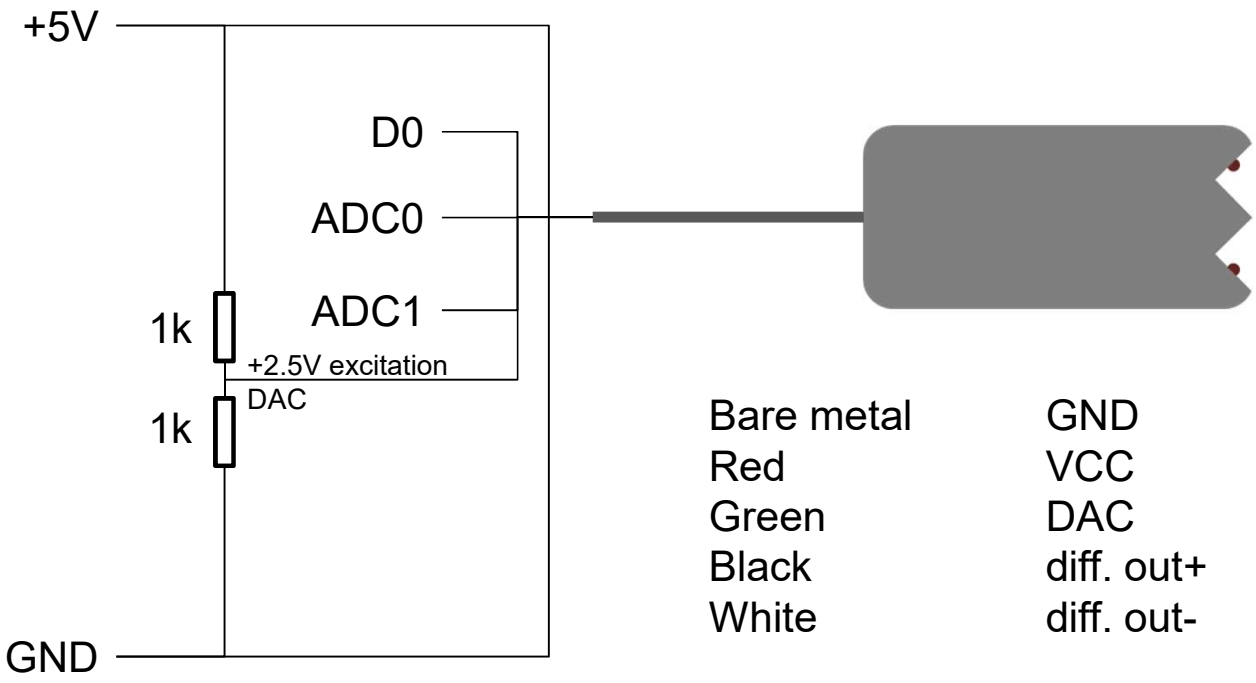
Connections



Bare metal	GND
Red	VCC
Green	DAC
Black	diff. out+
White	diff. out-

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Technical data

- **Absolute Maximum Ratings**
  - Supply voltage 5.5V
  - Excitation voltage 3.5V
  - Operating medium temperature -20°C to +60°C
  - Duration of short circuit to ground unlimited
- **ESD Ratings**
  - Electrostatic discharge Human-body model ±2000V
  - Electrostatic discharge Charged-device model ±1000V
- **Recommended Operating Conditions**
  - Supply voltage 5V ±10%
  - Excitation voltage 0-3.3V
  - Operating medium temperature -20°C to +40°C
- **Materials**
  - Housing and insulation of wire: PVC
  - Electronics is cast into epoxy resin
  - The product is lead-free

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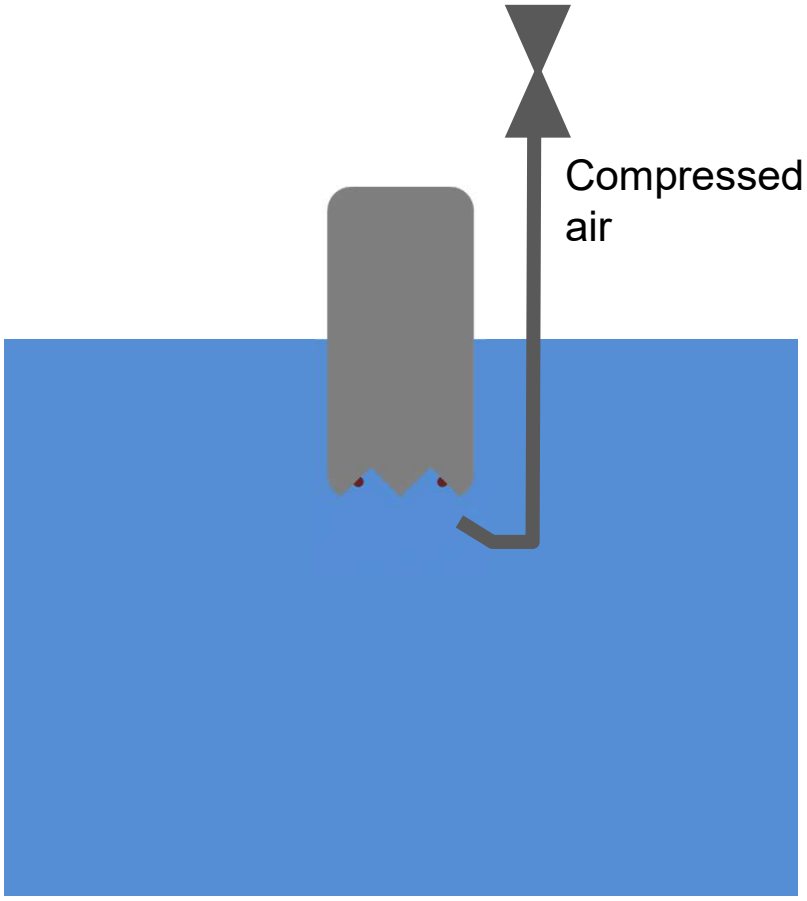
Measurement

- Immerse sensor to water so that the sensor head is well under water surface. The sensor is waterproof and can be immersed entirely under water.
- Keep the sensor far from any surfaces that can reflect IR light (at least 30 cm)
- Protect the sensor from sunlight or other light sources that can emit IR light.
- The sensor must be cleaned frequently. Automated cleaning by compressed air jet is recommended if the sensor is installed permanently.



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Arduino code

```
void setup() {

  pinMode(2, OUTPUT);  //Set excitation pin
  digitalWrite(2, LOW); //Set Excitation pin LOW
  Serial.begin(9600);

}

void loop() {

// Start measurement cycle
  digitalWrite(2, HIGH); //Set excitation voltage HIGH
  delay(50); //delay before measurements
  double out_neg = analogRead(A0); //measure diff.input 1
  delay(50);
  double out_pos = analogRead(A1); //measure diff.input 2
  double diff = out_pos - out_neg; //signal is the difference of measured signals

//print output
  Serial.print(diff);
  Serial.print(" ");
  Serial.print(out_pos);
  Serial.print(" ");
  Serial.println(out_neg);
  digitalWrite(2, LOW); //set excitation voltage LOW
  delay(1000);
//end measurement cycle

}
```

Arduino pins:

- D2 is for excitation (DAC) via voltage divider circuit
- A0 is differential input (-)
- A1 is differential input (+)