

# An innovative way of building turbidity signal sensor

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### ***Turbidity Meter Circuit Design:***

Principle of turbidity meter sensor is to use optic principle to estimate transmittance rate and scattering rate. It's similar to spectrometer which detects optical density. Water serves as blank for turbidity measurement. Phototransistor which is part of turbidity meter sensor and used to collect lights that pass through haze. photoresistor is the component that connects to the phototransistor. photodiodes is used to convert light into current because emitted sun light has photon. Photon is converted into electron which generates current. That's also the principle of converting solar energy into electricity. If light density is higher, it wil have high signal. After it collects the light, it will generate current. It can be collected to a resistor followed by op-amp to boost signal. The output of phototransistor is defined as base area of it and current gain of transistor.

Sample has higher amount of haze or total suspended solid (TSS) will decrease light transmittance meaning the turbidity sensor reading is lower. Sample with lower amount of haze will have increase reading. The unit for turbidity meter is NTU.

The general flow of detecting equipment is sensing element, signal conditioning, filter, analog to digital converter and microcontroller. [1] There are two turbididty sensors have been used in this project and comparison will be done to verify which one outperform (Figure 1-3). Analog signal output is sinusoidal and digital signal output is square signal in binary format. In otherwords latter one is discrete value. Keystudio sensor has ability to change between these two modes. Analog signal band pass is low but digital signal band pass is high.



*Figure 1: Hilittand Turbidity meter sensor*

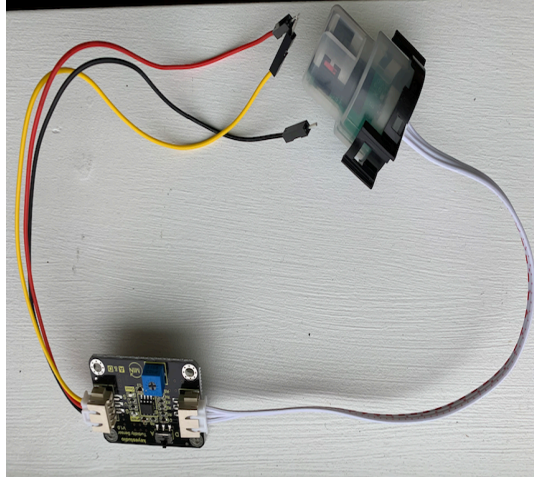


Figure 2: KEYESTUDIO Turbidity meter sensor

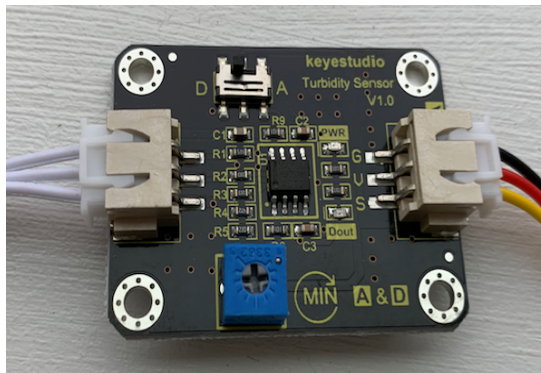
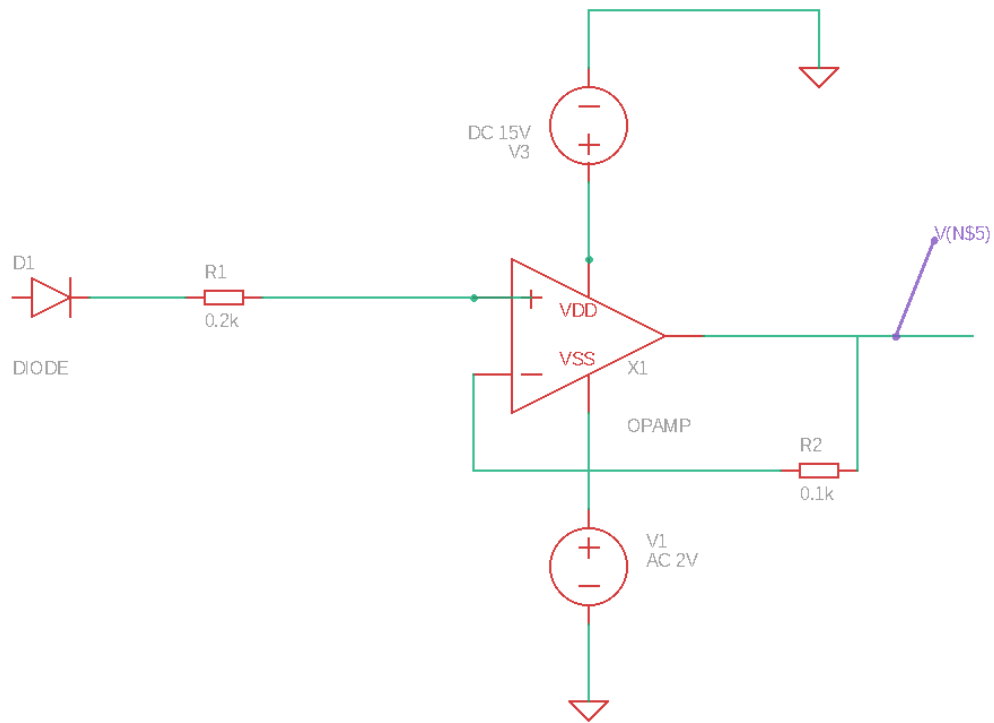


Figure 3: KEYESTUDIO sensor with Analog and Digital mode

Table 1: Turbidity Meter Sensor Comparison

brand	Operating_current	Operating_Voltage	detection_Range
KEYESTUDIO	11mA	DC 5V	0-4550NTU
Hilitand	30mA	DC 5V	N/A



*Figure 4: Turbidity meter sensor circuit plotted by EAGLE AUTODESK Software*

Figure 4 has shown the circuit schematic.

**Reference:**

[1] S. Ramesh, M. Sivaramakrishna, G. Rao. Design and development of a quasi-digital sensor and instrument for water turbidity measurement, Measurement Science and Technology, vol. 30, p. 115106, 2019