TURBIDITY SENSOR BT88i

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

http://www.cma-science.nl

Short description

Turbidity is a measure of water clarity; how much the material suspended in water causes light passing through the water to be scattered. The higher the intensity of scattered light, the higher the turbidity. Suspended materials in the water are for example soil particles (clay, silt, and sand), micro-organisms (phytoplankton, zooplankton) and other substances. These materials are typically in the size range of 0.004 mm (clay) to 1.0 mm (sand). Turbidity can affect the color of the water.

Turbidity is measured in Nephelometric Turbidity Units (NTU). Turbidity measured in NTU uses nephelometric methods that depend on passing specific light of a specific wavelength through the sample. The measurement is qualitative and cannot be correlated directly as micrograms per liter of suspended solids.

The CMA Turbidity sensor BT88i measures turbidity in the range between 0 ... 200 NTU. It is delivered with one empty cuvette and one cuvette containing 100 NTU StablCal Formazin Standard, which is used to calibrated the sensor.

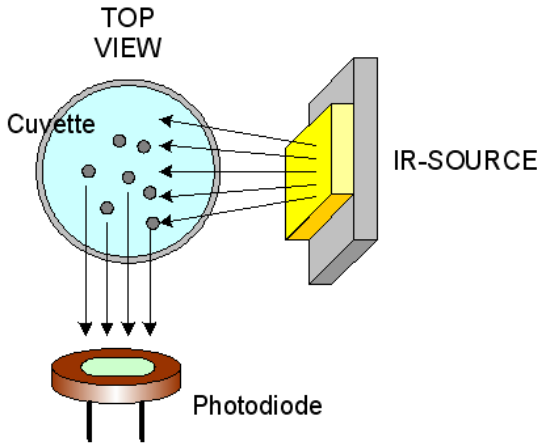
The CMA Turbidity sensor can be directly connected to the analog BT inputs of the CMA interfaces. The sensor cable BT - IEEE1394 needed to connect the sensor to an interface is not supplied with the sensor and has to be purchased separately (CMA Article BTsc_1).

Sensor recognition

The Turbidity sensor BT88i has a memory chip (EEPROM) with information about the sensor: its name, measured quantity, unit and calibration. Through a simple protocol this information is read by the CMA interfaces and the sensor is automatically recognized when it is connected to these interfaces. If your Turbidity sensor is not automatically detected by an interface you have to manually set up your sensor by selecting it from the Coach Sensor Library.

How the Turbidity sensor works

The CMA Turbidity sensor is a nephelometer in which infrared light beam is directed at a cuvette containing the sample water. A detector, consisting of a photodiode, is set up to the side of the light beam. More light reaches the detector if there are lots of small particles scattering the source beam than if there are few.



Calibration

The CMA Turbidity sensor BT82i is supplied calibrated.

The output of the Turbidity sensor is linear with respect to the turbidity. The supplied calibration function is:

$$\text{Turbidity(NTU)} = 150.0 * V_{out}(V) - 80.$$

The Coach software allows selecting the calibration supplied by the sensor memory (EEPROM) or the calibration stored in the Coach 6 Sensor Library. For better accuracy the sensor can be calibrated. The calibration is also necessary when you are measuring solutions with varying temperatures, or when using different cuvettes.

To calibrate the Turbidity Sensor:

1. Connect the sensor to your interface and let it warm up for about five minutes to assure a stable

voltage.

2. First Calibration Point:
   - Take the cuvette containing the Turbidity Standard (100 NTU) and gently invert it five times to mix in any particles that may have settled to the bottom.
     Important: Do not shake the standard. Shaking will introduce tiny air bubbles that will affect turbidity readings.
   - Avoid touching the glass with your fingers. Clean the outside of the cuvette with a soft, lint-free cloth or tissue.
   - Holding the standard by the lid, place it in the Turbidity sensor. Align the mark on the cuvette with the mark on the Turbidity sensor. Close the sensor lid.
   - Enter 100 as the value in NTU.

3. Second Calibration Point:
   - Prepare a *blank cuvette* by rinsing the empty cuvette with distilled water and filling it with distilled water. ***Important:*** The bottom of the meniscus should be at least to the top of the line for every measurement throughout this test.
   - Screw the lid on the cuvette. Avoid touching the glass with your fingers. Clean the outside with a soft, lint-free cloth or tissue.
   - Holding the cuvette by the lid, place it into the Turbidity Sensor. Align the marks. Close the sensor lid.
   - Enter 0 as the value in NTU.

Collecting data

1. Connect the sensor to your interface and let it warm up for about five minutes to assure a stable voltage.
2. Fill the cuvette at least to the top of the line with sample water. Screw the lid on the cuvette.
3. Gently invert the sample water to mix in any particles that may have settled to the bottom. ***Important:*** Do not shake the sample. Shaking will introduce tiny air bubbles that will affect turbidity.
4. Avoid touching the glass with your fingers. Clean the outside with a soft, lint-free cloth.
5. Hold the cuvette by the lid and place it into the Turbidity sensor. Make sure the marks are aligned. Close the sensor lid.
6. Monitor the turbidity value. Note that particles in the water will settle over time and turbidity values drift down; therefore, collect your turbidity data directly after placing the cuvette in the sensor.

Practical information

- Avoid collecting data around bright lights. Make sure that the lid is closed securely.
- Avoid or dilute dark-colored samples.
- Always fill the cuvette to the lid with at least 6 mL of sample.
- Before making a turbidity reading, use a sieve or pipette to remove “floaters” or large, visible particles of sediment from the sample.
- For subsequent measurements, always align the arrow with the screw. Do not switch caps between cuvettes.

Suggested experiments

- The measurement of turbidity is a key test of water quality. Compare the turbidity of water sample from various locations.
- Determine the rate of settling of a sample.
- Measure the formation of a precipitate.

Storage and Maintenance of the Turbidity Sensor

Handle and store turbidity cuvettes in a manner to prevent dirt, scratches, or other damage. Keep them clean, inside and out. After each use, wash with non-phosphate laboratory detergent, rinse repeatedly with deionized water until all detergent residue is removed, and allow cells to air dry in a dust-free environment. If turbidity cuvettes become scratched or broken empty cuvettes can be ordered from CMA.

If the 100 NTU Standard has been stored for more than one month, do the following before using it for calibration:

1. Shake the cuvette vigorously for one minute to stir up the particles.
2. Allow the cuvette to stand undisturbed for five minutes to eliminate air bubbles.
3. Gently invert the cuvette five times.
4. Clean the outside of the glass cuvette.

100 NTU StablCal Formazin Turbidity Standard (or other Stabilized Formazin Turbidity Standards) have a lifetime of 2 years and can be ordered from a local distributor of Hach company (www.hach.com).

Technical Specifications

Sensor kind	Analog, generates an output voltage between 0 - 5 V
Measurement range	0 .. 200 NTU
Resolution using 12 bit AD converter	0.2 NTU
Calibration function	Turbidity(NTU) = 150.0 * V_{out}(V) – 80
Accuracy	±2 NTU for readings under 25 NTU ±5% of readings above 25 NTU
LED wavelength	890 nm
Standard	StablCal Formazin Standard 100 NTU (Hach)
Connection	IEEE1394 connector for BT-IEEE1394 sensor cable. Sensor cable not delivered with the sensor.

Warranty:

The Turbidity sensor BT88i is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

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