ScienceCube

Wireless Colorimeter/Turbidity (WL 128CT)

User Guide

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

KOREADIGITAL

www.ScienceCube.com

The Science Cube wireless colorimeter/turbidity sensor can measure the chromaticity and turbidity of solutions.

The colorimeter sensors are used to determine concentration by measuring the transmittance or absorption of a solution through six different wavelengths of light. When a white light source passes through a cuvette, part of the light is absorbed by the solution, and the light excluding the absorbed amount reaches a detector with a built-in filter for each wavelength, and this amount of light is expressed as transmittance.

The turbidity sensor indicates the level of turbidity in the water and indicates how cloudy the water appears. It appears as fine suspended solids that reduce water clarity, and exists as colloidal substances such as bacteria, algae, soil particles, clay, and organic matter. The cuvette is illuminated with an infrared light source and the light scattered by the colloidal suspension is measured, expressing turbidity in NTU.

Suggested experiments

- Understanding Beer's Law
- Measure the concentration of the solution and observe the reaction time
- Determine the correlation between concentration and time
- Water quality analysis

Composition

The ScienceCube wireless colorimeter/turbidity sensor *consists of the following.*

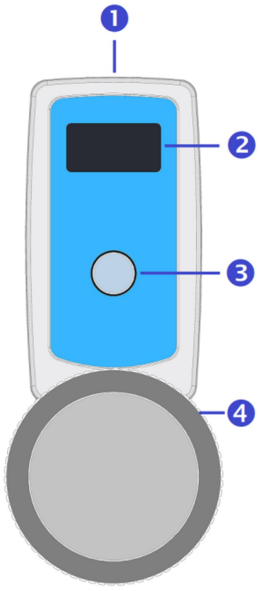
- Wireless colorimeter/turbidiy sensor(WL 128CT)
- 10 sets of disposable cuvettes and cuvette covers
- 100 NTU turbidity standard solution cuvette
- USB-A/C cable
- Booklet

Feature

- Up to four Science Cube wireless sensors can be connected to a PC or smart device at the same time.
- It supports dual-mode Bluetooth, allowing you to connect not only smart devices but also desktop and laptop PCs to conduct experiments using the Science# application.
- It can be connected to a PC through a USB port and experiments can be performed using the Science# program.

Function of wireless sensor

Structure



① USB port : Connect the sensor to a PC and use it for experiments or charging.

② OLED Display : Displays measured sensor values, sensor type, sensor ID, and remaining battery level.

③ Power/Function Button : It has functions such as power ON/OFF, measurement sensor change and calibration, etc.

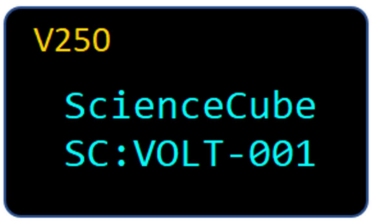
④ Sensing part : When you open the cover by turning it counterclockwise, there is a square chamber where you can place the cuvette.

Caution: The chamber in which the cuvette is located protects the very precise optical sensor, so be careful not to contaminate it with the measurement sample.

Power/Function Button

Status	Turn	Action	Description
When the power is off	Click once	■	A short press turns the sensor on.
	Long click	■■■■■	A long press changes the mode and turns on the sensor.
When it's on	Click once	■	Change sensor type or range. (Multi-sensor or range sensor only)
	Double click	■■	1) Zero point setting (For sensors with zero point function) 2) A user calibration (if the sensor has a calibration function) is performed and **U0** or **UC** is displayed above the device. 3) In the case of a sensor installed upside down, the screen may be displayed straight up or down.
	Long click	■■■■■	Turns off.

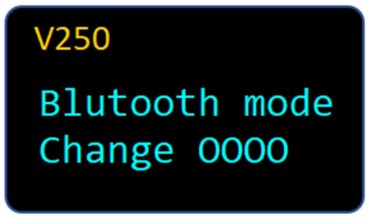
Start screen



V250 : Displays the sensor's firmware version.

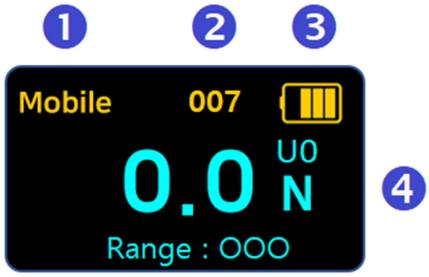
SC:VOLT-001 : When you search for a Bluetooth device, the device name will be displayed. (Sensor name and 3-digit serial number)

Change mode



When you press and hold the power button and turn it on, the Bluetooth connection mode changes to **Mobile** or **PC** with the following message.

Measurment screen

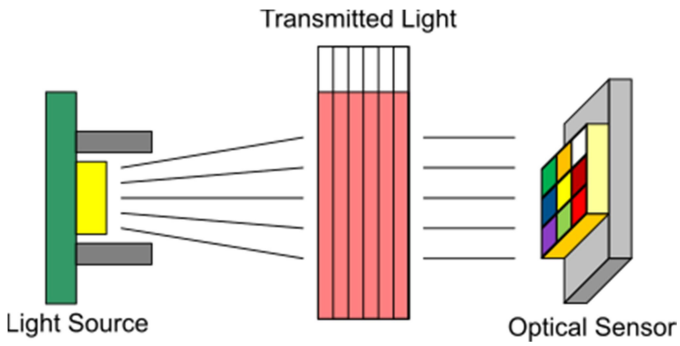


①**Connect mode**	**Mobile** : Connecting Androidor iOS. **PC** : Connecting to Windows PC ※ A long press changes the mode and turns on the sensor.
②**Sensor-ID**	This is the sensor's unique number and is displayed along with the sensor name in the device name when connected via Bluetooth.
③**Battery**	Check the battery status, and when charging via USB, the display will change to charging.
④**Value**	1) Displays sensor measurement values and units in real time. 2) If **user calibration** is used, **U0** or **UC** will be displayed above the units. 3) For sensors with multiple ranges, the current range is displayed.

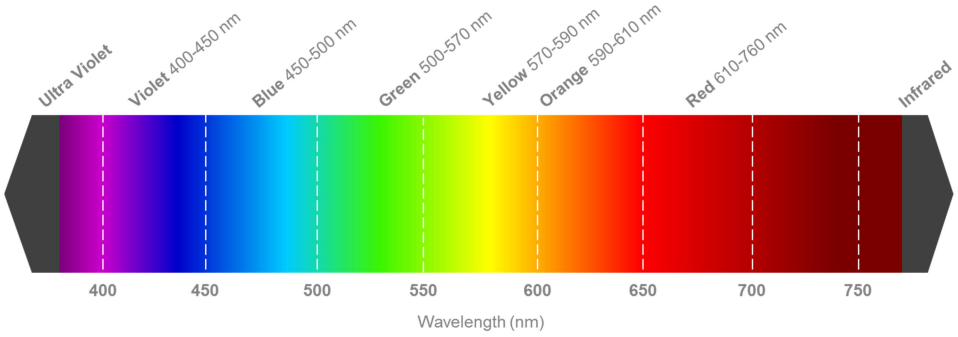
How it Works

Colorimeter

A colorimeter is used to determine concentration by analyzing the color of a solution. As shown in the picture below, the monochromatic light generated from the light source passes through the cuvette containing the sample solution and is partially absorbed by the solution. As a result, less light reaches the detector than is absorbed.



The colorimeter uses a detector with six filters: violet (425 nm), blue (470 nm), cyan (515 nm), green (555 nm), red (640 nm), and deep red (745 nm).



Transmittance and Absorbance

The amount of light passing through a solution is expressed as transmittance (T), expressed as a $\%$. Here, transmittance can be converted to absorption or absorbance (A) through the equation:

$$A = log\left(\frac{1}{T}\right) \quad or \quad A = 2 - log(T)$$

Here, for a solution contained in a cuvette cell of constant width, absorbance (A) and concentration (C) are proportional according to the Beer-Lambert law.

$$A = \varepsilon \cdot l \cdot C$$

Where ε is the absorptivity, ℓ is optical path length.

Therefore, if the transmittance is known, the concentration can be calculated using the absorbance.

Absorbance and transmittance range

For ideal test results from a colorimeter, the absorbance and transmittance should be within the following ranges:

Transmittance($\%T$)	10 ~ 90 $\%T$
Absorbance(A)	1.0 ~ 0.05

According to Beer's law, if the absorbance value is greater than 1.0 (transmittance less than 10%), the concentration of the solution is very high and Beer's law may not hold

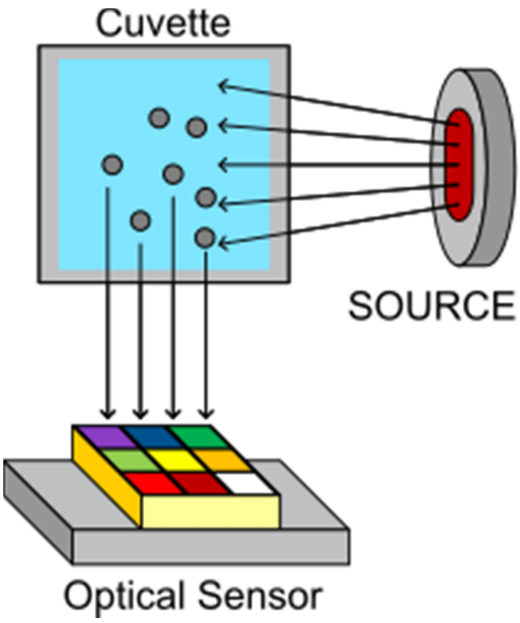
due to intermolecular interactions. If the solution has low transmittance (less than 10%), dilute the concentration of the solution so that the transmittance is in the range of 10 to 90%.

Turbidity

Turbidity refers to the degree of cloudiness of water and is used for the same purpose as visual inspection. A turbidity sensor is a device that measures the turbidity of water. It measures the degree to which light passing through water becomes increasingly blurred as it is scattered and absorbed by suspended substances in the water.

Turbidity measurement methods include instrumental analysis and visual methods.

- The instrumental analysis method uses nephelometry, which measures scattering by turbid particles, and the unit of turbidity is NTU (Nephelometry Turbidity Unit).
- The visual method uses the Jackson Turbidity Unit (JTU) as a measure of the degree to which turbidity impedes the passage of light.



NTU and JTU are measured differently. There is no correlation or conversion between these two units.

In the Nephelo method, light emitted from a light source passes through a sample cell containing a turbid liquid and is scattered in several directions by particles in the water. Among these scattered lights, the amount of light scattered in a 90-degree direction is measured and expressed as turbidity.

Turbidity samples show a decrease in value over time due to precipitation. Taking measurements as early as possible before precipitation

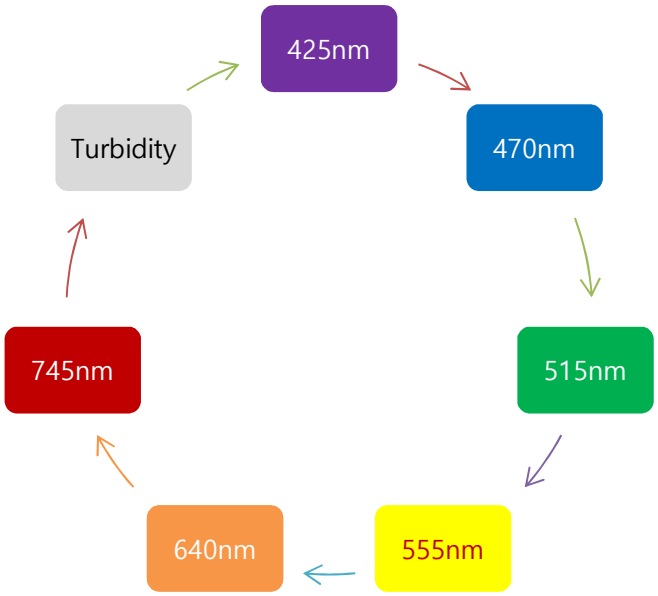
occurs will help you get accurate readings.

Using the Sensor

ScienceCube wireless colorimeter/turbidity sensor can measure colorimeter and turbidity at 6 wavelengths in the following ways.

1. Select the chromaticity wavelength or turbidity you want to measure. (see wavelength selection)
2. Place the sample cuvette containing the sample into the chamber.
3. Close the lid.
4. Check if the value is stable.

Selecting of wavelength



During measurement, each time you press the button on the sensor, the colorimeter wavelength changes sequentially, and turbidity can be measured after the last wavelength (745 nm).

Due to subtle differences in the optical properties on each side of the sample cuvette, it is recommended that repeated measurements be taken from the same side. More

reproducible experiments are possible by attaching the attached arrow (sticker) to the top of the cuvette and inserting it into the chamber in line with the arrow.

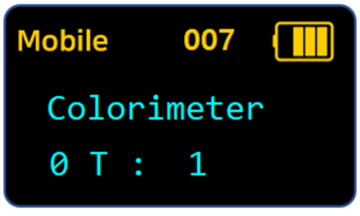
When measuring turbidity, the value drops after a certain period of time after adding the turbidity solution. The correct turbidity value is one where the value is stable and changes little (ideally about 30 seconds to 1 minute).

Calibration

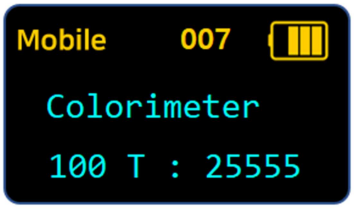
All sensors are precisely calibrated using standard solutions during the manufacturing process before being shipped and are ready for immediate use. However, you can perform **[User Calibration]** for more accurate measurements.

[User Calibration] is reflected temporarily and then returns to the default when the sensor is turned on again.

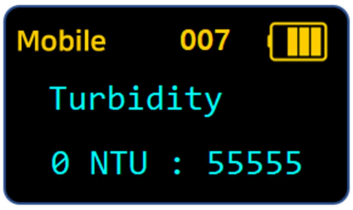
1. 1. Press the Power/Calibrate button twice in succession.
2. When the Colorimeter shows 0 T, do not place the cuvette into the chamber, close the cover and press the button.



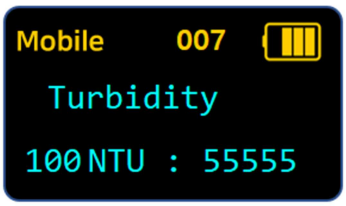
3. When the Colorimeter and 100 T are displayed, place the cuvette containing distilled water into the chamber, close the lid, and press the button.



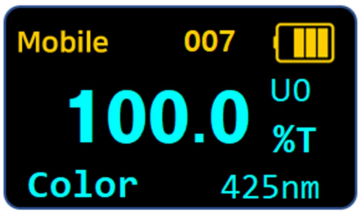
4. When Turbidity and 0 NTU are displayed, place the cuvette containing distilled water into the chamber, close the lid and press the button.



5. When Turbidity and 100 NTU are displayed, place the turbidity standard solution (100 NTU) cuvette into the chamber, close the lid, and press the button.



6. **[User Calibration]** is complete and the word "U0" is displayed above the unit on the sensor screen.



To cancel **[User Calibration]**, press the button twice in succession. U0 disappears and returns to default.

Storage and maintenance

- After using the color/turbidity sensor, clean the sample cell cuvette with distilled water. After washing, please dry it well and store it well to avoid scratches or foreign substances on the surface or interior. More accurate turbidity

measurements are only possible if the sample cell cuvette is in good condition.

- The square chamber in which the cuvette is located protects the extremely precise optical sensor, so be careful not to contaminate the measurement sample. If it is contaminated, lift it vertically to prevent contaminants from entering the sensor, separate it, and wash it with distilled water and rinse it well. Dry and reinstall.
- Store the 100 NTU turbidity standard solution cuvette in a shaded place between 5 and 25 degrees. If possible, use the product upright with the lid closed, and be careful not to touch the skin, eyes, or body when opening.

CAUTION: Turbidity standard solution (100 NTU) may be irritating to eyes or skin. It may also cause allergic skin reactions. If it gets into your eyes, rinse them under running water for about 15 minutes and then consult a doctor. If swallowed, consult a doctor immediately.

Note : Science Cube turbidity standards use StableCal® from Hach USA. Information on standard solutions can be found on the following website.

- Home page : https://www.hach.com
- Product Name : **StableCal®** Standard, 100NTU
- Catalog Number : 2660249

Specifications

Item		Description
Colorimeter	**Range**	0 ~100%T (recommend 10 ~ 90%T) (425nm, 470nm, 515nm, 555nm, 640nm,745nm)
	Resolution	0.1 %T
Turbidity	**Range**	0~200 NTU
Resolution		0.1 NTU
Sampling Time		Max. 100Hz (0.01 sec.), (Typical 1Hz)
Condition		0 ~ 60℃, 85%RH
Wireless Connection		Bluetooth 5.0 or Classic 2.1
Wired Connection		USB-C
Battery		700mAh Li-Polymer rechargeable
Charging Time		within 2 hours
Operating Time		Approximately 8 hours after full charge (depending on usage conditions)
EMC		CE : EN 61326-1, EN 55011, EN 55032, EN 301

CAUTION: Do not use the instrument beyond the measurement range or in conditions that exceed the short-term exposure limits. Prolonged exposure beyond the maximum permissible range can cause serious damage to the sensor.

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