

Standard Operating Procedures for Measuring Ultraviolet Transmittance

A Guide to Field Measurements Using a Portable Ultraviolet Transmittance Meter



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1. Purpose and Scope

- 1.1. This document is for the Washington State Department of Health (WSDOH) Standard Operating Procedure (SOP) for ultraviolet (UV) transmittance measurements.
- 1.2. This document describes the procedure for using a portable UV transmittance meter to measure the UV transmittance of a water sample. The UV transmittance meter measures the amount of UV light (measured at 254 nm) that passes through the water, relative to the amount of light that is emitted from a UV bulb. UV transmittance is an indicator of the wastewater characteristics that influence UV disinfection efficacy, most importantly the amount of natural organic matter.

2. Applicability

- 2.1. This procedure was developed for field measurements of UV transmittance of wastewater using the RealTech Real UV254 P200 battery-powered portable field meter. This document is intended for measuring UV transmittance in the 5-100% range.

3. Definitions

- 3.1. Calibration- To standardize or correct sensor after determining, by measurement or comparison with a standard, the correct value.
- 3.2. UV Transmittance- A measure of the amount of UV light (measured at 254 nm) that passes through the water, relative to the amount of light that is emitted from a UV bulb. The measurement is expressed as a percentage, % UVT.
- 3.3. WSDOH- Washington State Department of Health
- 3.4. Field Log- A standard document for recording field measurements. See Appendix.
- 3.5. MSDS- Material Safety Data Sheets
- 3.6. UV- ultraviolet

4. Personnel Qualifications/Responsibilities

- 4.1. All field measurements will be performed by WSDOH personnel with lab experience and a professional background in wastewater treatment.
- 4.2. Review appropriate Material Safety Data Sheets and manuals before use.

5. Equipment, Reagents, and Supplies

- 5.1. UV Transmittance Meter, model: RealTech Real 254 P200
- 5.2. 10 mm Quartz cuvette (2, one as a reserve)
- 5.3. Distilled water
- 5.4. DI water
- 5.5. 3 mL plastic pipette
- 5.6. Low-lint disposable wipes (e.g. Kimwipes)
- 5.7. 12 VDC 1A wall adapter
- 5.8. 12 VDC car adapter
- 5.9. 12 VDC battery charger
- 5.10. RealTech Real 254 P200 owner's manual

6. Summary of Procedures

6.1. UV Transmittance Meter Calibration

Calibration Frequency: According to RealTech manufacturer, the UV transmittance meter does not need to be calibrated before each use. The calibration should be checked before each day of use, and re-calibration is recommended if the accuracy of the calibration is low, the UV lamp is replaced, or a new cuvette is used for sampling.

Calibration Check

1. Turn Battery Pack on by turning the switch to the ON position.
2. Turn meter on by pressing POWER. Allow approximately 2 minutes for the meter to warm-up. When the meter display read “Ready,” continue.
3. Ensure that the meter is in UV transmittance mode by checking the display (should read UVT). If the meter is in UV Absorbance mode (UVA), hold down both the CALIBRATE and COMPUTE button for 2 seconds.
4. Make sure that the test chamber is empty.
5. Press the COMPUTE button.
6. Rinse a cuvette with distilled water twice. Then fill the cuvette with distilled water and wipe the sides with a low-lint wipe to remove any fingerprints, dirt, or residual water. NOTE: Always hold the cuvette by the frosted sides.
7. When the display reads “Insert Cuvette with test water,” insert the cuvette with distilled water, making sure that the black dot on the cuvette is aligned with the black circle on the meter.
8. Record reading in the Calibration Logbook.
9. If the calibration is not within 0.5% UVT (reading is less than 99.5 or more than 100.5), the meter should be re-calibrated (continue to first calibration step).

Calibration

1. Make sure that the test chamber is empty.
2. Press the CALIBRATE button.
3. Rinse a cuvette with distilled water twice. Then fill the cuvette with distilled water and wipe the sides with a low-lint wipe to remove any fingerprints, dirt, or residual water. NOTE: Always hold the cuvette by the frosted sides.
4. When the display reads “Insert Cuvette with DI water,” insert the cuvette, making sure that the black dot on the cuvette is aligned with the black circle on the meter.
5. When the display reads “100.0,” the meter is calibrated.
6. Record calibration date in the Calibration Logbook.
7. Press POWER to turn meter off.
8. Turn the Batter Pack off by turning the switch to the OFF position.

6.2. Grab Sample Measurement Procedure

1. Turn Battery Pack on by turning the switch to the ON position.

2. Turn meter on by pressing POWER. Allow approximately 2 minutes for the meter to warm-up. When the meter display read "Ready," continue.
3. Ensure that the meter is in UV transmittance mode by checking the display (should read UVT). If the meter is in UV Absorbance mode (UVA), hold down both the CALIBRATE and COMPUTE button for 2 seconds.
4. Make sure that the test chamber is empty.
5. Press the COMPUTE button.
6. Rinse a cuvette three times with the sample water. Then fill the cuvette with the sample water and wipe the sides with a low-lint wipe to remove any fingerprints, dirt, or residual water. NOTE: Always hold the cuvette by the frosted sides.
7. When the display reads "Insert Cuvette with test water," insert the cuvette, making sure that the black dot on the cuvette is aligned with the black circle on the meter.
8. Record the reading displayed on the meter in the Field Log.
9. To perform another test, repeat steps 3-7.
10. Press POWER to turn the meter off.
11. Turn the Battery Pack off by turning the switch to the OFF position.

6.3. Storage and Power Charging Procedure

Charge Frequency: Note that the battery pack for the RealTech Real UV254 P200 holds power for approximately 2-3 hours of testing. The battery should be recharged whenever not in use to prevent the meter from powering off while in the field.

1. When storing the UV transmittance meter, make sure that the cuvette is completely clean and dry before inserting it into the test chamber.
2. Place the foam protection layer on top of the test chamber and securely close the lid.
3. Ensure that battery pack is in the ON position and the meter is powered off.
4. Plug the meter in using the 12 VDC battery charger.
5. Allow 1-2 hours for the battery pack to be fully charged.

6.4. UV Lamp and White Light Check and Replacement

Replacement Frequency: The UV bulb in the RealTech Real UV254 P200 portable meter lasts for 1-2 years of testing. The UV bulb and white light should be checked if the display reads “Lamp Stabilizing” when turned on and allowed to warm up.

Light Checks

1. With the meter powered on, check if there is white light seen in the test chamber. If there is no light visible, the white light may need to be tightened or replaced.
2. Power the meter off. Then unscrew the faceplate and examine the white light (small bulb) and UV lamp (long bulb). Check for loose bulbs, cracks, or other damage.
3. If the bulbs are loose, tighten them. If they are damaged, they must be replaced.

Light Replacement

1. Make sure that the meter is powered off. Then unscrew the faceplate.
2. Use a flathead screwdriver to remove the UV lamp base.
3. Remove the old UV lamp and press the new lamp into the ceramic lamp socket.
4. Replace the lamp base and the faceplate.
5. The meter must be calibrated after lamp replacement.

7. Records Management

- 7.1. All hardcopy documentation of the data, such as the completed Field Log will be reviewed, verified, and entered into a database after being approved by WSDOH’s project manager.
- 7.2. All calibration and field records should include: the instrument manufacturer, model number, the calibration date and time, instrument readings, and the name of the person(s) who performed the calibration. An example of a complete Field Log and calibration record is shown in the Appendix.

8. Quality Control and Quality Assurance Section

- 8.1. The meter calibration should be checked at the beginning of each day of use.
- 8.2. Although field instruments are robust, they should still be handled carefully.
- 8.3. All procedures should be completed in accordance with the project Quality Assurance Project Plan.

9. Safety

- 9.1. Wear UVC protective safety goggles when testing wastewater.
- 9.2. Wash hands after calibration and after exposure to wastewater. Use hand sanitizer if soap and water are not available.
- 9.3. When using equipment in the field, be aware of your surroundings. Select an area in which you feel safe and secure from hazards.

10. References

RealTech, Inc. (2015) *Real UV254 Portable Meters P Series Specification Sheet*
<http://realtechwater.com/wp-content/uploads/2015/11/Real-UV254-Portable-Meter.pdf>

RealTech, Inc. (2014) *Importance of Measuring UV Transmittance (UVT) for UV Disinfection*
<http://realtechwater.com/wp-content/uploads/2015/09/Importance-of-Measuring-UV-Transmittance-UVT-for-UV-Disinfection.pdf>

RealTech, Inc. (2017) *Real UV254 P200 Owner's Manual – Version 1.3*