

LABORATORY EQUIPMENT OVERVIEW

ERTC/IRWA TRAINING 2023-2024

**SOUTHERN ILLINOIS UNIVERSITY
EDWARDSVILLE**



TODAY'S AGENDA

TYPE	INSTRUMENT
Colorimeters	Pocket Colorimeter II – DR300 – DR900 – SL1000 – CL-17
Probes	pH/ISE
Spectrophotometers	DR3900
Turbidimeters	2100P – 2100Q – TU5200 – TU5300

Explanation - Testing – Calibration - Maintenance

PORTABLE COLORIMETERS

➤ Types of Colorimeters

- Pocket Colorimeter II – Single Analyte
- DR300 – Single Analyte
- DR900 – Multiple Analytes
- SL1000 – Multiple Analytes (Simultaneously)
- CL-17 – Online Single Analyte (Chlorine)

POCKET COLORIMETER II and DR300

➤ Most Common Analytes

- Free and Total Chlorine
- Iron and Manganese
- Phosphate
- NAP (Total Ammonia, Monochloramine, Free Ammonia, and Nitrate)

DR300 Pocket Colorimeter, Chlorine & pH, with Box

Product Number: LPV445.97.12110

📅 Ships within 6-8 weeks

Parameter

Aluminum	Ammonia Nitrogen	Bromine	Chlorine dioxide	Chlorine, LR/HR
Chlorine, MR/HR	Chlorine, pH	Iron, Ferrover	Iron, TPTZ	Manganese, HR
Molybdenum, LR/HR	Monochloramine/Free Ammonium	Nitrate	Oxygen, dissolved	
Ozone	Phosphate	Zinc		

TOTAL CHLORINE OPTIONS

- Free or Total Chlorine (Low Range – LR)
 - Range = 0.02 mg/L – 2.00 mg/L
 - 10 mL sample – (1) 10 mL reagent pack – 25 mm sample cell
- Free or Total Chlorine (Mid Range – MR)
 - Range = 0.05 mg/L – 4.00 mg/L
 - 10 mL sample – (1) 25 mL reagent pack – 25 mm sample cell
- Free or Total Chlorine (High Range – HR)
 - Range = 0.1 mg/L – 8.0 mg/L
 - 5 mL sample – (2) 10 mL reagent packs – 1 cm sample cell
- Analysis Time
 - Free chlorine within 1 minute
 - Total chlorine 3-6 minutes

PORTABLE COLORIMETERS

➤ Calibration

- Initial Factory Calibration – No other calibration recommended

➤ Spec Checks

- Secondary Standards
- Liquid Standards
- Out of Spec – Return for Factory Calibration Reset



PORTABLE COLORIMETERS

➤ Spec Check Options

- DPD Chlorine LR
- DPD Chlorine MR
- DPD Chlorine HR
- Fluoride
- Monochloramine & Free Ammonia
- Ozone



DR900

➤ Benefits

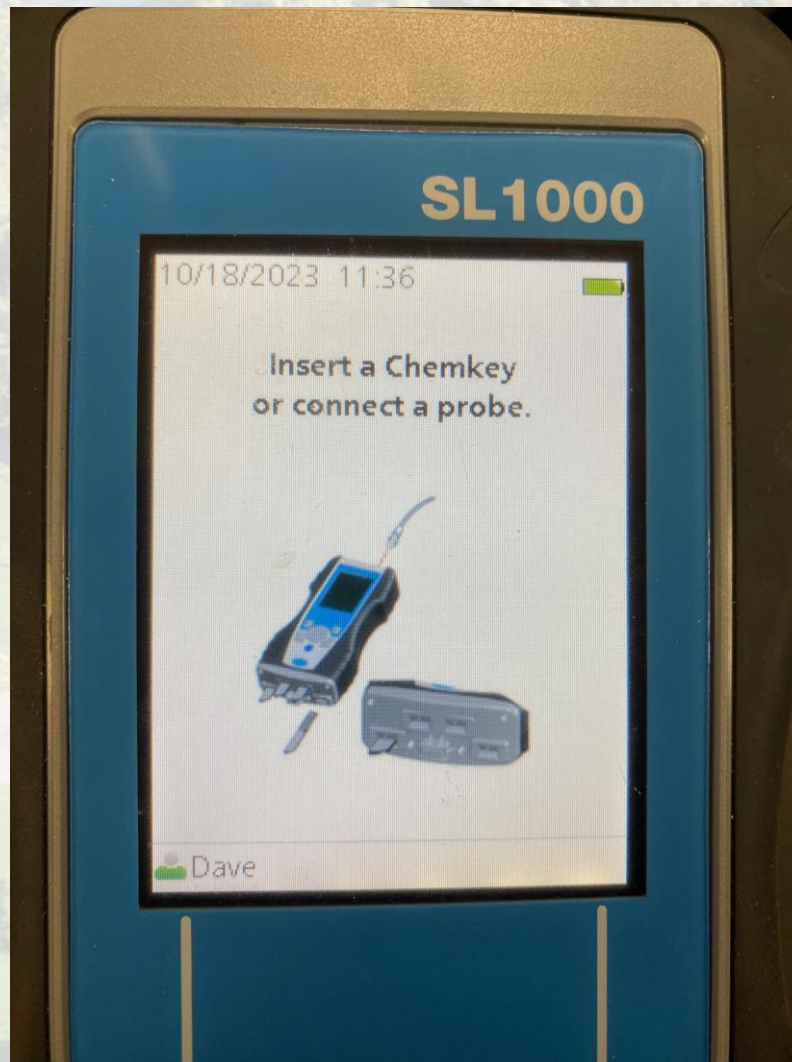
- Ability to read at different wavelengths
- Ability to read multiple analytes



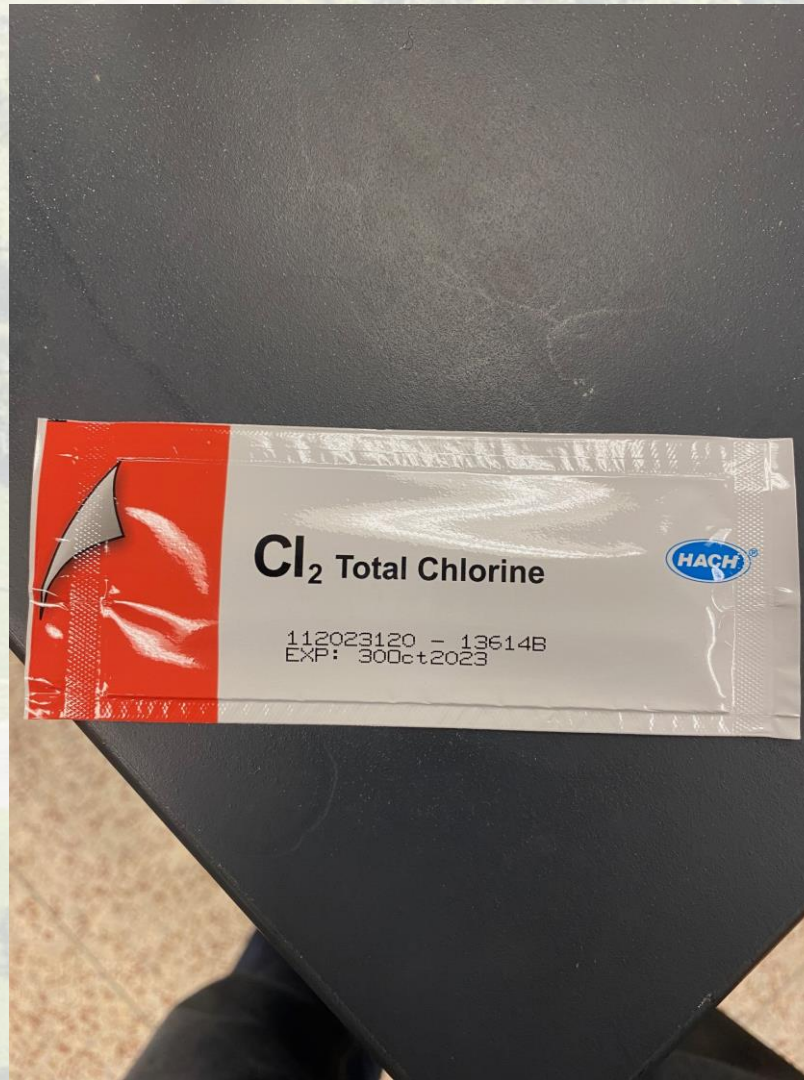
SL1000



SL1000



SL1000 Chem Keys



SL1000 Chem Keys



SL1000



SL1000



SL1000



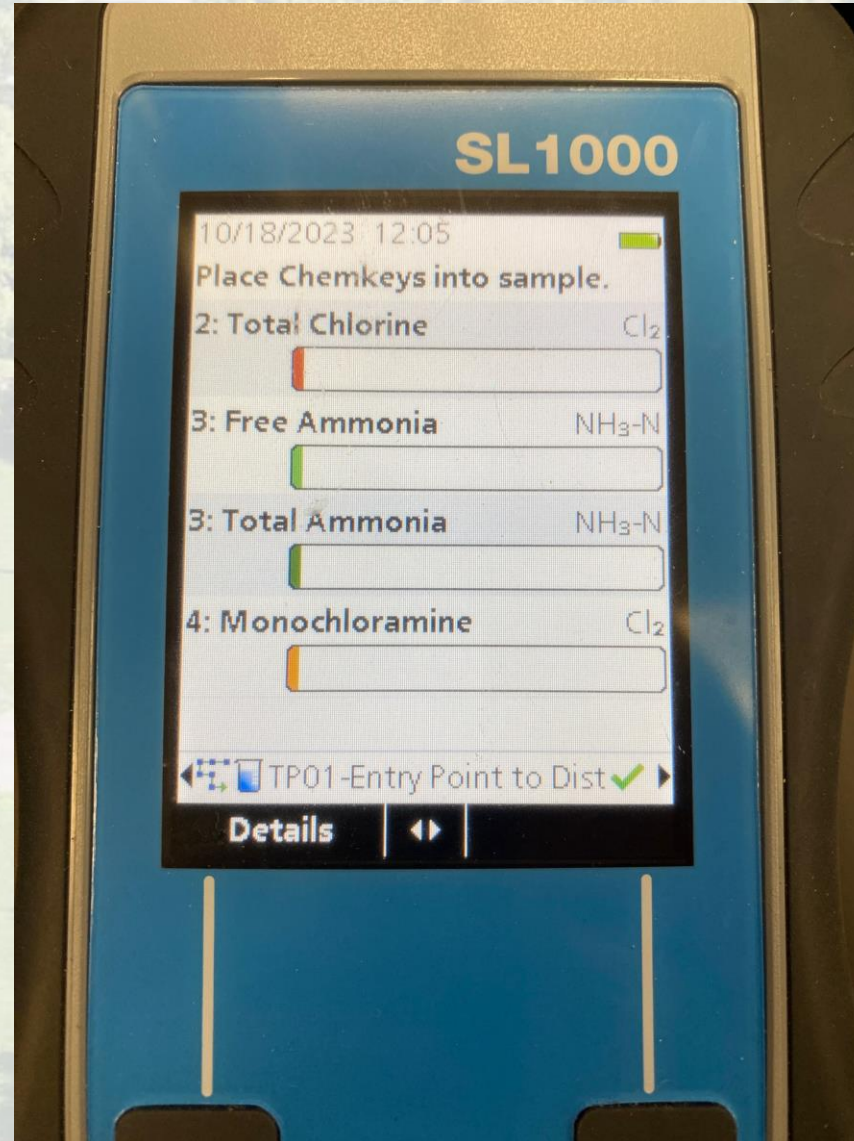
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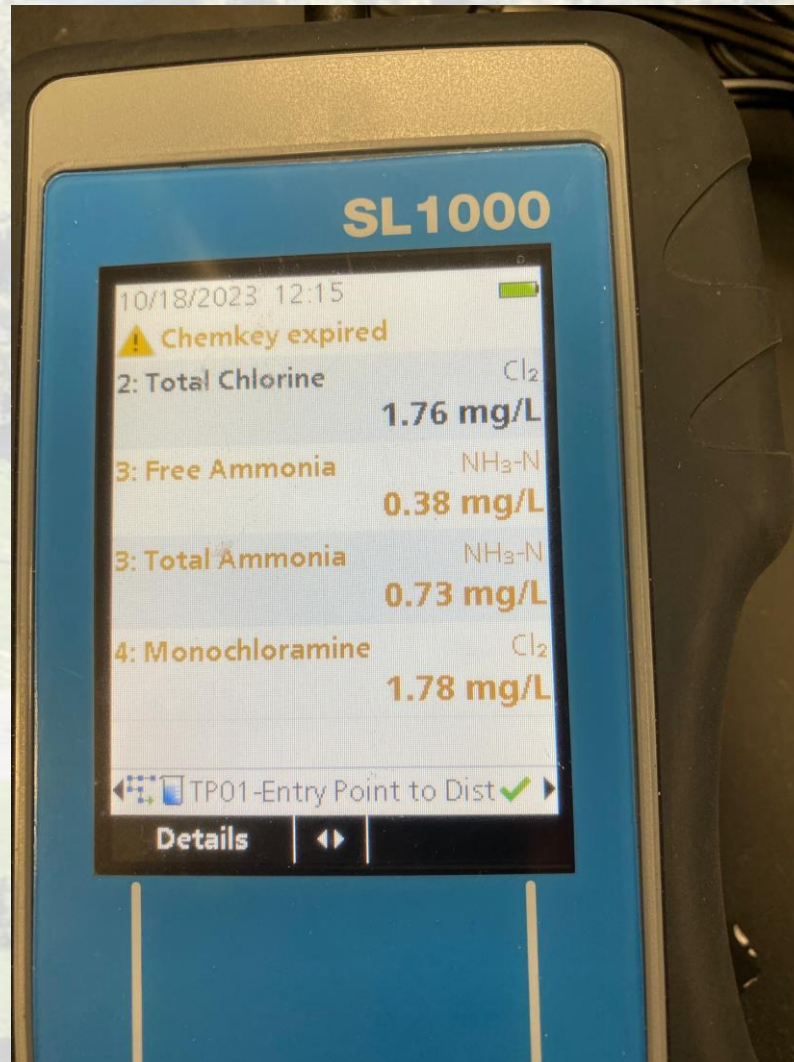
SL1000



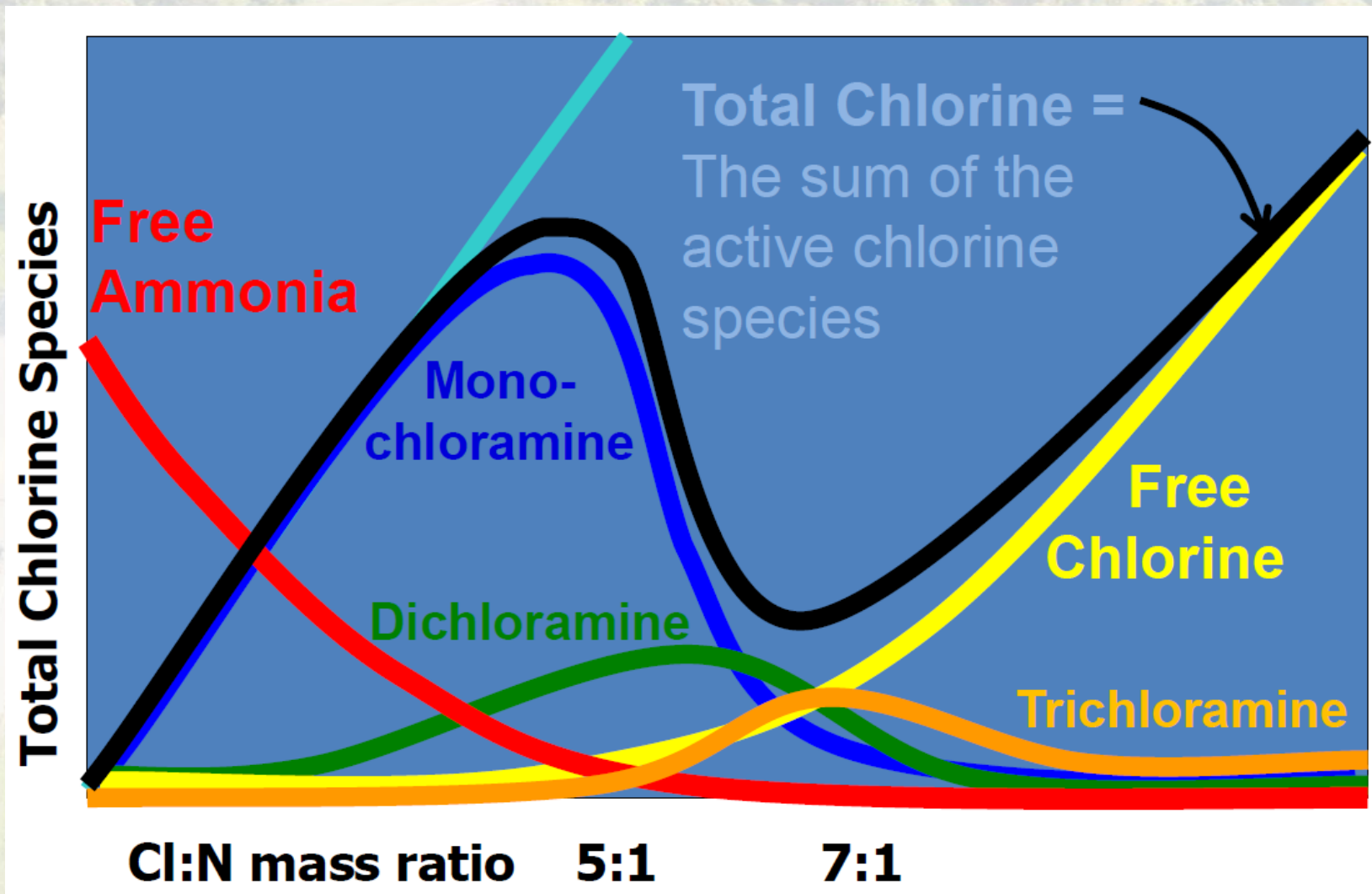
SL1000



SL1000



Breakpoint Chlorination Curve



SL1000 Results

SL1000

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Reading Log

Free Ammonia
493
Lot: 122022361
Slot: 3
Chemical Form: $\text{NH}_3\text{-N}$
0.38 mg/L
0.6429 abs
22.76 %

⚠ Chemkey expired

Exit | ⬇ | Details

ONLINE COLORIMETERS (CL-17)



ONLINE COLORIMETERS (CL-17)

Section 6 Calibration and adjustment

The calibration curve of the analyzer is set at the factory for performance to specifications. Calibration can be done for performance verification.

No user adjustments to the factory calibration curve are recommended unless required by a regulatory agency for compliance reporting purposes, or a large repair of the analyzer is done.

7.1 Maintenance schedule

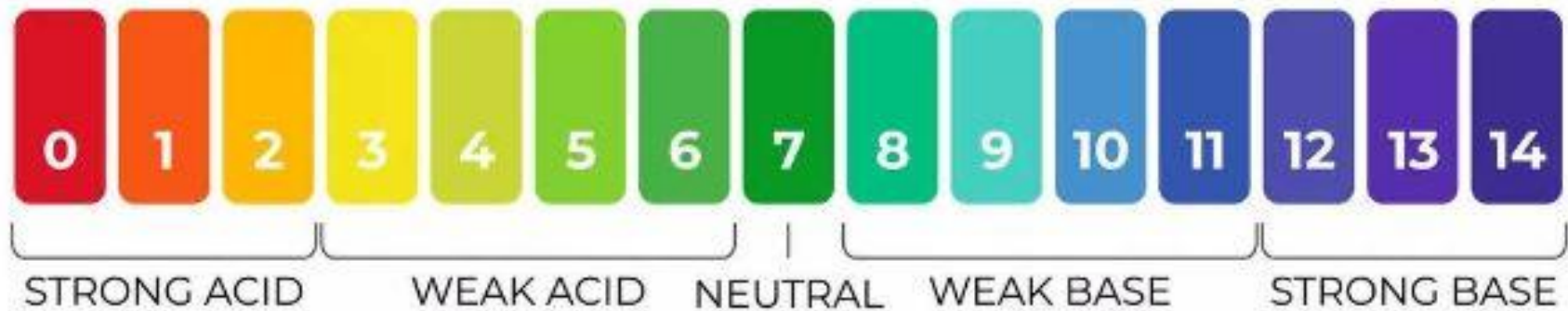
Table 6 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 6 Maintenance schedule

Task	1 month	6 months	As necessary
Clean the cell on page 20	X ²		
Replace the reagent bottles on page 21	X		
Replace the stir bar and tubing harness ³		X	
Clean the screen in the Y-strainer on page 22			X

pH

pH SCALE



pH

	pH	H+ Activity		OH- activity
acid	0	1.E+00	1	0.0000000000000001
	1	1.E-01	0.1	0.000000000000001
	2	1.E-02	0.01	0.00000000000001
	3	1.E-03	0.001	0.0000000000001
	4	1.E-04	0.0001	0.00000000001
neutral	5	1.E-05	0.00001	0.000000001
	6	1.E-06	0.000001	0.00000001
	7	1.E-07	0.0000001	0.0000001
	8	1.E-08	0.00000001	0.000001
	9	1.E-09	0.000000001	0.00001
base	10	1.E-10	0.0000000001	0.0001
	11	1.E-11	0.00000000001	0.001
	12	1.E-12	0.000000000001	0.01
	13	1.E-13	0.0000000000001	0.1
	14	1.E-14	0.00000000000001	1

pH Probe Conditioning

➤ Conditioning

- pH electrodes are shipped with the electrodes moist.
- Before first use, use the steps below to condition.

➤ Conditioning Steps

- Remove the cap or rubber boot and rinse with distilled or deionized water.
- Place the electrode in one of the below liquids for 20 minutes:
 - 3.8M or 4.0M KCl
 - 4.0 pH Buffer
 - 7.0 pH Buffer
- Rinse the electrode in distilled or deionized water. Ready for use.

pH Slope Calibration

➤ What is a pH slope?

- The linear correlation between raw voltage and a pH value

➤ Theoretical Slope

- At pH 7, the theoretical mV value should be 0 mV.
- The theoretical slope is 59.16 mV at 25 degrees C.
- So 1 pH unit lower = 59.16 and 1 pH unit higher = 59.16

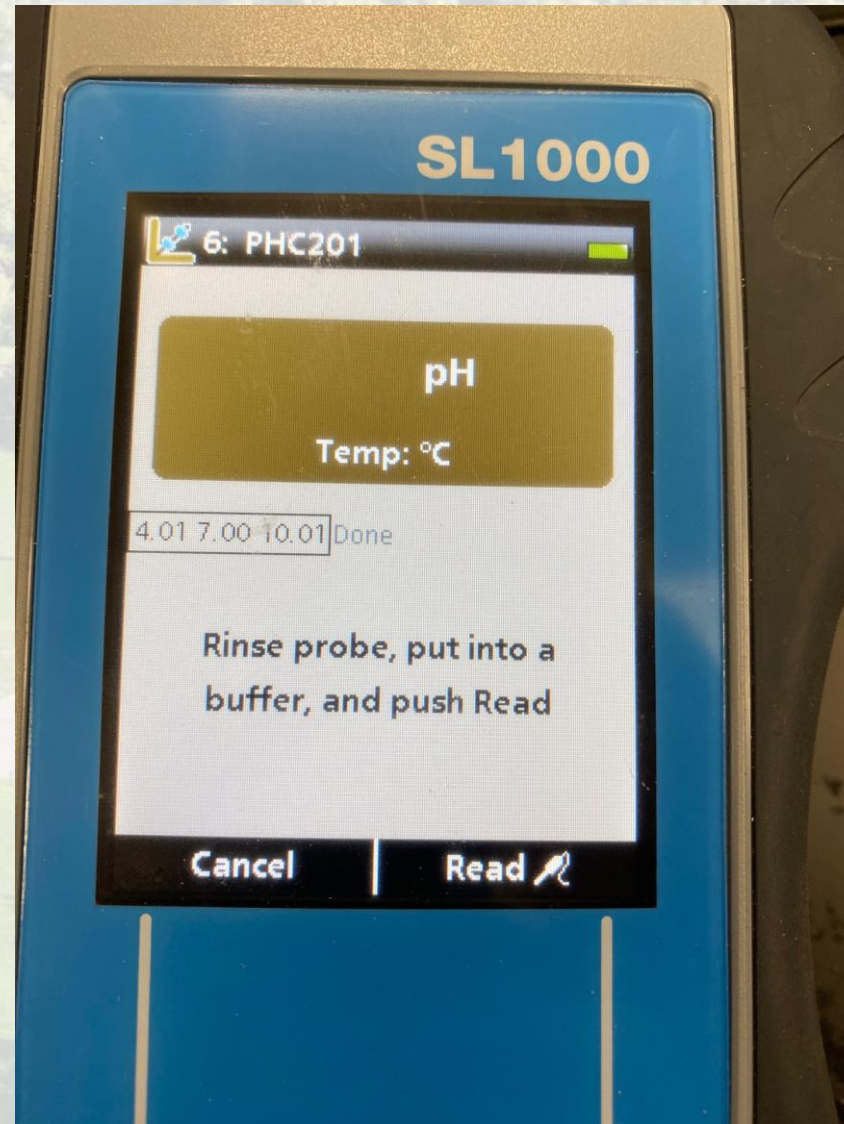
➤ Calibration

- Recommend at least a two-point slope.
- 7.0 pH buffer should be one of the points.

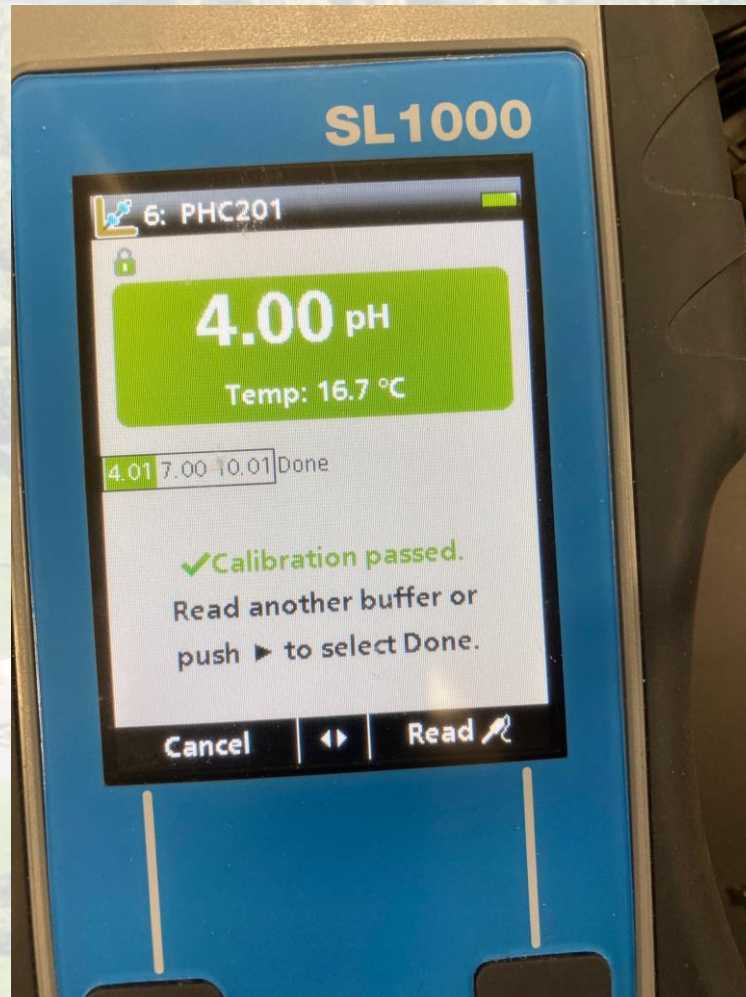
pH Probe Calibration Results

The ideal pH range for slope is 95% to 105%. However, a pH slope between 85% and 105% is also acceptable. If the pH slope is outside this range, it may be an indication that your pH probe needs replacing. Therefore, the pH slope range varies depending on how well your pH probe is working properly. Mar 14, 2023

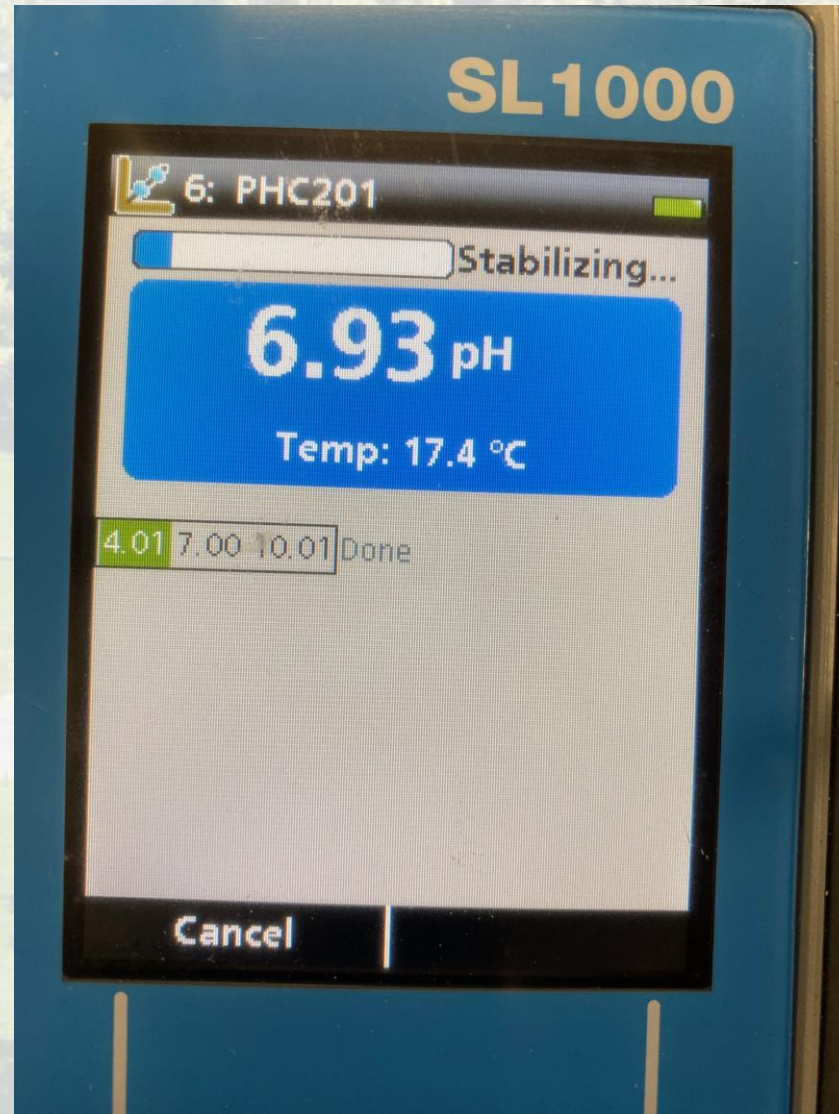
pH Probe



pH Probe



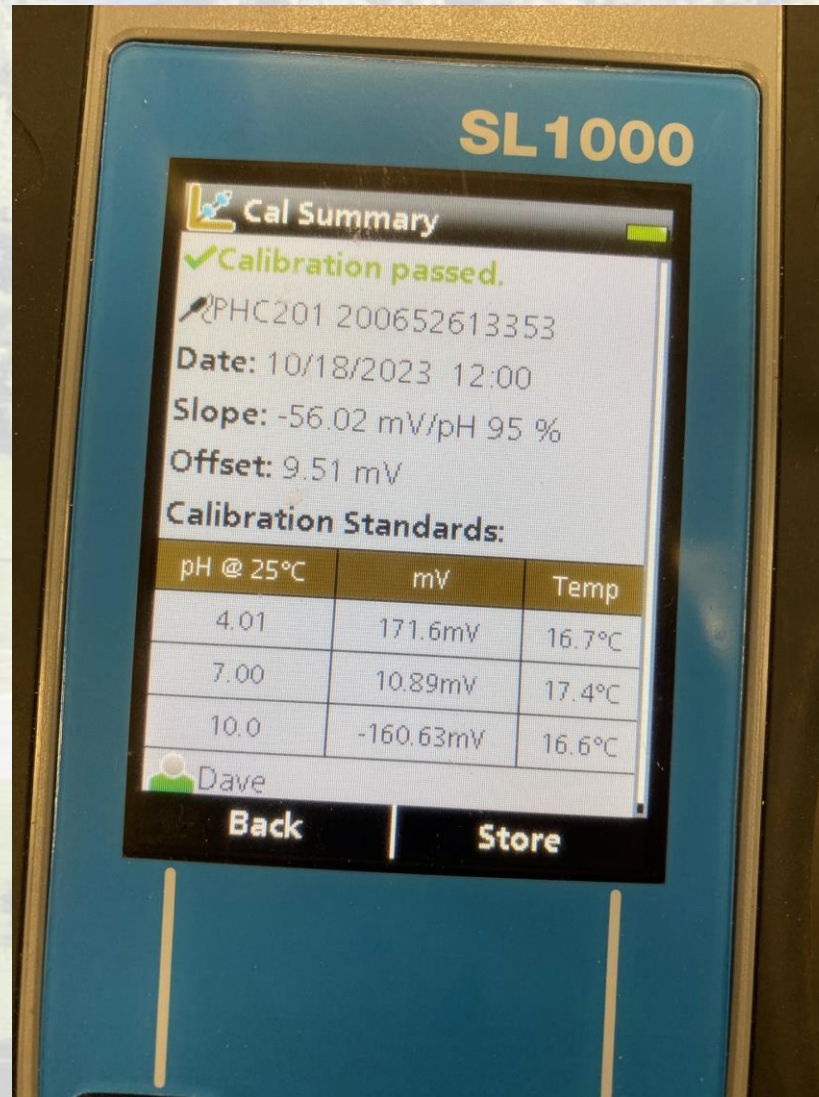
pH Probe



pH Probe



pH Probe



pH Probe Care

➤ Handling

- Rinse with distilled or deionize water between samples.
- Never wipe probe. Static charges cause erroneous readings.

➤ Filling Solution

- Fill up to the refill hole.
- Leave refill hole open when measuring to ensure flow.

➤ Storage

- Always keep moist.
- Store in 4M KCl, 4.0 pH buffer, or 7.0 pH buffer. Not DI or distilled.

Nitrate Probe



Section 10 Consumables

Note: Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Description	Quantity	Item no.
Nitrate Ionic Strength Adjustor Powder Pillows (buffer only)	100/pkg	2984799
Nitrate Ionic Strength Adjustor Powder Pillows (includes components to remove interferences)	100/pkg	4456369
Nitrate Ionic Strength Adjustor Buffer Solution (includes components to remove interferences)	500 mL	2488349
Nitrate Standard Solution, 1 mg/L NO ₃ -N	500 mL	204649
Nitrate Standard Solution, 10 mg/L NO ₃ -N	500 mL	30749
Nitrate Standard Solution, 100 mg/L NO ₃ -N	500 mL	194749
Nitrate Standard Solution, 1000 mg/L NO ₃ -N	500 mL	1279249
Wash bottle, polyethylene, 500 mL	1	62011
Disposable wipes, 11 x 22 cm	280/pkg	2097000

Nitraver Colorimetric vs Nitrate Probe

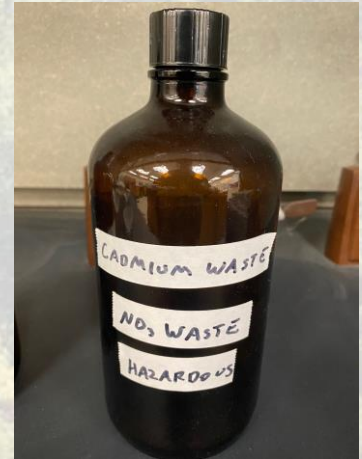
➤ Nitrate Probe

- Calibration standards don't encompass low range.
- Results tend to be erratic.

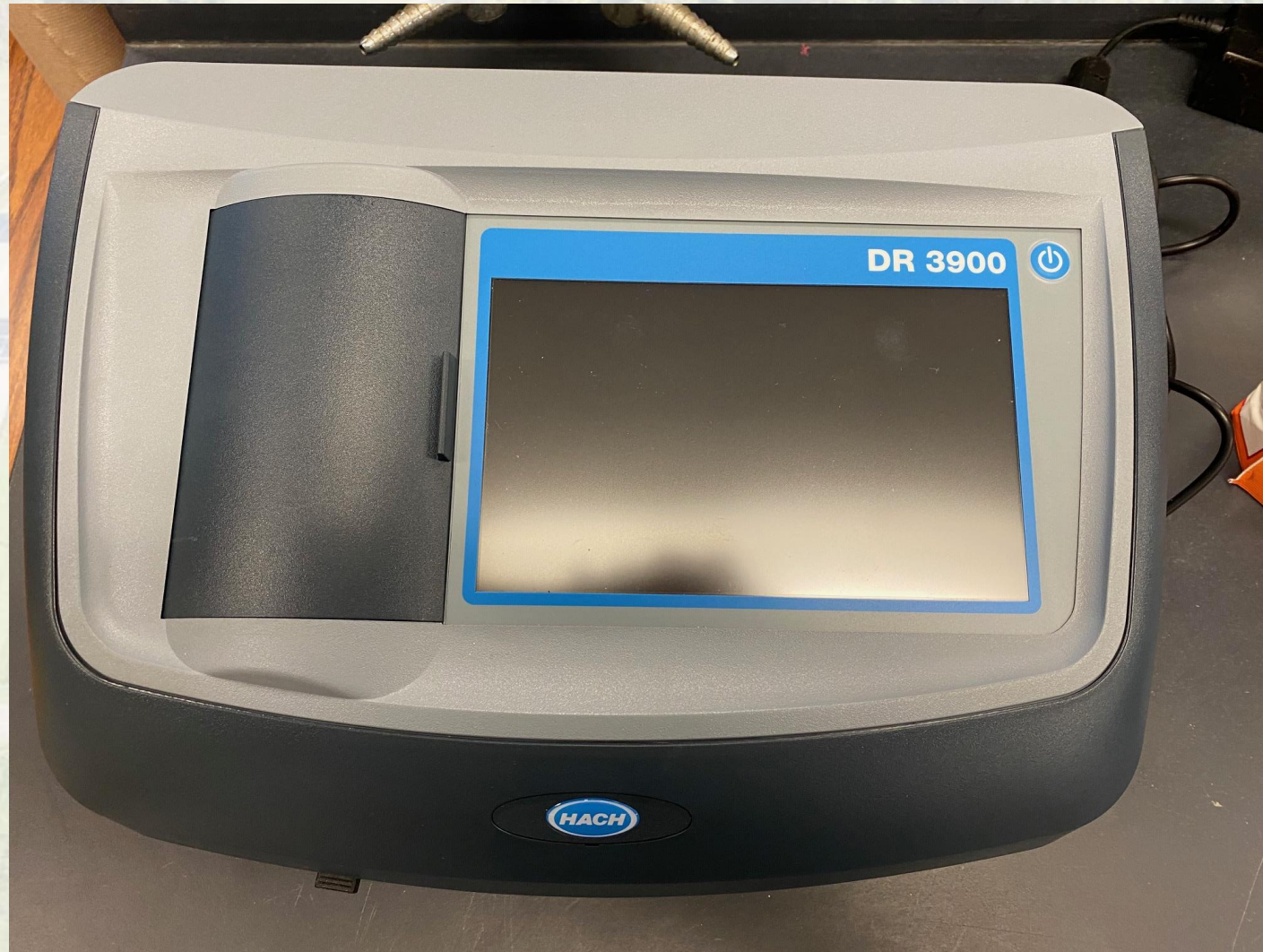
➤ Nitraver

Pollution prevention and waste management

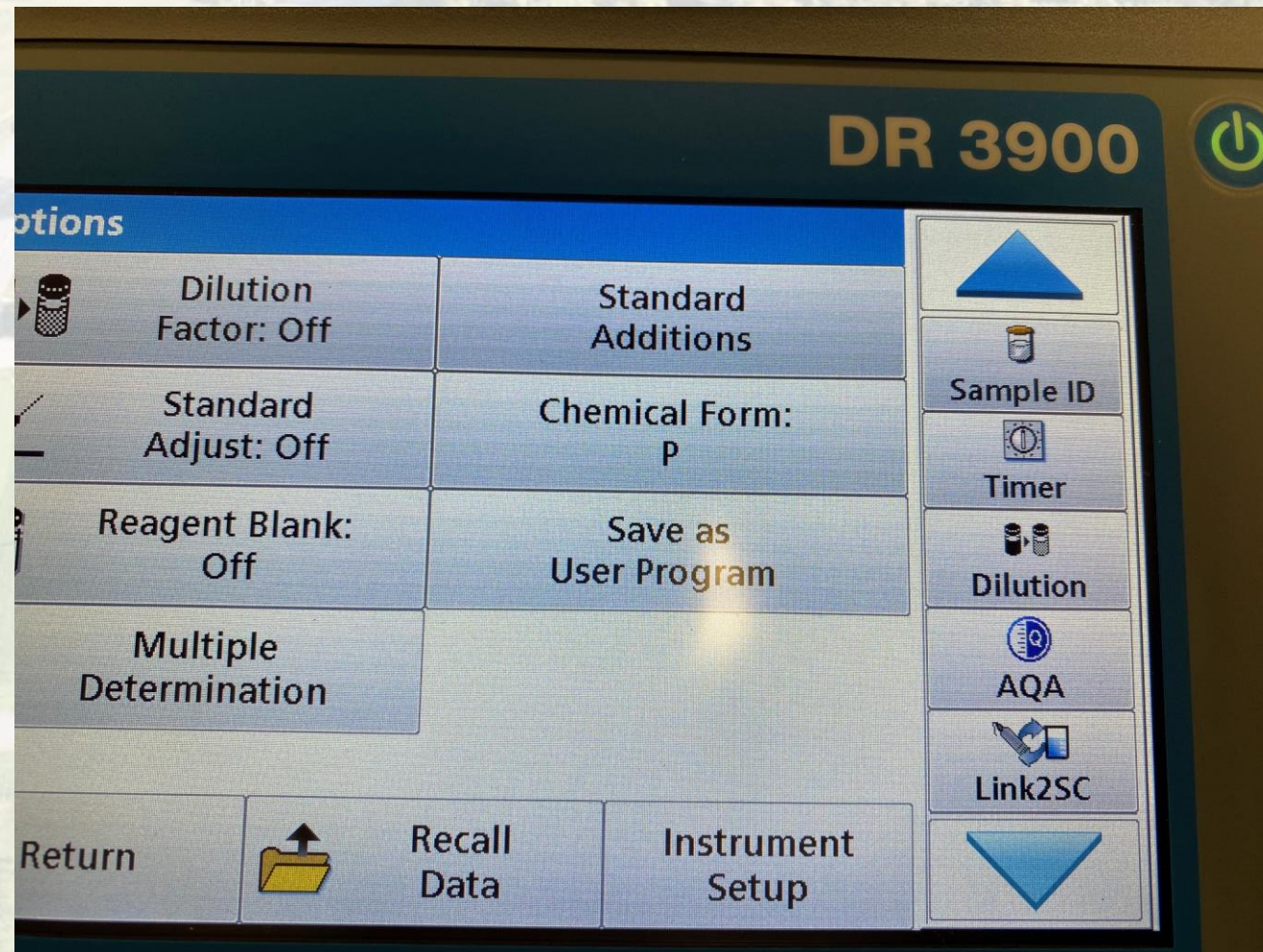
Reacted samples contain cadmium and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.



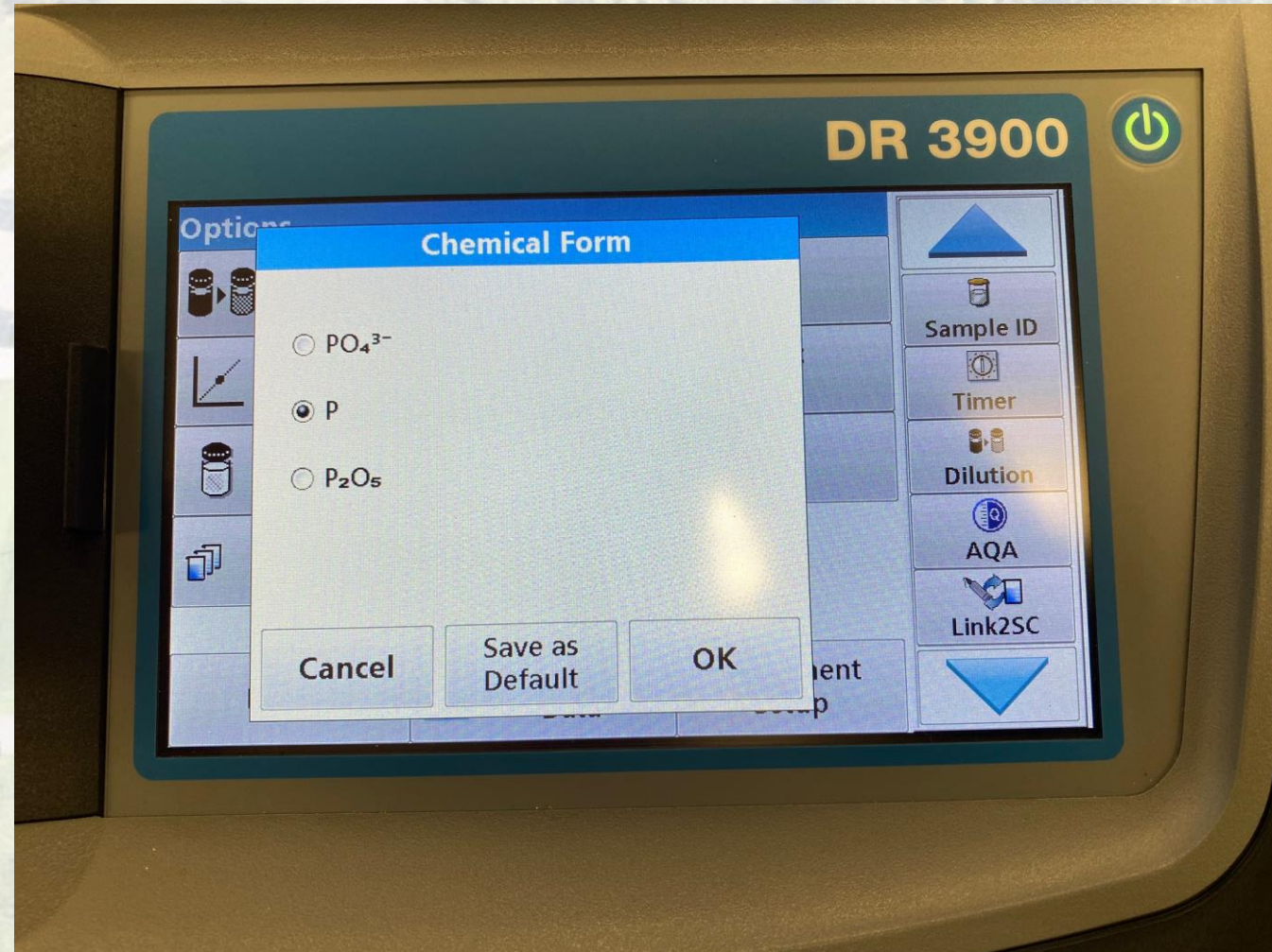
Spectrophotometers (DR 3900)



Spectrophotometers (DR 3900)



Spectrophotometers (DR 3900)





APPARATUS VARIANCE

➤ Separate Items for Each Analyte

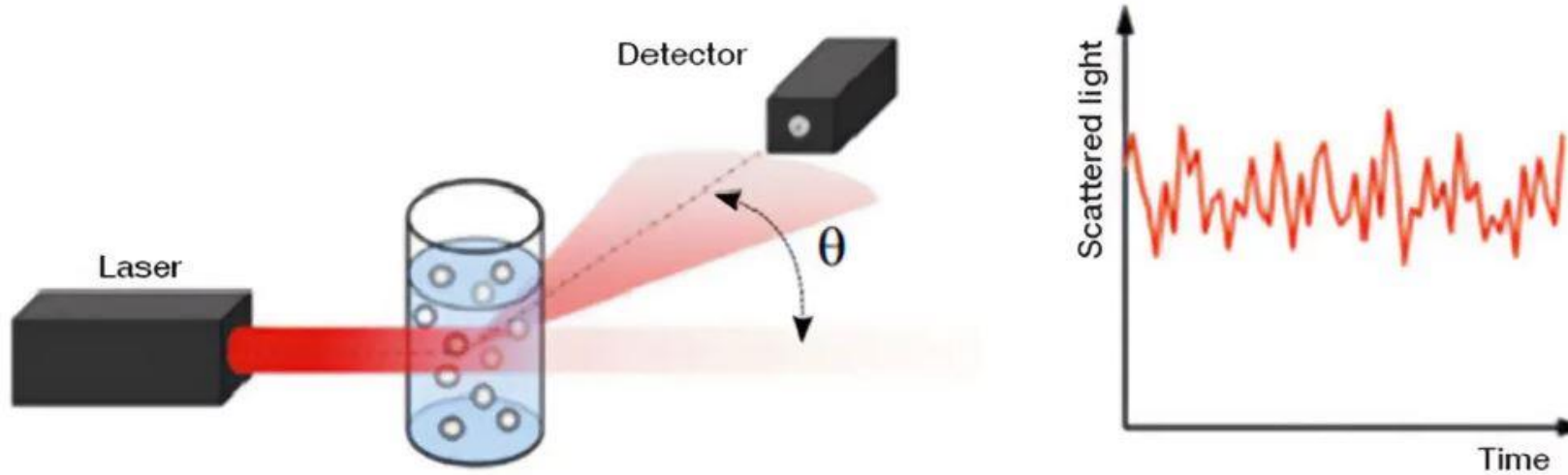
- Reagents
- Sample Cells
- Cell Orientation
- Procedures

Table 1 Instrument-specific information

Instrument	Sample cell orientation	Sample cell
DR 6000 DR 3800 DR 2800 DR 2700 DR 1900	The fill line is to the right.	2495402 
DR 5000 DR 3900	The fill line is toward the user.	
DR 900	The orientation mark is toward the user.	2401906 

Turbidimeters

2. The scattered light method



Also known as the **nephelometric method**, this measures the intensity of scattered light at 90° . This method is perfect for measuring samples with low turbidity, and both FNU and NTU can be used.

2100P Turbidimeters

1.4.4 Calibration

The 2100P Portable Turbidimeter is calibrated with Formazin Primary Standard at the factory. However, the instrument should be calibrated upon receipt for best results. Hach recommends recalibration with

16

SECTION 1, continued

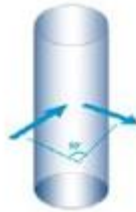
formazin once every three months, or more often as experience dictates. The Gelex Secondary Standards supplied with the instrument (included with 4650000 only) are labelled with general ranges for application, but must be assigned values before use from formazin calibration. See *Section 3.6* on page 37 for calibration instructions.

Turbidimeters



2100N/A/N

How accurate is your lab turbidimeter? And are your results repeatable?



A single detection point at 90° is prone to inaccuracy and repeatability issues.

- Sample cell needs to be indexed to get repeatable results using the same vial position
- Sample cell needs a thin layer of silicone oil to avoid measurement errors from scratches



TUS200

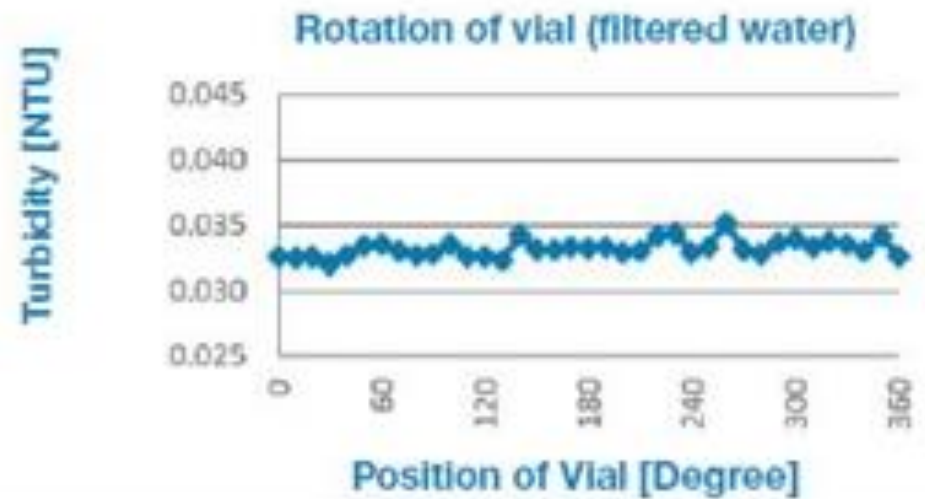
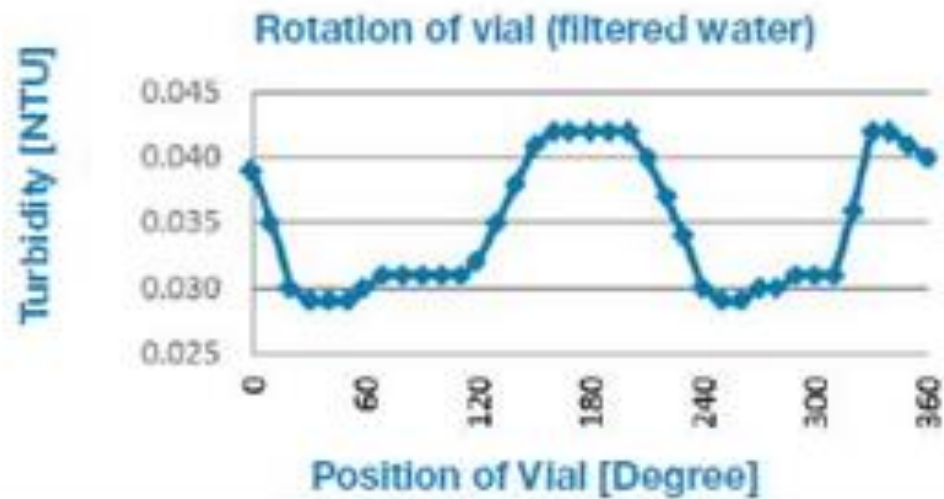
Experience more accurate and repeatable results with innovative technology



360° x 90° technology has detection points at 90° around the full radius of the vial for improved accuracy and repeatability.

- No need for indexing or application of silicone oil
- Effect of surface and position of the vial is minimized as each measurement collects data from the full 360 radii of the vial

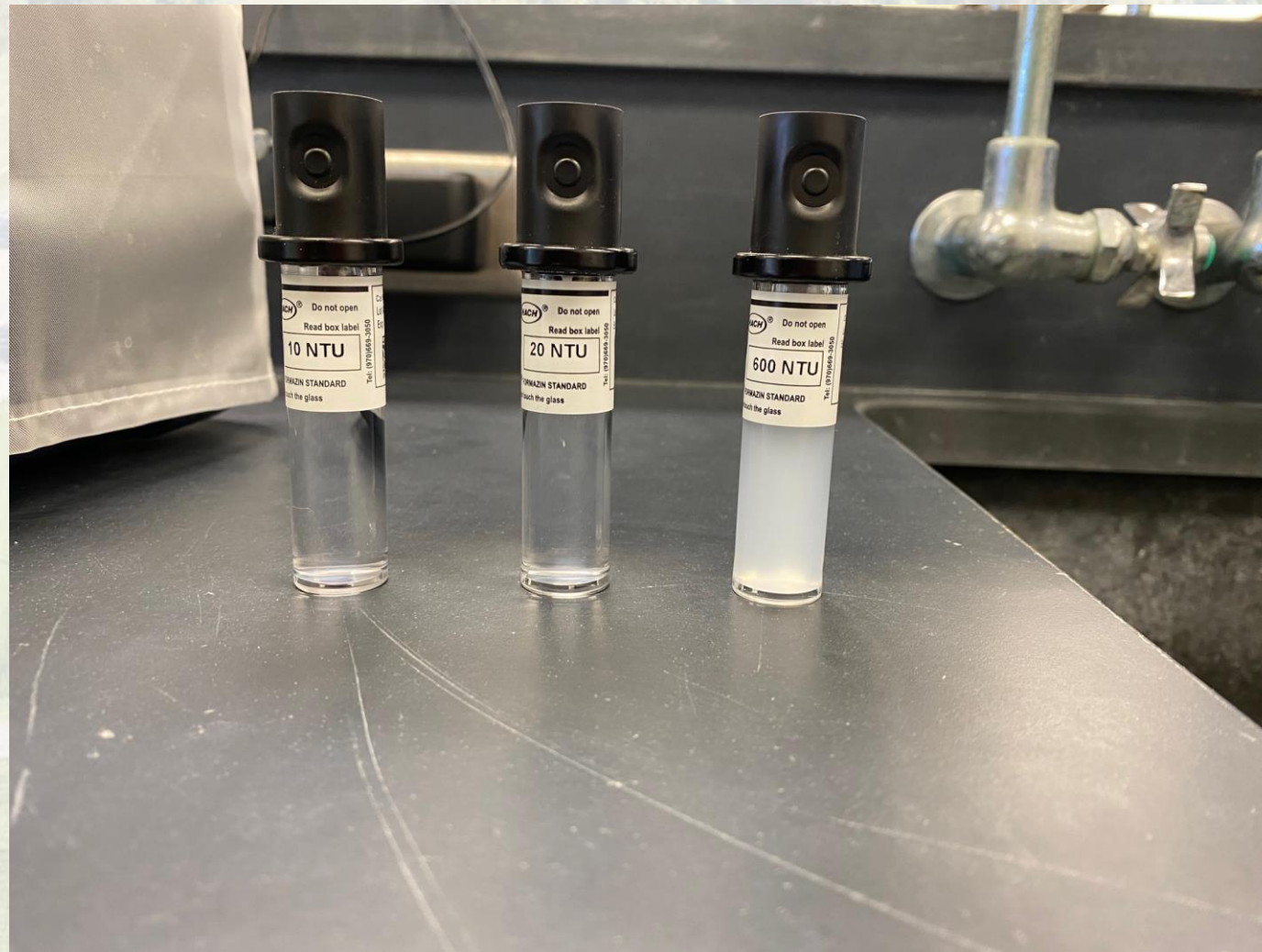
Turbidimeters



Benchtop Turbidimeters



Benchtop Turbidimeters



Online Turbidimeters



Online Turbidimeters (TU5300)

CAL CURVE²

Selects the type of standard and the calibration curve (range).

STABLCAL 0–40 FNU (default)—1-point calibration (20 FNU) with StablCal.

STABLCAL 0–1000 FNU—2-point calibration (20 FNU and 600 FNU) with StablCal.

FORMAZIN 0–40 FNU—2-point calibration (20 FNU and dilution water) with Formazin.

FORMAZIN 0–1000 FNU—3-point calibration (20 FNU and 600 FNU and dilution water) with Formazin.

CUSTOM—2- to 6-point calibration (0.02 to 1000 FNU) with StablCal or Formazin. The user selects the number of calibration points and the value of each calibration point.

STABLCAL 0–40 NTU (or 0–40 FNU) (default)—1-point calibration (20 NTU or 20 FNU) with StablCal.

STABLCAL 0–700 NTU (or 0–1000 FNU)—2-point calibration (20 NTU and 600 NTU or 20 FNU and 600 FNU) with StablCal.

FORMAZIN 0–40 NTU (or 0–40 FNU)—2-point calibration (20 NTU and dilution water or 20 FNU and dilution water) with Formazin.

FORMAZIN 0–700 NTU (or 0–1000 FNU)—3-point calibration (20 NTU and 600 NTU and dilution water or 20 FNU and 600 FNU and dilution water) with Formazin.

CUSTOM—2- to 6-point calibration (0.02 to 700 NTU or 0.02 to 1000 FNU) with StablCal or Formazin. The user selects the number of calibration points and the value of each calibration point.

Online Turbidimeters (TU5300)

CAL REMINDER

Sets the time interval between calibrations. The controller will show a reminder when a calibration is due. When a calibration is done, the calibration time is set to zero. Options: OFF(default), 1 day, 7 days, 30 days or 90 days.

QUESTIONS?

Personal Contact

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