



Be Right™

Process Instrumentation: EChem Sensors

OTCO'S ANNUAL WATER WORKSHOP
2024

Chad Csepeggi, Region Sales Manager

Introduction

- **Chad Csepeggi**
- **Regional Sales Manager - Muni**
 - Northern OH



Agenda



- How do pH & EChem sensors really work?
- Electrode care, cleaning, and calibration.
- Differential sensor regeneration.
- Installation.
- What's new.
- Your questions.



pH

So How Do These Things Work??



Nernst Equation

$$E = E_0 - \frac{2.3RT}{nf} \log a_i$$

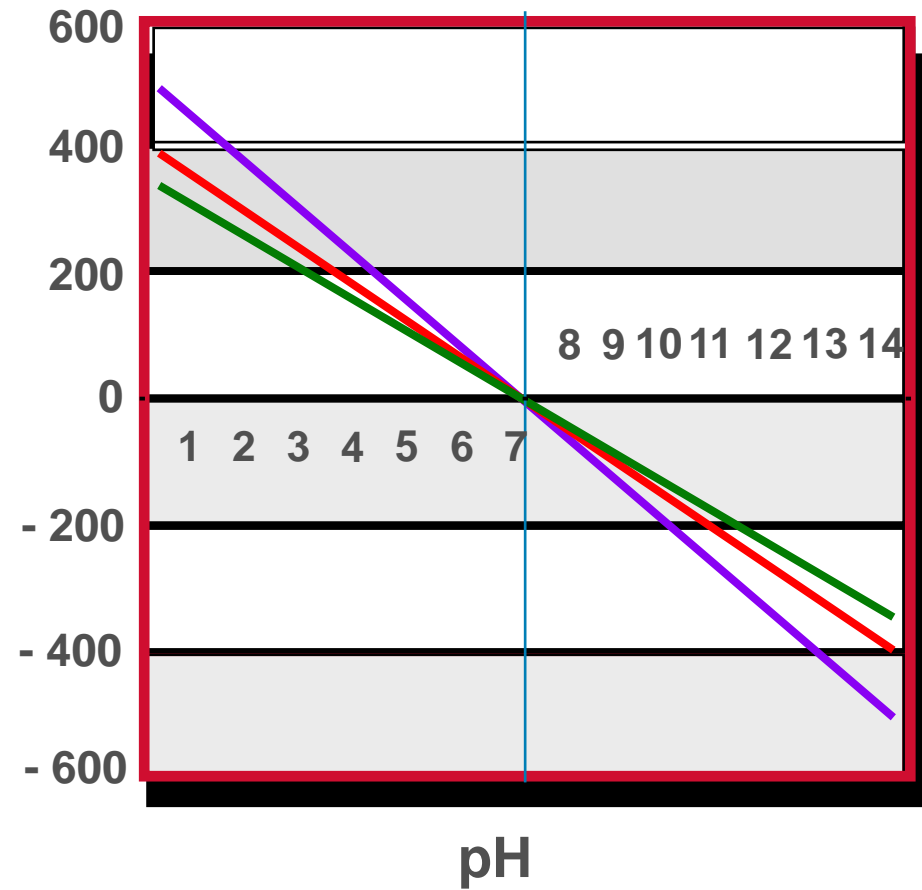
$$E = 59.16 \text{ mV per Decade}$$

@ 25°C

Temperature Effects on mV Output



mV Output



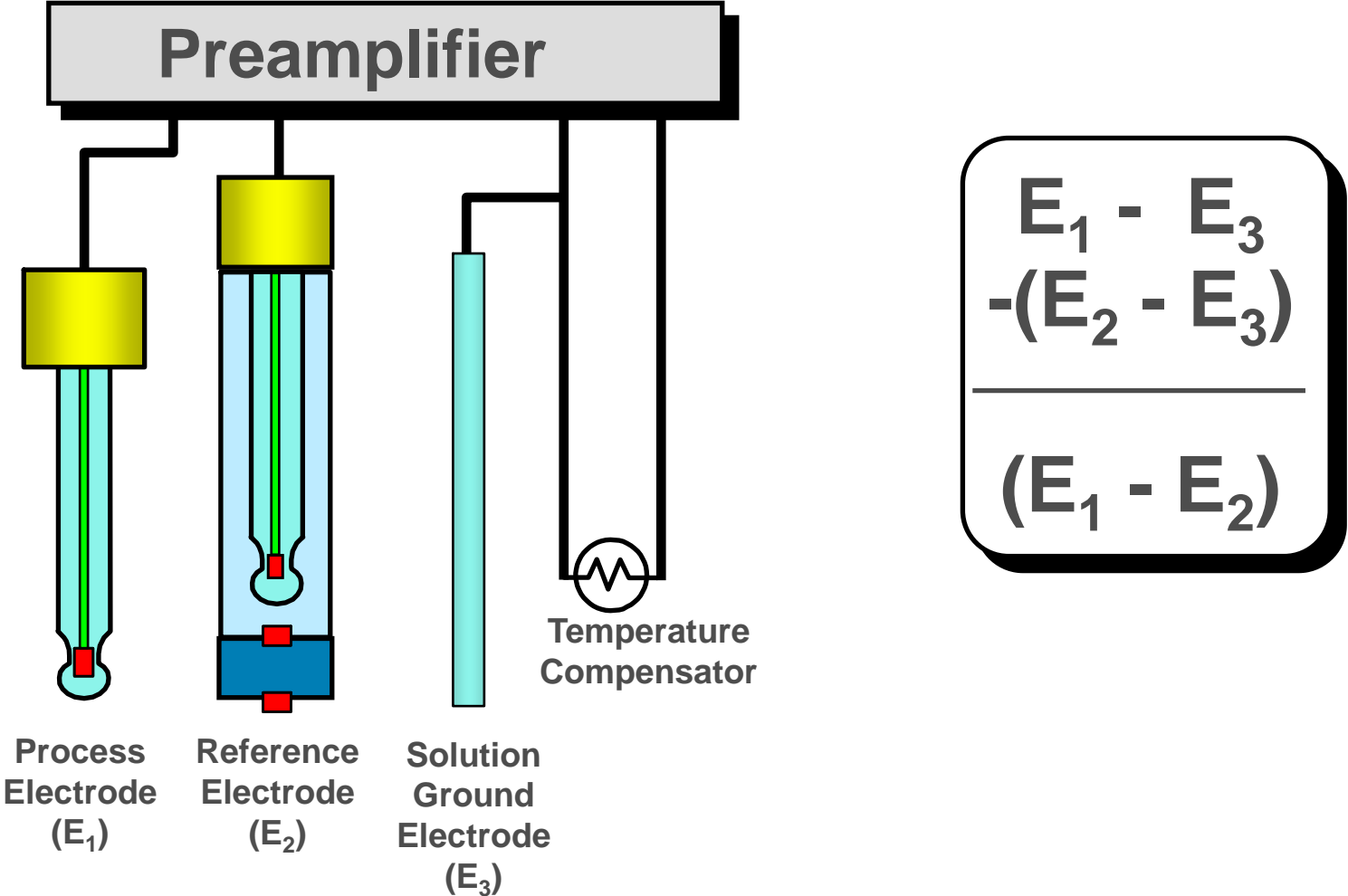
- 100°C (74.04 mV/pH)
- 25°C (59.16 mV/pH)
- 0°C (54.20 mV/pH)

pH Measuring Electrode Typical Problems



- pH membrane coating
- Slow response due to high impedance
- Abrasion and/or breakage
- Temperature shock

Hach's Patented Differential Sensor



Electrode Maintenance

Care of pH Electrodes

Transportation



Care of pH Electrodes - Storage



- Store between 10 and 30 degrees C
- Use protective caps
- KCL or pH 4 buffer solution

Care of pH Electrodes

Dehydration

- Slow response
- High glass resistance



Detrimental factors to electrode life

- Heat
- Cold
- Vibration



Sensor Cleaning



Remove contaminate buildup

Sensor Cleaning

Hach

Recommends using:

4 pH buffer solution or weak acid.

To clean the probe



Sensor Cleaning



- Clean electrode surface
 1. Rinse with water
 2. Soak in 4 pH buffer
 3. Clean with soft toothbrush
 4. Rinse with water
- Wipe probe dry with Kim wipe.

Sensor Cleaning



- Rinse and Calibrate

Sensor Calibration and Verification



pH Sensor Verification

Verification should be performed using buffer solutions

- Rinse with clean water and dry gently lint free lab cloth.
- Place the sensor in 7pH buffer, rinse with clean water and dry gently lint free lab cloth, then place it in the 4pH buffer.
- If the sensor is reading the buffers correctly you do not need to recalibrate.

pH Sensor Calibration

- Clean the sensor
- Calibration keystrokes will depend on analyzer used
- A two-point buffer calibration preferred
- 7 and 4 pH calibration is ideal

pH Sensor Verification



If verifying using a hand-held or portable meter

- Calibrate both the portable/handheld and the online system side by side in the same buffer solutions.
- Verify that both units slope fall within manufacturer specifications
- Be realistic with your expectations.

Hach's Differential On- Line pH Sensor Regeneration



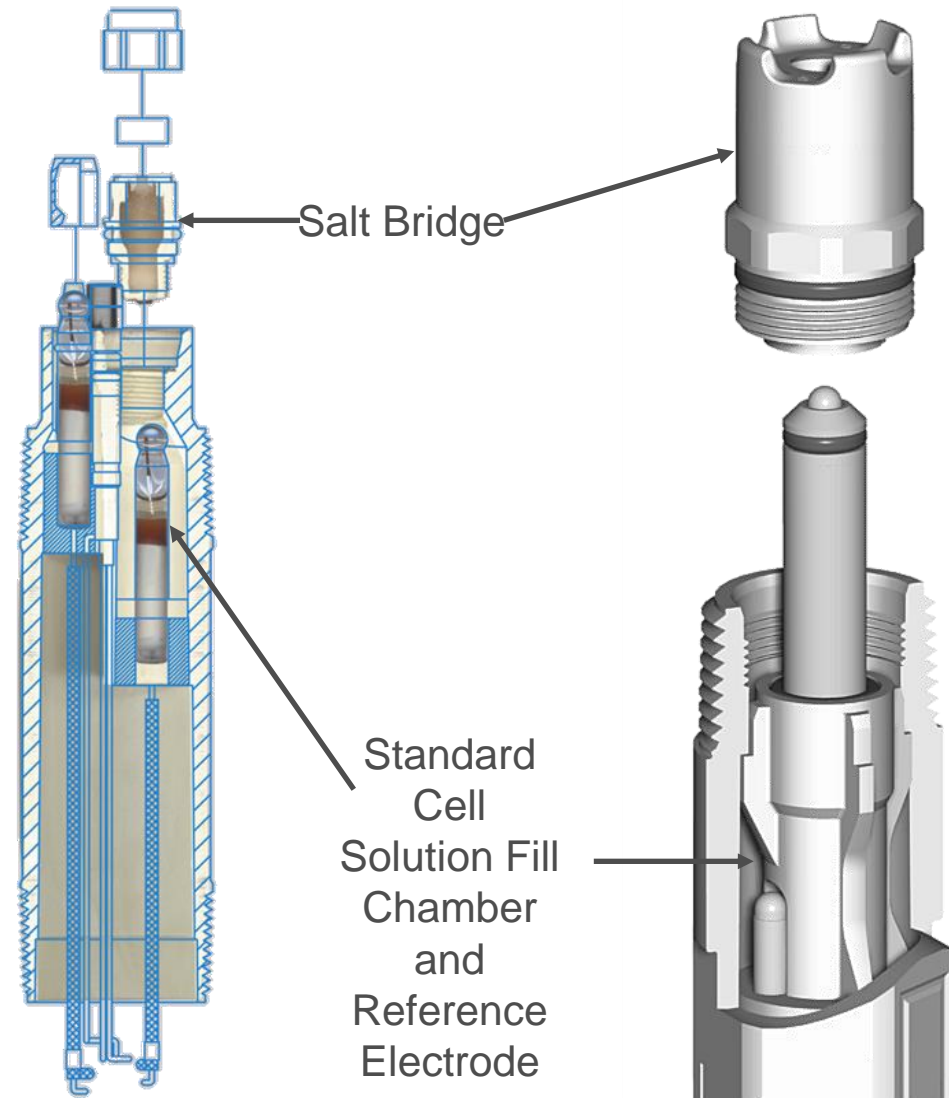
Maintenance for pH Sensors



What is a Salt Bridge?

- A double junction barrier between the process and the standard cell solution. This barrier extends the time between calibrations and reduces maintenance requirements

“Inside” Hach’s Differential pH Sensors



Maintenance for Differential pH Sensors



What is Standard Cell Solution?

- Standard cell solution is highly concentrated pH 7 buffer. A 100 to 1 dilution would represent a change in measured pH of only 0.05 units.

Frequency of Salt-Bridge/Standard Cell Solution Maintenance



How often do I need to change the salt-bridge and reference solution on the pH/ORP sensors?

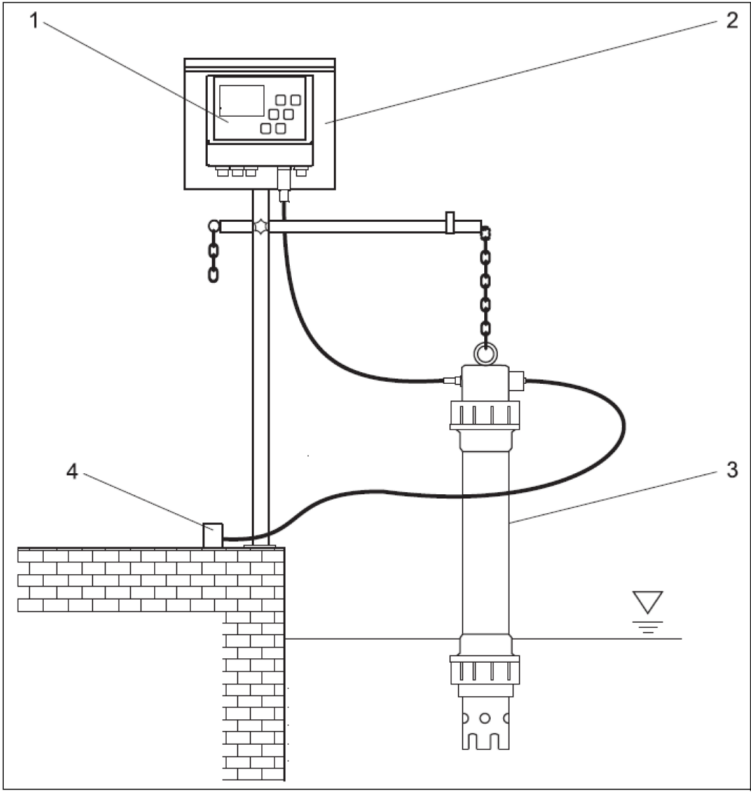
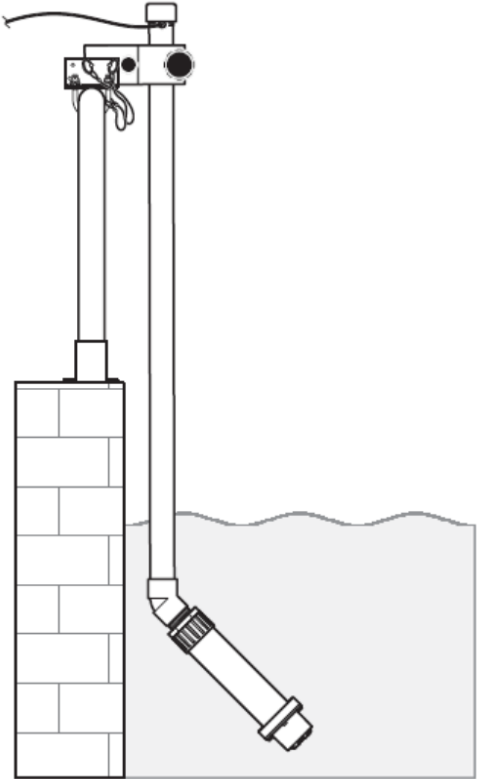
- This is process dependent, but generally at least twice a year.

What are the symptoms indicating the Salt-bridge/standard cell solution need to be changed?

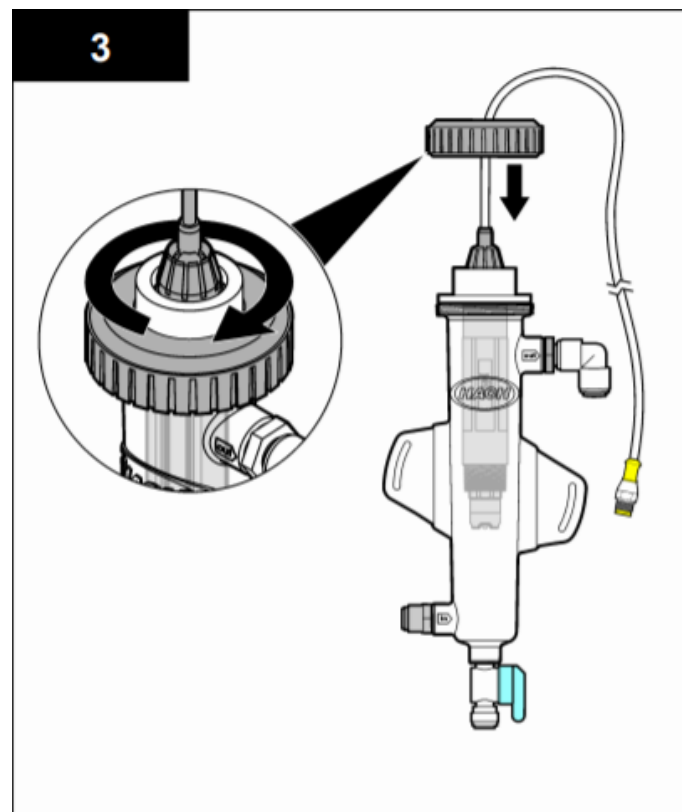
- System quickly goes out of calibration.
- The offset is greater than +/-20 mV.

Installation

Mounting Is Important



What's wrong with this picture?





Easy to calibrate?



It may be useful to be in contact with the water

Whats New

1. Hydrogen Sulfide
2. NT3100 Nitrate Probe
3. CL17sc
4. ULRCL17sc
5. sc4500
6. Panels

What are the Risks of H₂S?

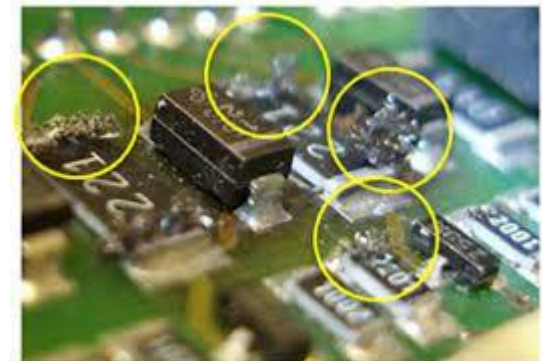
Safety



Odor Nuisances

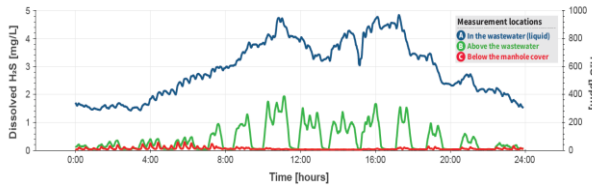


Asset Corrosion



The Importance of Measuring H₂S in Wastewater

Pinpoint Hazards



- *Identify risks* in areas prone to H₂S accumulation

Prevent Complaints



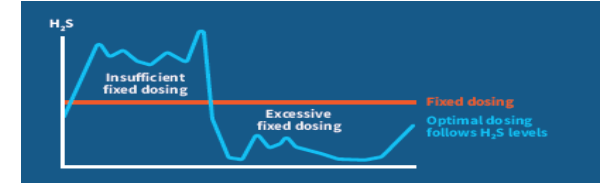
- *Neutralize odors* before they cause complaints

Protect Assets



- *Prevent damage, failures, and operational upsets*

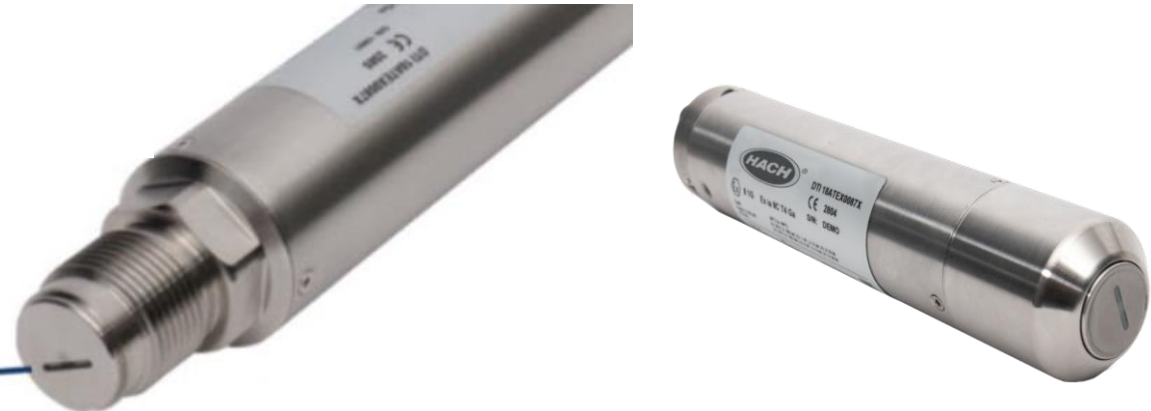
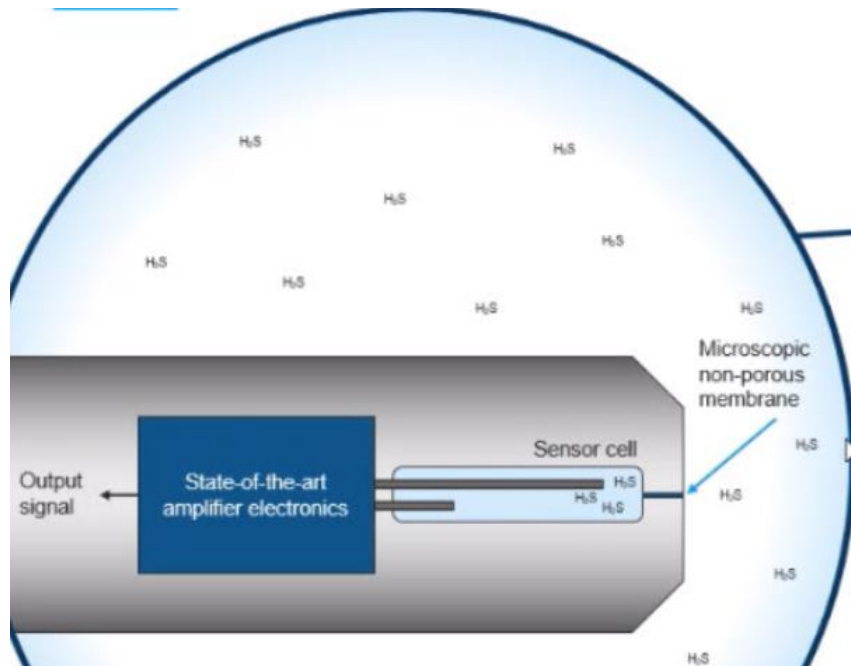
Optimize Chemical Use



- *Minimize excess chemical treatment* upsetting critical downstream biological treatment processes and wasting \$\$

GS1440/GS2440EX Hydrogen Sulfide Sensors

Principle of Measurement



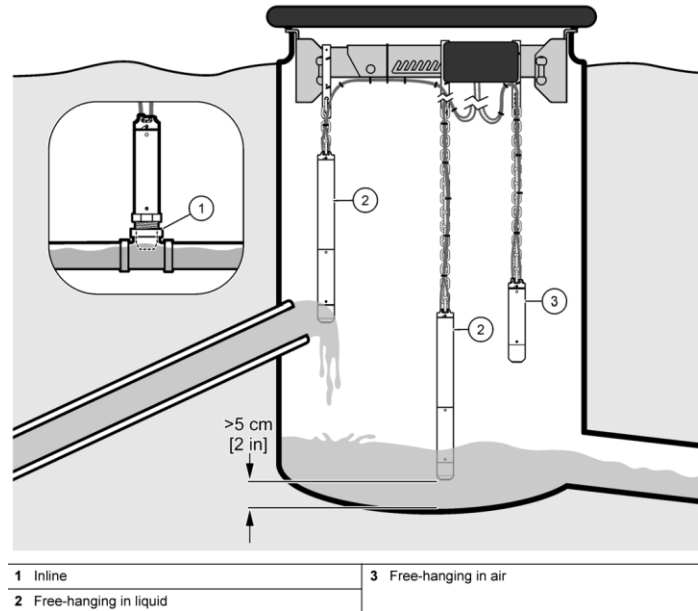
Microelectrochemical sensors

- ✓ Sensors measure H_2S partial pressure
- ✓ Insensitive to flow; Temperature compensated
- ✓ Measures in gas, providing readings in ppm with known barometric pressure
- ✓ Measures in liquid, providing readings in either μM or mg/L by using Henry's Constant and the molar weight
- ✓ Tolerates changing environments

Features of GS1440/GS2440EX H₂S Sensors

- **Installed via:**

1. Immersion
2. Insertion
3. Side-stream (Air Flow Cell)



H₂S Measurement Applications

Collection Systems

Manholes



Portable



Lift Stations



Fixed



WWTP's



- Headworks
- Primary Clarifiers
- Aeration Tanks
- Odor Scrubbers

GS1440 vs GS2440EX



GS1440

Is **EXCLUSIVELY** dedicated to non-hazardous areas

GS2440EX

Can be used in hazardous area

- Class 1 Division 1
- Class 1 Zone 0
- ATEX and UKEX
- IECEx

NO VISUAL DIFFERENCE BETWEEN BOTH SENSOR EXCEPT THE LABEL
(different part number / naming)



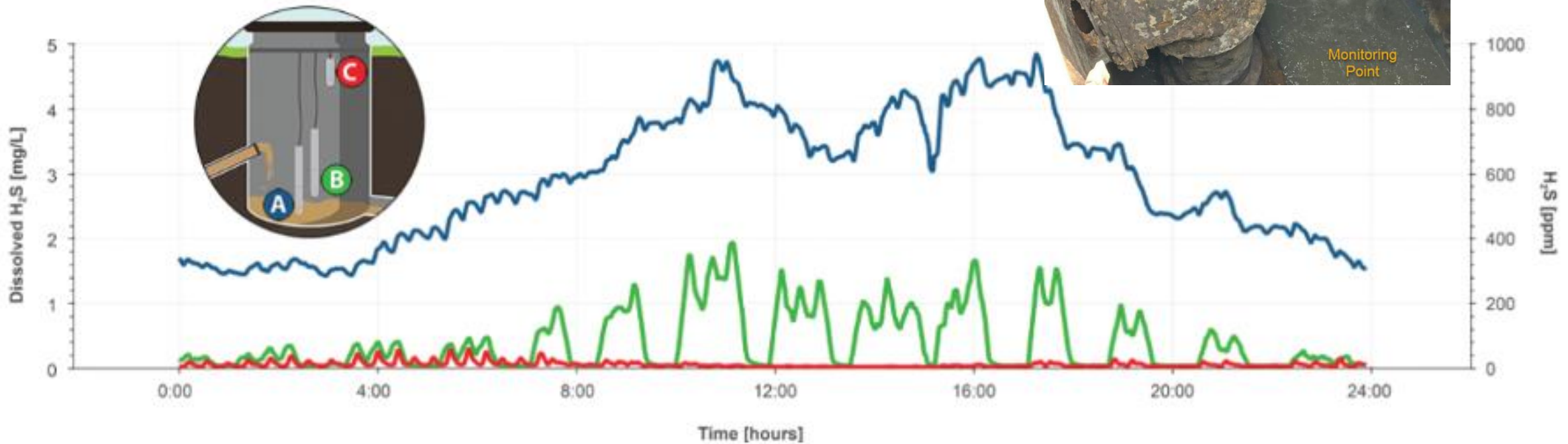
Hazard Classification is defined by customer, not by Hach

Caution: Hach H₂S Sensors Not Primary Safety Devices

- The GS1440 and GS2440EX sensors are designed to monitor H₂S concentrations in gas or liquid and serve as process instrumentation only
- These sensors are not designed or certified to protect humans from exposure to unsafe levels of H₂S
- Manuals for the sensors and field transmitters contain the following warning:

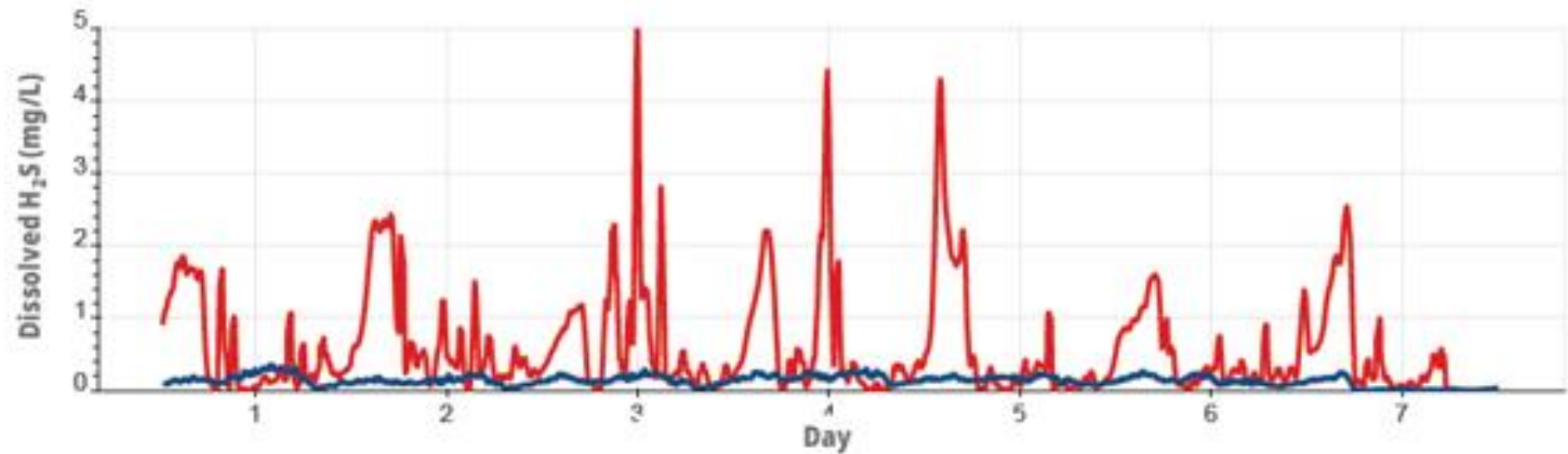
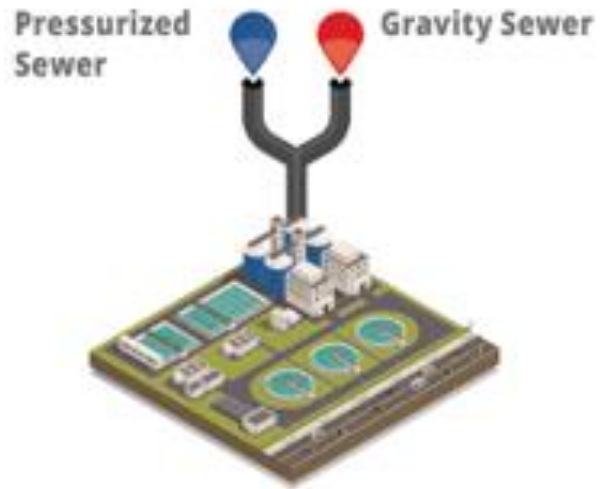
▲ DANGER	
	Do not use the GS1440 or GS2440EX sensor as a safety device to identify the hydrogen sulfide concentration in an area. Obey all applicable regulations and occupational health and safety precautions before entry into confined spaces and toxic hazard environments. Get advice from the occupational health and safety department at the workplace or the government regulatory body to identify the possible hazards and safety standards.

Application Example



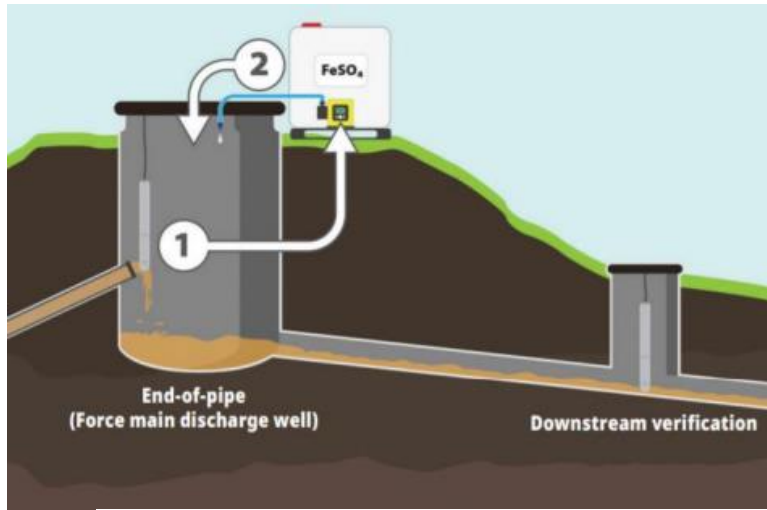
- A: Liquid-phase; B: Vapor-phase just above liquid level; C: Vapor-phase at top of manhole
- Liquid-phase: Demonstrated higher sensitivity, captured peak H₂S concentration events
- Gas-phase: Struggled to capture peaks unless influenced by turbulence from pumping activity

Application Example



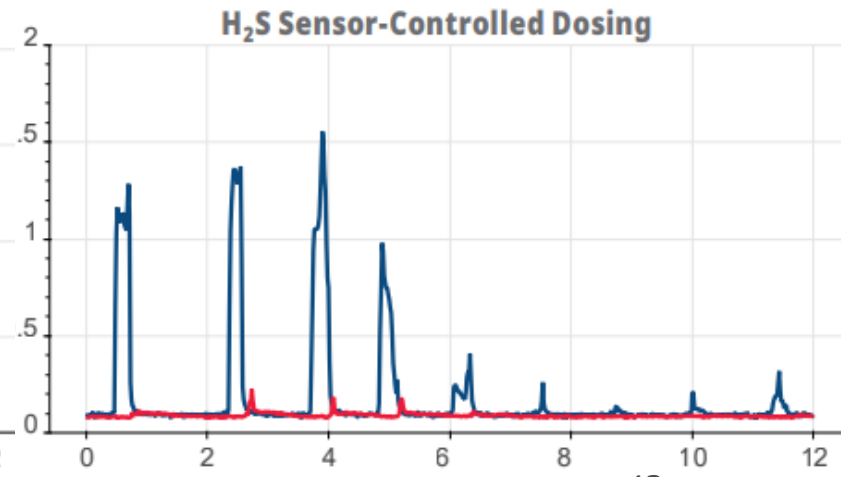
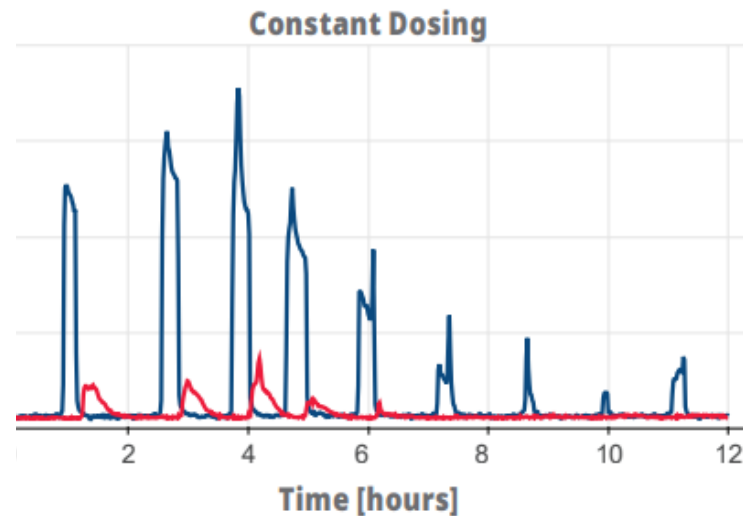
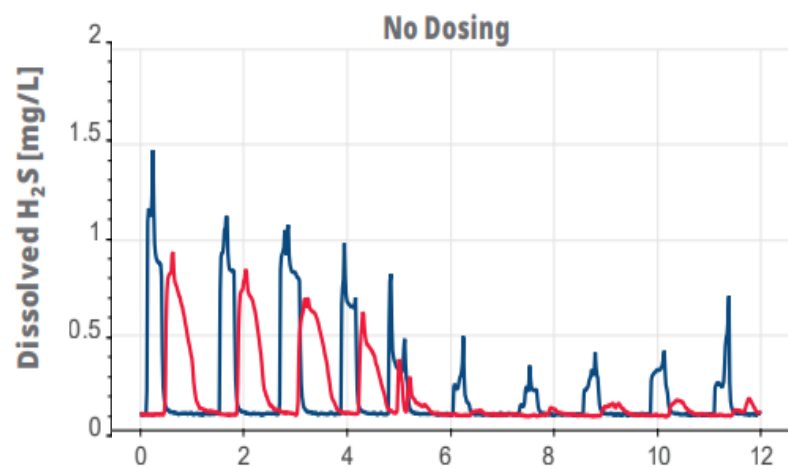
- Sensors showed impact that different types of collection systems have on H₂S concentration
- Both graphs reflect liquid measurements

Measuring Liquid-Phase H₂S in Dosing Strategy



- An H₂S measurement to pace ferrous sulfate chemical dosage improves system efficiency compared to a constant dosing strategy – 1.2 km pipeline.
- Use feed-forward or feed-back

■ End-of-Pipe
■ Downstream Verification

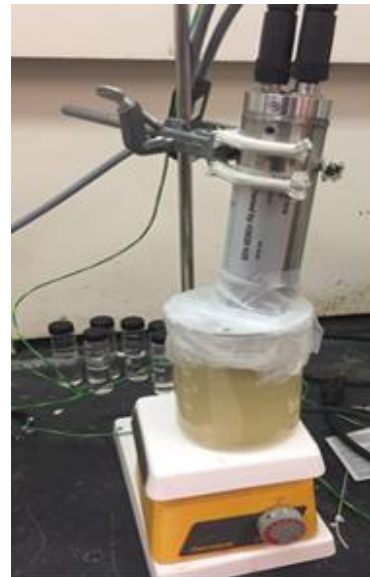


H₂S Measurement Comparisons – Sulfide (Method 8131, 10254)

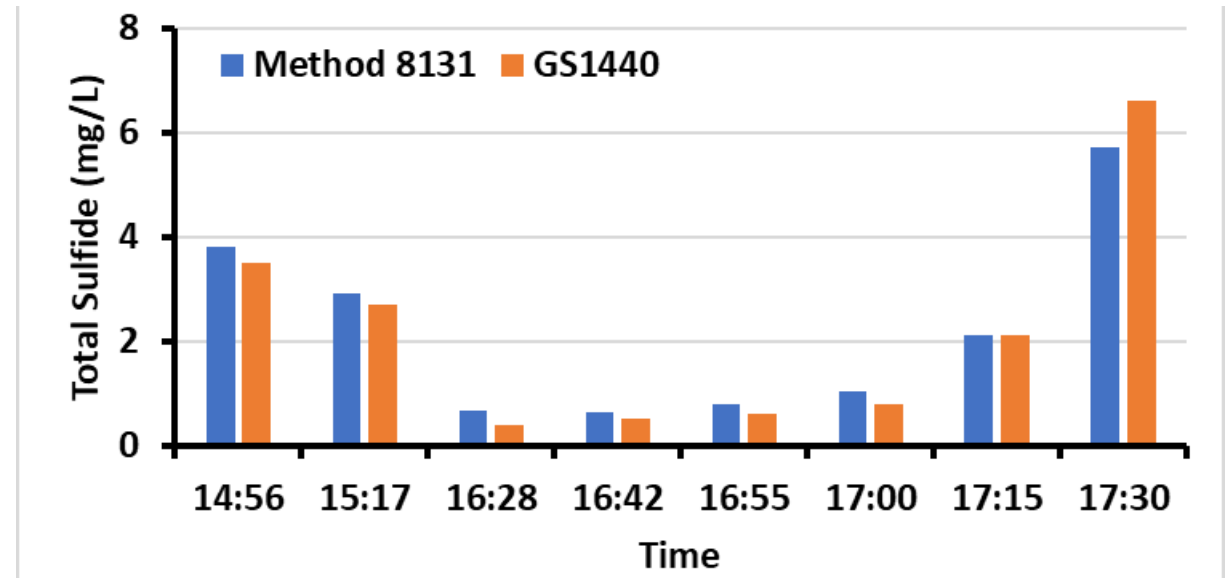
- Buffered with 50 mM phthalate (high buffer capacity), pH 4.01
- Parafilm over sample beaker, reducing loss of H₂S
- Converts all dissolved sulfide to H₂S -> detectable by GS1440/GS2440EX



Sensor calibration with sulfide standard



Sample measurement

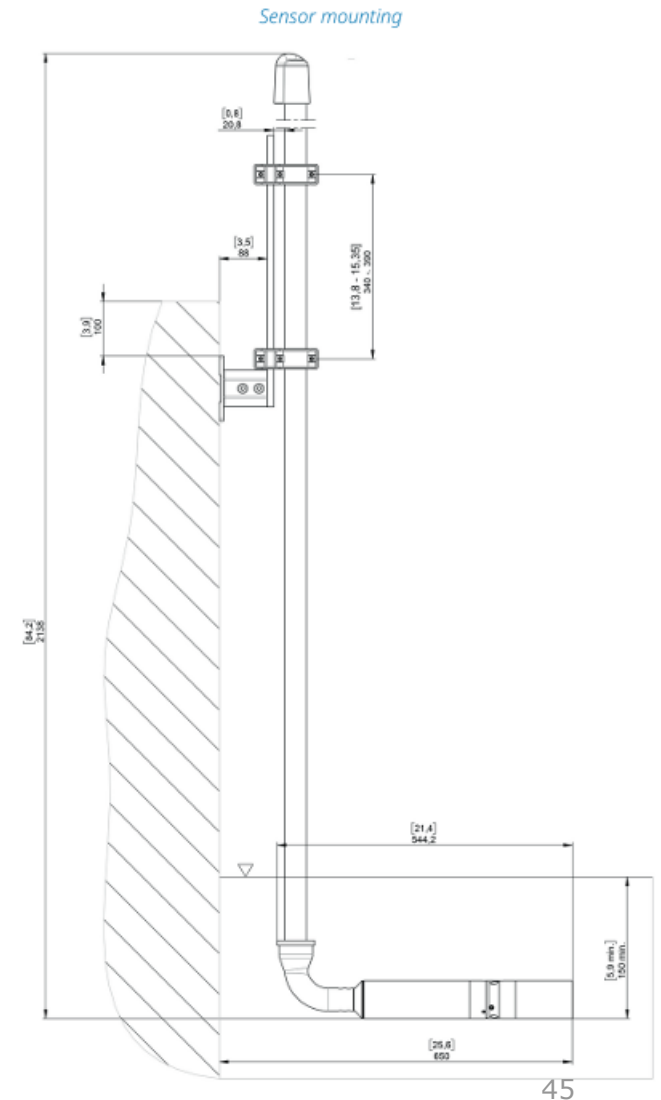


Nitrate Probe - Optical

- Hach's NT3100 Nitrate Probe (Updated Nitratax)
- Nitrate dissolved in water absorbs UV light at wavelengths below 250 nm
- Probe photometrically determines NO_3 without reagents
- Double-sealed stainless-steel housing
- Response time = 1 min



NT3100sc UV Nitrate Sensor	
	1,2,5 mm path length
Measuring Range	0.1 - 90 mg/L $\text{NO}_3\text{-N}$ (1mm)
	0.05 - 50 mg/L $\text{NO}_3\text{-N}$ (2mm)
	0.02 - 25 mg/L $\text{NO}_3\text{-N}$ (5mm)



CL17sc Colorimetric Chlorine Analyzer



MEASURING RANGE



Free or Total Chlorine
0.03 to 10 mg/L

Mounting



Wall Mount; Climate
Controlled
environment

Flow Rate

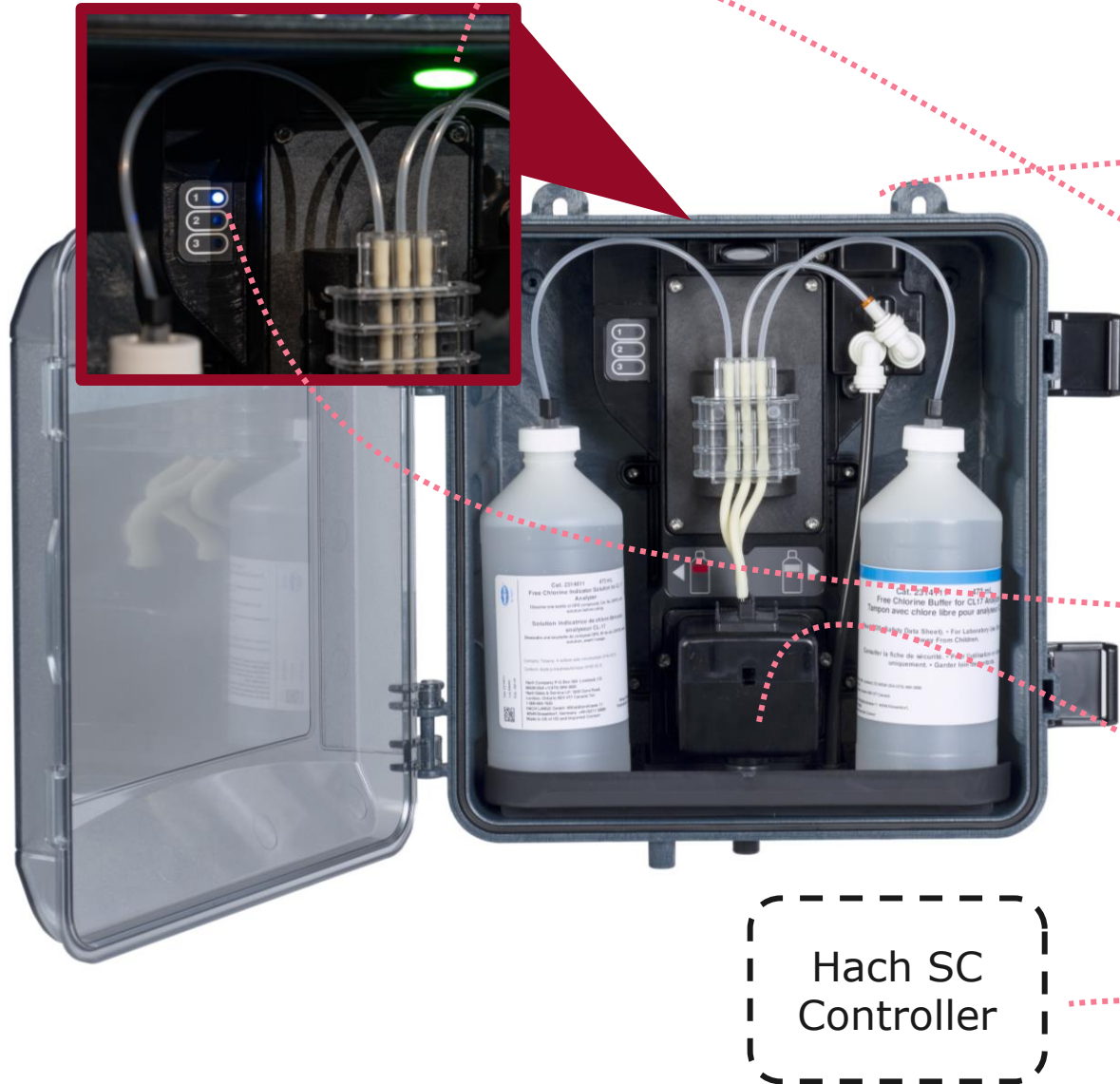


60 – 200 mL/min
through instrument.
~1 L/m to the
standpipe

**Measurement
Cycle Time**

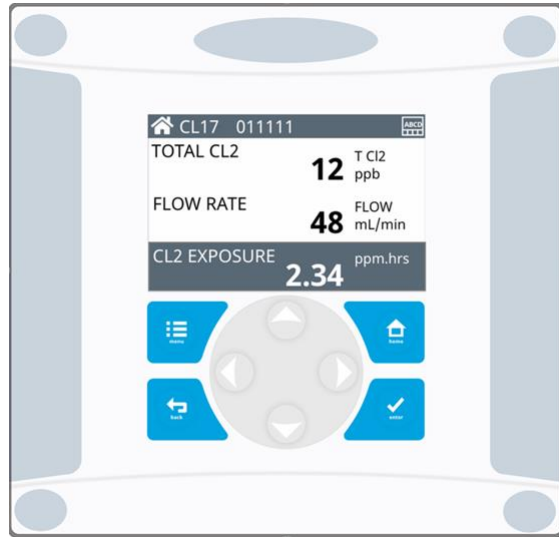
2.5 min

Features of the CL17sc—Diagnostics



- ❏ A **BUILT-IN FLOW METER** provides real-time flow readings (mL / min) on screen, addressing the most common troubleshooting issue with process analyzers: proper sample flow.
- ❏ A **THREE-COLOR STATUS LIGHT** gives immediate feedback—even from across the room—on the instrument's operating status.
- ❏ **MEASUREMENT CYCLE LIGHTS** show which stage of the measurement the analyzer is performing at all times. No more wondering whether the analyzer is flushing sample, mixing reagents, or taking a measurement.
- ❏ A **COLORIMETER WINDOW** allows for additional visual verification that the instrument is working as intended.
- ❏ **ON-SCREEN DIAGNOSTICS MENU** provides quick identification of warnings and errors.

Ultra Low Range CL17sc – Total Chlorine Analyzer



- ❏ A **LIMIT OF DETECTION** of 8 parts per billion means you can take precise control of your dechlorination process
- ❏ A **PARTS PER BILLION** reading gives you confidence to make quicker decisions relative to your process, residual, or RO membrane limits
- ❏ The **CUMULATIVE CHLORINE COUNTER™** tracks chlorine exposure over time. This data can give you insights into how much chlorine you are discharging over time (ppm/hours). You can also determine the potential for damage to your RO membranes.
- ❏ A **BUILT-IN FLOW METER** provides real-time flow readings (mL/min) on screen and will enable the analyzer to pause and resume operation when customers have intermittent flow
- ❏ **ON-SCREEN DIAGNOSTICS MENU** provides quick identification of warnings and errors.

Ultra Low Range CL17sc vs. Standard CL17sc Comparison



Features	Ultra Low Range CL17sc	CL17sc
Claros Enabled:	✓ (Mobile Sensor Mgmt.)	✓ (Mobile Sensor Mgmt.)
Measurement range:	0 to 5 mg/L	0 to 10 mg/L
Limit of Detection:	8 µg/L (LOD) (ppb)	30 µg/L (LOD)
Cumulative Chlorine Counter™:	✓	-
Calibration:	Ultra Low Range factory calibration	Standard factory calibration
Accuracy:	±0.01mg/L or ±5% from 0 to 4 mg/L ±10% from 4 to 5 mg/L as Cl ₂	±0.04 mg/L or ±5% from 0 to 5 mg/L, ±10% from 5 to 10 mg/L as Cl ₂
Precision:	±0.005 mg/L or ±3%	±5% or ±0.01 mg/L
Hach SC controller integration (at time of launch):	SC200, SC1000, SC4500	SC200, SC1000, SC4200, SC1500, SC4500
Flow meter:	✓ (Built-in; readings displayed on screen)	✓ (Built-in; readings displayed on screen)
Fast, simple tubing changes:	✓	✓
Enclosure rating:	IP66	IP66
On-screen diagnostics menu:	✓	✓

Hach SC4500 Digital Controller

Ready for Now.
Ready for the Future.



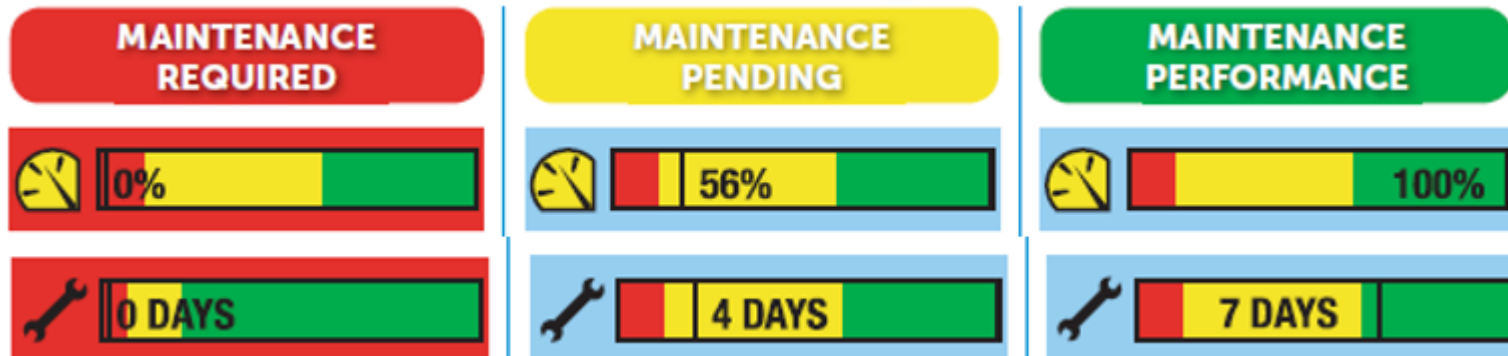
Prognosys & Display: Screen

Display

- 3.5-inch TFT color display
- Capacitive touchpad
- Flexible touch: works with or without gloves
- Built-in screen lock

Prognosys

- Color-coded errors & warnings
- Measurement Indicator
 - Monitors the instrument's components and uses that information to alert the user to upcoming instrument needs before measurements become questionable
- Service Indicator
 - Tracks the number of days until the instrument will require maintenance or service



#5 WATER QUALITY MONITORING PANEL (WQMP) (3rd GENERATION - AUTOMATIC CLEANING)

HACH P/N: XXXXXXX

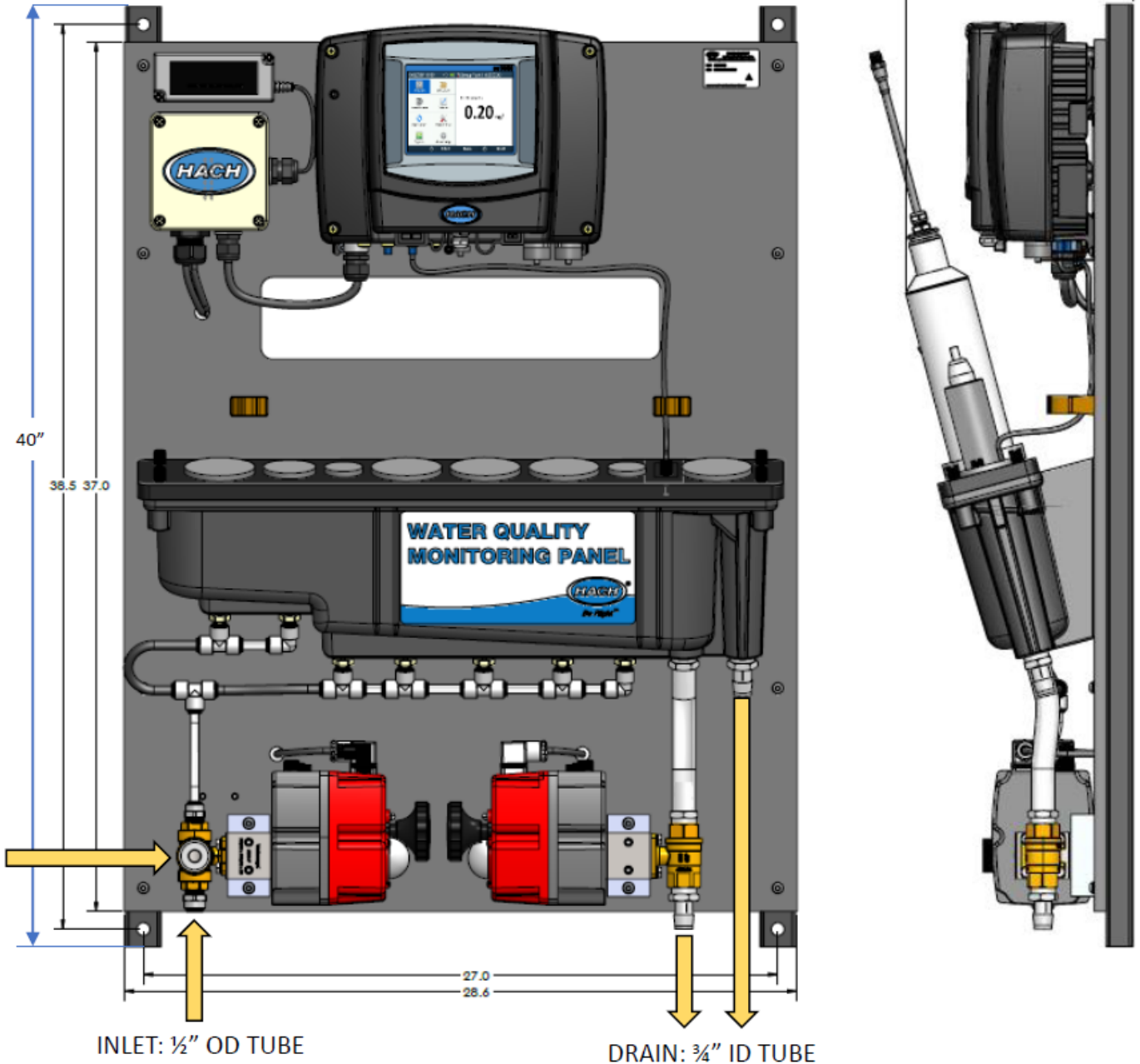
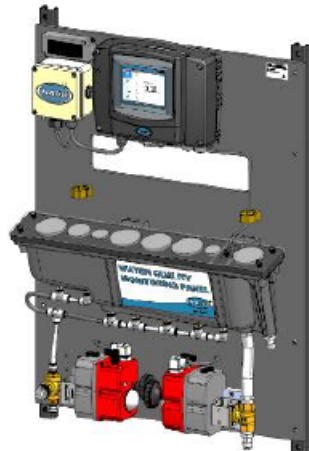
DESCRIPTIONS: ASSY, WQMP, AUTO CLEAN, SC1000, DIG OUTPUT

PANEL: STANDARD SWMP PANEL

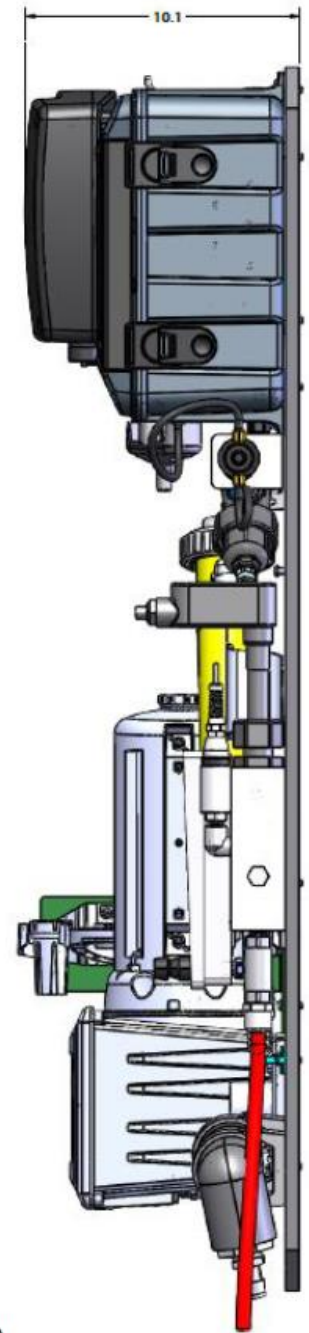
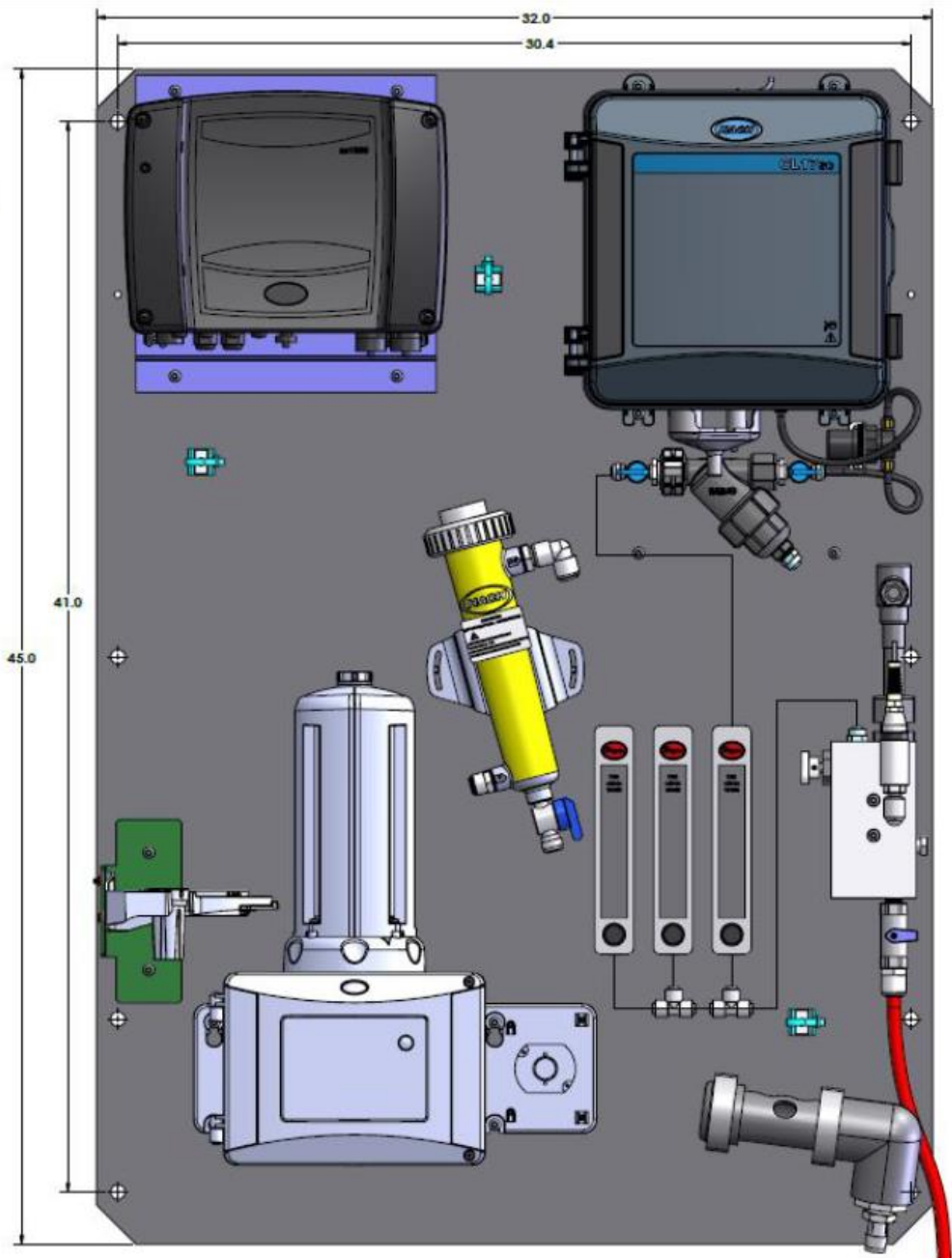
PACKAGING: STANDARD SWMP PACKAGING

Sensor Selection: OPTIONS

SENSOR P/N	SENSOR	Port Size	Adapter #
D3725E2T-WDMP	CONDUCTIVITY SENSOR	Med	6858800
DRD1R5-WDMP	ORP SENSOR	Small	6859000
DPD1R1-WDMP	pH SENSOR	Small	6859000
LXV441.99.11302	FP360 sc (OIL IN WATER)	Large	8549400
9020000	LDO 2	Large	8548600
LXV423.99.10000	SOLITAX T-LINE sc	Large	6858400
LXV423.99.10100	SOLITAX TS-LINE sc	Large	6858400
LXV323.99.10002	TSS sc	Large	6858400
LXV418.99.50002	UVAS PLUS sc	Large	8549400
LXV417.99.50002	NITRATAX PLUS sc	Large	8549400
LXV428.99.00001	3798-S sc	Large	8829300
LXV440.99.00002	AN-ISE sc	Large	6858400



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DRAIN INLET
 3/4" ID 3/8" OD
 TUBE TUBE



Thank You! Questions?

Chad Csepeggi | Regional Sales Manager (Northern Ohio)
M 614.535.6720
Hach | www.hach.com | ccsepegg@hach.com



Be Right™