

FC80 Free Chlorine Analyzer



ELECTRO-CHEMICAL DEVICES



FC80 System Configuration

- ❖ Free Chlorine Analyzer
 - 1) Constant Head Flow Controller
 - 2) S80- pH with Temperature Sensor
 - 3) Free Chlorine Sensor (FCS)
 - 4) T80- Analyzer and Controller
 - 5) Optional Spray Cleaner





What is Free Chlorine?

- ❖ **Free Chlorine** is the sum of the Hypochlorous acid and Hypochlorite ion in the sample.
- ❖ Chlorine gas (Cl_2) dissolves in water as Hypochlorous acid (HOCl) and Hydrochloric Acid.
 - $\text{Cl}_2 + \text{H}_2\text{O} > \text{HOCl} + \text{OCl}^- + \text{H}^+ + \text{Cl}^-$
- ❖ Bleach dissolves in water to form Sodium Hypochlorite and Sodium Hydroxide.
 - $\text{NaOCl} + \text{H}_2\text{O} > \text{HOCl} + \text{OCl}^- + \text{OH}^- + \text{Na}^+$





What is Free Chlorine?

- ❖ **Free Residual Chlorine** is the measured value, The amount available to do work.
 - Residual = Dose – Demand
 - It is the chlorine in the sample that is available to measure.
- ❖ The FC80 doesn't measure **Total Residual Chlorine**.
 - Total = Free + Combined
 - Combined Chlorine is chlorine bound to an organic molecule
 - Ammonia products being the most common, Chloramines.
 - Total Chlorine requires a reagent based wet chemistry technique or a special amperometric sensor.
 - Use The TC80





Free Chlorine Sensor

- ❖ FC80 Intelligent Free Chlorine Sensor
 - Stores Calibration
 - Digital Communication
- ❖ Polarographic Design
 - Polarization and measurement circuitry inside the FC80 sensor
 - Gold Cathode
 - Silver-Silver chloride Anode
- ❖ Replaceable rugged Teflon Membrane
- ❖ Refillable Potassium Chloride Electrolyte
- ❖ PVC outer body





How does it Work?

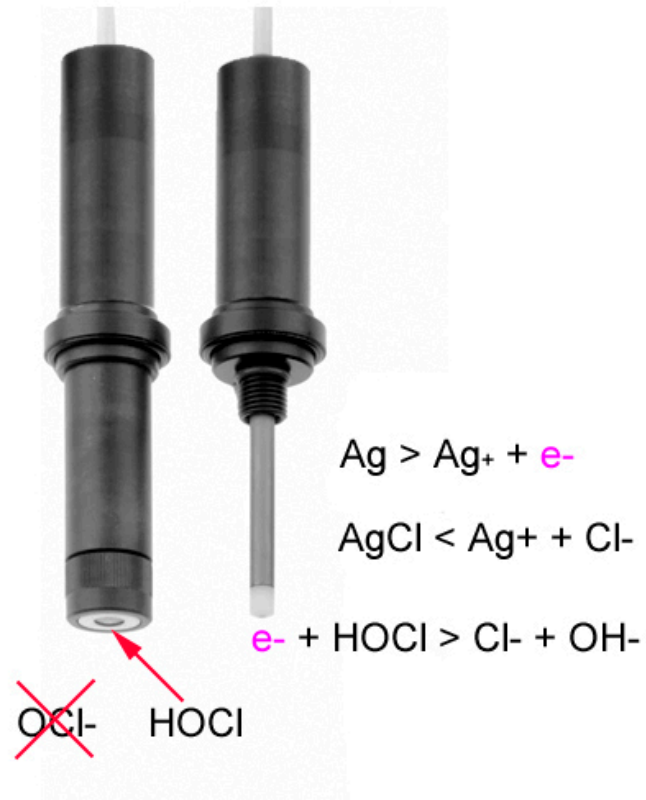
- ❖ A fixed voltage is applied between the Anode and Cathode.
- ❖ At Start Up, the polarization voltage consumes any oxidizable materials in the sensor.
- ❖ The current decreases with time as the sensor stabilizes at the “zero point current.”
- ❖ The initial polarization takes about 60 minutes.
- ❖ The Chlorine sensor is now ready to use.



How Does it Work? (cont'd)



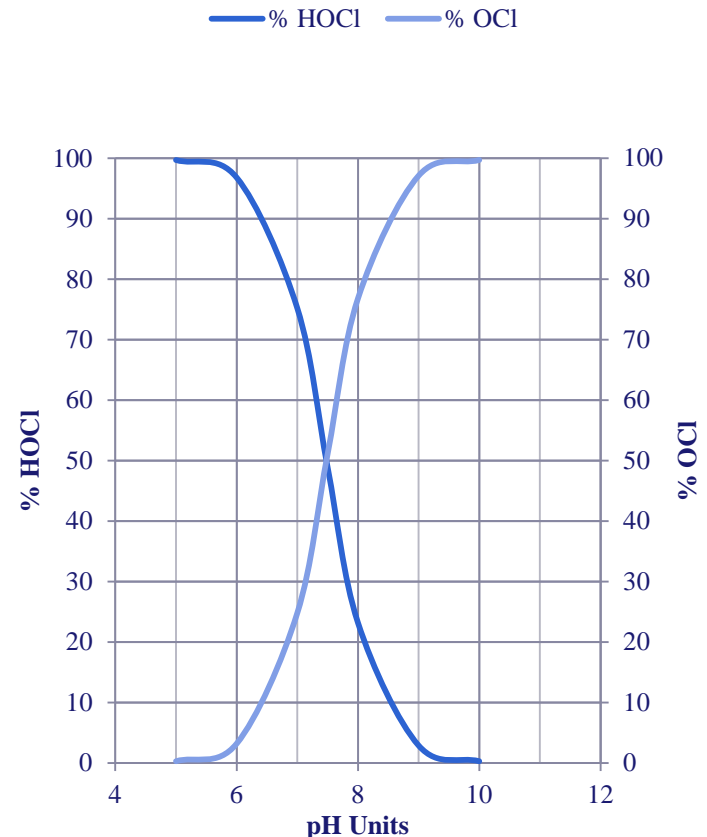
- ❖ The Teflon membrane allows only neutrally charged molecules to pass through
 - HOCl is a neutral molecule and will pass through the membrane.
 - OCl^- is charged and won't pass.
 - Salts are charged and won't pass.
- ❖ Hypochlorous acid, HOCl, diffuses through the membrane and is reduced (gains electrons) at the cathode to form chloride.
- ❖ Silver is oxidized (gives up electrons) at the anode which precipitates the chloride, as silver chloride, completing the current loop.
- ❖ HOCl is directly measured by the sensor and OCl^- is inferred from the pH.





Measurement Influences

- ❖ pH Sensitivity
- ❖ The ratio HOCl/OCl⁻ is pH dependent.
 - $\text{HOCl} \leftrightarrow \text{H}^+ + \text{OCl}^-$
- ❖ Where the pH of a solution = pK_a of a chemical, the ratio of acid to base species is 1:1
 - pK_a (hypochlorous acid)= 7.5
 - HOCl = OCl⁻ @ 7.5 pH
- ❖ By Measuring the pH, the T80 Transmitter can determine the percentage of free chlorine that is being measured and calculate the total Free Chlorine present.





pH Measurement

- ❖ Flange mounted S80 pH Sensor
- ❖ Measures pH and temperature
- ❖ Intelligent Sensor stores calibration information
- ❖ Digital communication
- ❖ Easily replaceable pH electrode cartridge
- ❖ Convenient sample port



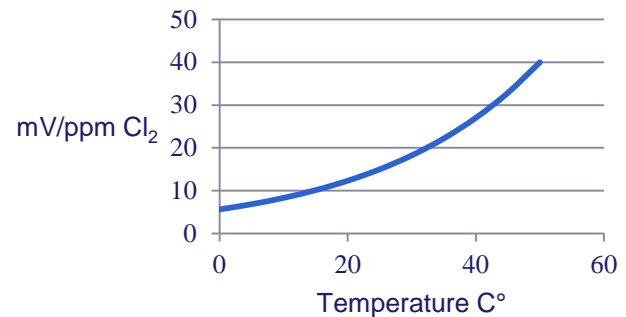


Measurement Influences

❖ Temperature Sensitivity

- Output increases with temperature, 4% per C°
- Output decreases with cooling
- Primarily due to the change in the permeability of the membrane with temperature

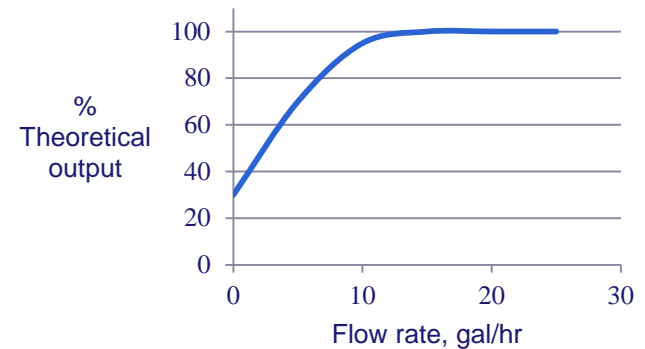
FCA Temperature Dependence, 4%/C°



❖ Flow Sensitivity

- The FC80 sensor consumes chlorine
- Flow replenishes the chlorine supply
- Flows above 10 gal/hour are flow independent
- Low flow = Low reading
- Constant flow = Stable reading

FCA Flow dependence



Constant Head Flow Controller



- ❖ The CH Flow Controller eliminates the need for Pressure Regulators and Rotameters that would be needed to keep the flow constant.
- ❖ The unique overflow design maintains a constant flow at the sensor with incoming variations between 8 and 80 gal/hr.





Where is it used?

- ❖ Chlorination of Municipal drinking water
- ❖ Cooling Towers
- ❖ Industrial disinfection of rinse waters
 - Food processing
 - Pasteurization lines
- ❖ Bleaching Processes
- ❖ Oxidation in Chemical processing
 - Mining
 - Sulfide removal



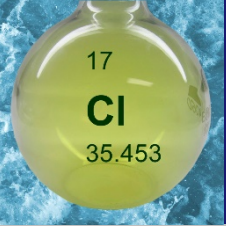


Start up Guide

- ❖ Mount FCA Panel securely to a wall or rail system.
- ❖ Supply power to the T80 Transmitter as shown in the “Wiring Instructions”.
- ❖ Install the FCS and S80 pH sensors into the flow cells. (The pH is closest to the CHFC tube).
- ❖ Connect sample line to the ¼” FNPT on CHFC tube.
- ❖ Connect drain line to ¾” barb fitting on the bottom of the CHFC tube.
- ❖ Supply sample to the FC80 and let run for 60 minutes.
- ❖ Verify the Calibration of the S80 pH sensor.
- ❖ Verify the Chlorine reading with a DPD test.
- ❖ IT’S DONE !!!
- ❖ Check Calibration monthly



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