

## CR-288 Concentration Monitor Implementations



*The CR-288 concentration sensor features materials and design compatible with ultrahigh purity and caustic chemicals.*

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## FEOL (Front End of Line): SC1, SC2, and HF

**Summary:** CR-288 enables real-time in-line highly precise monitoring of SC1 (Ammonium Hydroxide and Hydrogen Peroxide), SC2 (Hydrochloric acid and Hydrogen Peroxide), and HF (Hydrofluoric Acid) levels at front end of line (FEOL) wafer processing.

**Business Need:** The temperature and concentration of SC1, SC2, and HF directly impact product yield. Process Engineers rely on grab samples and laboratory analyses for information on liquid-chemical concentration with a significant opportunity cost because this method is neither done in real time nor continuously. Although it is accurate, it does not provide the benefits of point of use (POU) sensors.

POU sensors allow liquid chemicals to be adjusted, controlled, and monitored in-line, with immediate fault detection results. Tool failure modes can be identified and addressed, resulting in increased tool uptime and productivity. Liquid-chemical waste is reduced, lowering treatment and disposal costs. To realize these benefits, the POU sensor must be high-performance, integrated easily, and reliable.

### CR-288 Benefits

Because it measures temperature and concentration in-line, CR-288 offers multiple benefits over other test methods. Specifically:

- Chemical concentrations are measured in real time at point of use.
- Chemical mixture concentrations are monitored and controlled for each wafer in single wafer processing.
- Batch-to-batch chemical consistency is monitored and controlled for batch wafer processing.
- The high degree of accuracy, simplified calibration, and temperature corrections, enables greater process control with a "set it and forget it" track record
- The accuracy enables greater etch rate control for SEMI FEOL and BEOL chemistry, increasing yield and decreasing waste.

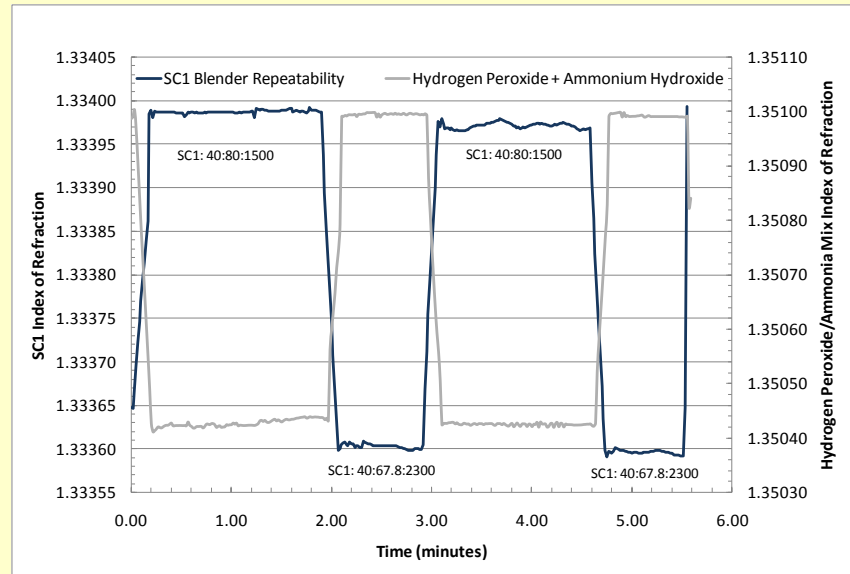
The flowcell footprint is only 3" x 2" x 4" (l x w x h) and is available in a variety of end connections providing flexible installation options.

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## Case Study: SC1 Blending

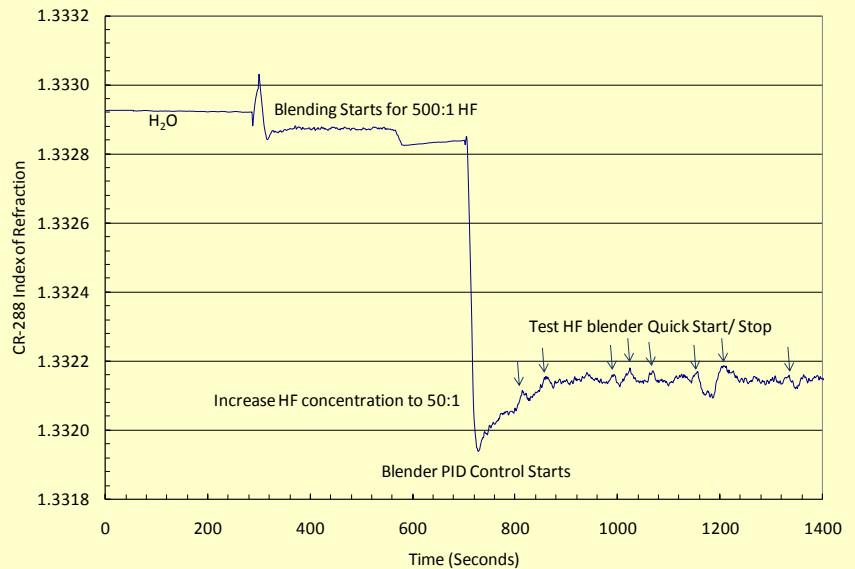
This graph demonstrates real-time measurements of blending of SC1 Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>), Ammonium Hydroxide (NH<sub>4</sub>OH), and water (H<sub>2</sub>O).

The SC1 and H<sub>2</sub>O<sub>2</sub>:NH<sub>4</sub>OH mixture concentrations are plotted as a function of time. CR-288 resolution is better than ±0.005% by weight. The graph illustrates the repeatability of the SC1 blender (blue line) and the repeatability of CR-288 to measure the H<sub>2</sub>O<sub>2</sub>:NH<sub>4</sub>OH mixture.



This graph demonstrates CR-288's capability to measure HF (50:1) and HF (5001:1) blending. CR-288 Index of Refraction is plotted as a function of time for HF (500:1) and HF (50:1) blending. CR-288 measures the entire range of HF from 49% to HF (1000:1) with high resolution and fast response time.

## Case Study: HF Blending (500:1 and 50:1)



### Realized Performance Data in weight %:

SC1 resolution: ± 0.004%

SC2 resolution: ± 0.004%

HF resolution: ± 0.004%