

## CR-288 Concentration Monitor Implementations



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

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## CIGS

**Summary:** CR-288 enables real-time, in-line, and highly precise monitoring of chemical precursor levels for state-of-the-art process tools designed for copper indium gallium di-selenide ("CIGS") solar cell manufacturing. Continuous monitoring at back end of line and front end of line enables substantial cost savings due to reduced reworking, scrap, and improved metal depositing control.

**Business Need:** CR-288 displaces costly and time consuming laboratory analysis providing process engineers with real-time feedback on CIGS deposition chemistry during manufacturing. For process development and continuous improvement, chemical concentration can be correlated to surface defect data through metrology studies leading to accelerated yield improvements and early identification of yield failures. In addition, concentration measurements promote the development of automatic maintenance techniques and establish best-known methods for high volume processing. They enable tools to become more process-flexible as chemical concentrations are adjusted to minimize waste, controlled and monitored at the point of use. Tool failure modes can be identified and addressed quickly, resulting in increased tool uptime and productivity. Overall liquid-chemical waste is reduced, lowering treatment and disposal costs.

## CR-288 Benefits

Because it is an in-line automated test, CR-288 offers multiple benefits over other test methods, specifically:

CR-288 continuously monitors the solar cell plating process, eliminating the need to sample for laboratory analysis, thus saving cost of consumables, labor, and time.

CR-288 can be set to alarm before the process continues with out-of-spec chemicals.

The high degree of accuracy, simplified calibration, and temperature correction enables greater process control with a "set it and forget it" track record.

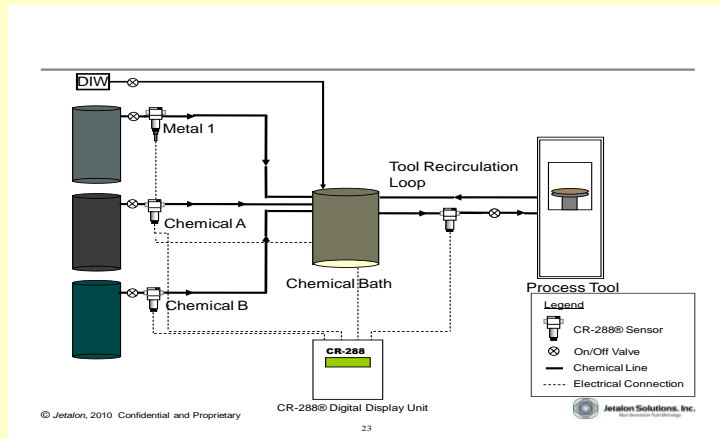
Tighter process control reduces liquid chemical waste and waste processing.

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## Implementation Diagram

This figure shows four CR-288 sensors measuring individual chemistries before and after blending and dilution.

The graph below shows the results of monitoring with a single sensor.



## Example of Real-Time Monitoring CIGS Deposition in Solar Cell Manufacturing

This graph shows the results of monitoring with a single CR-288 sensor. The customer monitors the blend of the chemicals as each constituent is added. This becomes a repeatable signature profile of the process and can be used to set process controls and limits.

*CR-288 detects minute changes. It can be set to alarm if a fault occurs before a process continues with out-of-spec chemicals.*

