# SI3401 Gas Concentration Analyzer for $NH_3$, HF, and HCl

## AMC Monitoring for Inorganic Gases

PICARRO


Analytical data that improves yield with early warning of contamination events!

- Parts-per-trillion (ppt) sensitivity
- Fast, continuous measurements in seconds
- Minimum maintenance with no consumables
- No field calibration, verify with proxy gas mix of $CH_4$, $CO_2$ and $O_2$

## $NH_3$, HF, and HCl 3-species AMC analyzer

Yield declines due to airborne molecular contamination (AMC) have been well documented (Ref: IRDS 2018). The **SI3401 multi-species AMC analyzer** utilizes Picarro's highly selective, sensitive, and accurate cavity ring-down spectroscopy (CRDS) for real-time measurement of three gases in one convenient chassis.

Designed to operate in both cleanrooms and plenums, this laser-based analyzer can operate for many months without user interaction. The analyzer can be commissioned and operating within minutes, with zero sample preparation. The gas concentration is displayed in real-time with no post-processing requirements. The analyzer can be configured to automatically export its measurement data at regular intervals, via an Ethernet or RS-232 interface.

$NH_3$, HF, and HCl are critical process chemicals that are routinely monitored in a semiconductor manufacturing fab. Furthermore, the analyzer measures $H_2O$, eliminating the need for a dedicated humidity sensor.

The SI3401 analyzer provides parts-per-trillion level detection of the gases within seconds. It also provides the best cost of ownership via a small footprint (one analyzer to cover all three gases), lower service costs, and lower electricity consumption.

Picarro's SI3401 analyzer offers the simplicity and reliability of CRDS technology for AMC monitoring in a robust, compact, and fixed or transportable package.

Designed for long-term stability and low maintenance, this analyzer is ideal for continuous operation in semiconductor manufacturing cleanrooms and plenums, as well as FOUP and EFEM applications. Every analyzer is certified to meet the published specifications.

| Performance Specifications | SI3401 | | | |
|---|---|---|---|---|
| | HCl | HF | $NH_3$ | $H_2O$ |
| Precision | ≤75 ppt (10 sec), ≤25 ppt (100 sec) | ≤40 ppt (10 sec), ≤13 ppt (100 sec) | ≤300 ppt (10 sec), ≤100 ppt (100 sec) | 20 ppm + (8 x %$H_2O$) (10 sec) 10 ppm + (4 x %$H_2O$) (100 sec) |
| Lower Detectable Limit (100 sec., 3σ) | 75 ppt | 40 ppt | 300 ppt | 30 ppm |
| Method Detection Limit (per Semi C10-1109) | 250 ppt | 500 ppt | 500 ppt | 40 ppm |
| Linearity (per IEC 61207) | ±1% | ±1% | ±1% | ±1% |
| Accuracy at span | ±5% @ full scale | ±5% @ full scale | ±5% @ full scale | ±5% @ full scale |
| Accuracy at zero | ±50 ppt | ±25 ppt | ±150 ppt | ±40 ppm |
| Instrument-to-Instrument Consistency | ±5% @ full scale ±50 ppt @ zero | ±5% @ full scale ±25 ppt @ zero | ±5% @ full scale ±150 ppt @ zero | ±5% @ full scale ±40 ppm @ zero |
| Measurement Range | 0–2 ppm | 0–1 ppm | 0–10 ppm | 0–40000 ppm |
| Measurement Interval* | <9 seconds | | <5 seconds | <9 seconds |
| Sample Flow Rate | ~2 slm | | | |
| Combined Response Times (T90/10 + T10/90) @ 20 ppb | <3 min | | | <20 sec (10,000 ppm challenge) |
| Fall Times T90/10 @ 20 ppb | <1 min | | | <10 sec (10,000 ppm challenge) |

* Measurement interval at span may increase as much as 2x above listed values.

| SI3401 System Specifications | |
|---|---|
| Measurement Technique | Cavity Ring-Down Spectroscopy |
| Operating Temperature | 15 to 35°C (operating); -10 to 50°C (storage) |
| Ambient Humidity | <85% RH non-condensing |
| Accessories | Pump (external, included), keyboard (included), mouse (included), LCD monitor (optional) |
| Outputs | RS-232, Ethernet, USB |
| Sample Inlet Connection | 1/4” Stainless Steel Swagelok® Tube Fitting (recommended 1/4” OD PFA Tubing) |
| Dimensions | Analyzer: 16.7” w × 8.4” h x 24.8” d (43 × 21.3 × 63 cm) |
| Weight | 70 lbs. (31.75 kg) including pump |
| Power Requirements | 100–240 VAC, 47–63 Hz (auto-sensing), <400 W (total): 250 W (analyzer), 150 W (pump) at steady state |

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