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Technology for Productivity

*Process Sense Model 20706A infrared endpoint detector upgrade for optimization and cost reduction of chamber clean for Applied Materials deposition tools*

Gas Analysis

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# Process Sense™

## INFRARED CHAMBER CLEAN ENDPOINT SENSOR

The Process Sense endpoint sensor is a small, low cost partial-pressure analyzer specifically designed for Remote Plasma Chamber Clean Endpoint detection for both semiconductor and flat panel deposition chambers. Process Sense is based on infrared absorption, the only technique applicable to all (in-situ and remote) plasma cleaning processes. The Process Sense installs into the rough line, ensuring no effect on deposition hardware. The signal levels reported by the Process Sense can be used to determine the completion level of any clean with respect to time, and communicate back to the process tool to signal endpoint.

## Features & Benefits

### Lower Cost of Ownership

- Fast response enables real-time chamber clean endpoint detection
- Typical gas savings from 5 to 20%
- Reduces chamber erosion from over-clean, extending the life of the chamber

### Increased Performance

- Optimizing chamber clean time increases tool availability for deposition typically by 2 – 4%
- Reduced over-clean lowers particulate generation for improved yield
- Permanent calibration unaffected by process conditions

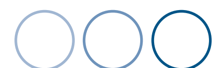
### Easy Integration

- Complete upgrade kits available for AMAT CVD tools
- Installed in the rough line — no impact on deposition hardware and no recalibration required

## Applications

### Chamber Clean Endpoint for Applied Materials CVD Tools

- Silicon Oxides (USG, FSG, PSG, BSG, BPSG)
- Silicon Nitrides
- Polysilicon
- Silane or TEOS processes
- For available kits, contact MKS



Unlike optical emissions-based endpoint sensors (OES), the Process Sense is quantitative. The calibration is constant over time and no user calibration is required. Measuring the partial-pressure, the Process Sense can monitor gas concentrations from % (Torr) to ppm (mTorr) levels, monitoring the gas through two process-matched optical view ports on a foreline section supplied by MKS. The sensor's optical and electrical components are never in contact with the process gas and can operate at pressures from mTorr to above atmospheric without any optical modifications. Since all of the sensors are calibrated identically, endpoint signal criteria are identical across tools and chambers, and field replacements and upgrades can occur without recalibration.

Process Sense lowers cost, improves yield and increases throughput. By accurately identifying the actual endpoint of a chamber cleaning step, the amount of $NF_3$ used for the clean is reduced, typically by 5 to 20%. Similar results are found for PFC cleans, reducing the amount of these emissions from the factory. Reducing chamber clean time to only what is necessary for the clean lessens the possibility of chamber erosion from over–cleaning, thereby reducing potential particulates and extending the life of the chamber. Additionally, the time saved is used for deposition, increasing throughput by as much as 2 – 4%.

This process improvement is offered as a complete upgrade kit for Applied Materials 200mm and 300mm CVD tools with software revision 3.1 and later.

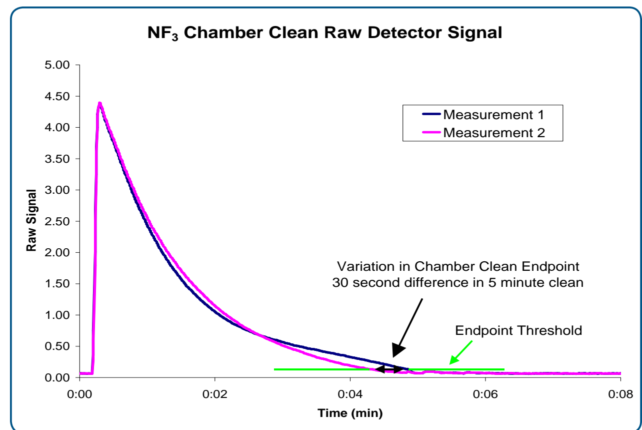



**Figure 1 —**

*Comparison of chamber clean runs illustrating Process Sense sensitivity to variations in chamber clean processes.*

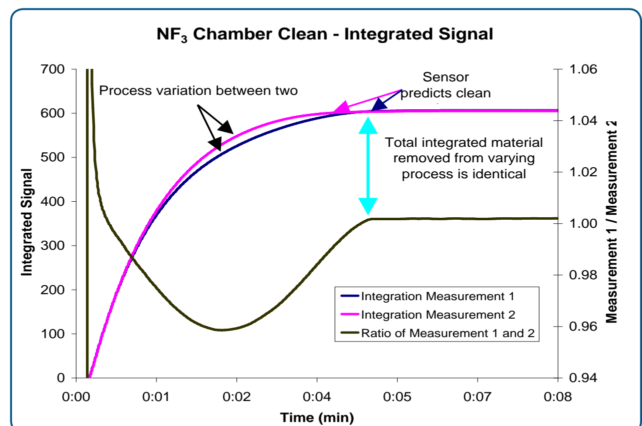
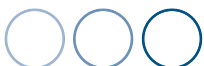



**Figure 2 —**

*Comparison of chamber clean runs illustrating Process Sense ability to predict the amount of material removed so as not to over clean a chamber.*

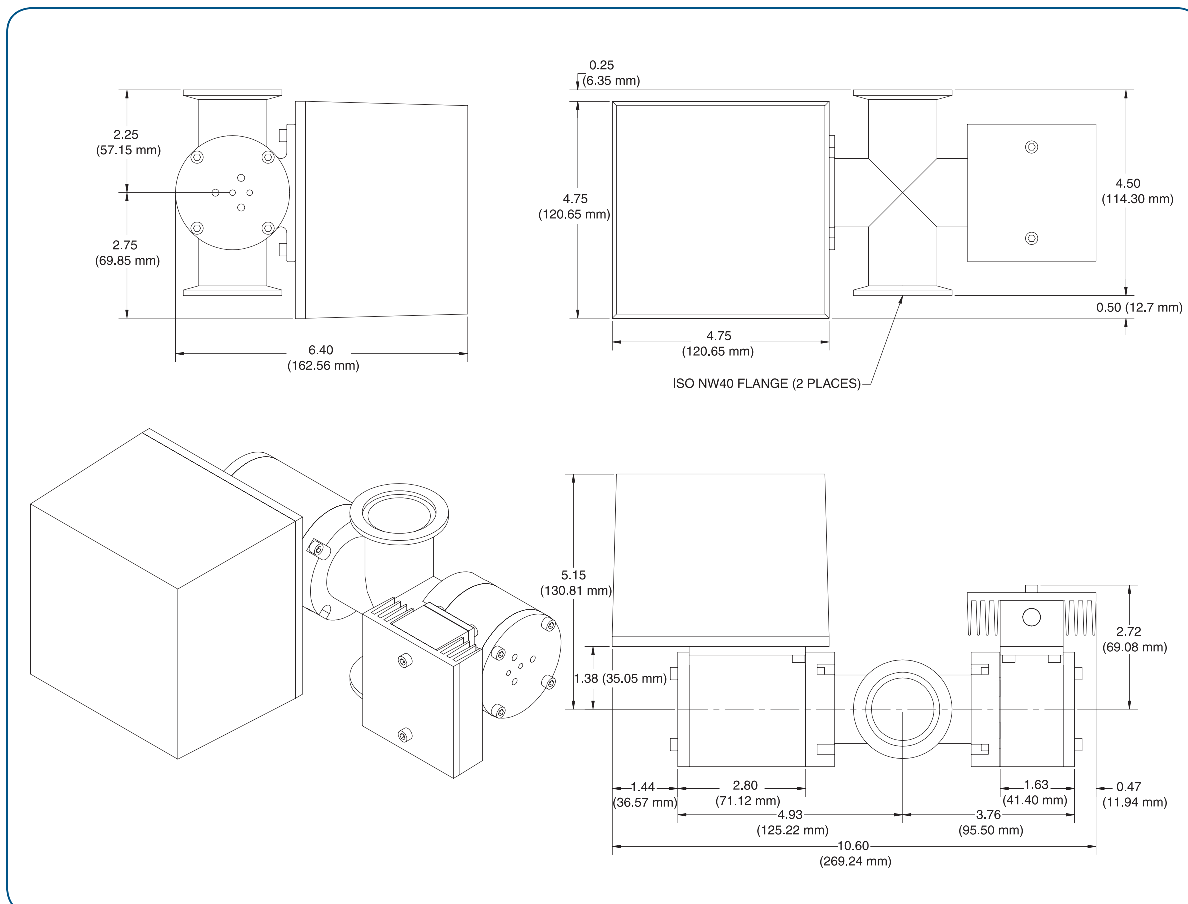


# Specifications

| | |
|---|---|
| **Dimensions** | 127 mm W x 165 mm L x 269 mm D (5.0"W x 6.5"L x 10.6"H) |
| **Weight** | 7 lbs. |
| **Response Time** | Continuous analog response with 50 msec update |
| **Signal Level** | 0 – 10 VDC |
| **Calibration Accuracy** | ±10% |
| **Detection Limit** | 1 mTorr partial pressure of $SiF_4$ |
| **Baseline Fluctuation** | ≤5 mV for the duration of a typical clean |
| **Infrared Source** | Resistively heated silicon carbide element |
| **Analysis Method** | Filter based NDIR |
| **Vacuum Cell** | Stainless steel flow-through vacuum cross |
| **Vacuum Fittings** | NW-40-KF fittings standard |
| **Vacuum Cell Optical Pathlength** | 85 mm long by 17.8 mm diameter beam path |
| **Vacuum Cell Windows** | $BaF_2$ windows 25.2 mm diameter x 5.0 mm thick |
| **Infrared Detector** | Temperature compensated $LiTaO_3$ |
| **Power Requirements** | +15 VDC (110 mA), -15 VDC (30 mA), +24 VDC (1 A nominal - 2 A initial) |
| **Analog Output Signals** | Single-ended referenced to ±15 VDC supply common |
| **Digital Input/Output Signals** | Isolated DI/DO designed for 24 VDC operation |

# Ordering Information

Please contact your local MKS office for price and availability information.




**Dimensional Drawing —**

*Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).*

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