

## A revolutionary software controlled POU abatement DRE measuring and reporting system.

### Introducing the WaveRunIR-DRE-MSS

Spectrum Environmental Solutions' Fourier Transform Infrared (FTIR) Monitoring System, WaveRunIR™-DRE-MSS is industry's first automated solution for performing Destruction or Removal Efficiency (DRE) measurements of fluorinated greenhouse gases (F-GHGs) in semiconductor manufacturing.

Calibration and measurements are fully compliant with EPA protocols. Measurement data is displayed real-time on a cloud (WaveRunIR™-DRE-MSS-C) or internal LAN dashboard (WaveRunIR™-DRE-MSS-L) and the measurement dataset is also downloadable over a user defined time interval for DRE report generation.

### System Overview

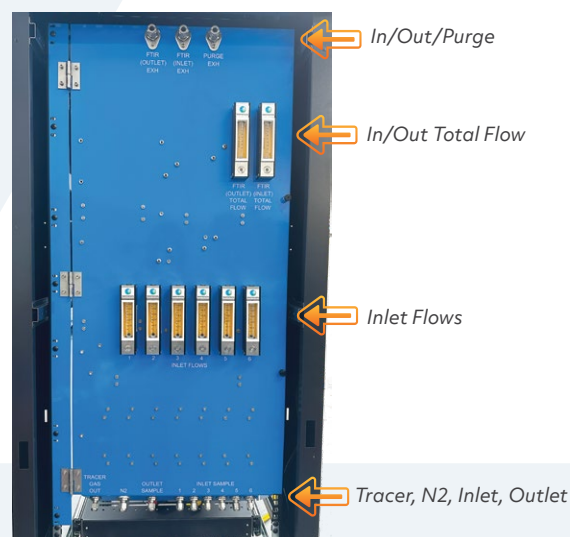
The system includes two FTIR spectrometers and a software-controlled gas manifold that accepts up to six inlets to a point of use (POU) abatement system. All inlet and outlet flows are measured and regulated by onboard digital mass flow controllers (MFCs). Sample particulate filters are monitored by digital pressure transducers to indicate when a filter change is needed. Rotameters are included on the manifold panel to provide visual awareness of all gas flows involved in the DRE measurements. The system automates EPA's 3-point tracer gas calibration protocol using an onboard tracer bottle and a user-friendly software wizard. The system is housed in a mobile cart so it can be easily moved between the POU abatement systems in sub-fabs that are associated with Etch and Deposition processes.

### Compounds of Interest

- CF<sub>4</sub>
- C<sub>2</sub>F<sub>4</sub>
- C<sub>2</sub>F<sub>6</sub>
- C<sub>3</sub>F<sub>8</sub>
- C<sub>4</sub>F<sub>6</sub>
- c-C<sub>4</sub>F<sub>8</sub>
- C<sub>4</sub>F<sub>8</sub>O
- C<sub>5</sub>F<sub>8</sub>
- CHF<sub>3</sub>
- CH<sub>2</sub>F<sub>2</sub>
- CH<sub>3</sub>F
- C<sub>2</sub>HF<sub>5</sub>
- NF<sub>3</sub>
- SF<sub>6</sub>
- N<sub>2</sub>O



DRE Rack



Gas Manifold

# Key Features

## About WaveRunIR™DRE-MSS

- Inlet FTIR - WaveRunIR-EXT 7.5cm
- Outlet FTIR - WaveRunIR-EXT 10m
- Two micro-PC's with keyboard monitor and Wifi
- 6-inlet, 1-outlet software-controlled gas manifold
- Programmable Mass Flow Controllers
- Rotameters for visual flow monitoring
- Sample filters with pressure gauges for service indication
- On board SF<sub>6</sub> bottle for 3-point tracer gas calibration

## Real-Time Data Dashboard

DRE calculations are made in real time and displayed on a feature rich dashboard (*Image A*) that displays the inlet composition and an output of real time DRE values (%) by compound. The solution provides a new level efficiency in the capture and reporting of POU DRE performance. The dashboards can be based on data sent to a secure cloud based Virtual Private Client (VPC) network.

## About Spectrum

Spectrum provides a wide array of real-time process monitoring solutions, services and applications for the semiconductor industry, with FTIR at the heart of our business.

Spectrum provides both on-site and virtual training and works with clients to solve specific technical issues. Our comprehensive consultancy support covers EHS programs, toxic release inventory (TRI) reporting, emissions calculations, regulatory compliance, and GHG abatement. This support includes onsite compliance or engineering testing, development of client-specific environmental dashboards, spectral validations, instrumentation operation and maintenance, software updates, and periodic reporting.

Spectrum stays abreast of current potential GHG emission concerns and regulatory requirements through long-standing relationships with the EPA, state and local environmental agencies, SEMI, the Semiconductor Industry Association (SIA), and regional and national semiconductor industry conferences (SESHA, SEMICON West, etc.). It is our mission to support the industry in their pursuit to Net Zero greenhouse gas emissions.

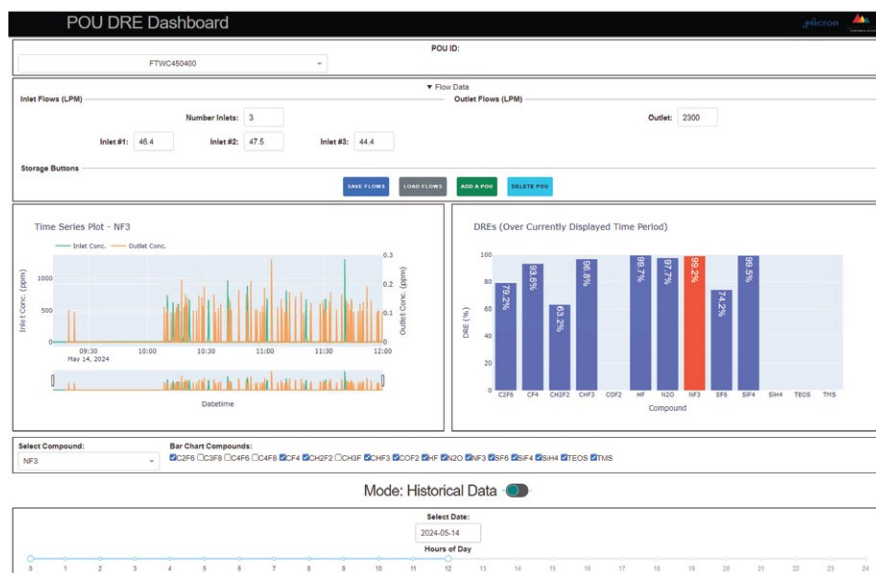


Image A

From FTIR, RAMAN, UV-DOAS, and optical remote sensing instrumentation, to real-time measurements, software integration and complete environmental consulting, Spectrum Environmental Solutions is a leading full service environmental solutions provider.