

**Process  
Insights**  
*Premium Insights Into Process*

**Tiger**optics

# Product Guide 2022

Issue 1





## Contents

Company Overview	4
Available Detections	5
Tiger Optics Detection Ranges Summary	6
HALO Series	7
Spark Series	18
T-I Max Series	21
Prismatic—Multispecies Detection	24
CO-rekt Series	25
ALOHA H <sub>2</sub> O Series	25
Extrel Quadrupole Mass Spectrometers	26
Application Features	28
Integration Solutions	30
Software Products	31
Featured Services & Upgrades	32
Tiger Optics Service	33
Overview of Cavity Ring-Down Spectroscopy (CRDS)	34

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## Company Overview

# Tigeroptics

Founded in 2001, Tiger Optics has been the preferred provider for high-performance, laser-based gas analyzers to advance industrial standards and enable cutting-edge research. By leveraging the expertise of scientists, engineers and industry specialists, we offer advanced total solutions, field support, analyzer training, and advice to help customers improve yields and reduce costs. By creating out-of-the-box solutions that deliver fast, reliable and stable measurements, Tiger Optics supports continuous innovation for gas & chemical production, semiconductor fabrication, and many other markets.



Field-proven, drift-free, ultimate performance



Outstanding manufacturing quality, consistency & reliability



Absolute, NIST-traceable measurement technology



Excellent customer service and on-time delivery



Strong local support through our global distributor network

**Analyze with Ease™**



ISO 9001:2015  
Certified



Our products and solutions are at work all over the world. We focus on innovative and differentiated solutions and technologies that add high value to our end-users applications and processes. We are committed to operational excellence and innovation that help our customers create the products and services that make our lives better. Our businesses are global in nature with meaningful presence in developed as well as emerging markets. Our continued strategic and global expansion offers significant future opportunities across our value chain for our customers, our channel partners and our suppliers.

Since 2018, Tiger Optics is part of  
Process Insights Holdings.

**COSAXENTAUR**  
A PROCESS INSIGHTS BRAND

**Tigeroptics**

**HYGROCONTROL**

**extrel**

**AQ** ALPHA OMEGA  
INSTRUMENTS

**GuidedWave**

**ATOM**  
INSTRUMENT  
a Process Insights Brand

**LAR**  
THE  
TOC  
COMPANY

**MBW** calibration  
—  
—  
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**Tigeroptics**

a Process Insights Brand

# Available Detections

Analyzer Series	Detection																		
	H <sub>2</sub> O	O <sub>2</sub>	NH <sub>3</sub>	CH <sub>4</sub>	HF	HCl	CO	CO <sub>2</sub>	CH <sub>2</sub> O	CH <sub>2</sub> O <sub>2</sub>	H <sub>2</sub> S	H <sub>2</sub>	C <sub>2</sub> H <sub>2</sub>	D <sub>2</sub> O H <sub>2</sub> O	N <sub>2</sub>	Ar	He	C <sub>x</sub> H <sub>y</sub>	
HALO Max QCL <i>NEW!</i>							✓	✓											
HALO KA Max	✓		✓	✓															
HALO KA	✓																		
HALO OK		✓																	
HALO 3	✓		✓	✓	✓	✓	✓	✓	✓	✓*	✓*			✓					
HALO LP	✓																		
HALO RP	✓				✓														
HALO QRP	✓																		
HALO H <sub>2</sub> O in N <sub>2</sub> O	✓																		
HALO H <sub>2</sub>												✓							
Spark / Spark+	✓			✓			✓	✓					✓						
T-I Max			✓		✓	✓													
T-I Max CEM			✓	✓	✓	✓	✓		✓		✓								
T-I Max AIR <i>NEW!</i>				✓				✓	✓										
Prismatic 3 <i>NEW!</i>	✓			✓			✓	✓											
CO-rekt	✓			✓			✓	✓											
ALOHA+ H <sub>2</sub> O	✓																		
Extrel VeraSpec APIMS	✓	✓	✓	✓			✓	✓				✓			✓	✓			✓
Extrel MAX300-LG		✓		✓					✓	✓		✓			✓	✓	✓		

\*Detection is currently under development or available upon request. Additional detections are available as a custom option. Please contact us for more information.

## Product Details Explained

**Shows readily available back-ground gas options, more may be available on request.**

**Typical background gas types:**  
 UHP = Ultra-High Purity Gas  
 IND = Industrial-Grade Gas  
 CR = Corrosive Gas (HCl, Cl<sub>2</sub>, HBr,...)  
 SP = Specialty Gas (CO/CO<sub>2</sub>, hydrides, fluorocarbons,...)  
 AIR = Ambient Air or Emissions Gas

**Product name**

**HALO KA Max H<sub>2</sub>O**

**Our highest performing moisture analyzer. The ultimate trace gas analyzer for the highest purity bulk gases used in advanced semiconductor manufacturing.**

**Available Background Gases**  
 N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

**Detected molecule(s)**

Detection **H<sub>2</sub>O**


**Features and Benefits**

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance

**Applications**

- UHP Gas quality control

**Gas Type** UHP IND CR SP AIR



# Tiger Optics Detection Ranges Summary

		Approximate Detection Range (UDL to LDL)*															
Analyzer	Detection	≥3000 ppm	≥1000 ppm	≥300 ppm	≥100 ppm	≥30 ppm	≥10 ppm	≥3 ppm	≥1 ppm	≥0.3 ppm	≥0.1 ppm	≥30 ppb	≥10 ppb	≥3 ppb	≥1 ppb	≥0.3 ppb	≥0.1 ppb
HALO Max QCL CO <b>NEW!</b>	CO																
HALO Max QCL CO <sub>2</sub> <b>NEW!</b>	CO <sub>2</sub>																
HALO KA Max H <sub>2</sub> O	H <sub>2</sub> O																
HALO KA Max NH <sub>3</sub>	NH <sub>3</sub>																
HALO KA Max CH <sub>4</sub>	CH <sub>4</sub>																
HALO KA H <sub>2</sub> O	H <sub>2</sub> O																
HALO OK†	O <sub>2</sub>																
HALO 3 CO	CO																
HALO 3 H <sub>2</sub> O	H <sub>2</sub> O																
HALO 3 NH <sub>3</sub> †	NH <sub>3</sub>																
HALO 3 CH <sub>4</sub>	CH <sub>4</sub>																
HALO 3 HF	HF																
HALO 3 HCl	HCl																
HALO 3 CO <sub>2</sub> †	CO <sub>2</sub>																
HALO 3 CH <sub>2</sub> O	CH <sub>2</sub> O																
HALO 3 D <sub>2</sub> O/HDO	D <sub>2</sub> O & HDO																
HALO LP H <sub>2</sub> O	H <sub>2</sub> O																
HALO RP H <sub>2</sub> O	H <sub>2</sub> O																
HALO RP HF	HF																
HALO QRP†	H <sub>2</sub> O																
HALO H <sub>2</sub> O in N <sub>2</sub> O	H <sub>2</sub> O																
HALO H <sub>2</sub>	H <sub>2</sub>																
Spark H <sub>2</sub> O	H <sub>2</sub> O																
Spark H <sub>2</sub> O in CO <sub>2</sub>	H <sub>2</sub> O																
Spark CH <sub>4</sub>	CH <sub>4</sub>																
Spark+ CO	CO																
Spark CO <sub>2</sub>	CO <sub>2</sub>																
Spark C <sub>2</sub> H <sub>2</sub>	C <sub>2</sub> H <sub>2</sub>																
T-I Max NH <sub>3</sub>	NH <sub>3</sub>																
T-I Max HF	HF																
T-I Max HCl	HCl																
T-I Max CEM NH <sub>3</sub>	NH <sub>3</sub>																
T-I Max CEM CH <sub>4</sub>	CH <sub>4</sub>																
T-I Max CEM HF	HF																
T-I Max CEM HCl	HCl																
T-I Max CEM CO	CO																
T-I Max CEM H <sub>2</sub> S	H <sub>2</sub> S																
Prismatic 3	H <sub>2</sub> O																
	CH <sub>4</sub>																
	CO																
	CO <sub>2</sub>																
CO-rekt CO	CO																
CO-rekt CO <sub>2</sub>	CO <sub>2</sub>																
CO-rekt H <sub>2</sub> O†	H <sub>2</sub> O																
CO-rekt CH <sub>4</sub> †	CH <sub>4</sub>																
ALOHA+ H <sub>2</sub> O	H <sub>2</sub> O																

\*Exact detection range is dependent on background gas  
 †Higher range models available  
 ‡Range depends on sample pressure (example given for 10 Torr)



# HALO Series

## HALO Max QCL CO NEW!

Detection **CO**

Gas Type **UHP**

This QCL-based system allows for fast & continuous real-time measurements, eliminating batch processing techniques commonly found with GCs. Additionally, QCL-CRDS eliminates the need for regular calibration and provides the most sensitive CO measurement with the lowest operating cost.

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

### Specifications

Detection	Range	LDL (3σ/24h)
CO in N <sub>2</sub>	0 – 0.5 ppm	200 ppt
CO in He	0 – 0.35 ppm	130 ppt
CO in Ar	0 – 0.4 ppm	150 ppt
CO in H <sub>2</sub>	0 – 0.5 ppm	200 ppt
CO in O <sub>2</sub>	0 – 0.45 ppm	170 ppt
CO in CDA	0 – 0.5 ppm	200 ppt

### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- Fast, real-time measurements—no batch processing
- No consumables or maintenance
- No expensive carrier gas required

### Applications

- UHP Gas quality control
- Semiconductor bulk gas

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software

See website for more details

## HALO Max QCL CO<sub>2</sub> NEW!

Detection **CO<sub>2</sub>**

Gas Type **UHP**

This system is also based on QCL-CRDS and offers extremely low detection limits for carbon dioxide (CO<sub>2</sub>) without the need for user calibration or regular maintenance. It also eliminates batch processing common with GCs.

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

### Specifications

Detection	Range	LDL (3σ/24h)
CO <sub>2</sub> in N <sub>2</sub>	0 – 2.5 ppm	100 ppt
CO <sub>2</sub> in He	0 – 2 ppm	90 ppt
CO <sub>2</sub> in Ar	0 – 2 ppm	80 ppt
CO <sub>2</sub> in H <sub>2</sub>	0 – 4 ppm	180 ppt
CO <sub>2</sub> in O <sub>2</sub>	0 – 2 ppm	90 ppt
CO <sub>2</sub> in CDA	0 – 2.5 ppm	100 ppt

### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- Fast, real-time measurements—no batch processing
- No consumables or maintenance
- No expensive carrier gas required

### Applications

- UHP Gas quality control
- Semiconductor bulk gas

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Requires inert purge gas for maximum performance

See website for details

## HALO Series

### HALO KA Max H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP**

Our highest performing moisture analyzer. The ultimate trace gas analyzer for the highest purity bulk gases used in advanced semiconductor manufacturing.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

#### Select Specifications

(see [website](#) for more)

Detection	Range	LDL*
H <sub>2</sub> O in N <sub>2</sub>	0 – 5 ppm	100 ppt
H <sub>2</sub> O in He	0 – 1 ppm	100 ppt
H <sub>2</sub> O in H <sub>2</sub>	0 – 4 ppm	100 ppt
H <sub>2</sub> O in O <sub>2</sub>	0 – 2.5 ppm	100 ppt
H <sub>2</sub> O in CDA	0 – 4 ppm	100 ppt

\*The LDL is defined as 3σ over 24h or the H<sub>2</sub>O drydown limit, whichever is higher.

#### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Semiconductor bulk gas

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software

[See website more details](#)

### HALO KA Max NH<sub>3</sub>

Detection **NH<sub>3</sub>**

Gas Type **UHP**

Our highest performing ammonia analyzer. The ultimate trace gas analyzer for the highest purity bulk gases used in advanced semiconductor manufacturing.

#### Available Background Gases

N<sub>2</sub>

#### Specifications

Detection	Range	LDL (3σ/24h)
NH <sub>3</sub> in N <sub>2</sub>	0 – 7 ppm	100 ppt

#### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Semiconductor bulk gas

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software

[See website for more details](#)



## HALO Series

### HALO KA Max CH<sub>4</sub>

Detection **CH<sub>4</sub>**

Gas Type **UHP**

Our highest performing methane analyzer. The ultimate trace gas analyzer for the highest purity bulk gases used in advanced semiconductor manufacturing.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub>

#### Specifications

Detection	Range	LDL (3σ/24h)
CH <sub>4</sub> in N <sub>2</sub>	0 – 8 ppm	500 ppt
CH <sub>4</sub> in He	0 – 5 ppm	400 ppt
CH <sub>4</sub> in Ar	0 – 7 ppm	450 ppt
CH <sub>4</sub> in H <sub>2</sub>	0 – 8 ppm	500 ppt
CH <sub>4</sub> in O <sub>2</sub>	0 – 7 ppm	500 ppt

#### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Semiconductor bulk gas

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software

[See website for more details](#)

### HALO KA H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP** **IND** **CR** **SP**

The state-of-art trace moisture analyzer for high purity bulk and specialty gases used in semiconductor manufacturing and other high-purity applications.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA · CO · CO<sub>2</sub> · GeH<sub>4</sub> (mix) · COS · Ne · Kr · Xe · Cl<sub>2</sub> · HCl · HBr · SF<sub>6</sub> · NF<sub>3</sub> · C<sub>x</sub>F<sub>y</sub>

#### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in N <sub>2</sub>	0 – 20 ppm	300 ppt
H <sub>2</sub> O in He	0 – 4 ppm	100 ppt
H <sub>2</sub> O in H <sub>2</sub>	0 – 16 ppm	200 ppt
H <sub>2</sub> O in O <sub>2</sub>	0 – 10 ppm	150 ppt
H <sub>2</sub> O in CO <sub>2</sub>	0 – 25 ppm	800 ppt

#### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Fast speed of response
- Large selection of gas matrices
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Semiconductor bulk gas
- Industrial gas QC
- High-Purity CO<sub>2</sub>
- Etch and cleaning gases
- Fluorinated gases

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Corrosion-resistant model
- Environmental enclosure

[See website for more details](#)

## HALO Series

### HALO OK

Detection **O<sub>2</sub>**

Gas Type **UHP** **IND** **SP**

The world's only all-optical ultra-trace oxygen analyzer. Ideal addition to HALO KA and HALO KA Max analyzers for purity monitoring of bulk gases used in semiconductor manufacturing.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · CO<sub>2</sub>

#### Specifications

Detection	Range*	LDL (3σ/24h)
O <sub>2</sub> in N <sub>2</sub>	0 – 2.5 ppm	200 ppt
O <sub>2</sub> in He	0 – 0.5 ppm	50 ppt
O <sub>2</sub> in Ar	0 – 1 ppm	90 ppt
O <sub>2</sub> in H <sub>2</sub>	0 – 2 ppm	150 ppt
O <sub>2</sub> in CO <sub>2</sub> <sup>†</sup>	0 – 5 ppm	5000 ppt

\*Higher range model available

<sup>†</sup>Special configuration required, must be specified at time of order.

#### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No false spiking or false positives

#### Applications

- UHP Gas quality control
- Semiconductor bulk gas
- Oxygen analysis in CO<sub>2</sub>
- Fuel-cell hydrogen analysis

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Requires H<sub>2</sub> utility gas

[See website for more details](#)

### HALO 3 CO

Detection **CO**

Gas Type **UHP** **IND**

Improved detection limits for carbon monoxide (CO) make this analyzer a compelling solution for various applications from air separation to fuel-cell hydrogen analysis.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

#### Specifications

Detection	Range	LDL (3σ/24h)
CO in N <sub>2</sub>	0 – 2000 ppm	40 ppb
CO in O <sub>2</sub>	0 – 1800 ppm	35 ppb
CO in CDA	0 – 2000 ppm	40 ppb
CO in Ar	0 – 1600 ppm	30 ppb
CO in He	0 – 1800 ppm	35 ppb
CO in H <sub>2</sub>	0 – 2500 ppm	50 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Industrial gas QC
- Air separation units
- Certified reference materials and calibration gases
- Research & development
- Fuel-cell hydrogen analysis
- Syngas and fuel gas

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

# HALO Series

## HALO 3 H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP** **IND** **CR** **SP**

Our most versatile moisture analyzer, with low-ppb detection limits, excellent range, and a large selection of background gases. The HALO 3 is the moisture analyzer of choice in many industries.

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA · CO · CO<sub>2</sub> · SO<sub>2</sub> · COS · Ne · Kr · Xe · Cl<sub>2</sub> · HCl · HBr · SF<sub>6</sub> · NF<sub>3</sub> · C<sub>x</sub>F<sub>y</sub>

### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in N <sub>2</sub>	0 – 20 ppm	1.2 ppb
H <sub>2</sub> O in He	0 – 4 ppm	0.25 ppb
H <sub>2</sub> O in H <sub>2</sub>	0 – 16 ppm	1.0 ppb
H <sub>2</sub> O in O <sub>2</sub>	0 – 12 ppm	0.7 ppb
H <sub>2</sub> O in CO <sub>2</sub>	0 – 25 ppm	2 ppb

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- Large selection of gas matrices
- No consumables or maintenance

### Applications

- UHP Gas quality control
- Semiconductor bulk gas
- Industrial gas QC
- Air separation units
- Fluorinated gases
- Gas standard preparation
- Gas-cooled nuclear reactors

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Corrosion-resistant model
- Environmental enclosure

[See website for more details](#)

## HALO 3 NH<sub>3</sub>

Detection **NH<sub>3</sub>**

Gas Type **UHP** **IND** **SP**

This analyzer offers a variety of ranges for ammonia analysis in bulk gases, plus an "N<sub>2</sub>O model" for analysis of NH<sub>3</sub> in pure nitrous oxide.

### Available Background Gases

N<sub>2</sub> · H<sub>2</sub> · CO<sub>2</sub> · N<sub>2</sub>O

### Specifications

Detection	Range	LDL (3σ/24h)
NH <sub>3</sub> in N <sub>2</sub> *	0 – 35 ppm	2.5 ppb
NH <sub>3</sub> in H <sub>2</sub> *	0 – 30 ppm	2.0 ppb
NH <sub>3</sub> in CO <sub>2</sub>	0 – 30 ppm	2.5 ppb
NH <sub>3</sub> in N <sub>2</sub> O†	0 – 200 ppm	8 ppb/40 ppb

\*Higher and lower ranges available  
 †Available with "N<sub>2</sub>O model"; lower LDL requires vacuum pump

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance
- Multiple detection ranges available

### Applications

- UHP Gas quality control
- Industrial gas QC
- Fuel-cell hydrogen analysis
- Gas standard preparation

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure
- Vacuum pump may be required for N<sub>2</sub>O model

[See website for more details](#)

## HALO Series

### HALO 3 CH<sub>4</sub>

Detection **CH<sub>4</sub>**

Gas Type **UHP** **IND**

Methane is a key indicator for hydrocarbon impurities in gases. This analyzer is designed to measure CH<sub>4</sub> down to low ppb levels to ensure bulk gases and standard cylinders are free from harmful hydrocarbons.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub>

#### Specifications

Detection	Range	LDL (3σ/24h)
CH <sub>4</sub> in N <sub>2</sub>	0 – 8 ppm	1.6 ppb
CH <sub>4</sub> in He	0 – 5 ppm	1.1 ppb
CH <sub>4</sub> in Ar	0 – 7 ppm	1.4 ppb
CH <sub>4</sub> in H <sub>2</sub>	0 – 8 ppm	1.6 ppb
CH <sub>4</sub> in O <sub>2</sub>	0 – 6 ppm	1.1 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance
- Multiple detection ranges available

#### Applications

- UHP Gas quality control
- Industrial gas QC
- Air separation units
- Gas standard preparation

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

### HALO 3 HF

Detection **HF**

Gas Type **UHP** **IND** **SP**

This analyzer specializes in monitoring hydrogen fluoride (HF) impurities down to sub-ppb levels in fluorinated specialty gases, as well as common inert bulk gases.

#### Available Background Gases

N<sub>2</sub> · He · SF<sub>6</sub> · NF<sub>3</sub> · C<sub>x</sub>F<sub>y</sub>

#### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
HF in N <sub>2</sub>	0 – 5 ppm	0.4 ppb
HF in He	0 – 1.3 ppm	0.4 ppb
HF in SF <sub>6</sub>	0 – 8 ppm	1.2 ppb
HF in NF <sub>3</sub>	0 – 7.5 ppm	0.6 ppb
HF in CF <sub>4</sub>	0 – 6 ppm	0.8 ppb

#### Features and Benefits

- Sub-part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Fluorocarbon chemistry
- Semiconductor specialty gas
- Gas standard preparation

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)



# HALO Series

## HALO 3 HCl

Detection **HCl**

Gas Type **UHP** **IND**

High sensitivity, fast speed of response and maximum ease of use make this system ideal for detecting trace hydrogen chloride (HCl) in various industrial and research applications.

### Available Background Gases

N<sub>2</sub> · H<sub>2</sub> · CDA

### Specifications

Detection	Range	LDL (3σ/24h)
HCl in N <sub>2</sub>	0 – 20 ppm	1.0 ppb
HCl in CDA	0 – 20 ppm	1.0 ppb
HCl in H <sub>2</sub>	0 – 10 ppm	1.0 ppb

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance

### Applications

- UHP Gas quality control
- CEM standard preparation
- Fuel-cell hydrogen analysis
- Research & development
- High-purity gas systems
- Gas mixtures

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

See website for more details

## HALO 3 CO<sub>2</sub>

Detection **CO<sub>2</sub>**

Gas Type **UHP** **IND**

This analyzer offers two different ranges to detect trace carbon dioxide (CO<sub>2</sub>) for bulk gas applications.

### Available Background Gases

N<sub>2</sub>

### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
CO <sub>2</sub> in N <sub>2</sub>	0 – 25 ppm	8 ppb
CO <sub>2</sub> in He	0 – 25 ppm	8 ppb
CO <sub>2</sub> in Ar	0 – 25 ppm	8 ppb
CO <sub>2</sub> in O <sub>2</sub>	0 – 25 ppm	8 ppb
CO <sub>2</sub> in CDA	0 – 25 ppm	8 ppb

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance
- Two detection ranges available

### Applications

- UHP Gas quality control
- Industrial gas QC
- Air separation units
- Certified reference materials and calibration gases
- Research & development
- Fuel-cell hydrogen analysis
- Syngas and fuel gas

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

See website for more details



## HALO Series

### HALO 3 CH<sub>2</sub>O

Detection **CH<sub>2</sub>O**

Gas Type **UHP** **IND**

This model detects trace amounts of formaldehyde in the low-ppb range. It is ideal for the preparation of CH<sub>2</sub>O air quality gas standards and the analysis of fuel-cell hydrogen.

#### Available Background Gases

N<sub>2</sub> · H<sub>2</sub>

#### Specifications

Detection	Range	LDL (3σ/24h)
CH <sub>2</sub> O in N <sub>2</sub>	0 – 40 ppm	5 ppb
CH <sub>2</sub> O in H <sub>2</sub>	0 – 40 ppm	6 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance

#### Applications

- UHP Gas quality control
- Industrial gas QC
- Fuel-cell hydrogen analysis
- Gas standard preparation
- Research & development
- Syngas and fuel gas

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

### HALO 3 D<sub>2</sub>O/HDO

Detection **D<sub>2</sub>O** **HDO**

Gas Type **UHP** **SP**

Deuterium (D<sub>2</sub>) is used in various applications from research to the manufacturing of optical fibers. Moisture impurities in D<sub>2</sub> are therefore a combination of the heavy water isotopes D<sub>2</sub>O and HDO. This analyzer is designed to detect traces of both molecules.

#### Available Background Gases

N<sub>2</sub> · D<sub>2</sub> (2H<sub>2</sub>)

#### Specifications

Detection	Range	LDL (3σ/24h)
D <sub>2</sub> O in D <sub>2</sub>	0 – 20 ppm	3 ppb
D <sub>2</sub> O in N <sub>2</sub>	0 – 50 ppm	7 ppb
HDO in D <sub>2</sub>	0 – 30 ppm	5 ppb
HDO in N <sub>2</sub>	0 – 40 ppm	6 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance

#### Applications

- Research & development
- Optical fiber manufacturing
- Semiconductor fabrication
- Healthcare & pharmaceuticals

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

# HALO Series

## HALO LP H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP** **SP**

The HALO LP is designed for the detection of trace moisture in hydrides, such as ammonia, phosphine and arsine, which are used in the production of LEDs and semiconductor devices.

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · NH<sub>3</sub> · PH<sub>3</sub> · AsH<sub>3</sub> · GeH<sub>4</sub> · SiH<sub>4</sub> · NO

### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in NH <sub>3</sub>	0 – 20 ppm	9 ppb
H <sub>2</sub> O in PH <sub>3</sub>	0 – 10 ppm	9 ppb
H <sub>2</sub> O in N <sub>2</sub>	0 – 6 ppm	1.0 ppb
H <sub>2</sub> O in NO	0 – 100 ppm	16 ppb
H <sub>2</sub> O in AsH <sub>3</sub> *	0 – 10 ppm	5 ppb

\*Detection in arsine requires special model

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance
- Low-pressure operation for interference-free detection

### Applications

- High-brightness LED production
- Semiconductor specialty gas
- UHP ammonia QC
- MOCVD

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure
- Requires vacuum pump

[See website for more details](#)

## HALO RP H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP** **CR** **SP**

This HALO RP model detects moisture impurities in chambers and semiconductor process tools down to 50 Torr of pressure in various background gases, incl. purge, cleaning and process gases.

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · CO · NH<sub>3</sub> · PH<sub>3</sub> · AsH<sub>3</sub> · HCl

### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in N <sub>2</sub>	0 – 20 ppm	1.5 ppb
H <sub>2</sub> O in H <sub>2</sub>	0 – 20 ppm	1.5 ppb
H <sub>2</sub> O in HCl	0 – 6 ppm	1.0 ppb
H <sub>2</sub> O in PH <sub>3</sub>	0 – 25 ppm	3 ppb
H <sub>2</sub> O in AsH <sub>3</sub> *	0 – 10 ppm	5 ppb

\*Detection in arsine requires special model

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance
- Large selection of background gases

### Applications

- Epitaxy
- MOCVD

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Requires vacuum pump
- Corrosion-resistant model

[See website for more details](#)

## HALO Series

### HALO RP HF

Detection **HF**

Gas Type **UHP** **SP**

This HALO RP model detects hydrogen fluoride impurities in low-pressure chambers and semiconductor process tools down to 50 Torr of pressure.

#### Available Background Gases

$N_2 \cdot BF_3$

#### Specifications

Detection	Range	LDL (3 $\sigma$ /24h)
HF in $N_2$	0 – 10 ppm	0.75 ppb
HF in $BF_3$	0 – 13 ppm	0.9 ppb

\*Arsine detection requires special model

#### Features and Benefits

- Sub-part-per-billion detection limits
- Calibration-free with zero drift
- Fast speed of response
- No consumables or maintenance

#### Applications

- Epitaxy
- MOCVD

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Requires vacuum pump

[See website for more details](#)

### HALO QRP

Detection **H<sub>2</sub>O**

Gas Type **UHP** **CR**

This HALO QRP is designed to monitor moisture impurities in state-of-the-art semiconductor process tools at pressures as low as 1 Torr.

#### Available Background Gases

$N_2 \cdot He \cdot Ar \cdot H_2 \cdot HCl$

#### Specifications

Detection	Range	LDL (3 $\sigma$ /24h)
$H_2O$	0 – 12 mTorr <sub>pp</sub> (1200 ppm @ 10 Torr)	1 $\mu$ Torr <sub>pp</sub> (100 ppb @ 10 Torr)

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- No consumables or maintenance
- Works over a wide pressure range from 1 Torr to 1000 Torr

#### Applications

- Epitaxy
- Atomic Layer Deposition (ALD)
- MOCVD

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Requires vacuum pump
- Corrosion-resistant model

[See website for more details](#)

## HALO Series

### HALO H<sub>2</sub>O in N<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP** **IND** **SP**

This analyzer specializes on detecting moisture impurities in high-purity nitrous oxide (N<sub>2</sub>O), but also offers ppb detection limits in common bulk gases.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · N<sub>2</sub>O

#### Specifications

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in N <sub>2</sub> O	0 – 20 ppm	7.5 ppb
H <sub>2</sub> O in N <sub>2</sub>	0 – 20 ppm	2.2 ppb
H <sub>2</sub> O in Ar	0 – 6 ppm	1.0 ppb
H <sub>2</sub> O in He	0 – 3 ppm	0.5 ppb
H <sub>2</sub> O in H <sub>2</sub>	0 – 12 ppm	1.9 ppb
H <sub>2</sub> O in O <sub>2</sub>	0 – 8 ppm	1.2 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- No consumables or maintenance
- Can be used in N<sub>2</sub>O, but also in bulk gases

#### Applications

- Gas standards preparation
- Medical gas
- Quality control for process gas or bulk gas systems

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Environmental enclosure

[See website for more details](#)

### HALO H<sub>2</sub>

Detection **H<sub>2</sub>**

Gas Type **UHP** **IND**

The HALO H<sub>2</sub> analyzer enables optical detection of hydrogen impurities, making this analyzer perfect for a numerous applications.

#### Available Background Gases

N<sub>2</sub> · He · Ar · CDA

#### Specifications

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> in N <sub>2</sub>	0 – 500 ppm	8 ppb
H <sub>2</sub> in He	0 – 125 ppm	4 ppb
H <sub>2</sub> in Ar	0 – 200 ppm	6 ppb
H <sub>2</sub> in CDA	0 – 5000 ppm	80 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- Virtually maintenance-free

#### Applications

- UHP Gas quality control
- Semiconductor bulk gas
- Quality control for process gas or bulk gas systems

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Requires N<sub>2</sub>/O<sub>2</sub> mixture or CDA utility gas

[See website for more details](#)



## Spark Series

### Spark H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **IND** **SP**

Our lowest cost moisture analyzer, ideal for industrial process and quality control. The Spark makes CRDS analysis affordable, while maintaining high levels of performance.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA · Ne · Kr · Xe · SF<sub>6</sub> · CF<sub>4</sub>

#### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in N <sub>2</sub>	0 – 2000 ppm	12 ppb
H <sub>2</sub> O in Ar	0 – 900 ppm	4.5 ppb
H <sub>2</sub> O in H <sub>2</sub>	0 – 1750 ppm	7.5 ppb
H <sub>2</sub> O in O <sub>2</sub>	0 – 1000 ppm	6 ppb
H <sub>2</sub> O in CDA	0 – 1800 ppm	10 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- Affordable price
- Extremely wide dynamic range

#### Applications

- Industrial gas QC
- Air separation units
- Truck fill measurements
- Fuel-cell hydrogen analysis
- Medical gases

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani interface software
- Speed+ performance upgrade
- Linear fit mode
- Dew point measurement
- Environmental enclosure

[See website for more details](#)

### Spark H<sub>2</sub>O in CO<sub>2</sub>

Detection **H<sub>2</sub>O**

Gas Type **IND** **SP**

Affordable & reliable, just like the Spark H<sub>2</sub>O, with the additional capability of detecting sub-ppm moisture in pure CO<sub>2</sub>. This analyzer is the ideal choice for industries requiring moisture analysis in CO<sub>2</sub> and inert gases.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA · CO · CO<sub>2</sub>

#### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in CO <sub>2</sub>	0 – 600 ppm	550 ppb
H <sub>2</sub> O in N <sub>2</sub>	0 – 500 ppm	7.5 ppb
H <sub>2</sub> O in O <sub>2</sub>	0 – 250 ppm	7.5 ppb
H <sub>2</sub> O in CDA	0 – 450 ppm	7.5 ppb
H <sub>2</sub> O in CO	0 – 480 ppm	7 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- Affordable price

#### Applications

- Industrial gas QC
- ASU process control
- Truck fill measurements
- Beverage CO<sub>2</sub> analysis
- Gas-cooled nuclear reactors

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Linear fit mode
- Dew point measurement
- Environmental enclosure

[See website for more details](#)



## Spark Series

### Spark CH<sub>4</sub>

Detection **CH<sub>4</sub>**

Gas Type **IND**

This analyzer is ideal for monitoring methane impurities in highly automated operations due to its affordable price, 24/7 operation, and zero maintenance.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

#### Specifications

Detection	Range	LDL (3σ/24h)
CH <sub>4</sub> in N <sub>2</sub>	0 – 80 ppm	7.5 ppb
CH <sub>4</sub> in Ar	0 – 70 ppm	6.5 ppb
CH <sub>4</sub> in He	0 – 50 ppm	6 ppb
CH <sub>4</sub> in H <sub>2</sub>	0 – 80 ppm	7.5 ppb
CH <sub>4</sub> in O <sub>2</sub>	0 – 50 ppm	6 ppb
CH <sub>4</sub> in CDA	0 – 80 ppm	7.5 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- Affordable price

#### Applications

- Industrial gas QC
- Air separation units (safety and process control)
- Fuel-cell hydrogen analysis

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

### Spark+ CO

Detection **CO**

Gas Type **IND**

This analyzer extends the affordable and reliable Spark series to the detection of trace carbon monoxide in a variety of bulk and industrial gases.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

#### Specifications

Detection	Range	LDL (3σ/24h)
CO in N <sub>2</sub>	0 – 2000 ppm	120 ppb
CO in O <sub>2</sub>	0 – 1800 ppm	110 ppb
CO in He	0 – 1800 ppm	110 ppb
CO in H <sub>2</sub>	0 – 2500 ppm	150 ppb
CO in CDA	0 – 2000 ppm	120 ppb
CO in Ar	0 – 1600 ppm	100 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- Affordable price

#### Applications

- Industrial gas QC
- ASU process control
- Truck fill measurements
- Fuel-cell hydrogen analysis

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

## Spark Series

### Spark CO<sub>2</sub>

Detection **CO<sub>2</sub>**

Gas Type **IND**

Carbon dioxide is a very common contaminant and can especially cause harm during when gases are liquefied. The Spark CO<sub>2</sub> offers an easy way to monitor this impurity before cryogenic transport and storage.

#### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub> · O<sub>2</sub> · CDA

#### Specifications

Detection	Range	LDL (3σ/24h)
CO <sub>2</sub> in N <sub>2</sub>	0 – 1500 ppm	250 ppb
CO <sub>2</sub> in O <sub>2</sub>	0 – 1200 ppm	220 ppb
CO <sub>2</sub> in He	0 – 1200 ppm	220 ppb
CO <sub>2</sub> in H <sub>2</sub>	0 – 2000 ppm	400 ppb
CO <sub>2</sub> in CDA	0 – 1500 ppm	250 ppb
CO <sub>2</sub> in Ar	0 – 1200 ppm	220 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- Affordable price
- Wide dynamic range

#### Applications

- Industrial gas QC
- ASU process control
- Fuel-cell hydrogen analysis

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

### Spark C<sub>2</sub>H<sub>2</sub>

Detection **C<sub>2</sub>H<sub>2</sub>**

Gas Type **IND**

This analyzer provides a much more convenient way to monitor acetylene in many safety-critical application compared to cumbersome GCs and NDIRs.

#### Available Background Gases

N<sub>2</sub> · O<sub>2</sub> · CDA

#### Specifications

Detection	Range	LDL (3σ/24h)
C <sub>2</sub> H <sub>2</sub> in N <sub>2</sub>	0 – 80 ppm	8 ppb
C <sub>2</sub> H <sub>2</sub> in O <sub>2</sub>	0 – 70 ppm	7 ppb
C <sub>2</sub> H <sub>2</sub> in CDA	0 – 80 ppm	8 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- Affordable price

#### Applications

- Industrial gas QC
- Air separation units (safety and process control)

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Environmental enclosure

[See website for more details](#)

# T-I Max Series

## T-I Max NH<sub>3</sub>

**Detection** NH<sub>3</sub>

**Gas Type** UHP AIR

The latest generation AMC monitor for the most advanced semiconductor fabs. This analyzer monitors ppt-levels of ammonia (NH<sub>3</sub>) in real-time in the cleanroom and other micro environments.

**Available Background Gases**  
Cleanroom Air · N<sub>2</sub> · CDA

**Specifications**

Detection	Range	LDL (3σ@100sec)
NH <sub>3</sub> in Cleanroom Air	0 – 40 ppm	300 ppt
NH <sub>3</sub> in N <sub>2</sub>	0 – 40 ppm	330 ppt
NH <sub>3</sub> in CDA	0 – 40 ppm	300 ppt


**Features and Benefits**

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No maintenance

**Applications**

- Airborne Molecular Contaminants in cleanrooms
- FOUF and Pod monitoring
- Reticle storage
- Mobile AMC cart (w/ GO-cart)

**Communication Interfaces**  
Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



**Options & Accessories**

- Serani Max interface software
- GO-cart mobile solution
- External particle filter
- Requires vacuum pump

[See website for more details](#)

## T-I Max HF

**Detection** HF

**Gas Type** UHP AIR

The latest generation AMC monitor for the most advanced semiconductor fabs. This analyzer monitors ppt-levels of hydrogen fluoride (HF) in real-time in the cleanroom and other micro environments.

**Available Background Gases**  
Cleanroom Air · N<sub>2</sub> · CDA

**Specifications**

Detection	Range	LDL (3σ@100sec)
HF in Cleanroom Air	0 – 1 ppm	20 ppt
HF in N <sub>2</sub>	0 – 1 ppm	25 ppt
HF in CDA	0 – 1 ppm	20 ppt


**Features and Benefits**

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No maintenance

**Applications**

- Airborne Molecular Contaminants in cleanrooms
- FOUF and Pod monitoring
- Reticle storage
- Mobile AMC cart (w/ GO-cart)

**Communication Interfaces**  
Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



**Options & Accessories**

- Serani Max interface software
- GO-cart mobile solution
- External particle filter
- Requires vacuum pump

[See website for more details](#)

## T-I Max Series

### T-I Max HCl

Detection **HCl**

Gas Type **UHP** **AIR**

The latest generation AMC monitor for the most advanced semiconductor fabs. This analyzer monitors ppt-levels of hydrogen chloride (HCl) in real-time in the cleanroom and other micro environments.

#### Available Background Gases

Cleanroom Air · N<sub>2</sub> · CDA

#### Specifications

Detection	Range	LDL (3σ@100sec)
HCl in Cleanroom Air	0 – 4 ppm	100 ppt
HCl in N <sub>2</sub>	0 – 4 ppm	110 ppt
HCl in CDA	0 – 4 ppm	100 ppt

#### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No maintenance

#### Applications

- Airborne Molecular Contaminants in cleanrooms
- FOUAP and Pod monitoring
- Reticle storage
- Mobile AMC cart (w/ GO-cart)

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- GO-cart mobile solution
- External particle filter
- Requires vacuum pump

[See website for more details](#)

### T-I Max CEM

Detection **NH<sub>3</sub>** **CH<sub>4</sub>** **HF** **HCl** **CO** **H<sub>2</sub>S**

Gas Type **AIR**

Its excellent sensitivity allows this analyzer to measure emissions from coal-fired power plants, cement kilns and other sources with high dilution ratio, thus simplifying CEM setups and compliance tests. Models for six different detections available.

#### Available Background Gases

Air · Diluted Stack Gas

#### Specifications in Air

Model	Range	LDL (3σ/24h)
T-I Max CEM NH <sub>3</sub>	0 – 40 ppm	6 ppb
T-I Max CEM CH <sub>4</sub>	0 – 20 ppm	1.5 ppb
T-I Max CEM HF	0 – 1 ppm	0.15 ppb
T-I Max CEM HCl	0 – 4 ppm	0.75 ppb
T-I Max CEM H <sub>2</sub> S	0 – 500 ppm	40 ppb

#### Features and Benefits

- Part-per-billion detection limits
- No heated sample lines needed for stack measurements
- Outstanding speed of response
- No maintenance
- Each model is designed for high specificity to its target detection without interference

#### Applications

- Continuous Emissions Monitoring (CEM)
- Air Quality Measurements

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software
- Dilution probe
- Linear fit mode
- Environmental enclosure
- Requires vacuum pump

[See website for more details](#)



## T-I Max Series

T-I Max AIR CH<sub>2</sub>O **NEW!**

Detection **CH<sub>2</sub>O**

Gas Type **UHP** **AIR**

The latest generation AMC monitor for the most advanced semiconductor fabs. This analyzer monitors ppt-levels of hydrogen chloride (HCl) in real-time in the cleanroom and other micro environments.

### Available Background Gases

Air · N<sub>2</sub> · CDA

### Specifications

Detection	Range	LDL (3σ/24h)
CH <sub>2</sub> O in Air	0 – 100 ppm	10 ppt
CH <sub>2</sub> O in N <sub>2</sub>	0 – 100 ppm	10 ppt
CH <sub>2</sub> O in CDA	0 – 100 ppm	10 ppt

### Features and Benefits

- Part-per-trillion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No maintenance

### Applications

- Indoor air quality
- 

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4-20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- External particle filter
- Requires vacuum pump

[See website for more details](#)



## Prismatic—Multispecies Detection

### Prismatic 3 **NEW!**

Detection H<sub>2</sub>O CH<sub>4</sub>  
CO CO<sub>2</sub>

Gas Type IND

This analyzer allows users to detect up to **four** trace molecules simultaneously in a single gas stream. The Prismatic 3 is ideal for fuel-cell hydrogen QC, laboratory analysis or any other application where convenience and sample preservation are most important.

#### Available Background Gases

N<sub>2</sub> · Ar · H<sub>2</sub> · O<sub>2</sub>

#### Select Specifications

(see [website](#) for more)

Detection	Range	LDL (3σ/24h)
H <sub>2</sub> O in N <sub>2</sub>	0 – 40 ppm	100 ppb
H <sub>2</sub> O in H <sub>2</sub>	0 – 25 ppm	100 ppb
CH <sub>4</sub> in N <sub>2</sub>	0 – 100 ppm	100 ppb
CH <sub>4</sub> in H <sub>2</sub>	0 – 100 ppm	100 ppb

#### Features and Benefits

- Part-per-billion detection limits
- Up to 4 simultaneous detections
- Outstanding speed of response
- No consumables or maintenance
- No vibration sensitivity

#### Applications

- Laboratory analysis
- Industrial gas QC
- Fuel-cell hydrogen analysis

#### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



#### Options & Accessories

- Serani Max interface software

[See website for more details](#)

# CO-rekt Series

## CO-rekt

Detection **CO** **CO<sub>2</sub>**  
**H<sub>2</sub>O** **CH<sub>4</sub>**

Gas Type **IND**

Featuring Class I, Div. 2 compliant housing, this analyzer is perfect for monitoring CO, CO<sub>2</sub>, H<sub>2</sub>O or CH<sub>4</sub> impurities in hazardous processes, such as HyCO, SMR, and syngas production.

### Available Background Gases

H<sub>2</sub> · Syngas

### Specifications in H<sub>2</sub>

Detection	Range	LDL (3σ/24h)
CO-rekt CO	0 – 2000 ppm	150 ppb
CO-rekt CO <sub>2</sub>	0 – 1500 ppm	500 ppb
CO-rekt H <sub>2</sub> O	0 – 16 ppm*	1.0 ppb
CO-rekt CH <sub>4</sub>	0 – 8 ppm*	1.6 ppb

\*Higher ranges available

### Features and Benefits

- Part-per-billion detection limits
- Calibration-free with zero drift
- Outstanding speed of response
- No consumables or maintenance
- No vibration sensitivity
- Class I, Div. 2 certification

### Applications

- Hydrogen production (HyCO and SMR)
- Syngas production

### Communication Interfaces

Ethernet, RS-232, 4–20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani interface software
- Speed+ performance upgrade
- Requires inert gas purge for hazardous locations

[See website for more details](#)

# ALOHA H<sub>2</sub>O Series

## ALOHA+ H<sub>2</sub>O

Detection **H<sub>2</sub>O**

Gas Type **UHP** **SP**

This analyzers was specifically designed for the analysis of moisture in ultra-pure ammonia used for the production of high-brightness LEDs and other specialized semiconductor devices. It offers the lowest H<sub>2</sub>O detection limit in the industry without background interference.

### Available Background Gases

N<sub>2</sub> · He · Ar · NH<sub>3</sub>

### Specifications

Detection	Range	LDL (3σ/8h)
H <sub>2</sub> O in NH <sub>3</sub>	0 – 20 ppm	3 ppb
H <sub>2</sub> O in N <sub>2</sub>	0 – 6 ppm	0.5 ppb
H <sub>2</sub> O in He	0 – 3 ppm	0.3 ppb
H <sub>2</sub> O in Ar	0 – 4 ppm	0.4 ppb

### Features and Benefits

- Single-digit part-per-billion detection limit in pure NH<sub>3</sub>
- Calibration-free with zero drift
- No consumables or maintenance
- No vibration sensitivity

### Applications

- High-brightness LED production
- Semiconductor specialty gas
- UHP ammonia QC

### Communication Interfaces

Ethernet, USB, RS-232, RS-485, 4–20mA analog, Modbus TCP (optional)



### Options & Accessories

- Serani Max interface software
- Speed+ performance upgrade
- Requires vacuum pump

[See website for more details](#)

# Extrel Quadrupole Mass Spectrometers



## VeraSpec™ APIMS **NEW!**

Detections H<sub>2</sub> O<sub>2</sub> CH<sub>4</sub> H<sub>2</sub>O CO  
CO<sub>2</sub> NH<sub>3</sub> N<sub>2</sub> Ar C<sub>x</sub>H<sub>y</sub>

Gas Type UHP

Ultra-high purity gas analyzers from Extrel have the speed, sensitivity, and ease-of-use to continuously monitor Nitrogen, Argon, Helium, Oxygen, and Hydrogen supply streams and rapidly report ppt-level contamination to protect the electronics fabrication process.

The VeraSpec™ APIMS combines Atmospheric Pressure Ionization (API) technology with a high-performance mass spectrometer (MS) optimized for ppt-level UHP gas analysis to mainly serve customers in the semiconductor industry.

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub>

### Detection Limit Specifications (3σ)

Detection*	in N <sub>2</sub>	in Ar	in He	in H <sub>2</sub>
Hydrogen (H <sub>2</sub> )	100 ppt	100 ppt	50 ppt	N/A
Oxygen (O <sub>2</sub> )	10 ppt	10 ppt	10 ppt	10 ppt
Methane (CH <sub>4</sub> )	10 ppt	10 ppt	10 ppt	10 ppt
Water (H <sub>2</sub> O)	10 ppt	10 ppt	10 ppt	10 ppt
Carbon Monoxide (CO)	50 ppt	10 ppt	10 ppt	50 ppt
Carbon Dioxide (CO <sub>2</sub> )	5 ppt	5 ppt	5 ppt	5 ppt
Ammonia (NH <sub>3</sub> )	500 ppt	500 ppt	500 ppt	500 ppt
Nitrogen (N <sub>2</sub> )	N/A	200 ppt	10 ppt	150 ppt
Argon (Ar)	200 ppt	N/A	10 ppt	50 ppt
Ethane (C <sub>2</sub> H <sub>6</sub> )	30 ppt	10 ppt	10 ppt	150 ppt
Propane (C <sub>3</sub> H <sub>8</sub> )	50 ppt	50 ppt	50 ppt	50 ppt
>C <sub>3</sub> (Butane, Pentane,...)	10 ppt	10 ppt	10 ppt	10 ppt

\*Additional detections are available

### Features and Benefits

- Confident supply of UHP production gases
- One analyzer for multiple contaminants
- Fully automated, real-time contamination alerts
- Reliable 24/7 process protection
- Maximized wafer yields

### Applications

- UHP Gas quality control
- Semiconductor bulk gas
- Quality control for process gas or bulk gas systems

### Communication & Software

- Questor 5 Process Control Software
- Tracks and records data
- Automated alarms, validations and calibrations
- Network accessible
- Secure to 21 CFR Part 11
- Ethernet, Modbus, Profibus, digital I/O, analog I/O, OPC



### Technology

Atmospheric pressure ionization is a technique that gives a mass spectrometer the very highest sensitivity for trace gas analysis in UHP samples.

Additional features:

- Easy-change Corona Discharge Needle
- Dual Source (API/EI) ionization functionality
- All-metal system and fittings design
- Dry, oil-free pumping configuration (single backing pump)
- 1-500 amu standard configuration (multiple mass ranges available)
- Pulse-counting electron multiplier
- Simple maintenance (<1 per year)

See website for more details

# Extrel Quadrupole Mass Spectrometers



## MAX300-LG™

Detections H<sub>2</sub> O<sub>2</sub> CH<sub>4</sub> CH<sub>2</sub>O  
CH<sub>3</sub>O N<sub>2</sub> Ar He

Gas Type UHP IND

The MAX300-LG™ brings an unmatched combination of speed, sensitivity and precision to continuous, quantitative gas analysis.

Based on cutting-edge quadrupole mass spectrometer technology, the MAX300-LG has the dynamic range to measure component concentrations from 100% down to the low parts per billion (ppb) in many gas or vapor samples. It provides a full composition update every few seconds and can analyze multiple sample points in a fully automated analysis routine

### Available Background Gases

N<sub>2</sub> · He · Ar · H<sub>2</sub>  
and many more

### Detection Limit Specifications (3σ)

Detection*	in N <sub>2</sub>	in Ar	in He	in H <sub>2</sub>
Hydrogen (H <sub>2</sub> )	60 ppm	60 ppm	100 ppm	N/A
Oxygen (O <sub>2</sub> )	1.0 ppm	1.0 ppm	1.0 ppm	1.0 ppm
Methane (CH <sub>4</sub> )	1.0 ppm	1.0 ppm	1.0 ppm	1.0 ppm
Formaldehyde (CH <sub>2</sub> O)	25 ppm	0.02 ppm	0.02 ppm	0.02 ppm
Formic Acid (CH <sub>2</sub> O <sub>2</sub> )	0.13 ppm	0.02 ppm	0.02 ppm	0.02 ppm
Nitrogen (N <sub>2</sub> )	N/A	5 ppm	5 ppm	5 ppm
Argon (Ar)	0.02 ppm	N/A	0.02 ppm	0.02 ppm
Helium (He)	0.5 ppm	0.5 ppm	N/A	0.5 ppm

\*Additional detections and ranges are available

### Features and Benefits

- Measures any gas/vapor sample
- Provides complete quantitative sample composition
- Real-time analysis of the input and effluent streams reveals what is happening in the reaction
- Useful at every stage of process development: laboratory, pilot, production

### Applications

- UHP Gas quality control
- Quality control for process gas or bulk gas systems
- Fuel-cell hydrogen analysis

### Communication & Software

- Questor 5 Process Control Software
- Tracks and records data
- Automated alarms, validations and calibrations
- Network accessible
- Secure to 21 CFR Part 11
- Ethernet, Modbus, Profibus, digital I/O, analog I/O, OPC



### Technology

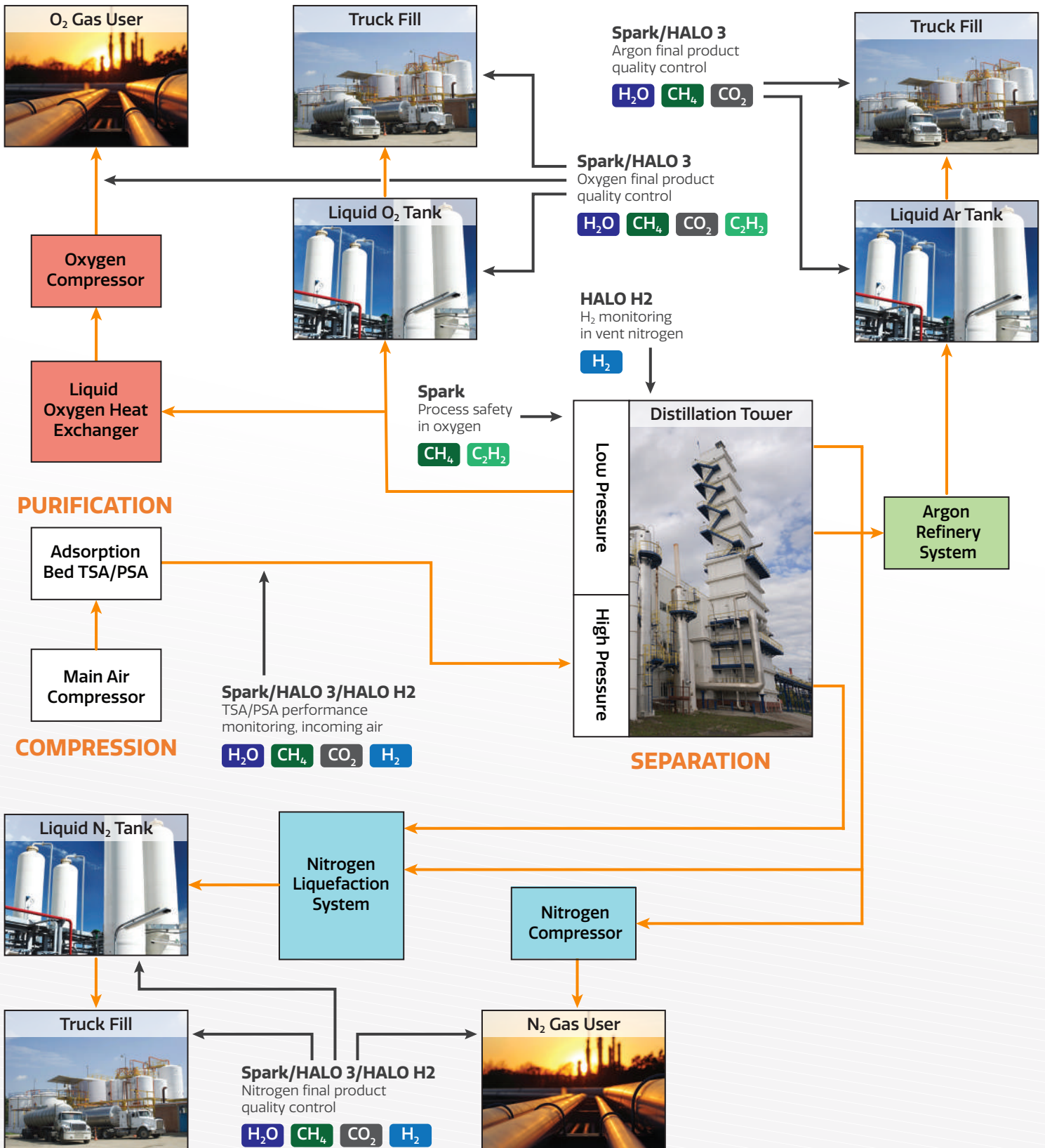
The MAX-300's industry-leading 19mm quadrupole mass filter, combined with state-of-the-art electronics, provides the user with an impressive list of advantages:

- Near-zero mass scale drift for outstanding measurement precision and stability
- Uniform resolution across the entire mass range for ultra-high sensitivity to all compounds
- Extreme resistance to corrosion and contamination for long-term, continuous, low-maintenance operation
- Performance specifications that exceed those common to other mass spectrometers and process technologies

See website for more details

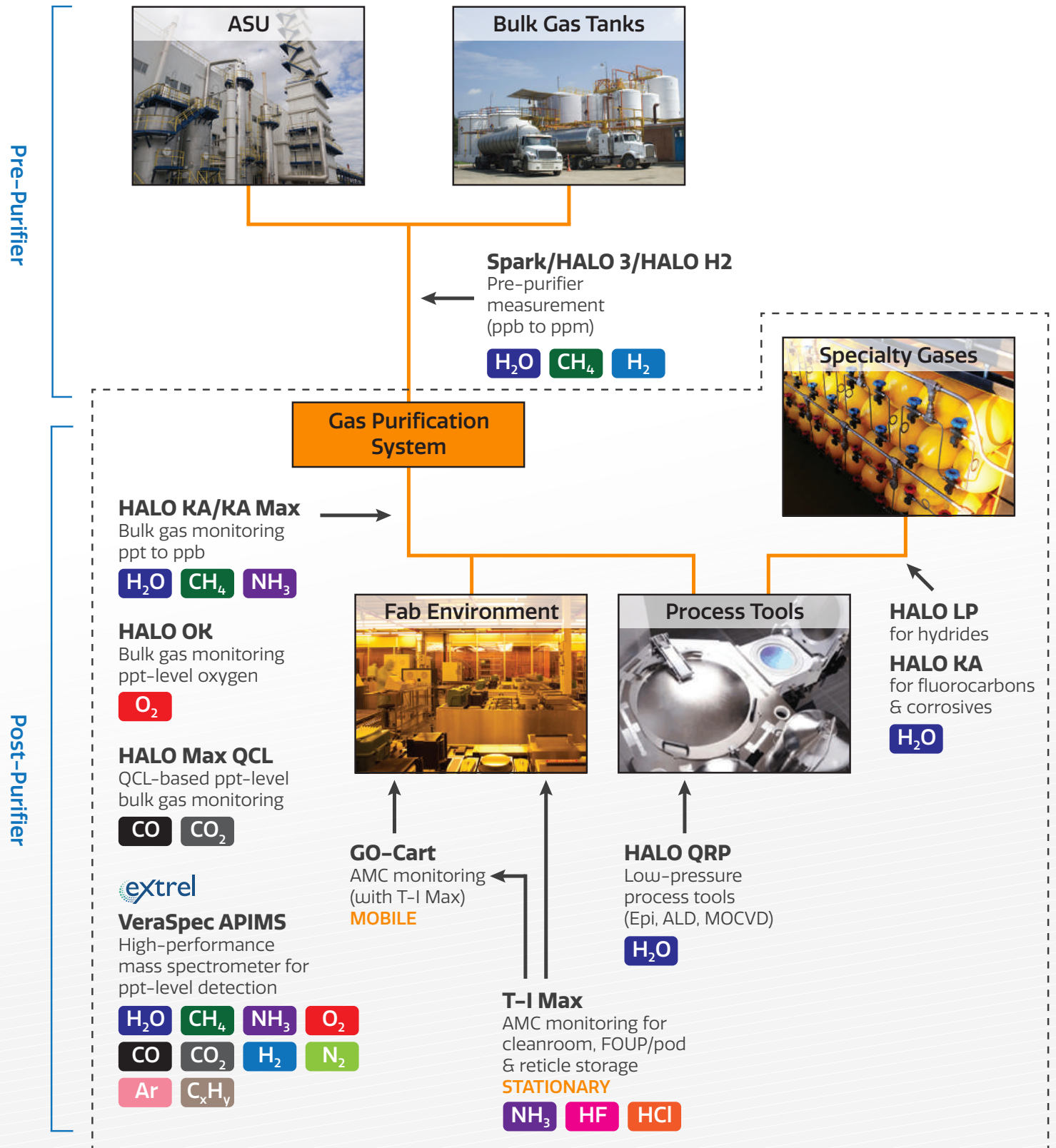


# Application Feature: Air Separation Units (ASUs)





# Application Feature: Semiconductor Fabrication



## Integration Solutions

### GO-Cart

This mobile cart is designed to provide a flexible monitoring solution for semiconductor cleanrooms. Equipped with up to three T-I Max AMC monitors, the GO-cart can be deployed rapidly to monitor AMCs in critical locations.

#### Compatible Products

T-I Max Series AMC monitors

#### Features and Benefits

- Fits up to 3 T-I Max analyzers
- Central 10.4" touchscreen for controlling all installed analyzers
- Cleanroom-compatible materials
- Backup UPS available

#### Applications

- Airborne Molecular Contaminants in cleanrooms
- Mobile AMC monitoring



### Environmental Enclosures

Some applications require analyzers to be installed outdoors or in unheated/uncooled instrument sheds. We offer custom-made enclosures for our analyzers to protect the system from environmental exposure and ensure reliable operation.

#### Compatible Products

Any HALO, Spark or T-I Max

#### Features and Benefits

- Custom-fit to your application and analyzer
- Heated/air-conditioned if needed
- Custom mounting options
- Available with virtually any Tiger Optics analyzer

#### Applications

- Unmanned Air Separation Units
- Environmental monitoring



### Gas Test Panels

Tiger's analyzers operate so reliably that they require virtually no maintenance or calibration checks. Thus, customers ask sometimes how to verify the analyzer's performance. We offer several convenient gas test panels that can be connected to the analyzer to perform zero baseline and span validations.

#### Compatible Products

Any Tiger Optics analyzer

#### Features and Benefits

- Three different basic configurations to match your application
- Purifiers and permeation devices available as accessories

#### Applications

- Zero and span verification
- Analyzer testing



## Software Products

### Serani & Serani Max Interface Software

The Serani/Serani Max software allows full control of your analyzer from your desktop or laptop.

#### Compatible Products for Serani

HALO and ALOHA H<sub>2</sub>O series analyzers w/o front USB port; Spark, CO-rekt and Tiger-i models

#### Compatible Products for Serani Max

HALO series and ALOHA+ H<sub>2</sub>O analyzers w/ front USB port, all T-I Max models

#### Features and Benefits

- Monitoring and control of your Tiger analyzer remotely
- Data plotting and download to your computer
- Easy change of analyzer settings, such as gas type and data filter
- One-step data collection for "Performance Verification"



### Speed+ Performance Upgrade

Intelligent data processing allows this software add-on to adjust the analyzer's response automatically and in real-time to deliver the best performance.

#### Compatible Products

Most new and existing Tiger Optics analyzers

#### Features and Benefits

- Boosts analyzer's speed of response without sacrificing sensitivity or measurement precision
- Software-only upgrade, no hardware changes required (with compatible analyzers)
- Analyze with Ease™—no manual adjustments required, Speed+ is fully automatic



### Linear Fit Mode & Dew Point Measurement

The Linear Fit mode add-on allows the user to use custom calibration curves or adjust readings for a dilution ratio.

Dew Point Measurement enables users to switch H<sub>2</sub>O readings from concentration to dew point.

#### Compatible Products

Most new and existing Tiger Optics analyzers

#### Features and Benefits

- Linear  $y = a x + b$  fit function permits user-defined calibration curves with programmable slope (a) and offset (b)
- Can directly display readings adjusted for a dilution factor
- Dew point capability allows easy comparison to dew point meters, such as chilled mirrors





## Featured Services & Upgrades

### Annual Performance Verification

This annual procedure ensures that your analyzer continues to meet its original specifications. This low cost process is 100% remote, no removal of the analyzer or expensive service visit are required. After completion, we issue a Verification Certificate testifying to the analyzer's correct operation.

#### Compatible Products

All Tiger Optics analyzers

#### Features and Benefits

- Easy, in-situ remote verification process, with no need to return the analyzer to the factory
- Up-to-date Verification Certificate to comply with your QA/QC standards
- Necessary data can be collected most easily via Serani or Serani Max interface software



### Installation & Commissioning Package

Purchasing this package with your new Tiger Optics analyzer means that the unit is correctly installed at your site by Tiger Optics trained personnel. This service guarantees that your analyzer will have the best possible performance.

#### Compatible Products

All Tiger Optics analyzers

#### Features and Benefits

- Ensures correct installation to prevent future issues with your analyzer or sampling system
- Provides standard user training
- Gains you peace of mind that your analyzer will not experience issues related to improper installation
- Saves money in the long run by avoiding expensive repair or maintenance costs



### Gas Library Additions

Our analyzers come with a variety of pre-calibrated background gases suitable for most users. To utilize the analyzer for more applications, additional background gases can be added, most of them via a simple software update.

#### Compatible Products

All Tiger Optics analyzers (availability of background gases varies by model)

#### Features and Benefits

- Use existing analyzer for new applications
- Measure in custom background gases used specifically in your facility
- Save money by purchasing additional background gas packages with your new analyzer



## Tiger Optics Service

### Tiger Optics' Service Capabilities & Offerings

**Tiger Optics is renowned in the industry for its robust, low-maintenance systems and its excellent customer service!**

- Experienced factory staff & field service engineers
- Fast response time to inquiries and issues
- Worldwide service from our headquarters in Pennsylvania and through global service centers and distributors
- More than 90% of issues are resolved without sending the analyzer in for service
- Fast turn-around time for analyzers requiring factory service or repair
- Refreshes and upgrades available for many older systems to keep them in service

#### Custom Service Agreements

Annual services tailored to your requirements bundled into an attractive fixed price. Typical services may include:

- Initial installation & training
- Annual Performance Verification
- Quarterly on-site inspections by TO field service personnel
- Annual refresher training
- Spare parts agreement
- Rental/back-up analyzer(s)

#### Customer Training

- Tailored training courses focusing on your specific needs
- Remote training via webinars
- Training at your site by experienced Tiger Optics personnel
- Extensive training at Tiger Optics headquarters

#### Application Support

- Support from experienced application engineers that help you through the process of selecting, purchasing, installing and optimizing your analyzer
- Sampling system optimization to obtain the best performance
- On-site setup inspection and consultation
- Rental units or spares to support your measurement needs

#### Calibration & Validation Services

- Factory-validation of your analyzer against NIST-traceable reference standards
- Calibrated rental units for on-site comparisons
- Easy & low-cost remote Performance Verification process

### Worldwide Service & Support Network



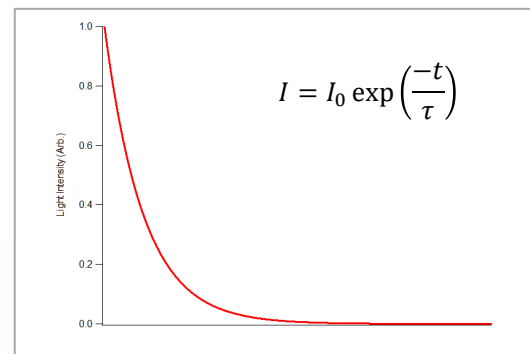
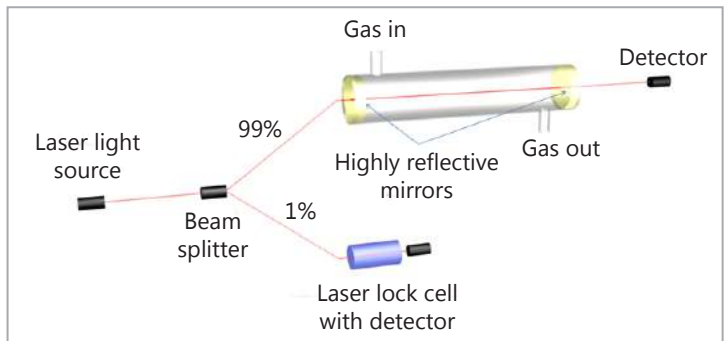
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## Overview of Cavity Ring-Down Spectroscopy (CRDS)

### How CRDS Works

1. A Continuous Wave (CW) laser emits a directed beam of light into a gas cell with two highly reflective mirrors on either end (cavity). The laser wavelength is chosen to be absorbed by the target molecule.
2. The light reflects back and forth between two ultra-high reflective mirrors multiple times, creating a total optical absorption path length of up to 100 kilometers.
3. Once the detector "sees" a sufficient level of light energy built up inside the cavity, the light source is turned off quickly, starting the measurement.
4. On each successive pass, a small amount of light or ring-down signal emits through the second mirror and is sensed by the light detector.
5. This exponential decay, or "ring-down" is recorded and is a direct measure of the losses inside the cavity, which includes the absorption of the target molecule.
6. The CRDS decay constant (ring-down time) is independent of laser fluctuations or external background and provides an absolute and extremely sensitive measurement of the target molecule's concentration.



### Advantages of Tiger's CRDS Technology



**High Accuracy,  
Specificity & Stability**



**Rapid Deployment &  
Fast Speed of Response**



**Versatility &  
Ease of Use**



**Unparalleled  
Sensitivity**



**Outstanding  
Reliability**



**Exceptionally Low  
Cost of Ownership**





[www.tigeroptics.com](http://www.tigeroptics.com)

[www.process-insights.com](http://www.process-insights.com)