

HALO Max QCL

QCL-CRDS Trace Gas Analyzer

GASES & CHEMICALS

CEMS

ENERGY

SEMI & HB LED

ATMOSPHERIC

LAB & LIFE SCIENCE

Our first analyzer series based on Quantum Cascade Laser Cavity Ring-Down Spectroscopy (QCL-CRDS), the HALO Max QCL series offers:

- Parts-per-trillion (ppt) detection capability for carbon monoxide (CO) or carbon dioxide (CO₂) in UHP bulk gases
- Incorporates mid-infrared QCL technology to achieve the ultimate sensitivity
- Absolute measurement (freedom from calibration)
- Excellent speed of response at ppb levels and below
- Continuous measurement—no batch processing typical with GCs
- Robust design & maximum ease of use



Expanding Optical Contaminant Detection Capabilities for Semiconductor Manufacturing

Tiger Optics takes Cavity Ring-Down Spectroscopy (CRDS) to the next level by bringing you the latest optical technology. Utilizing mid-infrared Quantum Cascade Lasers (QCLs), the new HALO Max QCL allows dramatic decreases in detection limits for certain molecules, such as CO.

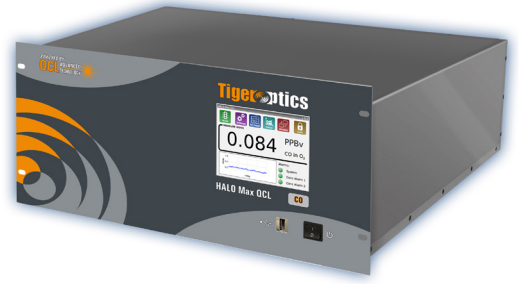
Introducing the HALO Max QCL for ppt-level CO or CO₂ detection, it is based on Tiger Optics' latest Max platform, offers exceptional speed and further improved usability in an all-inclusive and

robust package. The analyzer is fast to install, offers continuous, real-time detection, and is easy to use and effortless to maintain, with built-in zero verification and zero drift.

The HALO Max QCL CO and HALO Max QCL CO₂ perfectly complement Tiger's HALO KA Max series (for H₂O, NH₃ and CH₄) and the HALO OK (for O₂) to utilize the advantages of CRDS for detection of a large variety of critical trace impurities.

HALO Max QCL

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Performance

| | |
|--|--|
| Operating range | See table below |
| Detection limit (LDL, 3 σ /24h) | See table below |
| Precision (1 σ , greater of) | \pm 0.75% or see table below |
| Accuracy (greater of) | \pm 4% or LDL |
| Speed of response | < 1 min to 95% |
| Environmental conditions | 10°C to 40°C 30% to 80% RH (non-condensing) |
| Storage temperature | -10°C to 50°C |

Gas Handling System and Conditions

| | |
|----------------------------------|---|
| Sample gas connections | 1/4" male VCR inlet and outlet |
| Leak tested to | 1 x 10 ⁻⁹ mbar l / sec |
| Inlet pressure | 6 – 125 psig (1.4 – 9.6 bara) |
| Flow rate | ~1 slpm in N ₂ (gas dependent) |
| Sample gases | Most inert and passive gases |
| Gas temperature | Up to 60°C |
| Purge gas (CO ₂ only) | Inert gas (e.g. N ₂), <1 ppm CO ₂ 30 – 150 psig, 4 – 5 slpm |
| Purge gas connection | 1/8" Swagelok® |

Dimensions

| | H x W x D [in (mm)] |
|----------------------|--------------------------------------|
| Standard sensor | 8.75 x 19.0 x 24.0 (222 x 483 x 610) |
| (19" rack-mountable) | |

Weight

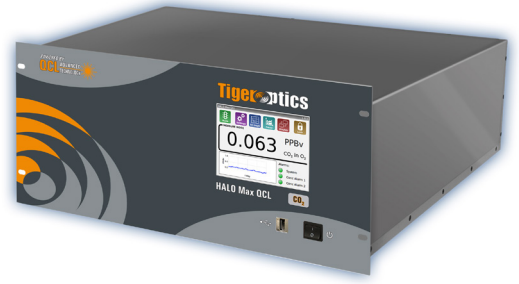
| | |
|-----------------|----------------|
| Standard sensor | 40 lbs (18 kg) |
|-----------------|----------------|

Electrical and Interfaces

| | |
|--------------------|--|
| Alarm indicators | 2 user programmable 1 system fault Form C relays |
| Power requirements | 90 – 240 VAC, 50/60 Hz |
| Power consumption | 100 Watts max. |
| Signal output | Isolated 4–20 mA |
| User interfaces | 5.7" LCD touchscreen 10/100 Base-T Ethernet USB, RS-232, RS-485 Modbus TCP (optional) |
| Data storage | Internal or external flash drive |

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HALO Max QCL CO

| Performance, CO: | Range* | LDL (3 σ) | Precision (1 σ) @ zero |
|------------------------|-------------|-------------------|--------------------------------|
| In Nitrogen | 0 – 0.4 ppm | 200 ppt | 70 ppt |
| In Helium | 0 – 0.4 ppm | 180 ppt | 60 ppt |
| In Argon | 0 – 0.4 ppm | 150 ppt | 50 ppt |
| In Oxygen | 0 – 0.4 ppm | 180 ppt | 60 ppt |
| In Clean Dry Air (CDA) | 0 – 0.4 ppm | 200 ppt | 70 ppt |

HALO Max QCL CO₂

| Performance, CO ₂ : | Range* | LDL [†] (3 σ) | Precision (1 σ) @ zero |
|--------------------------------|-------------|--------------------------------|--------------------------------|
| In Nitrogen | 0 – 0.4 ppm | 100 ppt | 35 ppt |
| In Helium | 0 – 0.4 ppm | 90 ppt | 30 ppt |
| In Argon | 0 – 0.4 ppm | 90 ppt | 30 ppt |
| In Oxygen | 0 – 0.4 ppm | 90 ppt | 30 ppt |
| In Clean Dry Air (CDA) | 0 – 0.4 ppm | 100 ppt | 35 ppt |

*Higher range is available upon request.

[†]Due to the high abundance of CO₂ in air, purging of the analyzer housing is required to achieve specified LDL (see previous page for purge gas requirements).

Contact us for additional analytes and matrices.
U.S. Patent # 7,277,177