Thermo Scientific™ Delta Ray™ is a high performance, mid-infrared laser based, isotope ratio infrared spectrometer. It offers simultaneous determination of δ¹³C and δ¹⁸O in CO₂ at ambient concentrations with a precision as low as 0.05‰.

- δ¹³C and δ¹⁸O in CO₂
- Precision as low as 0.05‰
- Mid-infrared laser based isotope ratio infrared spectrometer
- Portable, field deployable
- Universal Reference Interface – URI
- Up to 1 Hz data
- 200 ppm to 100% CO₂ with dilution
- Global support

Precise, Verifiable Isotope Ratio Measurements
The Delta Ray analyzer comes with a universal reference interface (URI) that provides fully automated referencing and calibration for verifiable measurements and long term confidence. Smart referencing adjusts the reference gas concentration to the sample to achieve superior performance. With the optional dilution box, samples with CO₂ concentration from 200 ppm to 100% can be analyzed.

Isotope Ratios To-Go
The modular design, low weight and built-in referencing make the Delta Ray the analyzer of choice for demanding field applications such as greenhouse gas monitoring, ecology, plant science, carbon sequestration and storage research, or volcanic monitoring. No need to fill vials and wait for the analysis back in the laboratory. Instead feature rich data is acquired autonomously 24 hours a day, 7 days a week, with a time resolution as low as 1 second directly where the sample originates. A quickstart guide gets you going in no time.

Real-Time Results
Powered by the Thermo Scientific Qtegra™ Intelligent Scientific Data Solution™ (ISDS), the data acquisition is driven by powerful workflows. Select sample ports, drive external valves, or synchronize your measurements with external triggers all with a few clicks. Qtegra software then acquires the data into a Qtegra LabBook without user interaction. The fully referenced and calibrated results can be inspected immediately and are easily exported to a spreadsheet or your favorite data analysis package. Qtegra software runs on the on-board Windows 7 computer, which in connection with an internet connection allows you to control your Delta Ray analyzer from anywhere in the world.
Simple, Robust, Powerful Mid-Infrared Technology

At the core of the analyzer is a difference frequency generation (DFG) laser that operates in the mid-infrared, where the absorption of CO₂ and its isotopologues are so strong, that 5 m path length are sufficient to achieve a precision as low as 0.05‰. It is simple, robust and powerful. Sample gas is dried in the analyzer to prevent any interaction of water and CO₂ (isotope exchange) with the added benefit of providing dry mole fraction concentration data. In the measurement cell, where the laser analyzes the gas, pressure and temperature are precisely controlled.

Analytical Performance

Performance Specifications, in Air

<table>
<thead>
<tr>
<th>Parameter</th>
<th>δ¹³C</th>
<th>δ¹⁸O</th>
<th>CO₂ Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision, 60 sec averaging, 30 replicates</td>
<td>0.15‰</td>
<td>1 SD</td>
<td>0.2‰</td>
</tr>
<tr>
<td>External reproducibility*, 300 sec averaging, 10 replicates</td>
<td>0.07‰</td>
<td>1 SD</td>
<td>0.1‰</td>
</tr>
<tr>
<td>Reproducibility, 1 h resolution, 24 h</td>
<td>0.05‰</td>
<td>1 SD</td>
<td>0.05‰</td>
</tr>
<tr>
<td>Operating range</td>
<td>200 - 3,500 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guaranteed specifications range without dilution (100% CO₂ with optional dilution)</td>
<td>380 - 1,500 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement interval</td>
<td>1, 10, 60 sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell exchange time (response time)</td>
<td>35 sec @ 80 sccm sample flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement technique</td>
<td>Tunable laser direct absorption in the mid infrared (4.3 µm) TDLAS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Demonstrated with Zero enrichment template: sample and reference are the same gas, 5 min sample average, 5 min reference average, repeat at least 10 times.

Operating Conditions

- Temperature range: 10 - 35°C
- Temperature gradient: 0.2°C/min
- Humidity: 10 - 80% R.H. up to 31°C
- Size: 19” rack mount chassis
- Weight: Analyzer: 25 kg, URI: 12 kg
- Power consumption: Analyzer: 100 - 240 V, 50 - 60 Hz, 150 W typical / 500 W startup at 25°C, URI: < 160 W
- Sample temperature: -10 to 45°C
- Sample pressure: Sensor input 700 - 1,200 mbar
- Sample flow: Sensor input 80 sccm @ 1,000 mbar abs.
- Pump: Internal, oil free
- Qtegra ISDS licenses: Each Delta Ray system comes with a Qtegra license for installation on one (1) instrument and up to three (3) additional desktop installations for data review and manipulation. Additional desktop licenses can be purchased as an option

Connections

- Electrical: Video: DVI port (incl. VGA), 4 USB ports
- Gas: Sample A (1 - 12 bar relative), Sample B (700 - 1,200 mbar (abs.)), passing through dryer
- Carrier out: for external dilution
- 2 x pure CO₂ with known δ¹³C and δ¹⁸O, synthetic air (CO₂ < 0.2 ppm)
- Fittings: 1/16” Swagelok, 10 - 32 coned port
- Vibration: MIL-STD 810 G
- Temperature: -33 to 63°C non condensing