# APPLICATION NOTE
# LD24-02

## Diving gas analyser

▲ MultiDetek3

The diving world is getting in popularity worldwide. For this reason, it is more and more required to find the best diving conditions that allow to go deeper in a safe manner. In the late years, it has been demonstrated than using Helium in the gas mixture for diving allows more safety. Depending of the diving conditions the gas mixture then uses a concentration of 18-21% oxygen in a balance of Helium and Nitrogen. Replacing the nitrogen content by a certain amount of helium will reduce the anesthtic effect generally caused by nitrogen. The helium has a low lipid solubility and, thus, a low anesthetic effect. For that reason, helium is added to diving breathing gases to reduce the fraction of nitrogen and mitigate the debilitating effects of nitrogen narcosis.

## LDETEK SOLUTION

Our MultiDetek3 gas chromatograph has been configured adequately for the analysis and production/qualification of such diving gas.

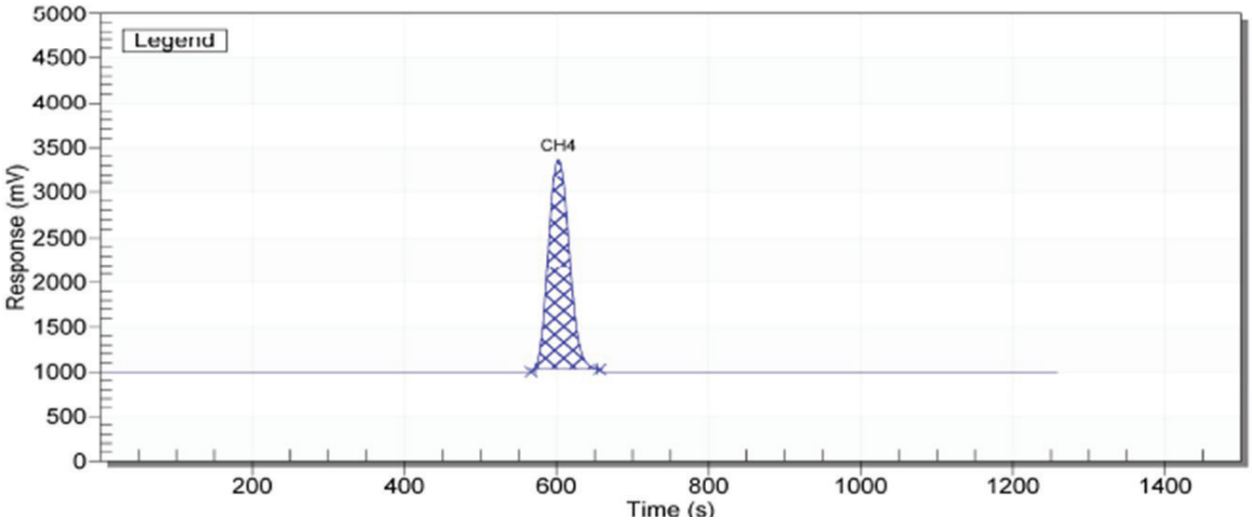
In a first step, the unit used a plasma emission detector (PED) integrated which is configured with the proper network of chromatography columns to measure the critical impurities for diving gas. A measuring scale of 0-50ppm CH4-CO-H2S-SO2 and 0-1000ppm CO2 has been configured to be measured by the PED channel. That channel is using helium as carrier gas. Measuring the trace impurities of these critical contaminants is important to be sure these are maintained below the breathable limit.

In a second step, the same unit used a thermal conductivity detector (TCD) integrated with the proper molecular sieve column to allow the percent analysis of O2 and N2. This channel also uses helium as carrier gas.

Combining both TCD and PED together allows to have the complete diving gas analytical instrument. The level of oxygen and nitrogen can then be monitored and produce the different type of diving gas mixtures depending on the deep requirements. The unit offers a quick analysis time with proven linearity/accuracy and robustness.

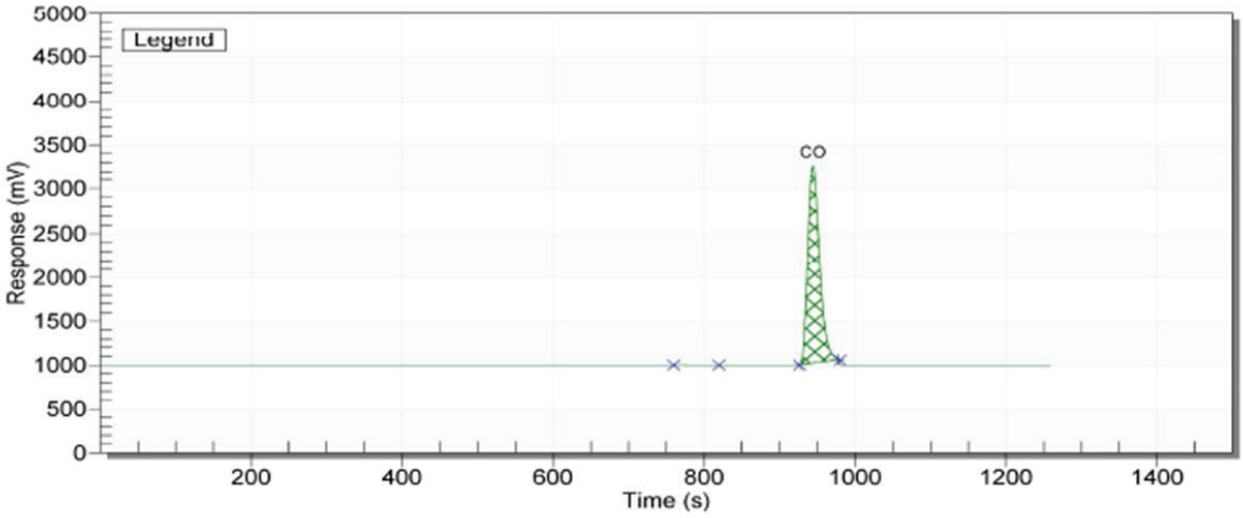
## RESULTS

Chromatogram (Span calibration) of trace impurity CH4 in balance O2/N2/He



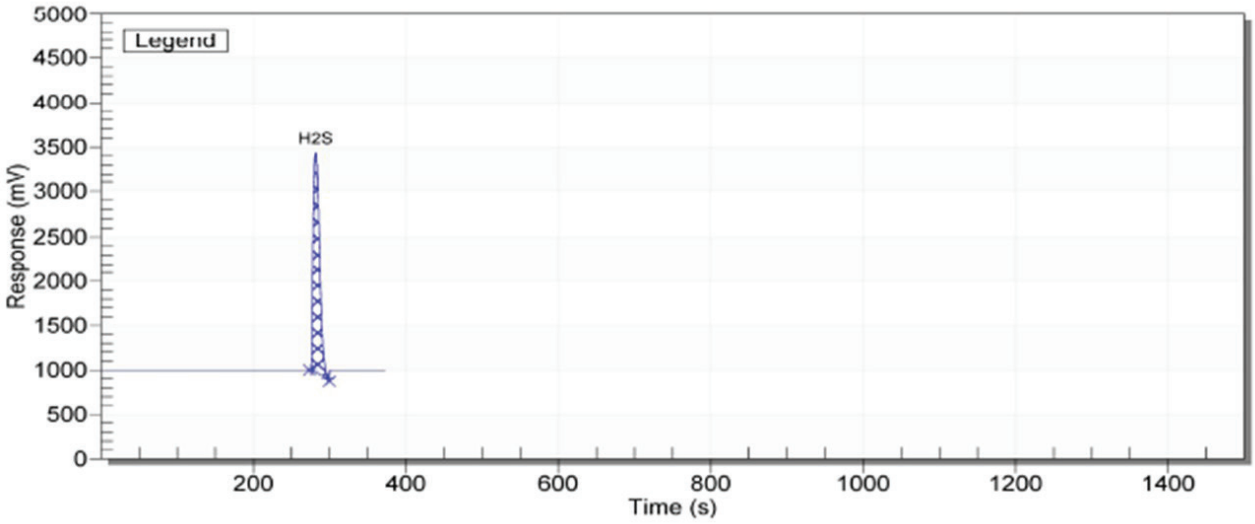

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| CH4 | ppm | 50.00 | 74636 |

Chromatogram (Span calibration) of trace impurity CO in balance O2/N2/He



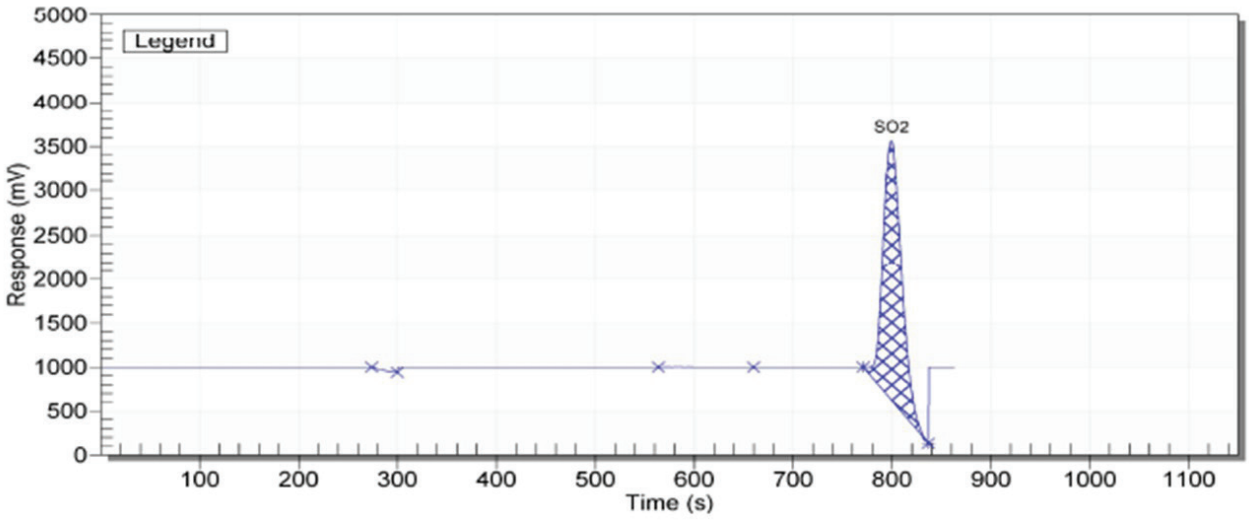

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| CO | ppm | 50.00 | 40430 |

Chromatogram (Span calibration) of trace impurity H2S in balance O2/N2/He



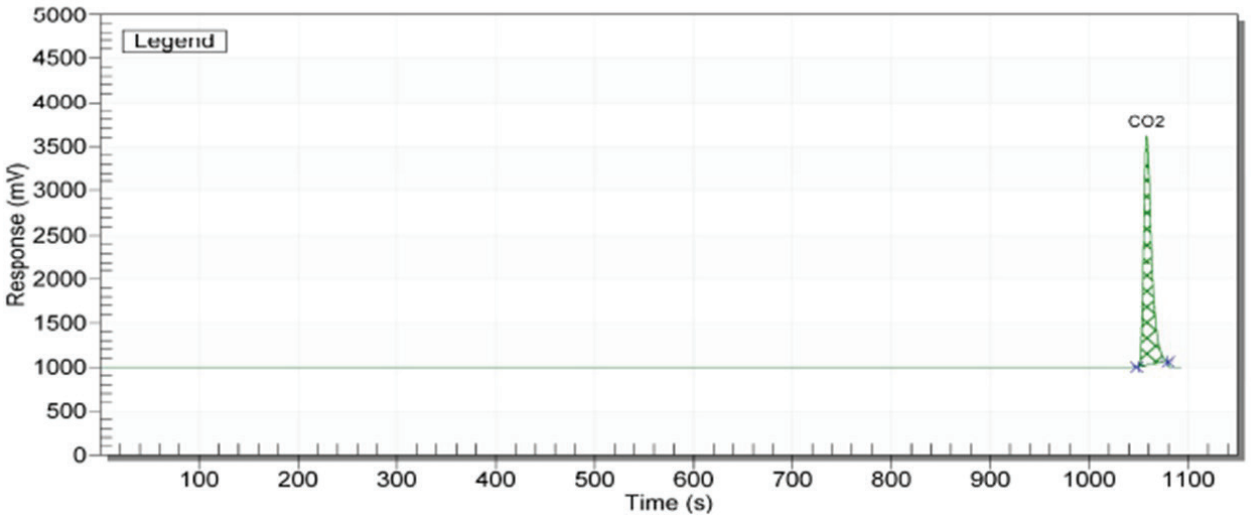

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| H2S | ppm | 25.00 | 23646 |

Chromatogram (Span calibration) of trace impurity SO2 in balance O2/N2/He



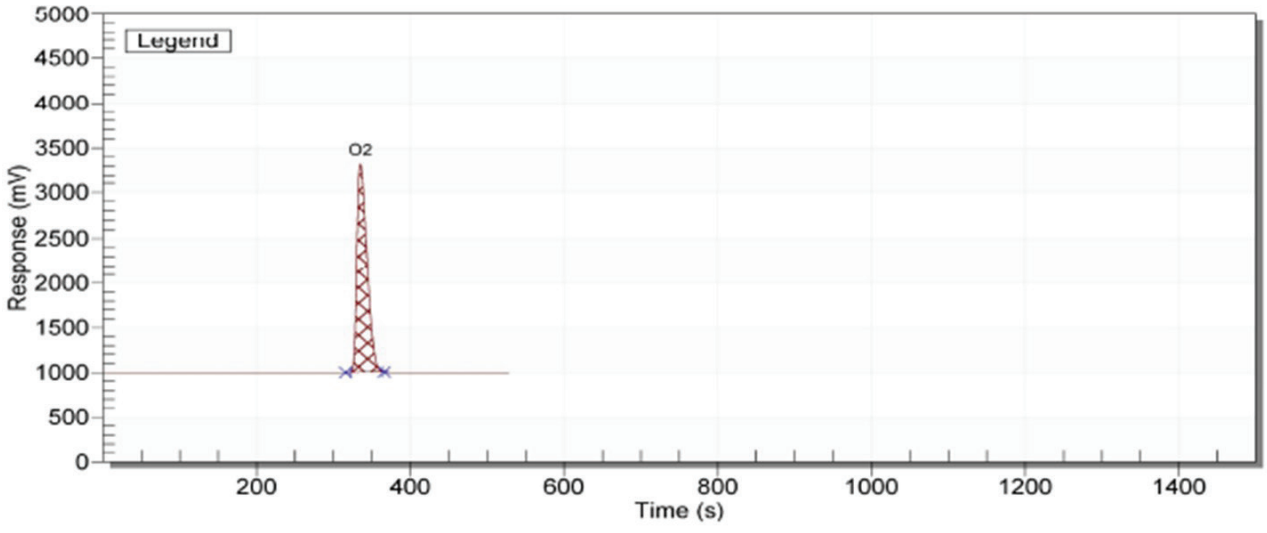

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| SO2 | ppm | 50.00 | 63728 |

Chromatogram (Span calibration) of trace impurity CO2 in balance O2/N2/He



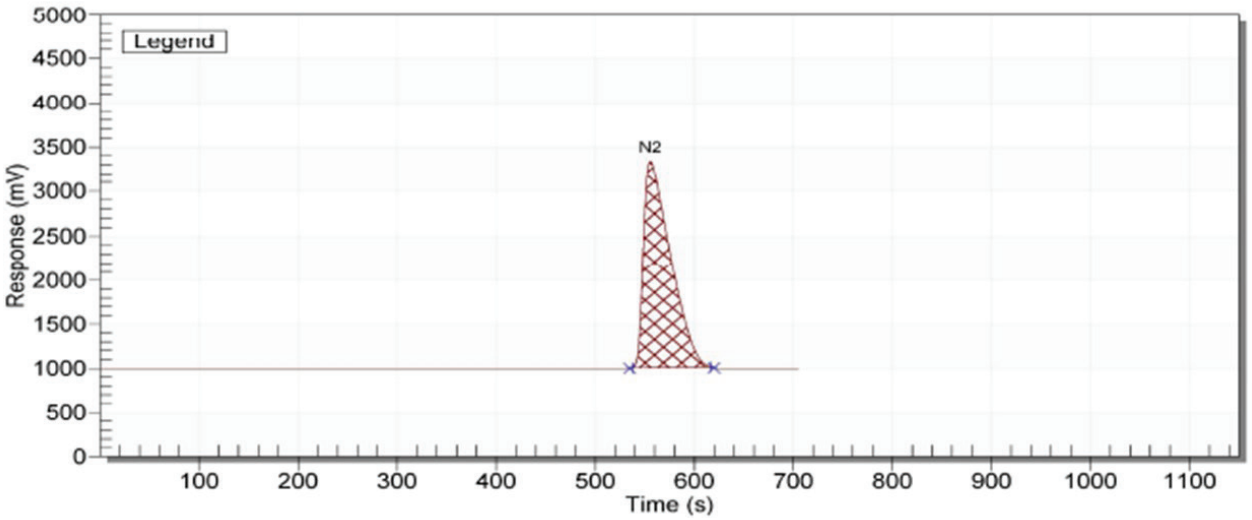

| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| CO2 | ppm | 1000.00 | 23791 |

Chromatogram (Span calibration) of percent O2 in balance N2/He




| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| O2 | % | 10.00 | 35227 |

Chromatogram (Span calibration) of percent N2 in balance O2/He




| Peak | Unit | Calibration Value | Area Counts |
|---|---|---|---|
| N2 | % | 20.00 | 74070 |

**Limit of detection** (based on 3 times the noise level from a blank)

| COMPONENTS | CONCENTRATION | PEAK HEIGHT | NOISE | LDL (3X NOISE) |
|---|---|---|---|---|
| CH4 | 50 ppm | 2400mV | 0.5mV | 0.030 ppm |
| CO | 50 ppm | 2400mV | 0.5mV | 0.030 ppm |
| H2S | 25 ppm | 2450mV | 0.5mV | 0.015 ppm |
| SO2 | 50 ppm | 2590mV | 0.5mV | 0.029 ppm |
| CO2 | 1000 ppm | 2660mV | 0.5mV | 0.560 ppm |
| O2 | 10% | 2400mV | 0.5mV | 0.1 % |
| N2 | 20% | 2400mV | 0.5mV | 0.1 % |

Note: other LDL could be obtained with different injection volume and chromatographic condition

**Repeatability:** Based on the GC standards. Using 6 of 10 consecutive runs, being lower than 5% of 3*CV%.

**Linearity:** Based on the GC standards. A linear curve having its R2 at a value between 0.998 and 1.00.

**Accuracy:** Based on the GC standards. <= 1% of error or ldl whichever is higher.

## CONCLUSION

Using the MultiDetek3 gas chromatograph configured with a PED and TCD channels makes it the ideal analyzer for the diving gas requirement. The PED channel allows the trace impurities detection to ensure the safety monitoring of the critical contaminants to be controlled while the TCD channel measures the mixing ratios of He/O2/N2 upon the diving requirements.

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