

About dynamic range

Dynamic range is defined as the ratio between the smallest signal that can accurately be measured and a full scale signal. Residual gas analyzers typically offer 3 to 4 orders of magnitude dynamic range. SRS RGAs use a logarithmic amplifier in the detector to achieve more than 6 orders of magnitude dynamic range. Figure 1 at the right shows a mass spectrum of 99.999% nitrogen, which was measured using the Faraday cup (FC) detector. The partial pressure scale covers seven decades (10^{-4} to 10^{-11} Torr) and data is acquired in a single scan without range changes. The effect of outgassing of the vacuum chamber has been removed using the background subtraction feature of our software. The RGA has sufficient resolution to detect $^{15}\text{N}_2$, which is naturally present at 15 ppm, even though it is only 2 amu away from a peak that is five decades larger.

Figure 1 shows a high pressure of 4×10^{-5} Torr ($^{14}\text{N}_2$), which is close to the saturation limit of the detector (1×10^{-4} Torr), and a noise floor of about 1×10^{-10} Torr. From these values we can determine that the detection limit of the RGA is a few ppm. Switching to the electron multiplier detector (CDEM) we can improve the signal detection limit of the RGA. Using the software's table mode (see figure 2), the RGA can be set for FC or CDEM detection for up to 10 masses. The Faraday cup is used for major species and the electron multiplier for minor species. Note the dynamic range has been significantly improved (8 orders of magnitude) with the noise floor now at about 10^{-13} Torr.

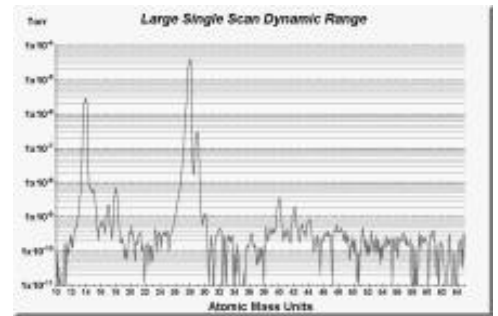


Figure 1

Gas	Name	Mass	Value	Alert	Speed	Gain	SEM
1	Nitrogen	28	7.0E-05	NORMAL	1	1.00	OFF
2	Water	18	7.0E-05	NORMAL	1	1.00	OFF
3	Hydrogen	2	7.0E-05	NORMAL	1	1.00	OFF
4	Oxygen	32	4.0E-04	NORMAL	3	1.00	ON
5	CO	28	1.0E-04	NORMAL	1	1.00	ON
6	CO2	44	1.0E-02	NORMAL	3	1.00	ON
14	He	4	1.0E-05	NORMAL	1	1.00	ON

Figure 2