



## Application Note GasMix 13-01

# AUTOMATIC VALIDATION OF AN ANALYZER WITH A GAS DILUTOR

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One of the possible applications of GasMix™ is the automatic validation of an analyzer. The following data were generated by a specialty gas producer, user of GasMix™.

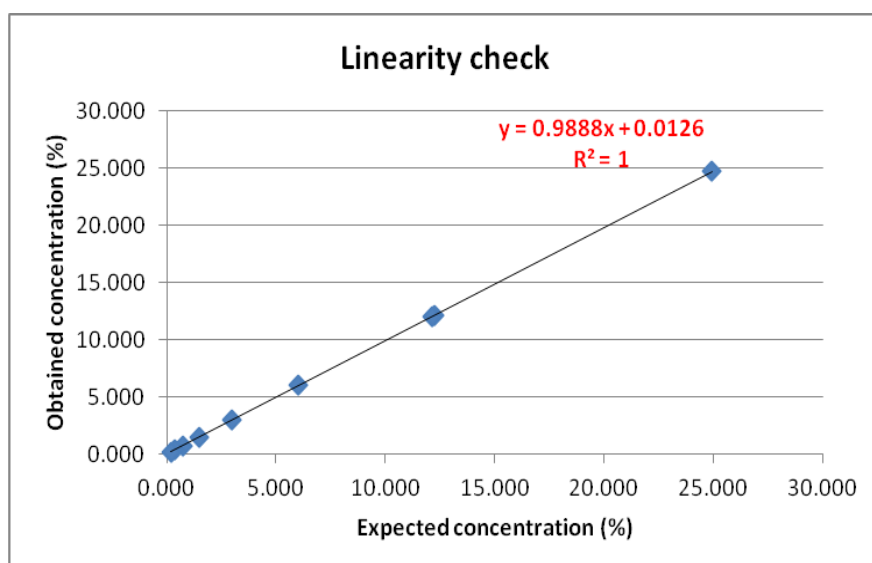
### Technical description

#### Linearity

On an analyzer of O<sub>2</sub>, several gas standards were recreated by mixing of a gas cylinder containing 100% O<sub>2</sub> and a second gas cylinder containing 100% N<sub>2</sub>. The dilutions were realized with a 4-channel GasMix™, using only 2 channels, one MFC of 500 NmL/min for O<sub>2</sub>, and one MFC of 10000 NmL/min for N<sub>2</sub>.

#	Cycle	Replicates	Total	Channel 1	Channel 2	Channel 3	Channel 4	Total	Analyte in use
# 1/10	00:10:00	1	00:10:00	0.0	499.9	0.0	500.1	1000.0	O2 : 49.9900 +/- 0.3144
# 2/10	00:10:00	1	00:10:00	0.0	249.6	0.0	750.4	1000.0	O2 : 24.9600 +/- 0.2131
# 3/10	00:10:00	1	00:10:00	0.0	122.5	0.0	877.5	1000.0	O2 : 12.2500 +/- 0.1351
# 4/10	00:10:00	1	00:10:00	0.0	121.4	0.0	878.6	1000.0	O2 : 12.1400 +/- 0.1342
# 5/10	00:10:00	1	00:10:00	0.0	60.0	0.0	940.0	1000.0	O2 : 6.0000 +/- 0.0824
# 6/10	00:10:00	1	00:10:00	0.0	30.0	0.0	970.0	1000.0	O2 : 3.0000 +/- 0.0501
# 7/10	00:10:00	1	00:10:00	0.0	15.0	0.0	985.0	1000.0	O2 : 1.5000 +/- 0.0303
# 8/10	00:10:00	1	00:10:00	0.0	10.4	0.0	1376.2	1386.6	O2 : 0.7500 +/- 0.0168
# 9/10	00:10:00	1	00:10:00	0.0	10.4	0.0	2762.8	2773.2	O2 : 0.3750 +/- 0.0084
# 10/10	00:10:00	1	00:10:00	0.0	10.4	0.0	5463.1	5473.5	O2 : 0.1900 +/- 0.0043

Expected	Obtained
49.990	49.296
24.960	24.696
12.250	12.144
12.140	11.970
6.000	5.994
3.000	2.982
1.500	1.489
0.750	0.750
0.375	0.377
0.190	0.193



## Repeatability

The repeatability was tested using the same configuration as the linearity check.

Measure N°	1	2	3	4	5	6	7	8	9	10
[O2] %	50.464	50.432	50.397	50.417	50.382	50.390	50.381	50.365	50.387	50.379

Average	50.3994
SD	0.0299
RSD %	0.0593

The results show a relative standard deviation of 0.06%.

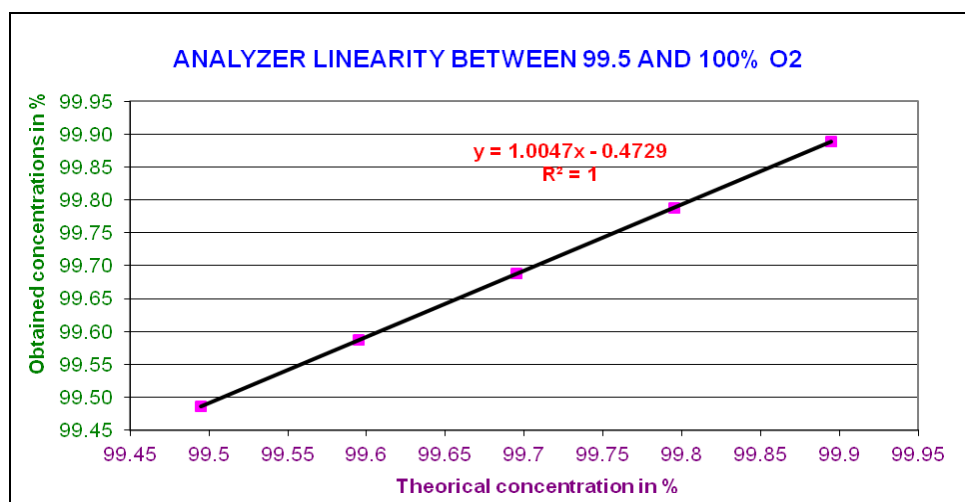
## Detection limit

Still on the same O<sub>2</sub> analyzer, our customer tested the ability of the analyzer to detect the difference between 99.5%, 99.6%, 99.7%, 99.8% and 99.9% of O<sub>2</sub>. This ability to detect such differences is useful in medical field, where oxygen concentration accuracy is critical.

The following sequence used one MFC of 50 NmL/min for N<sub>2</sub> and the same MFC of 10000 NmL/min for O<sub>2</sub>.

#	Cycle	Replicates	Total	Channel 1	Channel 2	Channel 3	Channel 4	Total	Analyte in use
# 1/5	00:10:00	1	00:10:00	15.0	0.0	0.0	2985.0	3000.0	O2 : 99.4950 +/- 0.0055
# 2/5	00:10:00	1	00:10:00	12.0	0.0	0.0	2988.0	3000.0	O2 : 99.5950 +/- 0.0053
# 3/5	00:10:00	1	00:10:00	9.0	0.0	0.0	2991.0	3000.0	O2 : 99.6950 +/- 0.0052
# 4/5	00:10:00	1	00:10:00	6.0	0.0	0.0	2994.0	3000.0	O2 : 99.7950 +/- 0.0051
# 5/5	00:10:00	1	00:10:00	3.0	0.0	0.0	2997.0	3000.0	O2 : 99.8950 +/- 0.0050

Expected	Obtained
99.495	99.486
99.595	99.587
99.695	99.688
99.795	99.787
99.895	99.888



## Conclusion

All these experiments were repeated with gas standards cylinders and a comparison was made, to determine the uncertainty generated by GasMix™. The difference between cylinders and GasMix™ is about 1% for the linearity and about 0.06% for the repeatability. All uncertainty figures are generated and monitored by the GasMix™ software.

Thus, GasMix™ is able to replace advantageously a set of gas standard cylinders without losing the accuracy that an analyzer validation requires.