

**Using the NDIR500 in a turbo-charged exhaust**

**Introduction**

An increasingly popular application for the NDIR500 is to sample from the exhaust of turbo-charged diesel engines. The sample inlet pressure can vary considerably and to provide pressure stability within the sample head (essential for NDIR measurements) extra restriction must be put into the sample line.

The criteria that is taken for sampling in a turbo exhaust is that there must be no pressure interference on the signal in response to a 0-2.5barg input with a T10-90% of about 0.7 seconds.

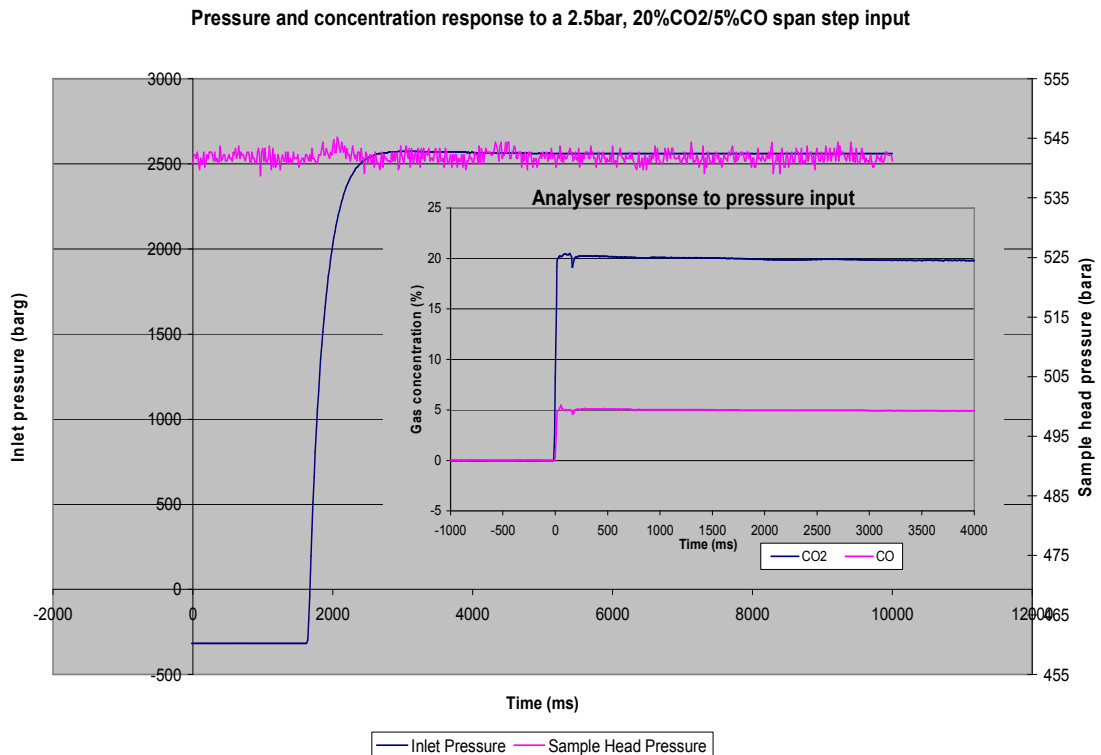
**Changes to standard configuration**

After internal tests a series of modifications should be made to meet the above sampling criteria:

- In-cylinder sample probe. This has a 0.026" id bore providing ample restriction to the high pressures.
- Vacuum expansion chamber: This further improves pressure stability and is positioned at the rear of the sample head. Volume is about 3litres.
- Change of pressure controller PID terms.

**Results**

The chart below shows the pressure of the sample head while the sample point pressure is subjected to a rapid 2.5barg pressure step.



The Inlet Pressure trace starts at -300mbar due to the method employed to produce the step response. The pink 'Sample Head Pressure' trace shows excellent stability during this step, and correspondingly the analyser output is stable.

The step response is produced with a 20%CO<sub>2</sub>/ 5%CO in N<sub>2</sub> span gas. The analyser samples atmosphere until the high pressure span gas is connected. There is a small disturbance in the output signal on both CO and CO<sub>2</sub> and this is also due to experimental setup.

Using a narrow bore sample probe will slow the time response to from 6ms to 16ms under atmospheric conditions. While using a sample filter with the in-cylinder sample probe a 50ms T<sub>90-10%</sub> has been observed.

## Conclusions

This work has solved the problem of fast and large pressure transients of the input pressure effecting output signal. The drawback of this setup is a slight loss in time response at **atmospheric pressure**, but this will only improve as the pressure in the exhaust increases. Therefore the time responses cited in this document should be taken as 'worst case'.