

Mobile CO&CO2 measurement on-board a diesel vehicle

Introduction

The fast NDIR500 CO&CO2 analyzer was adapted for mobile, on-board, measurement. Power requirements were reduced by using only one channel and a smaller vacuum pump. This allowed the unit to be powered from a battery and inverter after warming up and calibration on the mains. Warming up and calibrating when connected to the mains reduced the in-rush load on the battery and removed the need to carry calibration gases on-board. The vehicle tested was a Euro 5 2.0 litre diesel Ford Galaxy driven on a short urban route. Results were recorded via the instruments user interface and correlated with audio and video (gear shifter) of engine transients. The OBD port was also used to track % load.

Vehicle summary

- Ford Galaxy
- Year 2006
- 2.0 litre diesel
- Euro 5

Changes to standard configuration

- Smaller vacuum pump to reduce power consumption < 500W
- Single channel
- Small cabinet enclosure
- 600W 12V – 230V inverter
- Suitable battery (in this case 70Ah)
- Long sample probe
- Sample filter (optional)

Changes in instrument specification

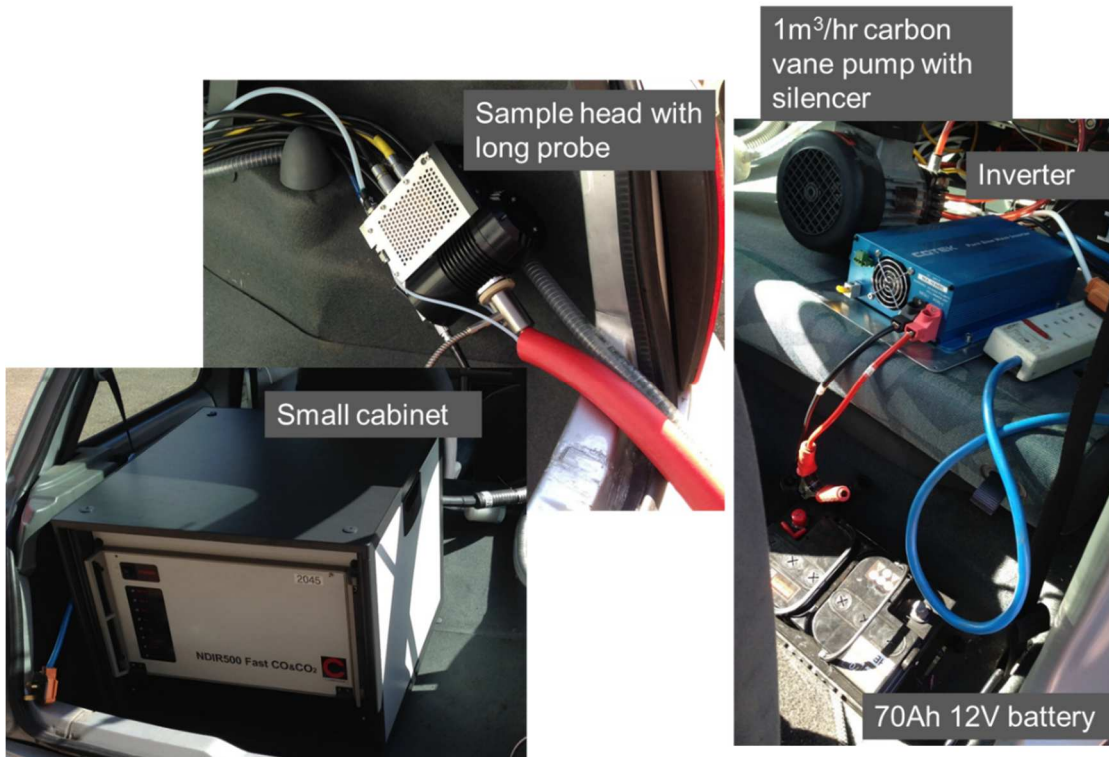
Feature	Standard NDIR500	Mobile configuration
T10-90% response time	8ms	~50ms
No. of channels CO&CO2	2	1
Available sample points	Intake, turbo, in-cylinder, exhaust	Tailpipe only
Enclosure	114cm high cabinet including vacuum pump	46cm high, vacuum pump external
Power supply	Mains 230/115V	12V inverter (500W)

Instrumentation photos



Direct tailpipe sampling

Important user note: avoid fitting probe tip too far into exhaust tailpipe and sampling water from muffler.



Sample head with long probe

1m³/hr carbon vane pump with silencer

Inverter

Small cabinet

70Ah 12V battery

Important user note: vacuum pump exhaust pipe should be routed to outside to avoid toxic gases entering the vehicle.

The (urban) route

Route is a circuit starting at Cambustion, marked by the red pointer.



Results

<https://www.youtube.com/watch?v=4V8cYFM1PX4> (best viewed with audio to hear engine transients and correlate with emissions)

Conclusions

- CO2 quickly returns to zero during decelerations
- Gear changes resolved as fast drop then rise in CO2
- Fast CO2 data was available much faster but only logged at ~1s intervals (to match ODB data rate)
- On-board CO was virtually zero throughout the test