S. Hardaker - 12th November 2007

Automotive Nitrogen Analyser Project

What does a nitrogen analyser do?

A nitrogen analyser does not actually measure the concentration of nitrogen in a gas mix; it measures the concentration of oxygen and subtracts this from 100% to *derive* the concentration of nitrogen present in a nitrogen/oxygen mix.

This point may be of little concern in the automotive industry where the nitrogen is commonly obtained by using a molecular sieve to separate oxygen and nitrogen out of air, as only oxygen and nitrogen will be present in any significant quantities.

However, this will be more of a concern if someone attempts to use the analyser with a gas mix that contain other gases, such as Trimix, and as such it would be prudent to make it clear that the analyser actually derives the nitrogen concentration and is only accurate in oxygen / nitrogen mixes.

Where is nitrogen used and why?

Specialist applications such as aircraft, motor racing tyres and heavy machinery use nitrogen as an inflation gas for a number of reasons:

Nitrogen dissipates heat faster than air, and nitrogen inflated tyres have a more consistent rate of expansion with temperature than air-inflated ones, resulting in more even pressures under various conditions. Air inflated tyres contain water vapour, which expands with increasing temperature at a different rate to dry air, this can cause unpredictable expansion of the tyre under extreme conditions.

The consistency of nitrogen lends itself to the extreme conditions of high performance vehicles, such as in motor sports, where high temperatures develop in the tyre; air inflated tyres will expand more at high temperatures due to increased pressure, which can affect vehicle handling and increase the risk of a blow-out.

Another advantage of nitrogen is that it permeates through the tyre casing at around a third of the rate of oxygen, which maintains tyre inflation for longer, leading to improved performance and economy.

The use of nitrogen also reduces oxidation of the rubber tyre compound caused by oxygen and water vapour present in a normal air fill, thus extending the life of the tyre. It may also prevent corrosion of the wheel.

Finally, nitrogen does not support combustion, which is one of the reasons it is used for inflating aircraft tyres, and those on the space shuttle.

Typically, the concentration nitrogen will be around 95% in a nitrogen-inflated tyre.

What adapters are required?

Fortunately the automotive and aircraft industries have standardised the types of valves used, with only 2 common variants.

The 8v valve is an 8 mm diameter valve, it is commonly found on almost all standard road vehicles, and some aircraft tyres.

The 12v valve is a 12 mm diameter valve, it is commonly found on almost all aircraft, with a few exceptions. It may also be found on heavy plant and other specialist vehicles.

To connect to an 8v valve an 8v tyre chuck is required, we have a source of these and stock them (pt. no. 0121251).

To connect to an 12v valve an 12v tyre chuck is required, we have a source of these and stock them (pt. no. 0121252).

Both of the aforementioned tyre chucks have a ¼" BSP thread at the opposite end to the sampling head; BSP being the common method of fitment in UK and EU air-line products.

U.S. products often use ¼" NPT (U.S. National Taper; the thread is slightly tapered), NPT threads will not mate directly to BSP and vice versa. To resolve this issue we supply a ¼" BSP male to ¼" NPT female adapter (pt. no 0121250).

The above adapter is required to connect either of the tyre chucks to a Teledyne AN300, which has a sensor holder cap with a ¼" NPT male thread.

If designing a new automotive analyser specifically for the EU, it would be preferable to avoid using ¼" NPT threads altogether.

An alternative solution may be to incorporate the Quick-Ox, as per the prototype illustrated below. This would also need to be manufactured in 8v and 12v variants.

Mounting options

Any new nitrogen analyser should ideally be able to utilize the existing range of mounting options for the Teledyne and Maxtec range of monitors:

<u>V-mount pole clamp (pt. no 0121201)</u>

This allows the mounting of a monitor with a V-mount adapter plate (pt. no. 0121213) as used on AX/MX/GB/AN300. The adapter plate would need to be affixed to the monitor and could be removable, as with the Teledyne system, or fixed.

Universal mounting clamp (pt. no. 0121200)

This allows the mounting of a monitor with a camera mount thread, which would need to be incorporated into the back or bottom of the monitor. A camera mount thread allows the user to utilize a wide range of existing mounting options, which can be obtained from photographic equipment suppliers.

Swivel mount (pt. no. 0121199)

This allows the monitor to be mounted on a desktop or shelf; it has fixing holes in the event that the user may need to screw it onto to a surface. To incorporate this mount, the camera mount thread would ideally be on the bottom of the monitor.

Free-standing

If the monitor is intended to be free-standing, a system incorporating sucker-feet could be used, as with the Teledyne AX/MX/GB/AN300 series, although for the sake of stability I would not advise a separate base unit, as this seems to be the cause of a lot of the damage sustained to the Teledyne units: the monitor can pop out of the base unit and falls to the floor if the cable is stretched.