

# FACTORS AFFECTING THE CHOICE OF SENSOR

In recent years, the increased utilisation of low-cost sensors has significantly affected the safety and environmental markets, but instead of replacing reference-grade analysers, low-cost sensors have dramatically expanded the scope and range of applications for gas and particle monitoring equipment; particularly for environmental applications. As a consequence, the number of sensor manufacturers has increased considerably, so in the following article, Arthur Burnley from Alphasense will outline some of the factors that should be considered when choosing a sensor manufacturer.

## Reputation and longevity

A sensor supplier is more than just a cog in a supply chain – it is a business partner, with responsibility for possibly the most important performance characteristics of a product. In many respects, the brand reputation of an instrument manufacturer rests on the quality and reliability of its sensor supplier, so this is an important decision. The Alphasense sensors have been developed over 25 years; benefiting from a continuous improvement ethos that focuses on sensor performance and reliability. Manufactured in the UK, these sensors now command a major share of the global market.



Alphasense UK Head Office

## Innovation

Alphasense was founded in 1996, but since that time the company's sensor range has expanded enormously. This is a direct result of a focus on research and development, which has been a major feature of the business throughout its history. Around 80% of the new product activity is driven by the 'voice of the customer', with the remainder coming from bright ideas within the company and its academic partners.

Once a new product or technology idea has been identified and



accepted as a promising market opportunity, a feasibility study is implemented, either internally or with one of Alphasense's academic partners. It is normal for a number of such projects to be running simultaneously, because there is no guarantee of success, so Arthur believes that it makes sense to ride more than one horse. Occasionally, new product ideas involve the measurement of a new parameter, but more frequently, the requirement is an adaptation of an existing technology. For example, in the early years, most Alphasense sensors were employed for toxic gas detection in health & safety applications. Typically, these instruments would measure in the PPM range, but with increasing environmental awareness, customers began asking for sensors that could operate reliably in the low PPB range. This prompted a number of R&D projects that resulted in a range of air quality sensors that now sell in their 100's of thousands all over the world.

In addition to toxic gases, customers in the environmental monitoring market also needed to monitor particulates. In most countries while toxic gases such as nitrogen dioxide are responsible for high numbers of premature deaths, the numbers attributable to fine particulates are even greater, so Alphasense developed a number of particle sensors that have become well established in the market.

VOC monitoring is important in both environmental and safety monitoring, with volatile organic compounds representing both toxicity and explosion risks. Alphasense has therefore become one

of the world's leading suppliers of PID sensors; typically selling around 30,000 per year.

As well as new parameters and sensitivity, the voice of the customer has also driven development work in areas such as power consumption and size. Both of these issues feature strongly in the objectives of most of Alphasense's product developments. This is because instrument manufacturers are constantly looking for ways to improve the ease with which monitoring can be undertaken, and this is significantly enhanced by making instruments that are small, lightweight and capable of running for extended periods without a requirement for frequent re-charging. Customers also look for sensors with a wider range and reduced



ETO-Electrochemical Sensor

interference from other gases. This has resulted, for example, in over 20 different versions of the Alphasense CO sensor, with a variety of range options and significantly reduced interference from hydrogen. Occasionally, development work to reduce interference has also resulted in solutions that involve sensors working together.

### Testing and Validation

For some reason, (presumably to lower costs) many sensor manufacturers batch test their products which means that they take a selection of sensors from a production batch, test them and assume that the results reflect the status of the entire batch. Importantly, this has never been the philosophy at Alphasense. A bespoke test and validation facility has been constructed and developed over many years at the company's factory near Stansted Airport in the UK, so that every single sensor is tested before it is passed for distribution.

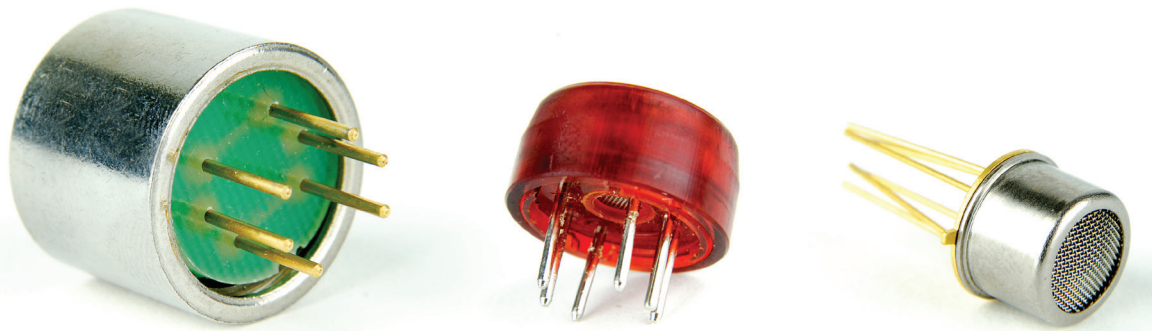
Typically, Alphasense manufactures sensors in batches of 64. Often, all of the sensors pass the rigorous in-house tests, but occasionally maybe 62 or 63 will pass, so that is great news for customers because it means that they won't have to be person that finds the 1 or 2 in 64 that have failed the stringent testing regime. However, the major advantage of testing every single sensor is that this provides a fantastic opportunity to identify opportunities for improvement. By constantly testing every product, it becomes possible to figure out why some sensors fail to meet the required specification. A good example lies with the use of expensive noble metals. Naturally, manufacturers will want to minimise the amount of costly components, but at Alphasense, root cause analysis has occasionally identified the thickness of a sensor's noble metal component as the source of potential failure, so the specification is changed to improve reliability. This may result in a slight increase in cost... but the cost of not doing so is greater!



OPC-N3 particle sensor

Many companies claim to operate a continuous improvement programme, but if you really want to be able to identify the root cause of potential problems, you have to test every product. Similarly, root cause analysis is applied to production and delivery activities to ensure that on-time delivery benefits from close scrutiny and continuous improvement.

In addition to the quality control activities outlined above, Alphasense also conducts what is internally known as 'killer testing' on samples from a batch of sensors. This involves testing sensors under extreme conditions of heat and humidity – to the point of destruction. Again, this informs the continuous improvement process, but competitors' sensors are also included; more often failing sooner or in higher volumes than Alphasense sensors.



Metal Oxide Sensors

### Technical Support

It is common for a number of technical questions to arise during the integration of an Alphasense sensor into an instrument. Around 95% of queries are responded to by the Alphasense sales and technical team within a working day, with the remainder being handled by the company's senior scientists and academic partners. This highlights the advantages of locating the head office and the factory in the same place.

The most common queries relate to the interfacing of sensors with different devices, but they can also address issues such as cross-sensitivities and environmental effects. Other issues may result from customers' own testing. For example, they may be using an inappropriate sample line or an inadequate flow rate to test the sensor.

Occasionally, misunderstanding may result from an expectation that a low-cost electrochemical sensor should perform in the same way as a calibrated reference gas analyser. It is important, therefore, to appreciate that whilst reference gas analysers can be expected to provide defensible monitoring data, they are substantially more expensive, both in terms of capital cost and service/calibration.

### Partnerships into the Future

The health & safety market is relatively mature, but new applications are being developed by Alphasense and its partners. For example, personal monitors are becoming wearable monitors as the sensors become smaller, lighter and less power hungry. As a result, personal monitoring is becoming less obtrusive; providing accurate measurements for example, of the air being breathed.

In the environmental market, low-cost sensors are dramatically increasing the number of monitoring points. They are not replacing reference gas analysers, but are providing supplementary data of tremendous value. For example, scientists from Cambridge University used Alphasense sensors to monitor air quality all over the city of Cambridge. They found that while the local reference station was recording acceptable air quality values, many of the low-cost monitors showed readings for gases such as nitrogen dioxide several times higher than the European limit. This helps to identify air quality hot spots and measure the effects of remediation. Similar advantages in air quality monitoring were achieved by the Breathe London project which utilised Alphasense sensors, located strategically on lamp posts, buildings and street infrastructure in central London.

Looking forward, Alphasense's partners are increasingly exploiting the benefits of advances in communications and of real-time monitoring networks. As outlined above, small, low-power, low-cost sensors enable users to monitor air quality where it matters, rather than where planning permission can be obtained to install a reference monitoring station. However, the value of a network is greater than the sum of the individual monitors because networks enable the tracking and visualisation of pollution as it moves through an area. Coupled with wind monitoring data, this also helps to identify the sources of pollution. Such networks are

not necessarily designed to measure absolute, legally-defensible values. More importantly, they are looking to detect change. That might be change in air quality outside a school during drop-off, or change in air quality when a mitigation measure is implemented, or it might be a longer-term change; monitoring the effects of pedestrianisation for example.

Networks are also able to lower monitoring uncertainty because when one node reports significantly different data from the others, it may be due to a local source of pollution or an error, which can be checked. The quality of data from networks can be assured by co-locating a node with a reference station or, if that is not possible, some users locate one of the nodes close to a large expanse of water to help establish a value that is close to zero in the early hours of a Sunday as an example.

Developments in low-cost sensors are also enabling citizen science; smaller cheaper sensors make it easier for citizens to conduct their own monitoring, using the IoT to contribute to a central data management facility.

Looking forward, the current trend in developments will continue with sensors that are smaller, more sensitive, use less power, have less interference, measure wider ranges etc. However, the most remarkable developments will be in sensor and network intelligence. Automated monitoring systems will track the health status of sensors and networks will be able to calibrate themselves.

In summary, there are many factors that should be taken into consideration when choosing a sensor manufacturer to partner with, but whilst cost is important; sensor quality, reliability and support are more so.

**Based in the UK, Alphasense is a totally independent gas sensor development and manufacturing company founded in response to a demand from gas detection equipment manufacturers for better quality gas sensors and a higher level of after-sales support.**

**The company's technologies include Electrochemical, Catalytic, Laser optical particle counting, Metal Oxide semiconductor and Optical (including NDIR & PID). Driven by customer demand, new technologies are continually explored and developed.**

**Alphasense aims to deliver defect-free product on-time, every-time, achieving the lowest warranty returns in the industry through continual improvement and quality-focused development.**

**With access to some of the best technical and academic expertise available, Alphasense works closely with universities and research organisations worldwide, and the company's strong re-investment policy maximises the benefits of this privileged position.**

**Through the delivery of its products and services the company contributes to a world that is safer, cleaner and more energy efficient.**

Read, Print, Share or Comment on this Article at: [envirotech-online.com/article](http://envirotech-online.com/article)



### Author Contact Details

Arthur Burnley - Sales and Marketing Director, Alphasense Ltd • Sensor Technology House, 300 Avenue West, Skyline 120, Great Notley, Essex CM77 7AA, United Kingdom • Tel +44 (0) 1376 556 700 • Email: [sensors@alphasense.com](mailto:sensors@alphasense.com) • Web: [www.alphasense.com](http://www.alphasense.com)

