

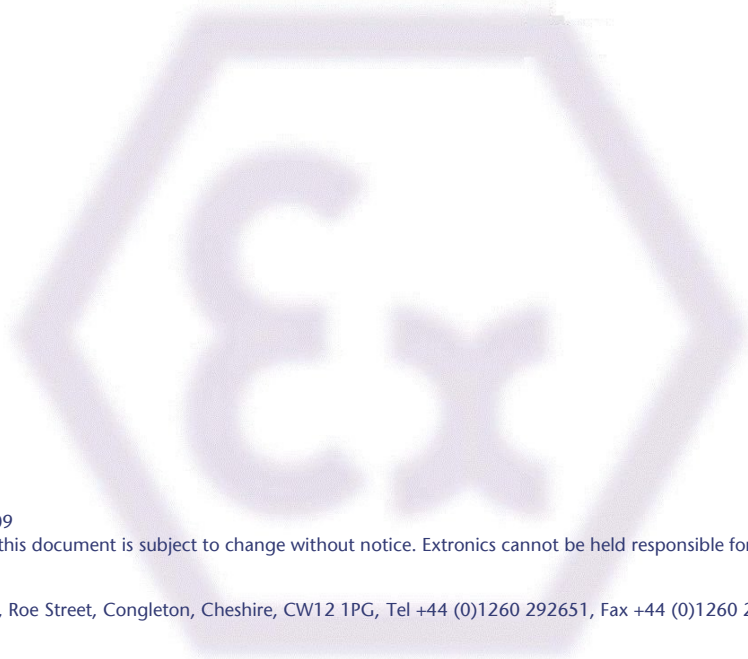


WHITE PAPER

GAS MEASUREMENT WITHOUT SAMPLING SYSTEMS

February 2009

By Paul Lazor, Sales & Marketing Director



Copyright © Extronics Ltd 2009

The information contained in this document is subject to change without notice. Extronics cannot be held responsible for any errors or inaccuracies within this document.

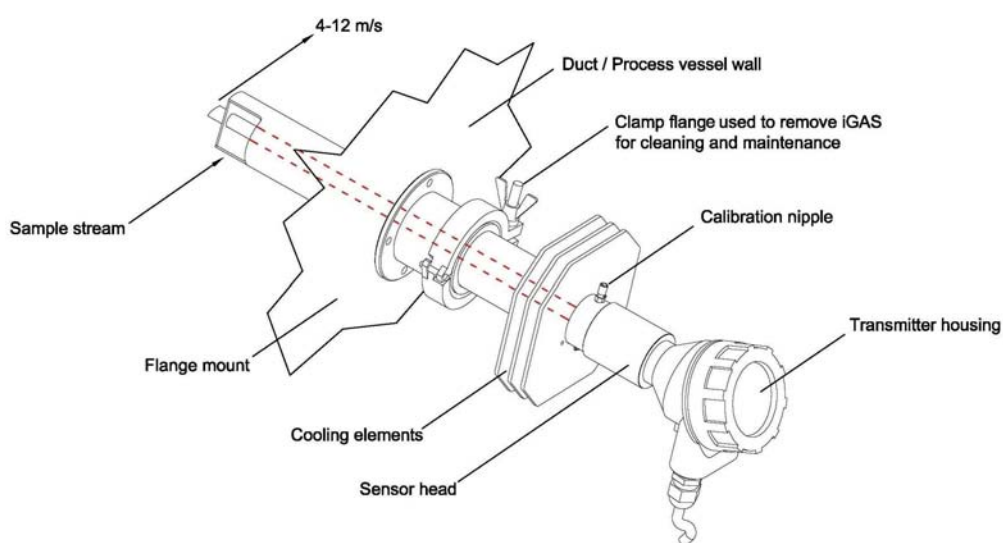
Extronics Ltd, Meridian House, Roe Street, Congleton, Cheshire, CW12 1PG, Tel +44 (0)1260 292651, Fax +44 (0)1260 297280 | www.extronics.com

Gas measurement without sampling systems for the iLEL100 flammable gas and solvent monitor and other GAS applications!

The use of Gas measurement equipment whether for process applications, laboratory research or area monitoring has generally been considered an expense that companies could do without! Few applications provide a rapid Return on Investment when implementing gas analysis systems.

Complex sampling and conditioning systems which may utilise pumps or aspirators, filters, heated lines and water condensate removal vessels with coolers dramatically increase the capital cost of the equipment required to undertake the measurement of the target gas or gases. In addition the installation and commissioning costs can be extremely high, requiring support gases to be piped through to the analysis equipment which may require long and tortuous pipe runs all of which present the operator with a substantial maintenance regime with a high cost of operation!

To address the above issues it is important to appreciate the nature of the application and identify whether a different approach can be taken to eliminate the complexity of a system.



iLEL100 Solvent Monitor

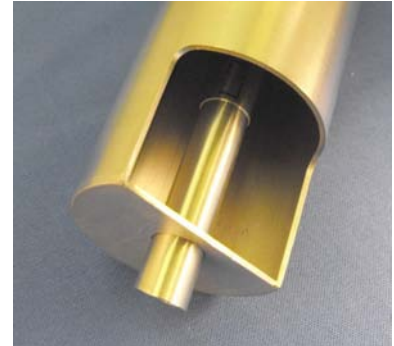
The iLEL100 is a solvent monitor, which has been designed to measure the flammability (Lower Explosive Limit, or %LEL) of a gas or solvent vapour by direct insertion into a process stream or extraction exhaust duct.

The principal of measurement is Infra Red based utilising the dynamics of the flowing gas stream to fuel its operation (velocity of gas stream required is between 4m – 12m per second). The primary objective with this philosophy is to eliminate the complexity of the system.

With any extractive sampling system one of the major operator concerns is system blockage! If the sample has the potential to condense within the extraction system the question that arises is how long will it operate for before it finally fails? This is a difficult question to answer; therefore a contingency plan must be built into the maintenance schedule in readiness for such a situation.

Normally this means stocking costly spares to ensure that the system failure can be addressed promptly without major downtime of the process, resulting in lost production.

Generally most extraction systems use 4mm ID pipework to carry the target gas through an elaborate piped network of pumps, filters and coolers. It is within this labyrinth that deposition may occur, which may be due to plasticisers in the extracted gases, particulate matter or as a result of a physical/chemical reaction causing the system to ultimately block and fail as well as the universal enemy, - water, which can create myriads of problems! If heated line is used as part of the sampling system blockages can be very difficult to remove and the replacement cost of such components is extremely high.



Large Diameter Pipework

If the maintenance of the system prevents the operation of the process then this further compounds the costs to the operator due to lost production.

To address the many issues detailed above a great degree of consideration has been attributed to the design of the probe of the iLEL100 solvent monitor.

For example the recognition of the fact that narrow bore pipework readily blocks, has resulted in the probe design utilising pipework diameters between 10mm and 40mm for the passage of gas to the sensor. Whilst there is always the potential for deposition to occur blockage is extremely unlikely.



Multiple orifice exits to increase homogenisation of sample

The entire probe assembly is manufactured from stainless steel and is located in situ hence the sample path is extremely short and the probe is maintained at the process temperature eliminating the need for heated lines or condensate devices, as well as reducing response time to an absolute minimum, which for safety applications is critical!

The gas path has been designed to create a high level of turbulence to provide a homogenous sample and also to create a degree of self-cleaning for dirty samples.

Extensive trials of the iLEL100 on an adhesive coatings plant revealed a gelatinous deposition within the process oven but none was evident upon examination of the iLEL100 Solvent Monitor's sample path or sensor head.

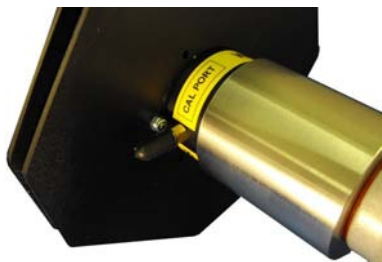
With many extractive systems a panel or enclosure has to be designed and built with the various extraction components populating the gas path and if the area outside of the process is deemed to be "Hazardous" in accordance with the ATEX Directive then panels or enclosures may have to be mounted in a safe area quite some distance away greatly increasing the cost of installation and further exacerbating the potential for blockage.

Maintenance of such extractive systems requires many areas of its construction and operation to be addressed, checking the integrity of the system by examining couplings, glands and seals, removing and examining pumps or cleaning aspirators as well as changing filters, all of which present a major maintenance programme for the operator.

The simplicity of the iLEL100 probe requires only the fitting of a flange and wiring back to a panel, radically reducing costs. Additionally in the very unlikely event of a blockage arising then the end of the iLEL100 can be very quickly removed during a maintenance routine and the large bore gas path can be easily rodded out and cleaned. The only spare required is in essence a sensor head!

A calibration nipple on the iLEL100 probe assembly allows gas to be passed across the head of the sensor on a bi-annual basis, which concludes the extent of the maintenance programme.

The subject matter of calibration however raises many questions for operators creating unnecessary concerns.



Calibration nipple

Flammability is a physical/chemical factor relating to the properties of the gas or vapour.

The measured value of the %LEL in an analysis system may itself be far adrift of the true %LEL within the process as this measurement is dependant upon many other parameters, such as how the original calibration gas value of LEL was calculated. Data table's show that values for the same gas may vary dramatically globally, additionally temperature has an effect upon the LEL, as does pressure and the concentration of Oxygen.

In considering all of these factors, it is very difficult to provide a universal absolute value for the measured %LEL in a process without taking other measurements into consideration and correcting the measured value against the other defined data using various algorithms.

It is important therefore that the above is placed into context with the application and its requirements as a high level of accuracy for flammable measurements is very difficult to achieve! But a rapid increase in the concentration of flammable gases or vapours in a process or system can be very dangerous. Therefore providing that the system response time is kept to a minimum, this can be the most important factor to insuring the safety of the operation.

Gas measurement data provides an operator with advanced warning of changing conditions away from the expected norm and alerts the operator of an impending problem within the process; hence the rapid response is critical, if this information is not secured quickly then the consequences can be potentially catastrophic.

The elimination of an extractive sample system dramatically reduces the response time of the system and also the potential for sample contamination through dilution.

This aspect has been a primary factor in the design of the iLEL100 solvent monitor. The output of the iLEL100 can be monitored via a control panel and relays can be configured to initiate a controlled mechanism of actions to ensure the safety of the process or redress any adverse changes in the process.

Whilst no system is perfect the iLEL100 addresses many of the inherent operational problems in extractive systems by providing a simpler measurement philosophy. The use of this measurement technique has also opened the door for other applications where extractive technology has proven both costly and difficult to maintain.

To determine whether the probe section of the iLEL100 can be used in conjunction with different sensors for the measurement of other gases requires an assessment of the application.

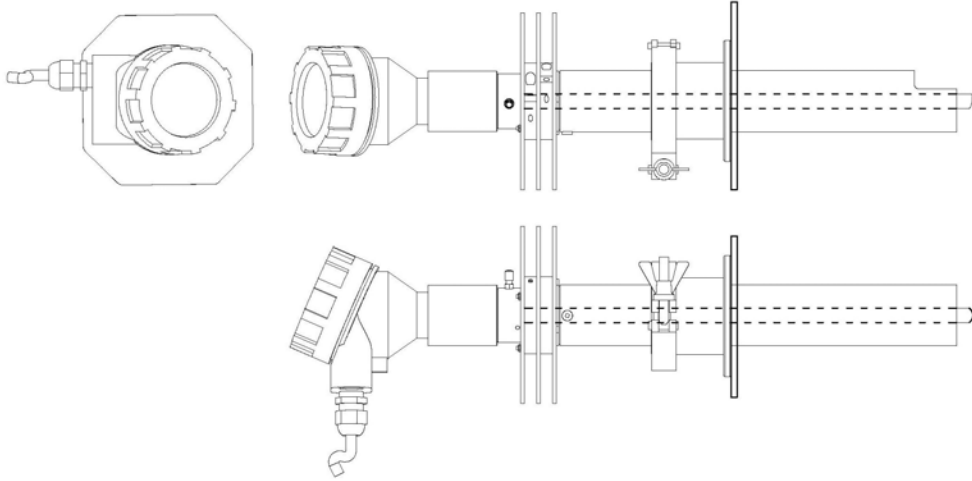
Factors to take into consideration include the following points:

1. What level of accuracy is required?
2. Where is the measurement of the target gas to be made?
3. What are the operational conditions in terms of temperature and pressure?
4. What is the velocity of the target gas?
5. What is the purpose of the measurement?
6. What is the composition of the gas stream?
7. What is the "driver" for the measurement?

With respect to any measurement made in a process stream other questions may arise relating to the accuracy of the measurement in terms of its validity as a representative sample.

For example where should the measurement point be located, what level of penetration should be used to obtain a representative measurement? These are additional factors, which can change the "measured values" and can impact negatively or positively on the interpretation of the measured values of gas concentration. Hence whether measuring solvents our vapours that are very flammable or other gases which present a toxic hazard there will always be a question of the accuracy of the measurement!

The philosophy exercised in designing the iLEL100 solvent monitor and utilising the probe technology for flammables or other gas measurements is fundamentally based on addressing many of the concerns that operators have expressed with respect to the complexity of Gas measurement systems by designing a device that is simple and provides long-term reliability with the minimum of service and maintenance.



To discuss your application and determine whether the iLEL100 solvent monitor or its variants a can provide a solution for your Gas measurement application please contact:

Mr Paul Lazor
Extronics Ltd
Meridian House
Roe Street
Congleton
Cheshire CW12 1PG

Tel: 01260 297 274
Fax: 01260 297 280
Email: paul@extronics.com