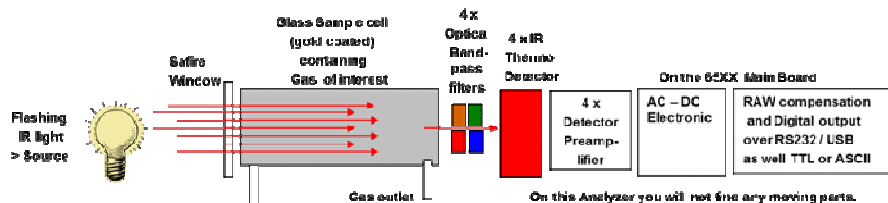


## QUESTIONS AND ANSWERS

26 November 2013

### LumaSense FAQs

#### What is the principle of your system's technology? Can you describe NDIR?



Detectors (two for each DGA measurement instrument) are based on a four-element thermoelectric sensor socketed as a quad detector with a glued thermopile chip and thermistor (lower part) and cap with glued optical band pass filters (upper part).

- First, the glass sample cell (gold coated) is filled with the gas to be detected. (IR Source and IR Detector are opposite sides).
- Then, the wavelength filter (in front of the IR detector transmitting IR light) filters the wavelength absorbed by the gas.
- The resulting signal depends on the gas concentration.

#### Is there a diagnostic capability to guarantee that analyser is functioning properly? Since your system involves light, are the optics sturdy enough to resist spoilage, salty mist/rain, high temperature humidity, and temperature in the country?

Yes, there are two sets of indications. One set is located on the front panel of the SmartDGA EZHub™ device (bright LEDs). The other indicator is located on the SmartDGA instrument itself, a sealed plate that changes colour depending upon the status of the system.

#### How is sample extraction done? How can we guarantee there are no bubbles introduced to the main tank? Since flow is by gravity, would it not introduce bubbles to the oil tank?

The principle is the oil is pumped from the transformer to the instrument and back to the transformer. During the initial set-up and commissioning of the system, the oil lines are "bled" free of bubbles using a 'sample' valve port located on our oil manifold.

#### Does heating affect the sample extraction and measurement process of the oil?

There is no effect. If there is excess build-up of heat from the transformer oil, we have a heat vent on the instrument to release any accumulated heat build-up.

#### Is there any pressurisation involved during extraction and measurement?

There is an equalisation pressure routine that is performed during installation and commissioning to balance the pressure of the transformer and the SmartDGA instrument.

#### The gas ratios seem complete and ample, could we still program key gas limits and alarm

**levels? Also, the limits that we use are having time factors, could this be programmed with the analyser?**

Yes, individual gas levels are programmable for Caution, Warning, and Alarm levels. Also specific gas ratios and rate-of-change-levels are user programmable.

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