Use of an Infrared Flue Gas Analyser

These instructions are tailored to the Photon infrared flue gas analyser from madur, but many of the principles will apply to other instruments as well.

General:
The important thing with the Photon (and any infrared system) is to keep the conditions identical. You must remember that the dryer is removing moisture when you are measuring flue gas but it is probably adding moisture when you use calibration gas. To do this there must be a small quantity of moisture present in the dryer. This is generally the case, but may not be so with a completely new instrument.

The system should always be used complete. That is to say with Photon, PGD-100 and heated hose. This ensures that conditions are always the same. Just add a very little water to the dryer. Measuring steam from a kettle or something like that is fine. Just until the first drop of water has come from the peristaltic pump. Then you know that the system is primed and conditions will always be constant.

Switching on:
The system must be zeroed as a complete unit, and ideally the analyser will have run for some time in complete form before zeroing. This ensures there are no traces of water in the system, except for the constant value provided by the PGD-100.

Zero the system again about 30 minutes after the temperature has reached stability. Shortening the period of temperature stabilisation will provide poor results. This will allow you to use the instrument but you will not get the accuracy. You can certainly not do this when you are checking the instrument against calibration gas. The way the instruments are generally used is that the sensors are zeroed before every measurement.

Operation:
These steps should give you accurate readings whether with test gas or flue gas.

In general the PGD-100 will have a reasonable reserve of condensed water in the first dryer to allow testing with dry gas to occur without any necessity of considering the level of moisture in the gas outlet. Whilst a level of zero moisture would theoretically produce the best results, this is in practice impossible to achieve, and the best compromise is a constant level of moisture.

The effect of this is most felt on the NO sensor. Regrettably H_2O has an absorption line so close to the basic NO absorption line that there is no real way to separate them. Standard filters will always catch both lines. Keeping the level of moisture low and strictly constant allows this to be treated as a simple offset to the value, and hence removed by subtraction. The offset on the Photon is typically around 400 ppm on the NO sensor. The exact quantity will depend on a number of factors such as the bandwidth and quality of the filter, detector temperature, dryer temperature and age of the light source. None of these factors are constants, so zeroing the instrument before measurements is essential here.

The effect of water vapour will also be felt on the SO_2 sensor, but differently. Whilst there is no cross-sensitivity effect, the reading will react slowly due to absorption of the SO_2 in the condensate in the dryer unit. This must reach an equilibrium between absorbed SO_2 and free

SO_2. The result will take about double the time for the other sensors to become fully stable. The final result will be correct, however.

The software can be used to vary the amount of tolerance the instrument has for internal temperature drift. Increasing the tolerance will naturally increase the length of time the instrument can operate before requiring the temperature stabilisation to be reset, but will also increase the amount of drift to be seen in the readings. Especially the NO sensor will exhibit increased zero drift if the temperature is not strictly regulated. As in all things, this is a matter of setting priorities, but it is probably best to leave the factory setting active unless it really needs to be changed.

As with all such systems, pressure transients (blocking the probe inlet, for instance) will produce a transient response on the display. So long as this does not occur at a critical time such as during zeroing, it will only be transient and removed after a maximum of two averaging cycles of the sensor. During zeroing it will result in a shift in the zero point that will remain until the sensor is zeroed again. The extra few seconds of work needed to correct this are well worth the trouble.