Moisture Measurement of Light Liquid Hydrocarbons with an XPDM

Moisture measurement in light hydrocarbons, C1-C4, in gas phase is possible with a Xentaur portable XPDM dew point meter independent of the phase of the sample stream. Liquid propane, propylene, butane, LPG or other similar compressed liquid hydrocarbon streams change phase as the pressure is reduced across a regulator. The moisture content of this gas stream is accurately measured with the proprietary Xentaur HTF™ sensor technology.

The Xentaur XPDM portable dew point meter is the only portable meter that is outfitted with an integral sample system. For the measurements in question, the sample system configuration consists of a pressure regulator, an expansion loop, a coalescing filter and a flow meter.

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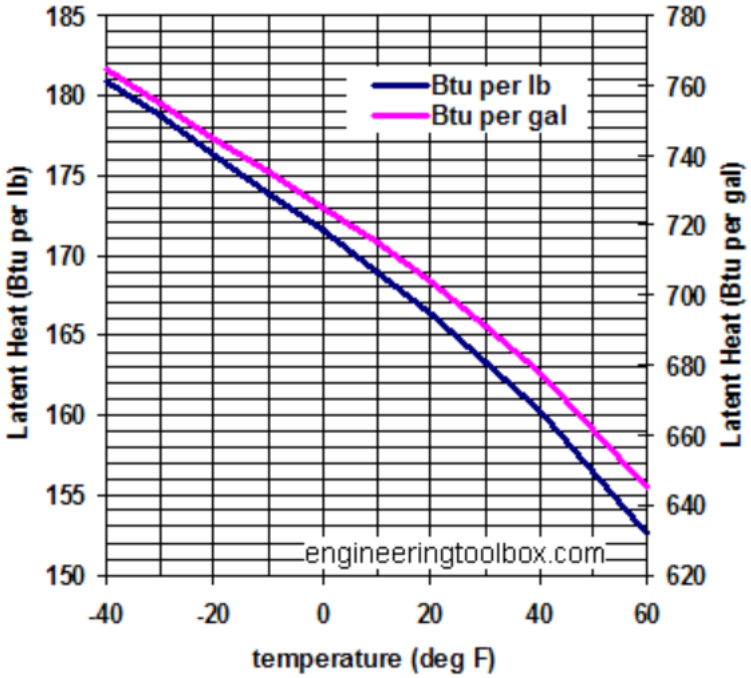
Because of the latent heat of vaporization of this liquid sample streams (see propane as an example below), the flow rate across the regulator is controlled by reducing the pressure on the outlet of regulator to approximately 1 psig. The cooling by the liquid to vapor expansion is reduced at this rate such that only vapor will reach the sensor. A coalescing filter is in the gas stream to further prevent any residual aerosol hydrocarbons from reaching the sensor.



At the factory settings, the flow rate is about 1.5 lpm with the measurement being made in about 15-20 minutes. Specific instructions for using the XPDM are included in a separate manual. On the XPDM, the units of the measurement are normally dew point in degrees C or F and then also concentration in ppmv.

Because the XPDM has an integral temperature sensor, the moisture concentration in ppmw can be calculated. Using the dew point or concentration and the temperature of the measurement cell from the XPDM, Henry's Law can be applied to calculate ppmw. Using the COSA Xentaur M-Calc program (available as a PC application at www.cosaxentaur.com or as an iPhone or Android app) the ppmw can be calculated.

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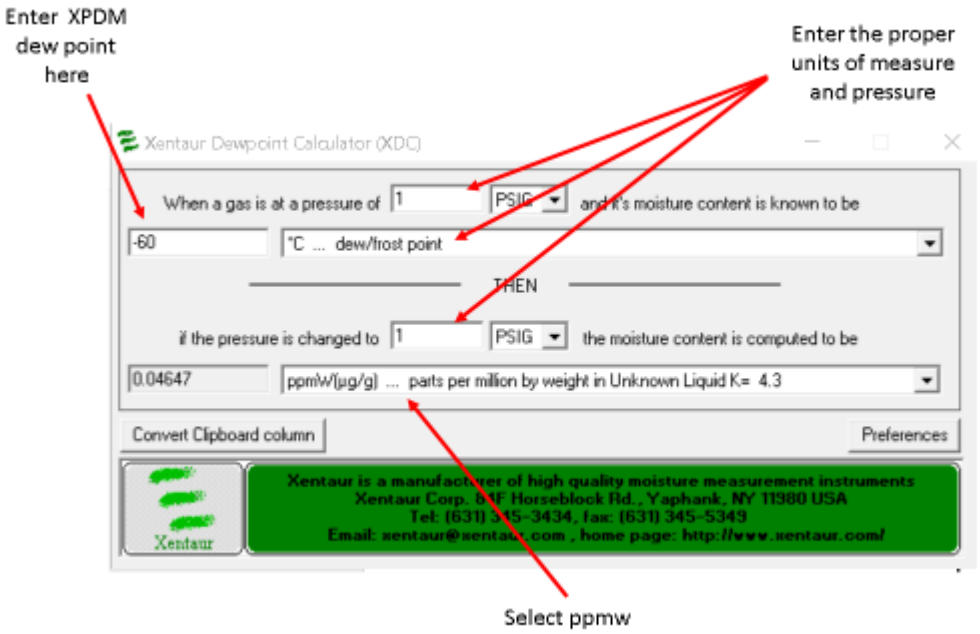
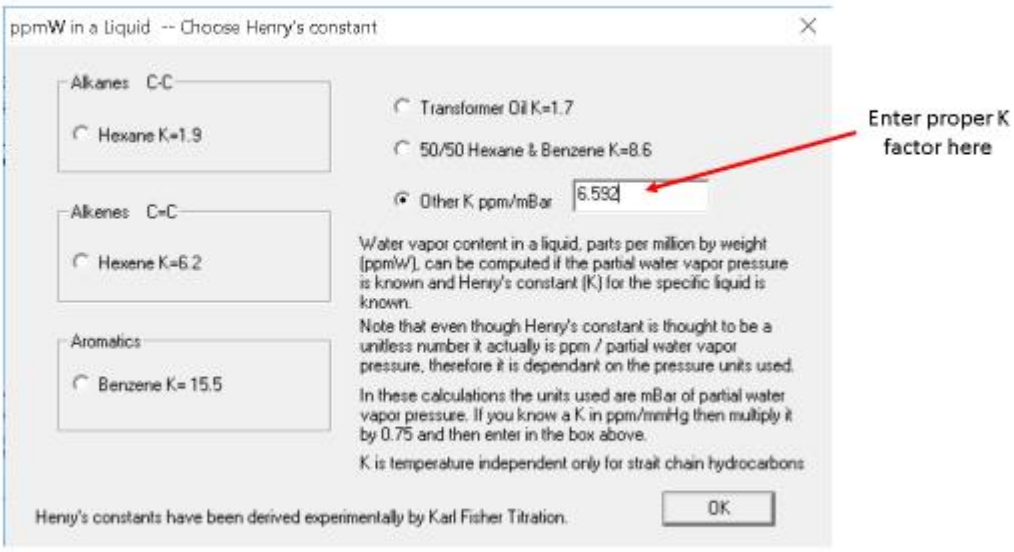
Sample Stream	Temperature in °C					
	0	10	20	30	40	50
BUTANE	3.277	2.773	2.568	2.452	2.509	2.474
ETHANE	5.079	5.302	5.565	5.895	5.424	4.866
ETHYLENE	25.73	21.53	18.36	15.94	14.04	13.06
ISOBUTANE	4.096	3.426	3.039	2.83	2.739	2.758
METHANE	0.983	1.305	1.712	1.91	1.858	1.703
PROPANE	9.176	7.586	6.592	5.659	5.221	4.704
PROPENE (PROPYLENE)	48.99	33.36	24.19	18.32	15.6	12

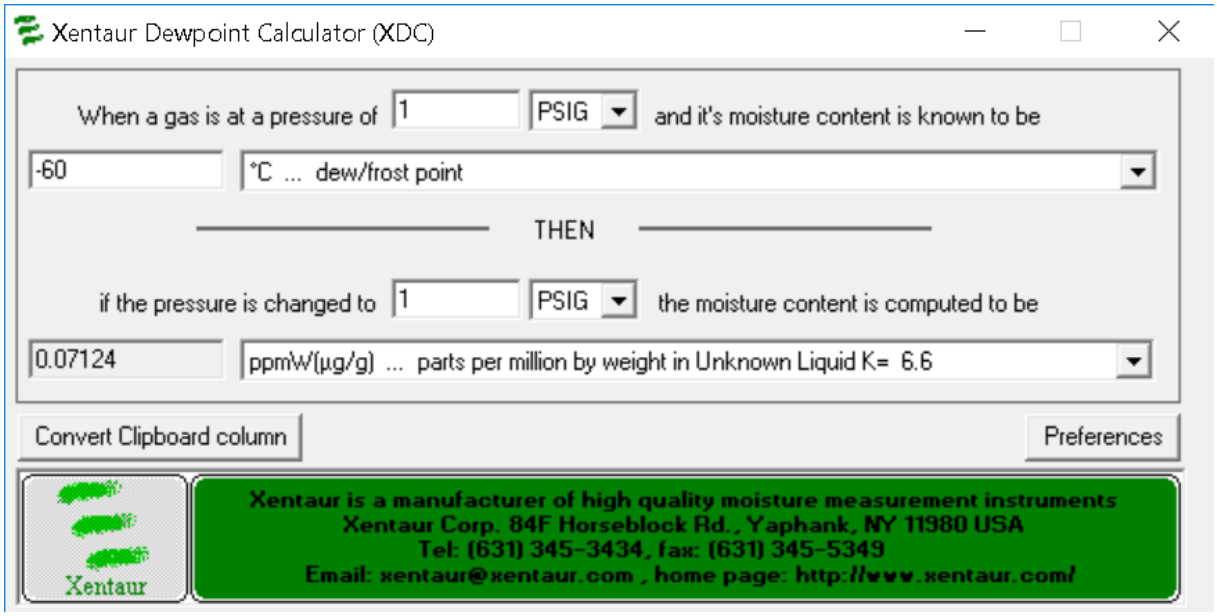
Using the temperature from the XPDM, select the proper value of the K factor. The table above is for example only, COSA Xentaur can provide the K-factors for any mixed streams required with the instrument. With the proper k-factor use the M-Calc program to calculate the ppmw. For example we will convert a propane gas phase dew point of -60 C to ppmw at 20 C. The K-factor from the table above is 6.592



When ppmw is selected, another window will appear to enter the proper K factor: in the case 6.592.



With the proper K-factor value entered, the moisture concentration in ppmw in the liquid phase will be calculated:



One note is that the flow values for the instrument have been factory set by adjusting the regulator. If this setting increased, icing and sensor damage can occur (see picture below). If the flow rate exceeds the 1.5 lpm, remove the lock nut on the regulator and adjust the regulator setting so that the flow is between 1 and 1.5 lpm. The factory settings are valid for ambient temperatures down to 10 C.