EXPERTS IN ANALYSiS

aqua 40.00

AQUA 40.00 with LPG/LNG Module

Application

Determination of water content
in liquefied Dimethyl ether (DME)

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Application

It is described the application of coulometric titrator AQUA 40.00 with LPG Module of ECH for determination of moisture (water content) of the liquefied gas dimethyl ether (DME).

Principle

The Karl Fischer titrator AQUA 40.00 coupled with a LPG/LNG module is designed for an easy and accurate determination of water in liquefied and gaseous samples such as LPG, LNG and other gases.

The device version of AQUA 40.00 is suitable for all kind of gases - flammable, inert as well as changing mixtures. A large sample loop ensures precise gas dosage. The determination of pressure is carried out in the sample loop, so no additional rinsing gas is needed.

The gas sampling part is equipped with a quick connector for high pressure cylinders (max. 240 bar/3480 psi) (figure 2). Small cylinders can be fixed vertically by fixing clips. Other sample vessels can be positioned beside the device.

The sample decompression part consists of a heating unit to avoid freezing in the tubes during the decompression process. The dosing volume is determined by a large sample loop (130 mL) combined with a pressure sensor (figure 3).

A pressure controller reduces the sample pressure to adjustable 0.5 - 3.5 bar (7 - 50 psi). Different rinsing and dosing steps can be adjusted in the software by switching three solenoid valves (figure 1).

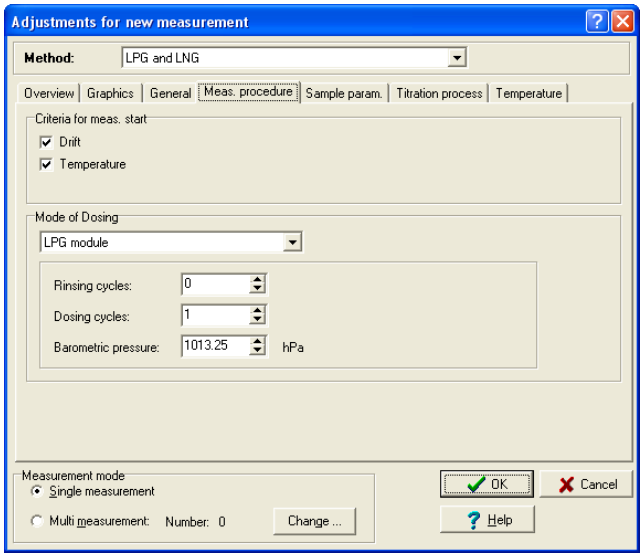

Figure 1: Free adjustable rinsing and dosing steps in the software

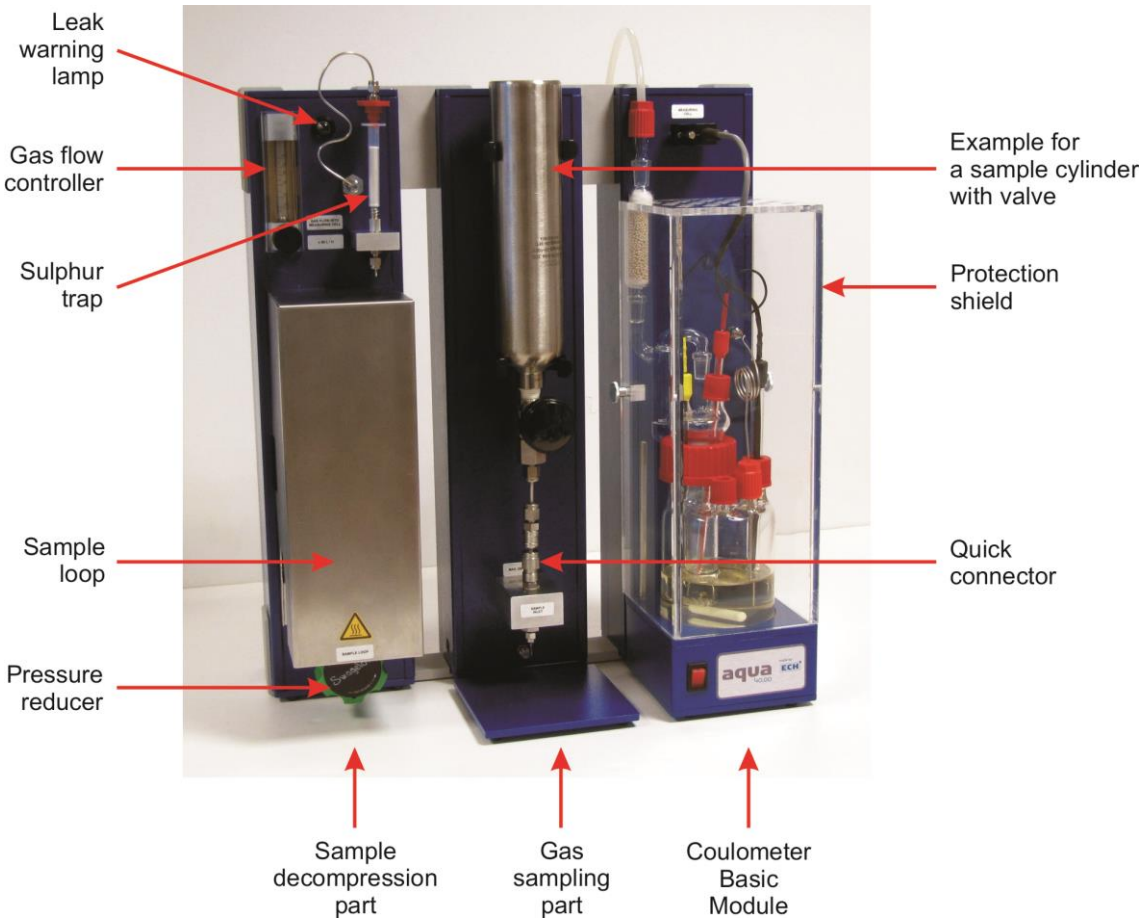

Figure 2: AQUA 40.00 with LPG gas dosing module

The rinsing gas can be transferred by a tube to a lab hood. The gas is dosed into the measuring cell with a flow rate of about 80 L/h max.

The output results can be adjusted to your needs by using a formula generator. The device can also be used in a carrying case for on-site measurements.

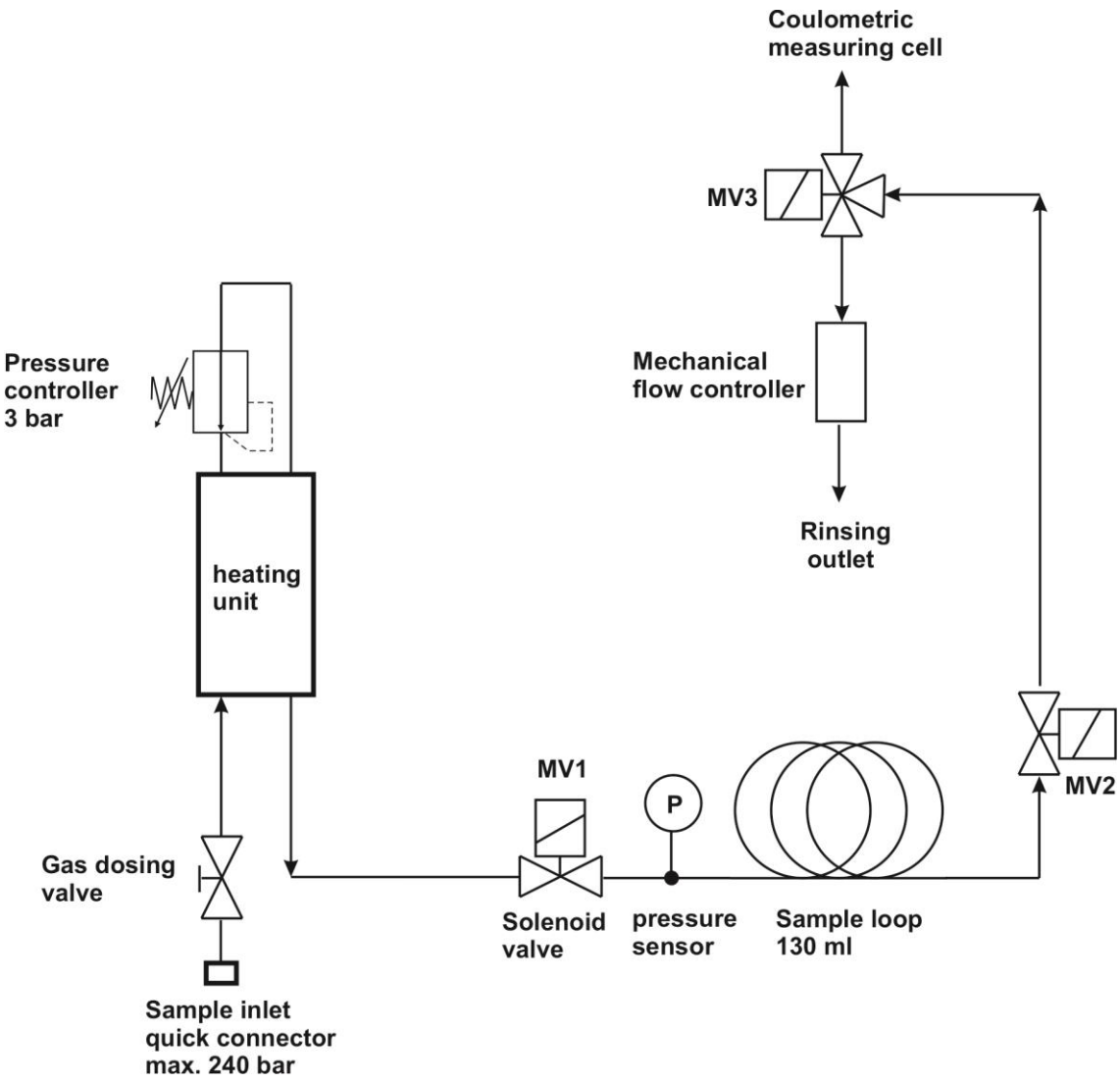

Figure 3: Flow scheme of the LPG module

Results

The pressurized gas sample was connected by stainless steel tube 1/8” with a quick connector to the gas inlet port of the titrator.

At the beginning the gas tubes will be rinsed with the new sample. Either a manual switching of the valves or automatic rinsing steps integrated in the first measurement run are possible. It is possible to adjust unlimited numbers of automatic repeated measurements.

The compressed gas cylinder was fixed in heads up position with a stainless steel transfer line to the LPG Module of the titrator. The sample decompression part was heated to 80 °C. The decompression was adjusted to 2 bar (29 psi). The sample loop temperature (26 °C) and the current air pressure were measured and taken into the calculation formula of the results.

In table 1 the overview of the results of the liquefied gas sample:
Dimethyl ether D-400 2016-02-11 15.7740 lbs (5.1 bar – 75 psi)

Table 1: Repeatability of water determination in Dimethyl ether (DME)

No. of dosing steps	Sample volume (decompressed gas) mL	Total water µg	Result Vppm
1	255.584	28.4	151.9
1	255.584	28.3	151.1
2	528.564	59.4	153.5
2	528.827	59.5	153.7
3	779.718	89.5	156.7
3	781.556	89.1	155.7
4	1049.514	117.3	152.6
4	1049.514	116.0	150.9
5	1311.958	144.3	150.2
5	1313.009	146.4	152.2

Mean value: 152.8 Vppm
Standard deviation: 2.1 Vppm (1.37 %)

The results are created with different dosed gas volumes (250 mL - 1300 mL). The deviations are lower than 1.5 %.

This procedure shows: the moisture in the gas is absorbed completely in the coulometric reagent during the introduction process. In figure 4 is shown the linearity of the titrated water amount regarding the dosing steps.

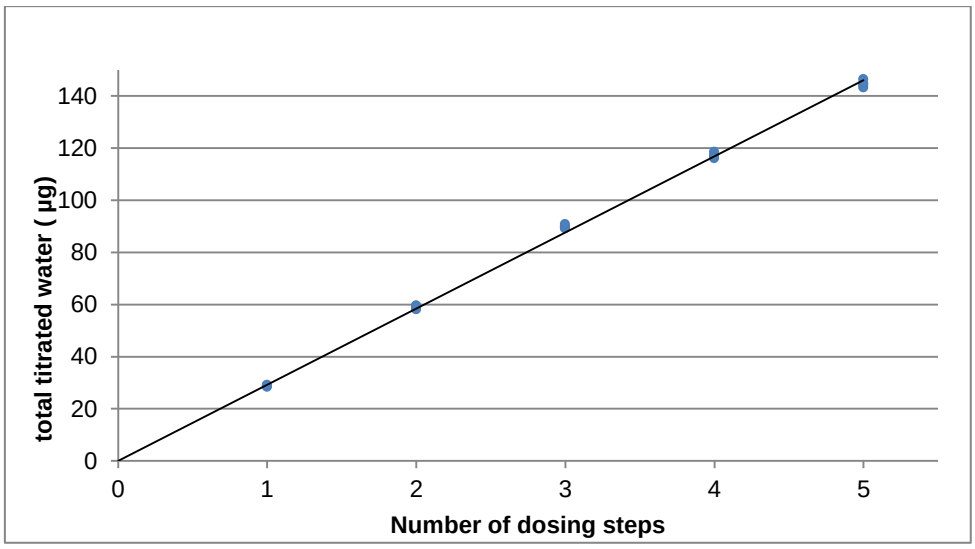

Figure 4: Diagram of titrated water (µg) regarding to the dosed volume of DME gas sample (No. of dosing steps)

Examples of typical measurement curves of the DME sample are shown in figures 5 and 6. The introduced water into the titration cell is to be seen by the stepwise decreasing of the indicator signal.

The titration starts as a fast automatic process after accumulation of the sample moisture in the cell. The measuring time depends on the number of dosing steps (sample volume). The titration of water is completed within 2 min.

One dosing step

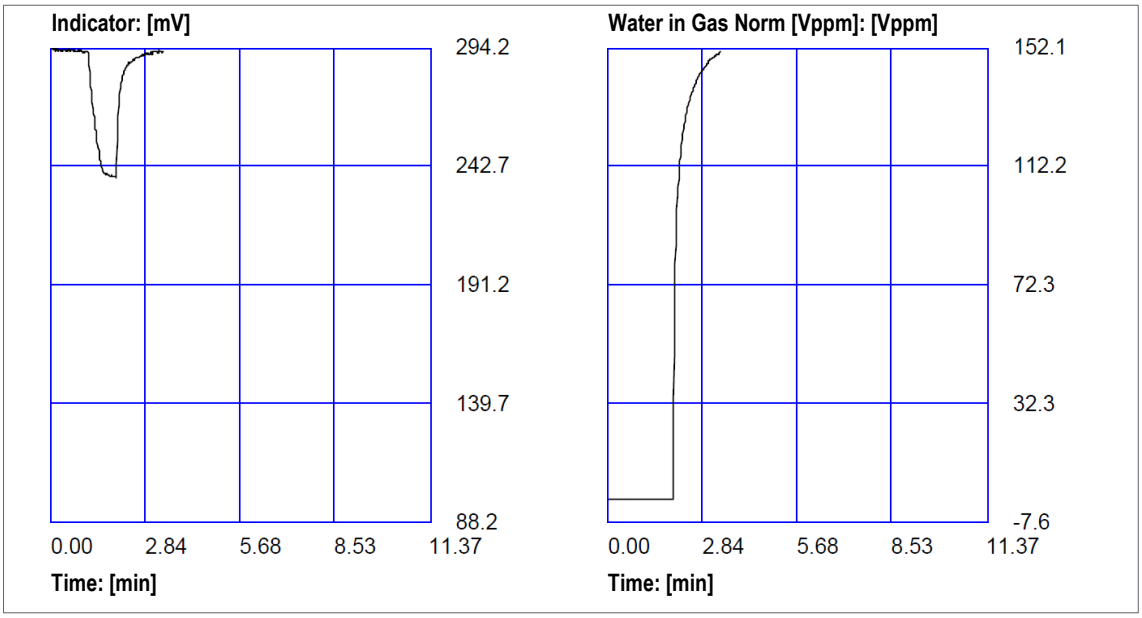

Figure 5: Titration curves of water determination of DME gas sample - adjusted different dosing steps **One dosing step**

Three dosing step

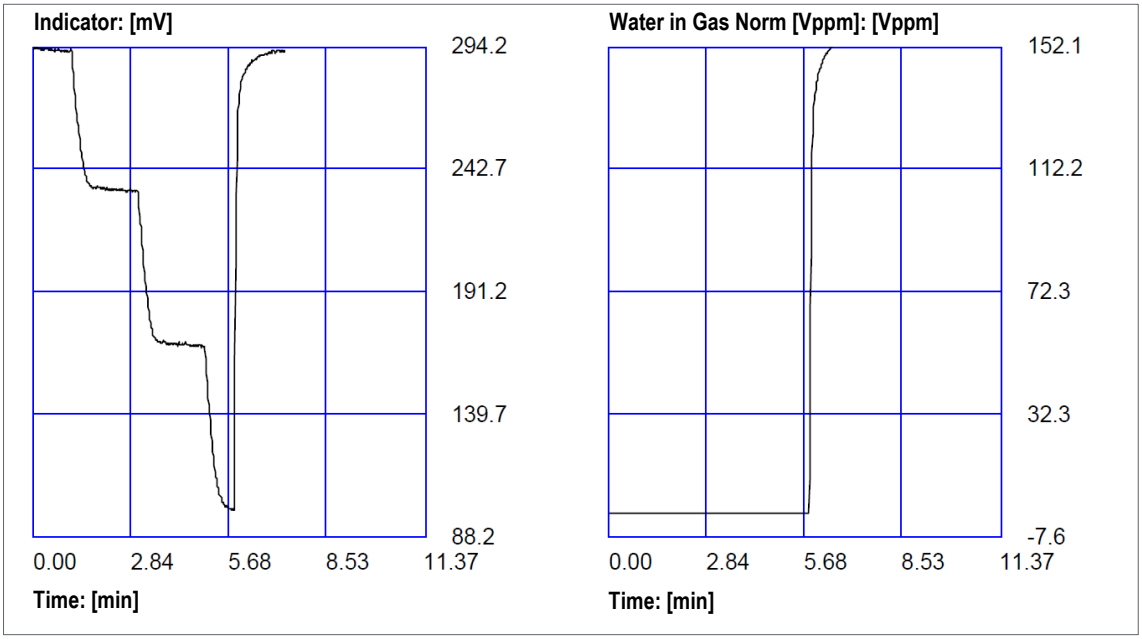

Figure 6: Titration curves of water determination of DME gas sample - adjusted different dosing steps **Three dosing step**

Conclusion

The determination of water in liquefied gas samples was tested for the gas Dimethyl ether (DME) with the LPG Module of the AQUA 40.00 coulometric titrator. This device is applicable for pressurized gases up to 240 bar (3480 psi).

The determination of water in DME can be realized without modification of the equipment or of the adjustments for gas measurements. All parameters are predefined in an analytical method, so the automatic run can be started to analyze the gas samples complete automatically.

The measurements show, that the device is suitable for the water determination in these kinds of liquefied gas samples.

We are here for you

ECH Elektrochemie Halle GmbH
Otto-Eissfeldt-Str. 8
D-06120 Halle (Saale), Germany
Tel.: +49 345 279570-0
Fax: +49 345 279570-99
E-mail: info@ech.de
Website: www.ech.de