

Application Note 102

CONTINUOUS DETERMINATION OF MERCURY IN WASTE AND PROCESS WATER USING THE PSA 10.225 ONLINE MERCURY LIQUID SYSTEM

Introduction

The sampling for mercury analysis is challenging, particularly as it is difficult to preserve sample integrity especially when associated with complex matrices and process plant applications. PSA's online liquid mercury analyser overcomes these challenges whilst providing continuous mercury analysis in liquid streams from ppt to ppm levels. The outstanding detection capability is combined with the simplicity of operation and reliability demanded by process engineers.

Figure 1 PSA 10.225 Online Hg Liquid Analyser



The PSA 10.225 is the latest version of the popular PSA Online Liquid system. The system is designed to be wall mounted and includes integrated PC control via a touch screen monitor. The system consists of 3 parts; touchscreen monitor, chemistry section and electronics section. The chemistry and electronics sections are separately housed in a three part cabinet. The front part houses the chemistry section and the back part holds the electronics and computer. This layout minimises corrosion and contamination. Figure 2 shows the analyser system mounted to a wall (a floor mount frame option is also available) figures 3 and 4 give a side view of the cabinet showing the separate electronics and chemistry sections. The design of the cabinet allows easy access to the chemistry section for user maintenance and also for service.



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Figure 2
Front view



Figure 3
Side view with front section open

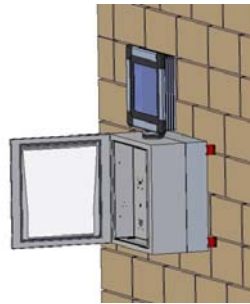


Figure 4
Side view with rear section open

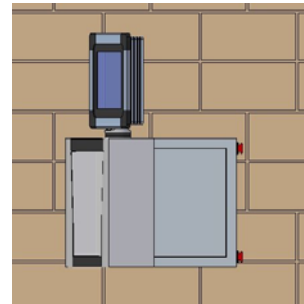
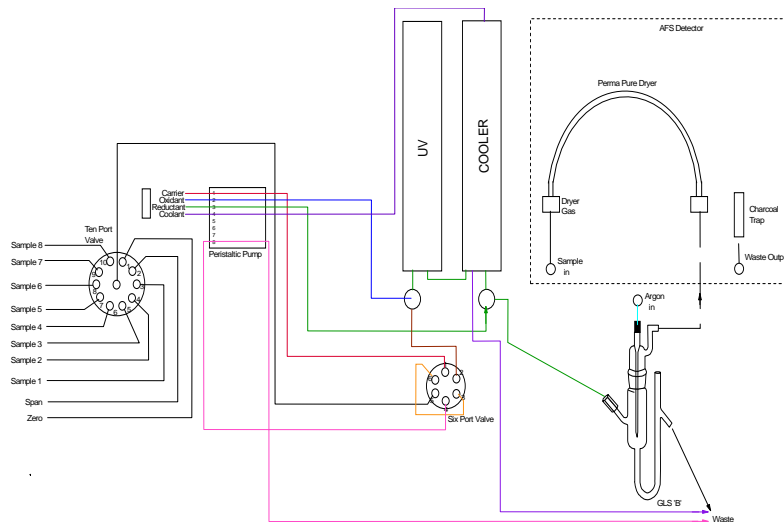


Figure 5 Schematic of Chemistry section



The wet section consists of a 10 port stream selection valve, six port injection valve, peristaltic pump, digestion manifold, gas liquid separator dryer system and AFS detector. These components are controlled via the online software. Under normal conditions the software determines which sample stream needs to be measured, it then selects the appropriate stream via the 10 port stream selection valve. When the loop is filled, the injection valve is fired and a discrete slug of sample/standard enters the digestion manifold where additional oxidants are added prior to the sample/standard entering the UV manifold to speed up the digestion (other manifolds such as heater or heater and UV are available). The sample then goes through a cooling coil prior to the addition of the reductant and entry into the gas liquid separator.

After the digestion manifold all the mercury in the sample is reduced to the Hg^{2+} state, this is then reacted with stannous chloride and the Hg^{2+} is converted to Hg^0 which is purged from the sample with a stream of argon into the gas liquid separator. The gas is passed through a dryer system to remove any entrained moisture and enters the atomic fluorescence detector where the Hg peak is measured. The system is very flexible and many different digestion and reduction chemistries can be used as well as various combinations of UV and heating to ensure a complete digestion of the sample.



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Analytical Performances
Figure 6 Calibration Curve of 0-10 ppb

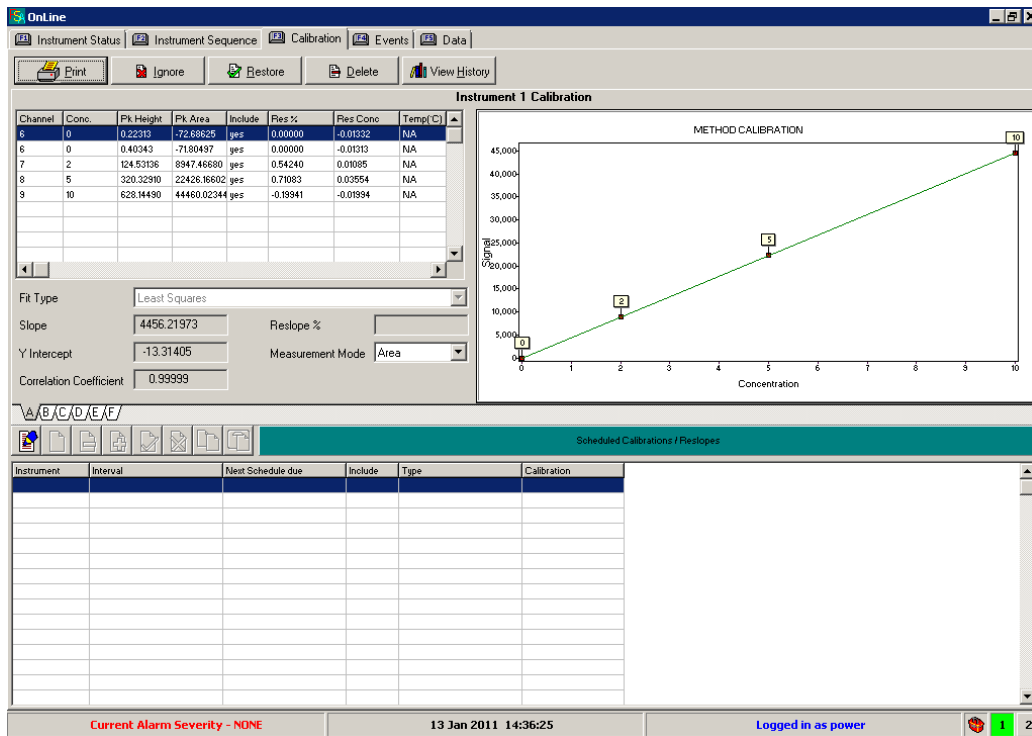
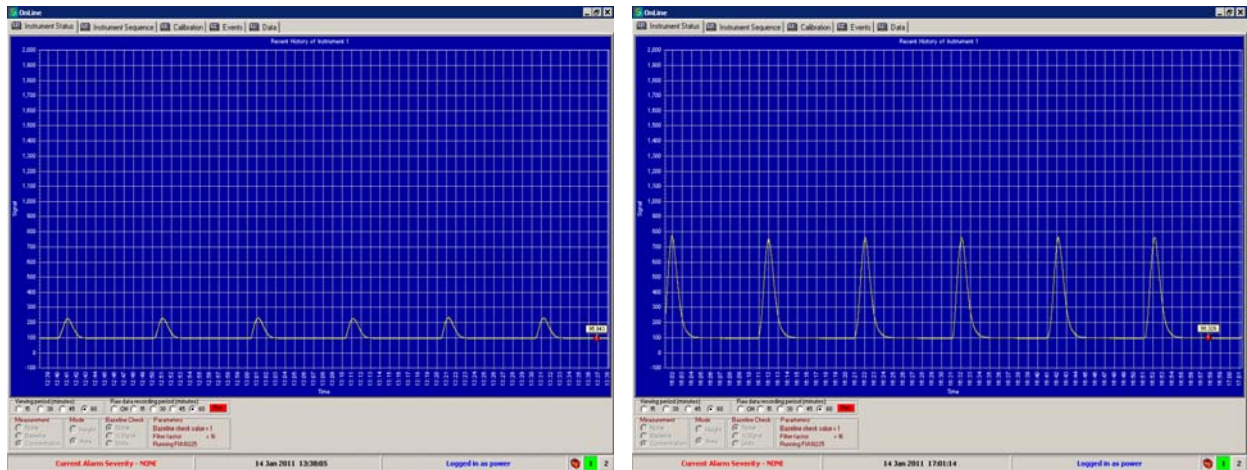


Figure 7 Continuous Flow Injections of 2 and 10 ppb Standards



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Figure 8 Results of Continuous Flow Injections of 0.2 to 10 ppb Standards

Date/Time	Instrument	Channel	Concentration	Volume ()	Name	Run Number
14Jan2011 ...	1	5	10.028	...	Sample 5 - 10ppb	3 of 10
14Jan2011 ...	1	5	10.029	...	Sample 5 - 10ppb	2 of 10
14Jan2011 ...	1	5	10.040	...	Sample 5 - 10ppb	1 of 10
14Jan2011 ...	1	4	5.036	...	Sample 4 - 5ppb	10 of 10
14Jan2011 ...	1	4	5.033	...	Sample 4 - 5ppb	9 of 10
14Jan2011 ...	1	4	5.021	...	Sample 4 - 5ppb	8 of 10
14Jan2011 ...	1	4	5.023	...	Sample 4 - 5ppb	7 of 10
14Jan2011 ...	1	4	5.019	...	Sample 4 - 5ppb	6 of 10
14Jan2011 ...	1	4	5.003	...	Sample 4 - 5ppb	5 of 10
14Jan2011 ...	1	4	5.029	...	Sample 4 - 5ppb	4 of 10
14Jan2011 ...	1	4	5.008	...	Sample 4 - 5ppb	3 of 10
14Jan2011 ...	1	4	4.970	...	Sample 4 - 5ppb	2 of 10
14Jan2011 ...	1	4	4.991	...	Sample 4 - 5ppb	1 of 10
14Jan2011 ...	1	3	1.957	...	Sample 3 - 2ppb	10 of 10
14Jan2011 ...	1	3	1.973	...	Sample 3 - 2ppb	9 of 10
14Jan2011 ...	1	3	1.953	...	Sample 3 - 2ppb	8 of 10
14Jan2011 ...	1	3	1.948	...	Sample 3 - 2ppb	7 of 10
14Jan2011 ...	1	3	1.933	...	Sample 3 - 2ppb	6 of 10
14Jan2011 ...	1	3	1.947	...	Sample 3 - 2ppb	5 of 10
14Jan2011 ...	1	3	1.948	...	Sample 3 - 2ppb	4 of 10
14Jan2011 ...	1	3	1.954	...	Sample 3 - 2ppb	3 of 10
14Jan2011 ...	1	3	1.946	...	Sample 3 - 2ppb	2 of 10
14Jan2011 ...	1	3	1.952	...	Sample 3 - 2ppb	1 of 10
14Jan2011 ...	1	2	0.188	...	Sample 2 - 0.2ppb	10 of 10
14Jan2011 ...	1	2	0.198	...	Sample 2 - 0.2ppb	9 of 10
14Jan2011 ...	1	2	0.204	...	Sample 2 - 0.2ppb	8 of 10
14Jan2011 ...	1	2	0.184	...	Sample 2 - 0.2ppb	7 of 10
14Jan2011 ...	1	2	0.203	...	Sample 2 - 0.2ppb	6 of 10
14Jan2011 ...	1	2	0.198	...	Sample 2 - 0.2ppb	5 of 10
14Jan2011 ...	1	2	0.192	...	Sample 2 - 0.2ppb	4 of 10
14Jan2011 ...	1	2	0.183	...	Sample 2 - 0.2ppb	3 of 10
14Jan2011 ...	1	2	0.197	...	Sample 2 - 0.2ppb	2 of 10
14Jan2011 ...	1	2	0.144	...	Sample 2 - 0.2ppb	1 of 10
14Jan2011 ...	1	9	9.990	...	10	1

Conclusions

The PSA 10.225 online system allows ppt detection limits with calibration ranges from a few ppt to over 100 ppm. The system is controlled by a computer with touch-screen monitor located within an IP55 19 in. instrument enclosure cabinet. The wet chemical stage of sample pre-treatment now takes place in a sealed enclosure within the front section of the 19 in. racking system avoiding contamination/corrosion of sensitive electronic components and the whole rear section of the 19 in. rack mounted cabinet can now be purged with instrument air, preventing corrosion of vital components.

New process control software (see News Update 034 for more details) running under Windows Vista allows user definable analysis sequences with full data and statistical reporting formats. Definable software security allows pre-determined access levels of system control. A user definable error system has the ability to provide various alarm outputs including audible, visual and contact closures from internal instrument sensors.

Further information is available in application notes for the 10.223 and 10.225 Online Liquid Systems, plus relevant product specification sheets. For further information, please contact P S Analytical or your local distributor.



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