Initial operation of a Lonestar® 3.0 with a pump

Issue/Version	Date	Author	Details
AAA	19/02/2013	Jonathan Angove	The Original
AAB	22/12/2015	Céline LAINÉ	Update and reformatting
AAC	08/01/2016	Céline LAINÉ	Change title, reformatting and update pump pictures
AAD	10/05/2016	Céline LAINÉ	Condense from standalone Lonestar to Lonestar used with a pump. Remove scrubber usage for sample cleaning and split flow box presentation.
AAE	23/05/2016	Andrew Pauza	Restructure and add info on pump configuration
AAF	24/05/2016	Céline LAINÉ	Final corrections

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Notices

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The supplied system is in compliance with international regulations. If this system is used in a manner not specified by Owlstone Ltd, the protection provided by the system could be impaired.

Warning Labels

This symbol is used to highlight a section explaining particularly important safety considerations

This warning label indicates danger of electrical shock hazard

This warning label indicates parts of the product that will become hot during use. Please take care.

Introduction

This document details the procedure to install a Lonestar® analyser with an external pump and to realise the initial operation to ensure the system performs as required.

Using a pump allows to draw the sample headspace through the inlet filter to the Lonestar® analyser (negative pressure systems).

For further details on how to use the Lonestar® software, please consult the documentation on the Owlstone® website, in the Support section.

Pump Selection

Owlstone® can supply a pump assembly (part number 01-0080) which can be controlled via the Lonestar® software (Figure 1).

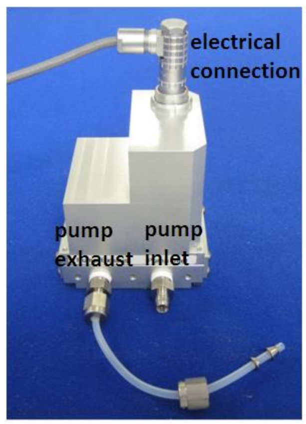


Figure 1: Pump assembly supplied by Owlstone® (part number 01-0080).

This pump assembly uses the Thomas BL-G 12/085M brushless pump, of which the specification is given in the following document:

http://support.owlstonenanotech.com/entries/21868996-Brushless-Pump-specification

The instructions given below are specifically for the pump supplied by Owlstone® shown in Figure 1, but much will also be applicable for other types of pump.

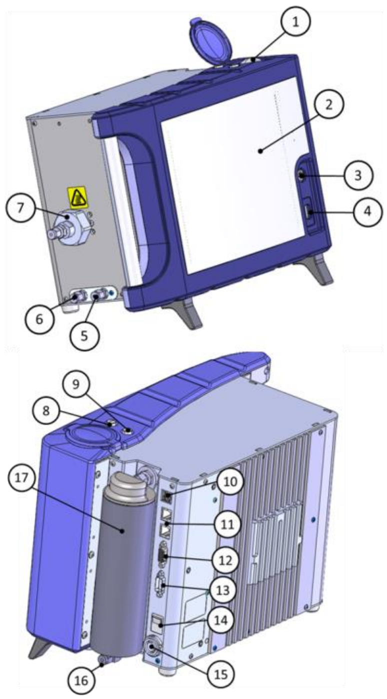
If a different pump is being used, it must be chosen with care as explosive mixtures may occur, so an explosive-proof pump must be purchased depending upon the sample type.

Because the Lonestar® analyser is very sensitive to small changes in flow, the pump must also be chosen to minimise the gas flow variation. Rotary vane pumps should have at least eight vanes to minimise flow noise. Diaphragm pumps will present a too high flow variation unless significant efforts are made to reduce flow variation by using large expansion volumes and/or coiled pipes.

System Components

Please familiarise yourself with the components naming before starting the installation of the system.

Figure 2 shows a labelled diagram of the components of the Lonestar® analyser.



1. Tracker Ball
2. Screen
3. On/Off Button
4. USB Port
5. Exhaust
6. Clean Air Inlet
7. Inlet Filter
8. Left Mouse Button
9. Right Mouse Button
10. USB Port x 2
11. Network cable port x2
12. RS 232/485
13. GPIO Port
14. On/Off Switch
15. Power Supply Socket
16. Scrubber Inlet
17. Scrubber

Figure 2: Labelled diagram of the components of the Lonestar® analyser.

Pump Installation

Once risk assessments have been performed and a suitable site for the location of the Lonestar® system has been determined, remove the Lonestar® analyser from its PeliCase and place it on a solid, level surface capable of supporting its weight.

For more information regarding the installation and system requirements see the "Installation and Location" document in the Lonestar® pre-installation guide using the following link: http://support.owlstonenanotech.com/entries/21619163-Installation-and-Location

The gas passing over the sample through the Lonestar® system must be clean and dry as changes in humidity will affect the trajectory of analytes detected, and airborne contaminants may affect the detection of analytes of interest.

To avoid any contamination of the Lonestar® system flow path, make sure to wear gloves to protect the equipment from finger grease contamination.

The inlet filter provided with the Lonestar® system should be fitted with a 1 µm filter to prevent particles > 1 µm in diameter from entering the Lonestar® system. If a significant number of particles enters, it can compromise the performance of the FAIMS chip detection.

In a negative pressure installation, the pump is used to draw the sample through the external inlet filter into the Lonestar® analyser for detection. Figure 3 shows the external inlet filter supplied with the Lonestar® analyser fitted to the Lonestar® inlet.

Figure 3: External inlet filter.

The pump is connected as shown in Figure 4. The pump inlet is connected to the Lonestar® analyser exhaust, so the sample gas will be drawn through the Lonestar® analyser and then through the pump.

The pump exhaust can have a short pipe connected to act as a noise reducer, or it can be connected to a longer pipe for venting safely. However, the longer the pipe, the more back pressure on the pump, so the pipe length should be kept as short as possible before venting to atmosphere.

The grey power and control cable are connected to the top of the pump with the right angled Lemo® connector on one end and to the back of the Lonestar® analyser with the straight Lemo® connector.

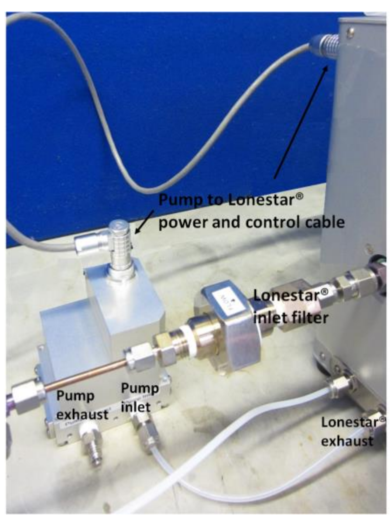


Figure 4: The pump connected to the Lonestar® analyser.

Pump Operation

Once the Lonestar® system hardware has been installed, turn on the Lonestar® analyser. The Lonestar® system starts in Analyser Mode by default (see Figure 5). This mode of software operation is for running developed methods rather than for method development. Press the **Advanced** button to view the Lonestar® parameters.

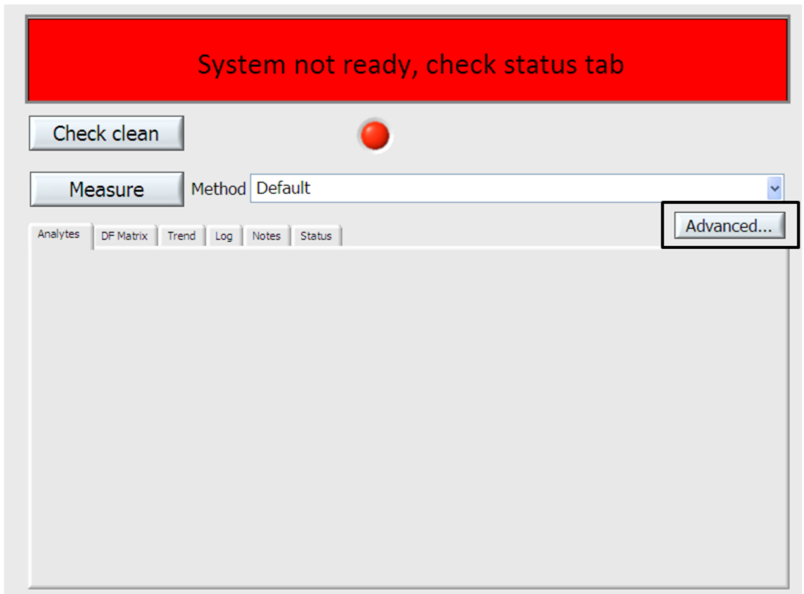


Figure 5: Screenshot of the Lonestar® in analyser mode

The Lonestar® software controls the pump. The pump operation modes are accessible from the Lonestar® software Settings tab as shown in Figure 6.

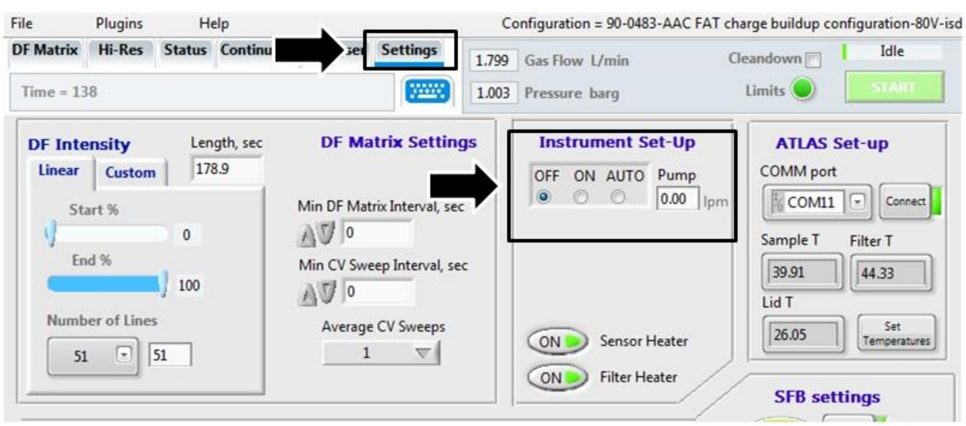


Figure 6: The Lonestar® Settings tab, showing the pump operation modes.

The Lonestar® software offers three different pump operation modes detailed in Table 1.

Lonestar® software option	Pump functionality
	Pump is OFF
	Pump is continuously ON when ON is selected
	Pump is turned ON when the Lonestar® software START button is pressed. The start of the scan is delayed by the "Pump on Before" time set in the Lonestar® software configuration.

Table 1: Pump operation modes.

The pump control parameters are displayed in the Lonestar® software configuration screen accessible by editing the configuration from the Lonestar® software task bar and selecting the pump tab as shown Figure 7.

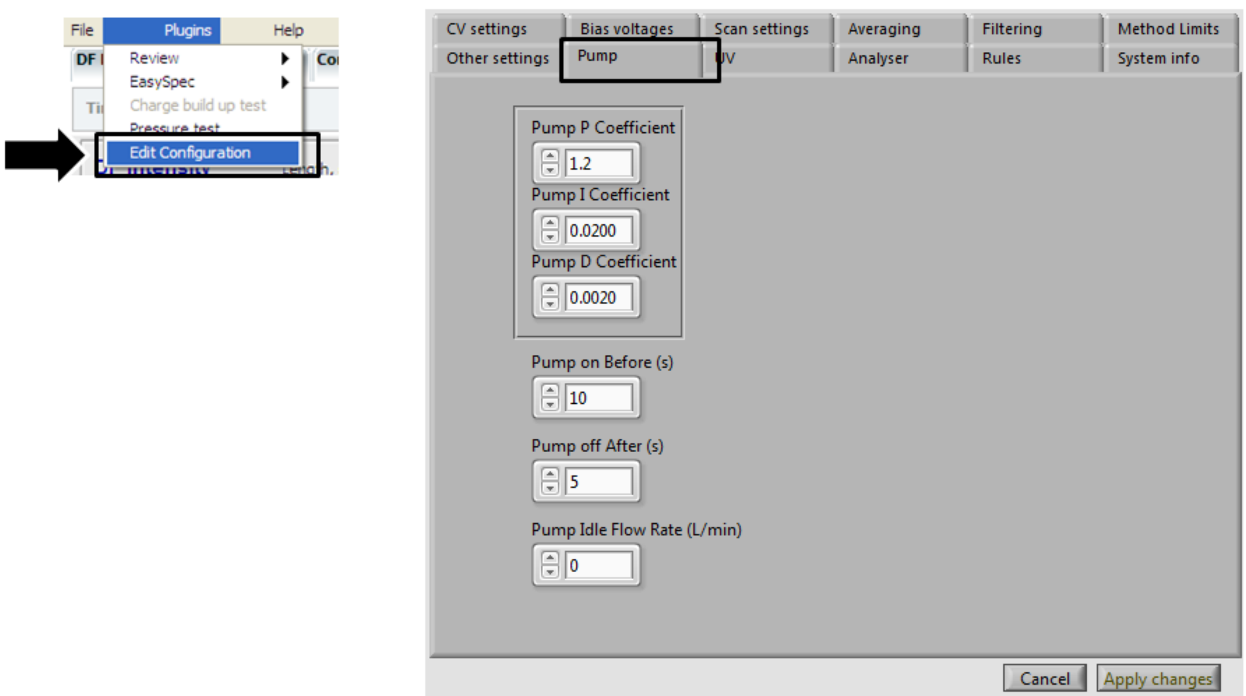


Figure 7: Screenshot of the pump configuration screen (right) accessed from the Lonestar® software taskbar (left).

The **Pump P, I and D Coefficients** values in the outlined box have been optimised for the pump supplied by Owlstone® to give a stable flow that settles quickly. If using this pump, it is recommended to keep the Pump P, I and D Coefficient values at 1.2, 0.0200 and 0.0020 respectively.

The **Pump on Before** time is the time in seconds that the pump will run in order to stabilise the flow after the START button is pressed when the pump is in auto mode.

The **Pump off After** time is the time in seconds the pump will run after a scan is stopped when the pump is in auto mode.

The **Pump Idle Flow Rate** is the flow in L/min that will be set when there is no sample analysis (analysis is stopped). This flow rate can be used to allow continuous running at a low flow in order to keep the Lonestar® system clean. The recommended **Pump Idle Flow Rate** is between 0.2 to 5 L/min.

The maximum non continuous operating flow is around 2.5 L/min. It varies from pump to pump and can also be determined by how much resistance is applied to the flow from the sampling system. Each item added to the flow path will generate a larger pressure drop and consequently reduce the maximum flow possible.

The maximum continual flow is the flow at which the system gives about 150 mbar pressure drop (see http://support.owlstonenanotech.com/entries/21868996-Brushless-Pump-specification).

Pump operation at high flows should be limited to periods of 30-60 minutes before allowing the pump to cool by setting zero or a low flow.

The pump has a finite lifetime of about 5000 hours (200 days).

Basic Sampling Setup

In a basic sampling setup of the Lonestar® system, the pump can be used to draw the sample air directly through the Lonestar® analyser at a flow between 1.5 and 2.5 L/min.

If the concentration of the analyte of interest being monitored is too high at the Lonestar® analyser detector, a loss of the Reactive Ion Peak (RIP) will show RIP trace. This suggests that system saturation occurs. A lower sample flow or a split flow can be used in conjunction with a makeup flow to reduce the headspace concentration at the Lonestar® analyser detector and avoid system saturation. Figure 8 shows a Dispersion Field matrix where the detection of concentrations of one or two analytes is too high and RIP trace suggest system saturation.

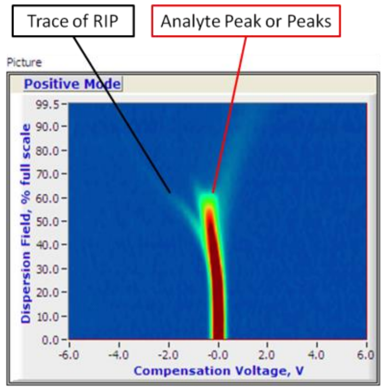


Figure 8: Dispersion Field matrix of high concentrations of analytes.

By diluting the sample flow, the RIP can be clearly seen in Figure 9, as can two analyte of interest peaks. Diluting the sample has resulted in more information from the sample analysis.

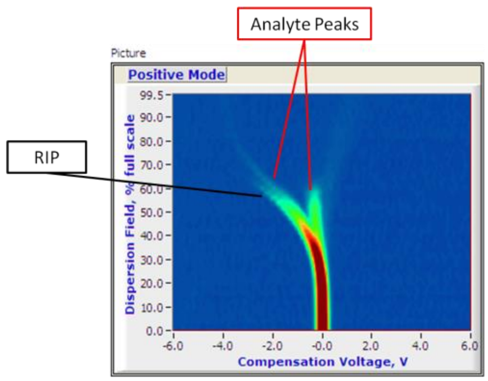


Figure 9: Dispersion Field matrix of diluted sample flow.

If the concentration of the analyte of interest being monitored is too high at the Lonestar® analyser detector, then a restriction can be placed before the inlet filter.

The restriction may be a needle valve, a rotameter, a mass-flow controller or a fixed orifice. In the example shown in Figure 10, a needle valve is shown.

A tee is placed between the restriction and the inlet filter and connected to the clean gas outlet on the left hand side of the Lonestar® analyser.

By using a restriction before the inlet filter, the sample flow is reduced. A makeup flow of clean air is then directed through the hydrocarbon scrubber to maintain sufficient flow for the Lonestar® analyser.

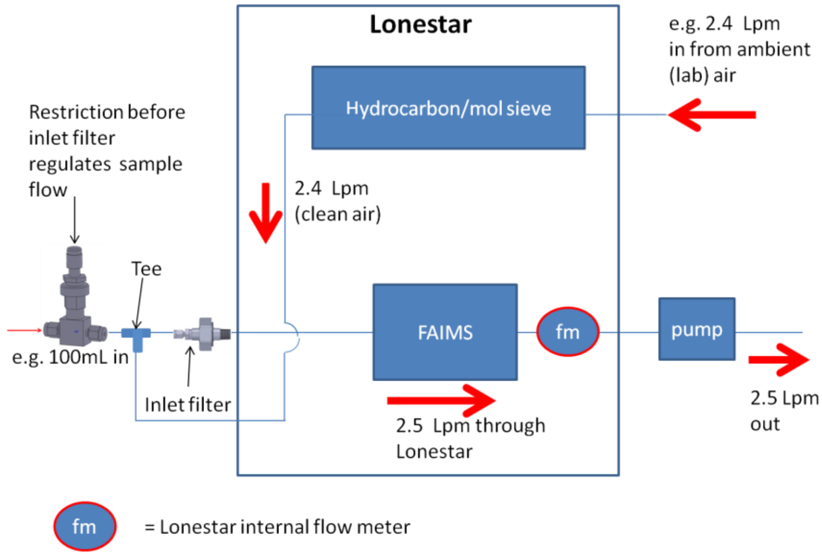


Figure 10: Flowpath of a negative pressure system drawing a restricted sample flow and a makeup flow through the scrubber.

Between each sample analysis, the Lonestar® system flowpath should be cleaned for the next detection. System cleaning is realised by passing clean air through the Lonestar® system and/or through the sampling system to allow any remaining analyte and background to be removed.

About Owlstone®

Owlstone® develops and commercializes innovative new technologies to address the critical need for compact, dependable and cost-effective chemical and biological detection solutions for a wide range of markets.

Owlstone® was formed through the recognition of the opportunities created by the application of micro- and nano- technology to develop improved sensing solutions.

Owlstone® is focused on the innovation of detection technologies to address unmet needs, developing solutions that are flexible enough to target a range of markets with the potential for growth by enabling new application opportunities.

From homeland security to home safety, Owlstone® is working with leading manufacturers and integrators across a range of markets to develop products incorporating our microchip chemical sensing solution.

Owlstone® is headquartered in the United States and has laboratory facilities in the United Kingdom. Owlstone® Ltd was founded in 2003 with a seed investment of two million dollars from Advance Nanotech, Inc., a New York based company specializing in the investment in and commercialization of nanotechnologies.