Apex2 Application Note

Constant Pressure Mode*

(*Plus and Pro Models Only)

About The Apex2

The Casella Apex2 personal sampling pump combines class beating performance with great features. Monitor your pump remotely with Bluetooth® 4.0 and the supporting Airwave® Android App on your phone without having to disturb the wearer. Email the run data alongside notes and photographs to make your reporting easier and with its slim, ergonomic design and simple operation, the Apex2 offers the user true confidence in their results.

A new feature of the Apex2® pump is the 'Constant Pressure Mode'*(*Plus and Pro Models only) which enables the user to collect more than one sample at a time.

About Constant Pressure Mode

Most air sampling pumps on the market use a 'Constant Flow' method of controlling the pump. The current standard (ISO: 13137) states that the flow should not deviate by more than ±5% of the initial set flow rate. So, if you're monitoring in very dusty conditions and the filter becomes loaded, the pump will detect the rise in back pressure and compensate by making the pump work harder to draw the same amount of air through. For most sampling protocols for total and respirable dust, you're working in the region of 2-2.2l/min and this works well. This is the default setting for the Apex2®.

However, the Apex2® also has a 'Constant Pressure Mode' and this is a different method of ensuring good flow control. Instead of keeping the flow constant, as described above, it holds a constant low pressure level inside the tubing between the pump and the sample. The flow rate needs to be set separately by a control valve and the pump will detect the pressure that exerts and maintains it.
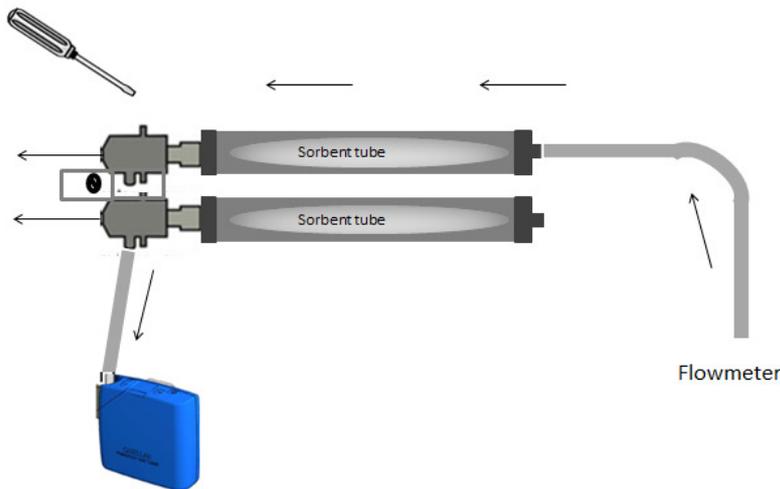
So, what is the advantage of this? Why would you use a 'Constant Pressure Mode' as opposed to just keeping the flow constant? The big advantage is for low flow applications (below 1l/min), using sorbent tubes. Up to four separate sorbent tubes can be sampled at the same time using a manifold. There are also applications at higher flow rates (1-5l/min) where you want to sample more than one hazard simultaneously and where the back pressure is anticipated to be high, for instance if you are expecting high filter loading on media with small pore sizes, e.g. 22mm 0.8µm

MCE filters. For this reason of being able to take more than one sample simultaneously, it is sometimes referred to as 'multi-flow' control.

So, how does that work then? With constant flow control it is not possible to split the sample. If one side becomes loaded or blocked, the pump would detect the change in total flow and speed up the motor accordingly. Similarly, if you needed to sample at different flow rates, the pump could only detect an 'average' and would adjust accordingly meaning that you would have no idea which proportion of the flow would be drawn through which side of the split. With constant pressure control, it is the pressure inside the tube which is maintained so the force driving each side of the split remains the same such that, even if one side were completely blocked, the other side would still maintain its set flow rate.

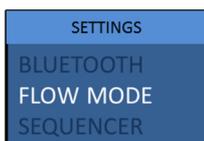## Setting up Constant Pressure Mode

Calibrating for constant pressure mode using sorbent tubes would look like this:
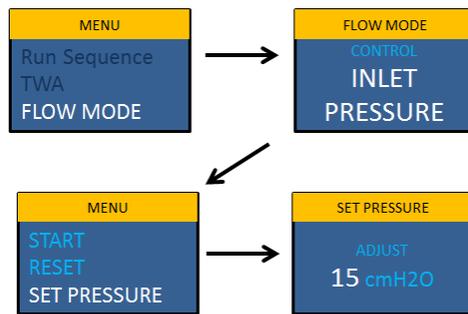

Break off both ends of the sorbent tubes and fit into the holder with the arrow pointing towards the pump. Connect the other to the flowmeter.

Set 'Constant Pressure Mode' on the pump:

- Ensure that the 'Advanced Mode' on the Pump is on. To do this, you would access the settings menu by pressing and holding the <↑> and <↵> keys immediately after powering up the pump. Scroll through the items until the desired function is highlighted. Confirm with the Enter <↵ > key.

- Return to the Main Menu and scroll through using the <↓> key until 'Flow Mode' is highlighted. Press <↵ > and select 'INLET PRESSURE'

- Return to the menu and select 'SET PRESSURE' and then adjust to the desired level. The set point for the pressure <u>must</u> be greater than the anticipated back pressure exerted by the samples, so if you do a test run with a flowmeter and the back pressure exerted is $25cmH_2O$, set the pressure level on the pump to around $40cmH_2O$. It is possible to change the pressure units to 'inches of water' from the 'Settings Menu' at startup.
- Start the pump
- Adjust the flow using the screw adjustment of each individual sorbent tube on the manifold/adaptor to the level required on your flow meter. The set-up is now calibrated
- Remove the sorbent tubes and replace with fresh ones for the sampling operation.

It is possible also to do the same basic process for higher flow measurements (1-5l/min) with a sampling head and filter arrangement. However, the anticipated back pressure must be reasonably high, around $25cmH_2O$ or greater for the Constant Pressure Mode to register changes to control.

In Conclusion

The Apex2® Personal Sampling Pump has two control methods built into the pump: 'Constant Flow Control' and 'Constant Pressure Control'.
- Constant Flow Control is the 'normal' method of controlling a pump. As filters become loaded, more back pressure is exerted. The pump will detect the change and work harder to compensate to keep the flow constant.
- Constant Pressure Control is where a constant pressure is maintained in the tubing between the pump and the sample head/tube. Flow rate of an individual sample is set independently using a flowmeter.
- Constant Flow Control is used in the range 1-5l/min and is particularly valuable when sampling for respirable dust fractions using cyclone heads, where the performance of the cyclone itself is dependent on the stability of the set flow rate.
- Constant Pressure Control is most useful when you are taking more than one sample simultaneously at low flow rates (<1l/min) but also has applications for multi samples at higher flow rates (1-5l/min) where high back pressure is expected. Flow rates for each sample can be set independently.

For more information about the Apex2, please visit us at: http://www.casellasolutions.com

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