9720/9722
PROFILER UTILITY
MANUAL

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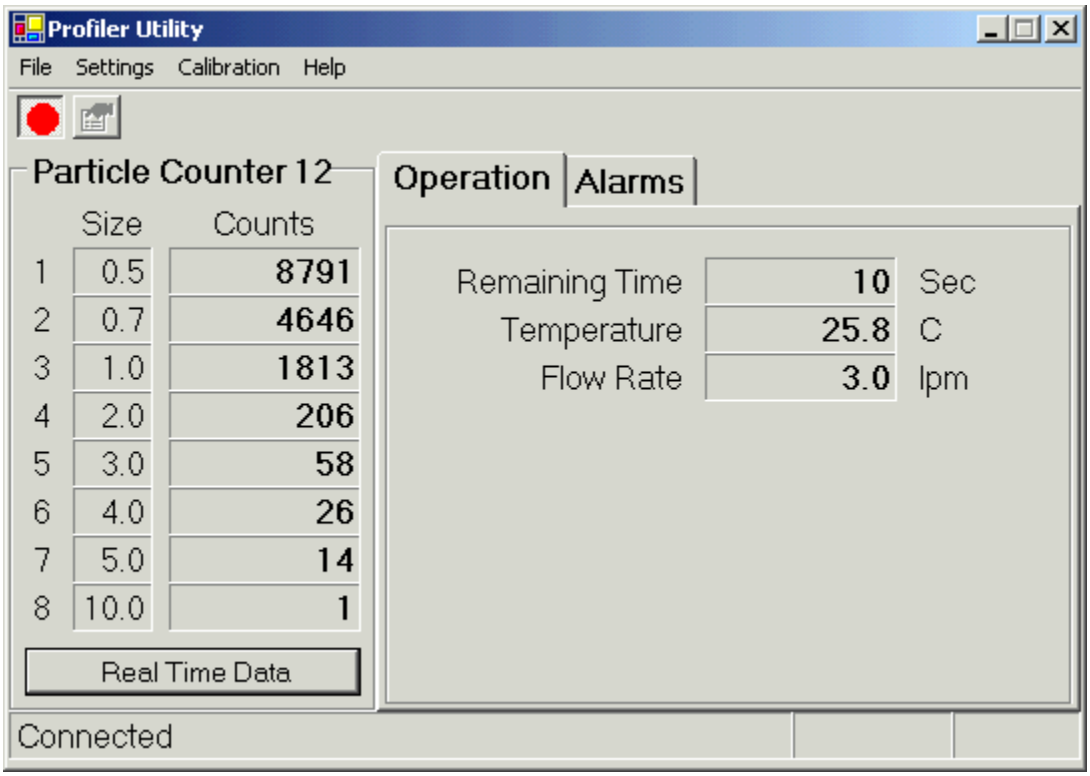
Table of Contents

1 The Main Screen

This Profiler Utility program is used to configure and monitor a single 9720 or 9722 series particle counter. The main screen displays all the feedback that is important for a successful particle counter operation.

The different parts of the main screen are explained in detail in the following sections.



1.1 Tool Bar

Press the  button to start and stop the particle counting operation.

Press the  button to change counter settings.

1.2 Particle Counter Panel

The heading of the particle counter panel includes the unit ID (e.g. 12).

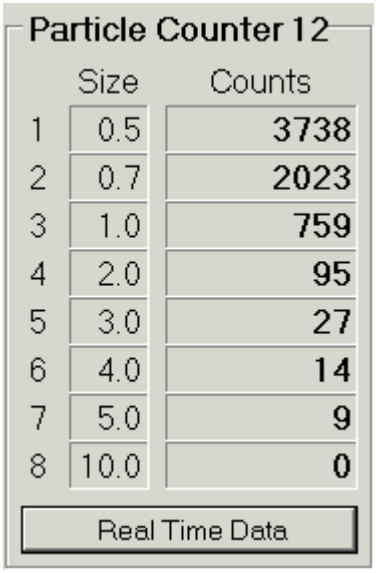
The particle counter panel displays the channel sizes and counts or channel sizes and counts/volume.

Counts will be used to get a real time feedback of count events, i.e. to see when particles are being counted. This number will increase with sample time.

Counts/volume or concentration will be used to get a quick feedback about the particle concentration at the sample location. Since the counts are divided by the sampled volume this number will typically fluctuate around a concentration value and get more refined the more volume is sampled.

Use the Units Setting dialog to make the change.

Press the Real Time Data button to switch the count display to show previous count sample.

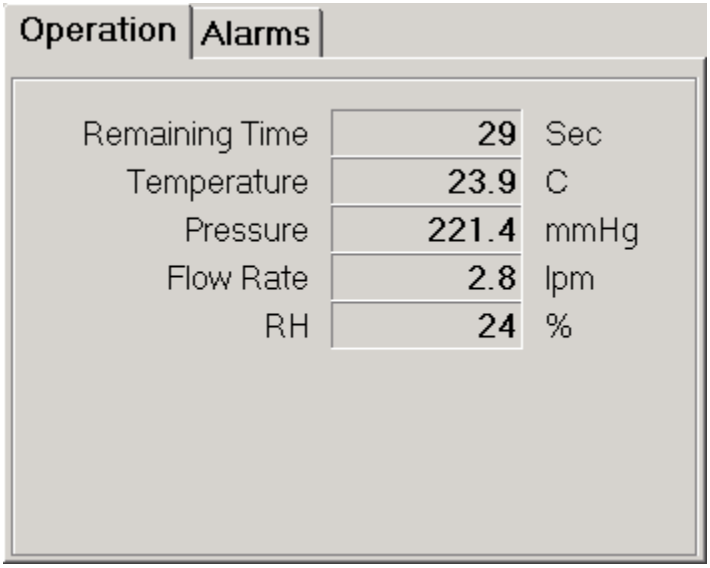


1.3 Operation Tab

The operation tab displays the operational parameters: remaining time, temperature, pressure, flow rate and RH. Note: not all Profilers come equipped with these sensors.

Remaining Time is the amount of time remaining for the sample event.

Report and Flow settings determine when the Temperature, Pressure, Flow Rate and RH readings are displayed.



Note when the Flow Mode is configured as Manual the flow rate returned from the unit is a simulated value because there is no flow sensor connected. The value return is 2.83 lpm for a non-sheath system and 1.0 lpm for a sheath system.

1.4 Alarms Tab

The alarms tab displays the operational alarms: laser calibration, vacuum pump, air filter, pressure sensor, temperature sensor, and non-volatile memory.

The Non-Volatile Memory fails when the factory calibration settings are lost. The unit must be returned to the factory for recalibration.

The Laser Calibration fails when the laser has run for more than 8760 hours.

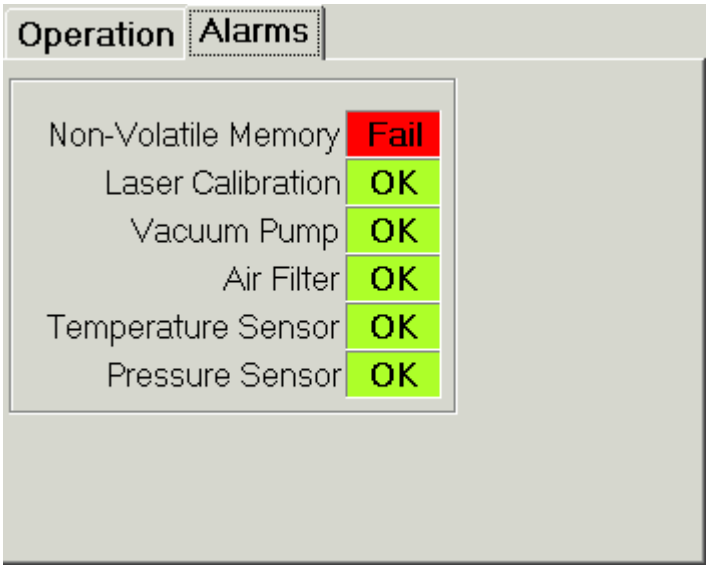
The Vacuum Pump fails when the pump runs for more than 6000 hours. It also fails if the pump control is at a maximum and the flow rate is less than 2.5 lpm.

The Air Filter fails when the pump control is at a maximum.

The Temperature sensor fails when the reading is less than –30.0 °C or greater than 50.0 °C.

The Pressure sensor fails when the reading is less than 600 mmHg or greater than 772 mmHg.

Depending on the flow mode settings not all of these values will be displayed.



1.5 Status Panel

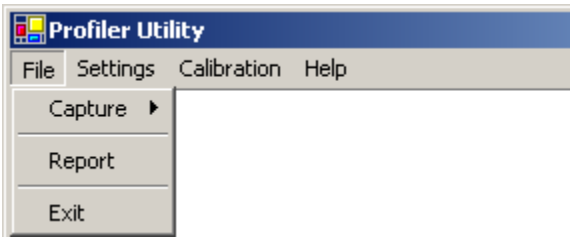
The status panel shows the state the serial port connection, the capture mode and the alarm condition.

If Capture is started then Capture will be highlighted in green otherwise a gray box with no text is shown.

If an Alarm is pending then Alarm will be highlighted in red otherwise a gray box with no text shown.

2 File Menu

The file menu gives the user access to file related functions listed below.



2.1 Capture File

This item will start and stop data capture to a file. The data is stored in a comma separated variable (CSV) file. The capture file is stored in the Data directory.

For more information see section 6 Capture Data.

2.2 Report File

This item will create a Profiler Report. All settings and readings from the 9720 or 9722 unit are saved to a csv-file. If the user sends this file to the factory, this report will be used for factory diagnostics.

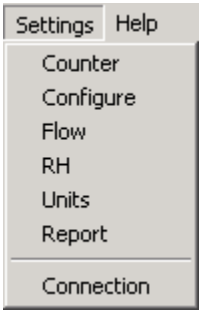
For more information see section 7 Profiler Report.

2.3 Exit

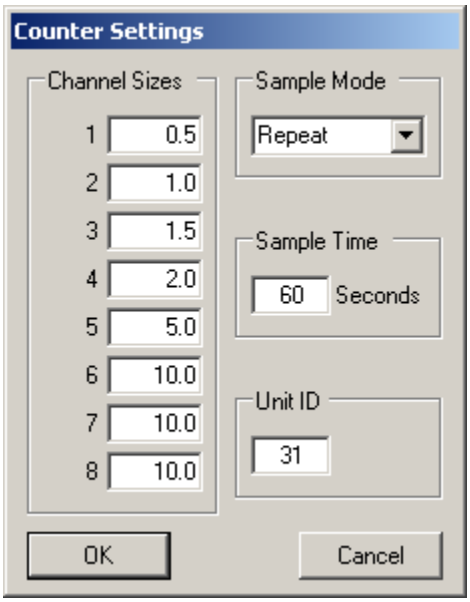
This item will exit the program.

3 Settings Menu

The settings menu gives the user access to change the operational settings pertaining to the counter, flow, RH, units of measure, report, or the connection. The RH setting is only shown when the 9720 or 9722 series particle counter supports that operation. Otherwise, the RH setting item is not shown on the main menu.



3.1 Counter Settings



3.1.1 Channel Sizes

There are 8 possible channel sizes. The size settings must ascend sequentially.

Allowed: 0.5, 0.7, 0.8, 1.0, 2.5, 5.0, 7.0, 10, or 0.5, 0.7, 1.0, 2.5, 10, 10, 10, 10.
Not allowed: 0.5, 0.7, **1.0, 0.8**, 2.5, 5.0, 7.0, 10, since 0.8 is smaller than 1.0.

Note: The software enforces an ascending sequence.

There are 2 size ranges depending on what sensor was purchased.

A 972X-1 has a size range from 0.3µm to 10µm.

A 972X-2 has a size range from 0.5µm to 10µm.

3.1.2 Sample Mode

There are 2 sample modes—Single or Repeat.

Single – Single mode counts for 1 sample cycle. The sample time sets the length of the sample cycle.

Repeat – Repeat mode repeats the sample cycle until a stop is issued.

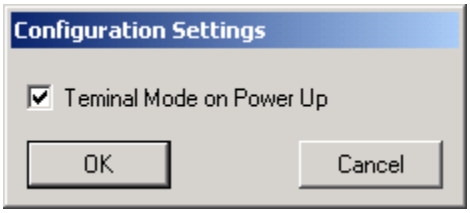
3.1.3 Sample Time

The sample time sets the length of the sample cycle. The sample time can be set from 1 second to 3600 seconds (1 hour).

3.1.4 Unit ID

This is a 2-digit unit ID that can be set from 1 to 99.

3.2 Configure Settings



The 9720 or 9722 series particle counter supports two (2) RS232 communication modes—Modbus or Terminal.

Check the **Teminal Mode On Power Up** item to stay configured in Terminal mode on power up.

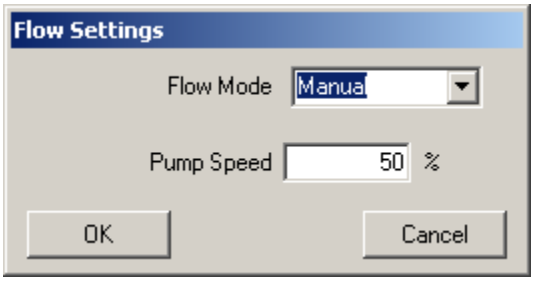
Uncheck the **Teminal Mode On Power Up** item to stay configured in Modbus mode on power up.

3.3 Flow Settings

There are 3 flow control modes – Manual, Actual or Standard.

3.3.1 Manual Flow Mode

Manual – Manual mode is an open loop flow control. Setting the pump speed controls the flow. A pulse-width modulation driver controls the pump speed. The pump speed can range from 0 to 100 %.



3.3.2 Actual Flow Mode

Actual mode is a closed loop flow control using a set point controller.

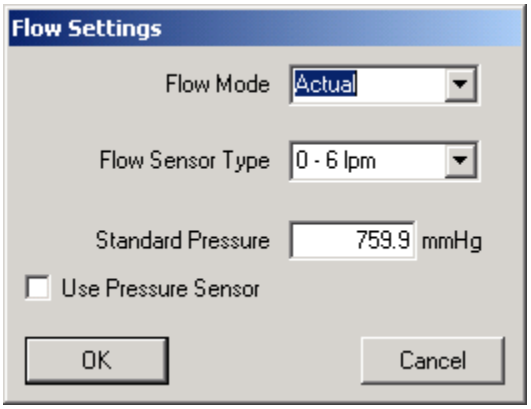
For units with sheath air the set point is fixed at 3.0 lpm. The sample flow rate is 1.0 lpm and the sheath flow rate is 2.0 lpm.

For units without sheath air the set point is fixed at 2.83 lpm. The sample flow rate is 2.83 lpm.

In both cases the flow rate measurement is corrected to ambient temperature and pressure. For more information refer to section 7 Standard and Actual Flow.

If a pressure sensor is not available then the pressure reading can be replaced with a Standard Pressure setting. The range is from 600 mmHg to 825 mmHg.

The flow system supports two types of flow sensor. Select the one you are using (0 – 6 lpm or 0 – 5 lpm).



3.3.3 Standard Flow Mode

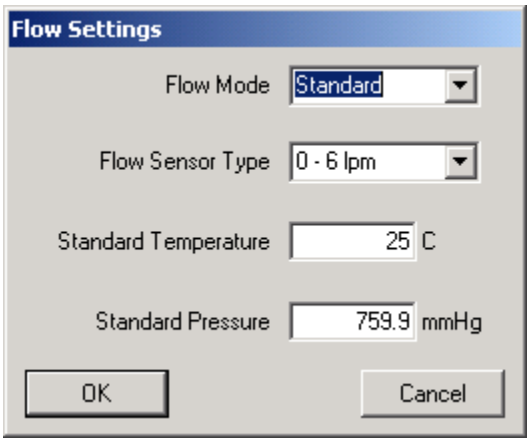
Standard mode is a closed loop flow control using a set point controller.

For units with sheath air the set point is fixed at 3.0 lpm. The sample flow rate is 1.0 lpm and the sheath flow rate is 2.0 lpm.

For units without sheath air the set point is fixed at 2.83 lpm. The sample flow rate is 2.83 lpm.

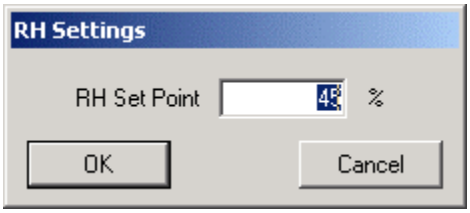
In both cases the flow rate measurement is corrected to standard temperature and pressure. For more information refer to section 7 Standard and Actual Flow.

The flow system supports two types of flow sensor. Select the one you are using (0 – 6 lpm or 0 – 5 lpm).



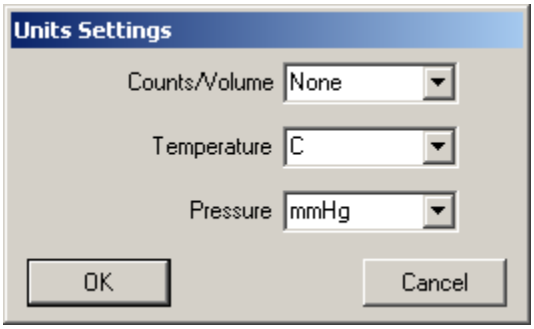
3.4 RH Settings

For versions of the 9720 or 9722 series particle counter which include RH control (versions 1.10.0 and above), the following screen is available to adjust the RH set point. For non supporting versions the RH settings option is not shown on the main menu.



3.5 Units Settings

Here the user can select what units are used for volume, temperature, and pressure.



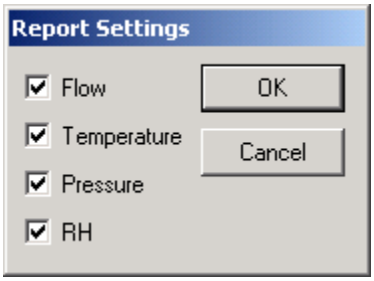
There are 4 volume units - None, Liter, Cubic Foot, or Cubic Meter.

There are 2 temperature units - °C or °F.

There are 4 pressure units—inHg, mmHg, Pa, or kPa.

3.6 Report Settings

Some Profilers come equipped with flow, temperature, pressure, and RH sensors. This screen sets which sensor readings are include in the Capture Data report. Any checked item is included in the report.

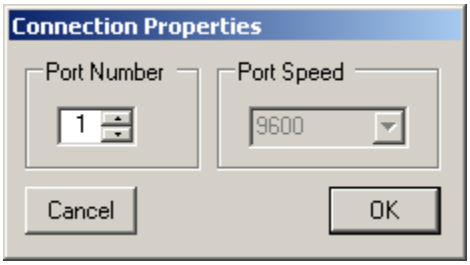


3.7 Connection Settings

This screen sets which PC serial port is to be connected to the sensor.

The port number can range from 1 to 99.

The port speed is fixed at 9600 baud.

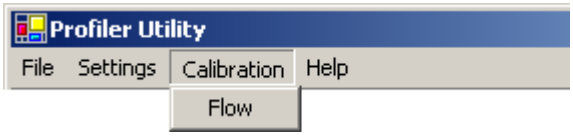


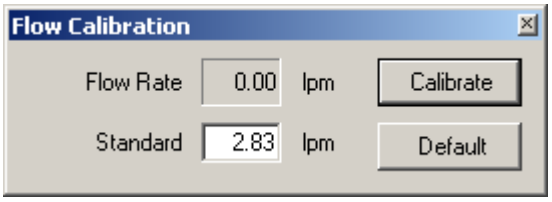
Calibration Menu

3.8 Flow

The flow system can be calibrated by the user.

This is only recommended if the user has a calibrated and traceable flow standard.





To calibrate the flow system, first set the Sample Mode to Repeat and the Sample time to 60 seconds.

See your particle counter manual to know where to connect your flow standard.

Press the start sample button  to turn on the flow system.

Display the Flow Calibration window.

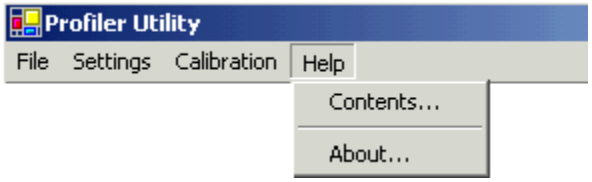
Wait for the flow system to stabilize.

Enter the Standard reading.

Press the Calibrate button to calibrate the flow system.

Press the Default button to remove the flow calibration.

4 Help Menu



4.1 Contents…

Select Contents to show the program's online help.

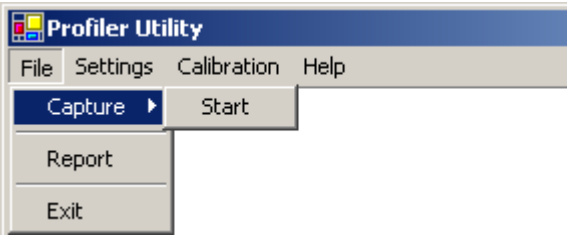
4.2 About…

Select About to show the Profile Utility software version. It also shows the product model number and version; and firmware version and revision.

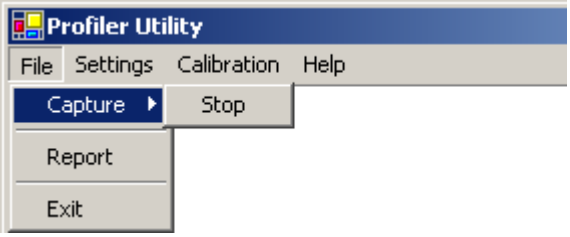
5 Capture Data

Sample events can be captured to a file.

Select File/Capture/Start to begin data capture.



Select File/Capture/Stop to halt data capture.



The capture file is stored in the Data directory.

The file name is `31 2005-07-26-13-51-10.csv`. Where `31` is the unit ID number and `2005-07-26-13-51-10` is the current date and time.

5.1 CSV File Format

The data is stored in a comma separated variable (CSV) file. The first row contains the column header labels. The remaining rows contain data. The data saved is in the following columns:

- Unit ID
- Date/Time
- Size 1
- Size 2
- Size 3
- Size 4
- Size 5
- Size 6
- Size 7
- Size 8
- Alarms

The following data are included when Report Setting items are checked.

- Flow
- AT
- BP
- RH

5.1.1 Column Header Labels

Some of the column labels are determined by setup.

A column header label example is:

- Unit ID
- Date/Time
- 0.5 (Count/m3)
- 0.7 (Count/m3)
- 1.0 (Count/m3)
- 2.0 (Count/m3)
- 3.0 (Count/m3)
- 4.0 (Count/m3)
- 5.0 (Count/m3)
- 10.0 (Count/m3)
- Alarms

The following column labels are included when Report Setting items are checked.

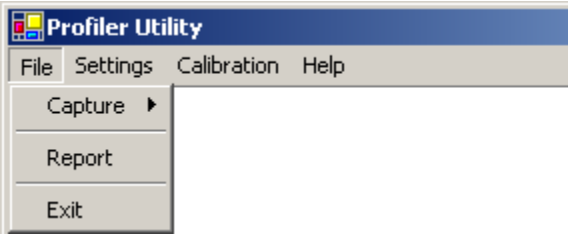
- Flow (lpm)
- AT (C)
- BP (mmHg)
- RH (%)

An alarm value is determined by adding up the values of failed conditions.

For example if the Alarm value is 18 then the Laser Calibration and Temperature Sensor have failed.

Fail Condition	**Value**
Non-Volatile Memory	1
Laser Calibration	2
Vacuum Pump	4
Air Filter	8
Temperature Sensor	16
Pressure Sensor	32

6 Profiler Report



The Profiler Report is created from the File/Report menu item.

Typically this report is used for factory diagnostics.

The report is stored in a comma separated variable (CSV) file format.

The File name is "`Report 31 2005-07-26-14-48-18.csv`". Where `31` is the unit ID number and `2005-07-26-14-48-18` is the current date and time.

All settings and readings from the 9720 or 9722 unit are reported.

The following is an example of a typical report output.

Profiler Report (1.4)	
09/22/2006 10:43	
Unit ID	31
3x Readings	
ulSampleTime	0
ulCount 1	886
ulCount 2	486
ulCount 3	211
ulCount 4	21
ulCount 5	7
ulCount 6	5
ulCount 7	4
ulCount 8	0
ulLastTime	541
ulLastCount 1	15206
ulLastCount 2	8411
ulLastCount 3	3287
ulLastCount 4	399
ulLastCount 5	112

ulLastCount 6	52
ulLastCount 7	35
ulLastCount 8	1
usCountState	0
usTestState	0
flIOP	0.366
flLight	0.004
ulLaserTime	300328
ulPumpTime	300328
flFlow	0
flTemp	25.968
flPres	101311.7
flVol	0
flLastVol	1
usAlarms	0
flRH	23.695

4x Settings	
usDAC 1	578
usDAC 2	825
usDAC 3	1310
usDAC 4	3175
usDAC 5	6244
usDAC 6	10500
usDAC 7	15554
usDAC 8	51497
usOpCmd	0
usPassword	0

EE Settings	
Model	3624-01 R1.9.0
usSlaveAddr	1
usBaudRate	5
usSerialNum	1234
usPWM	29491

ulSampleTime	2400
usIOP	2047
usFlowMode	1
usSize 1	5
usSize 2	7
usSize 3	10
usSize 4	20
usSize 5	30
usSize 6	40
usSize 7	50
usSize 8	100
flFlowSetPt	3
usIGain	1000
usPGain	5000
flFlowOffset	0
flStdPress	101311.7
flStdTemp	25
usConfig	7
usOpMode	1
usCommMode	1
usStatus	42405

Spline Settings	
usSplineSize 1	3
usSplineSize 2	7
usSplineSize 3	10
usSplineSize 4	20
usSplineSize 5	50
usSplineSize 6	100
usSplineSize 7	0
usSplineSize 8	0

flSplineThres 1	0.0286
flSplineThres 2	0.063
flSplineThres 3	0.1

flSplineThres 4	0.2423			
flSplineThres 5	1.1867			
flSplineThres 6	3.929			
flSplineThres 7	0			
flSplineThres 8	0			
flCoeff 1	0.0286	0.075026	0	0.06859
flCoeff 2	0.063	0.107949	0.082308	-0.103424
flCoeff 3	0.1	0.12941	-0.010773	0.023663
flCoeff 4	0.2423	0.178854	0.060217	-0.004967
flCoeff 5	1.1867	0.406043	0.015513	0.002594
flCoeff 6	3.929	1.31816	0.054424	-0.00381
flCoeff 7	0	0	0	0
flCoeff 8	0	0	0	0
usStatus	0			

7 Standard and Actual Flow

Standard temperature and pressure (STP) is a standard set of conditions for experimental measurements to enable comparisons to be made between sets of data. The mass flow meter is calibrated from the manufacturer at a STP of 0 C and 760 mmHg. The Ideal Gas Law is used to translate mass flow from one set of conditions to another.

The conservation of mass tells us that if mass flow is held constant over temperature and pressure. Using this relation and the Ideal Gas Law yields the following equation:

$$\frac{mP_x}{nRT_x} \cdot Q_x = \frac{mP_r}{nRT_r} \cdot Q_r$$

Solving for Qx gives the following equation:

$$Q_x = Q_r \cdot \frac{P_r}{P_x} \cdot \frac{T_x}{T_r}$$

Definitions

Tr = Temperature at some reference condition in K (Kelvin)

Pr = Pressure at some reference condition in mmHg

Qr = flow at some reference condition of pressure and temperature

Tx = Temperature at some other condition in K (Kelvin)

Px = Pressure at some other condition in mmHg

Qx = flow at some other condition of pressure and temperature

n = Number of moles of gas

R = Gas constant

m = Mass in grams (g)

7.1 Standard Flow

If mass flow meter is calibrated from the manufacturer at a STP of 0 C and 760 mmHg and you want to know the mass flow at 25 C and 760 mmHg, the equation would look like this.

$$Q_x = Q_r \cdot \frac{P_r}{P_x} \cdot \frac{T_x}{T_r} = Q_r \cdot \frac{760}{760} \cdot \frac{273.15 + 25}{273.15}$$

Where Q_r is the reading from the mass flow sensor and Q_x is the mass flow at STP of 25 C and 760 mmHg.

7.2 Actual Flow

If mass flow meter is calibrated from the manufacturer at a STP of 0 C and 760 mmHg and you want to know the actual flow at ambient conditions of 21.4 C and 765.2 mmHg, the equation would look like this.

$$Q_x = Q_r \cdot \frac{P_r}{P_x} \cdot \frac{T_x}{T_r} = Q_r \cdot \frac{760}{765.2} \cdot \frac{273.15 + 21.4}{273.15}$$

Where Q_r is the reading from the mass flow sensor and Q_x is the actual flow at ambient conditions.