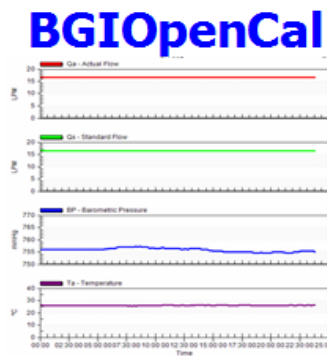


INSTRUCTION MANUAL for OPERATIONAL SOFTWARE



Downloader for BGI Calibrators:
deltaCal
tetraCal
The Challenger
HiVolCal
triCal (Discontinued)

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We dwell in a litigious age and whilst every effort is made to be accurate, correct and polite, perfection is a goal and not always a reality. Therefore, the following exculpatory statement is necessary: [Disclaimer & Limit of Liability](#)

NOTICE

Although this instruction manual may be printed and read, frequent use is made of electronic links which may be readily accessed if the document is used on line. [Blue underline](#) items are direct links. Words in [green](#) will take you to the Glossary of terms at the back of this manual.

1. Introduction

BGIOpenCal is the name of the software that we have designed to improve the state of the art for utilizing and expanding the output of our Air Flow Calibrators. This software will work with all BGI electronic calibrators regardless of vintage or firmware version. However, it was specifically created to support the completely revised firmware of BGI electronic calibrators.

Our original electronic firmware **deltaCal O/S** is now replaced with **PrimeCal O/S**.

*This new O/S will be an automatic upgrade to all new calibrators as well as those received for recalibration and repair. There will be no charge made for this upgrade. If the new firmware is resident in your calibrator the letter **P** will appear in the version number.*

The reason for this change is to launch the most user friendly versatile operating system ever presented in an airflow calibrator.

- All calibrators are dispatched from our factory with one set of default parameters.
- A [utility program](#) is provided with each calibrator and on line, which will permit the selection of a wide range of operating parameters.
- Changes may be made to parameters while the instrument is in use.
- Automatic port finding is a standard feature.
- New graphical software works with all previous versions of firmware.

Since all BGI electronic calibrators are based on a DP (Differential Pressure) [First Principle, Primary Element](#) Venturi or orifice, the flow is dry and non pulsating. The superior pressure drop recovery characteristics of the Venturi permit calibrations and audits to be conducted under very realistic conditions, as good scientific practice demands. All BGI Air Sampling Instruments alluded to in this Manual have their flow rate measured by a built in [Bernoulli device](#), comprising either a Venturi or Orifice. BGI specializes in Air Sampling applications for Environmental, Industrial Hygiene and IAQ. Similarly, our air flowrate measurement devices also focus on our specific chosen field.

One of the most useful features of this Software is that it presents the Flowrate information as both Actual (Qa) and Standard (Qs) flow. The concept of standard and actual flow rate has been [presented on our website](#) in considerable detail. Briefly, Qa is the flow rate at the actual prevailing Barometric Pressure and Temperature. Qs is the flow rate corrected to a "standard" or base value of Temperature and Pressure. In every case the Pressure is that at sea level. There are several temperatures having historical and current legal precedent; the most common are 0°C (worldwide), 20°C (Engineering) and 25°C (United States Environmental Protection Agency, USEPA). With the introduction of the P series of Calibrator firmware a number of options become available as discussed below.

In order to appreciate all the information that can be provided by your BGI [Venturi Prover](#) calibrator, Figure 1 will be of considerable assistance.

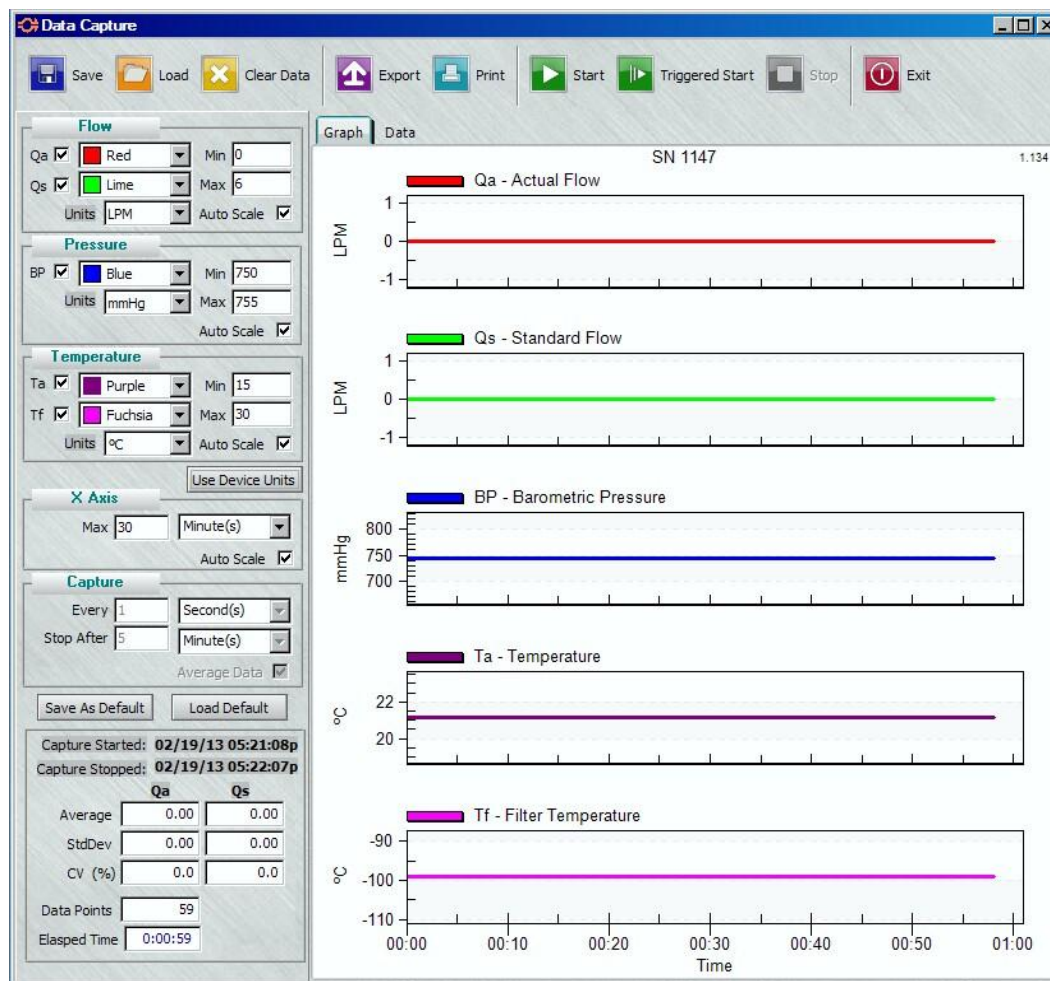


Figure 1. Example of the Capture Data Stream screen

Each of the graphical functions will be discussed in the following pages. In addition to the graphical data, tabular information is also presented.

2.0 Installation

BGIOpenCal software is furnished online from the BGI website as [BGIOpenCal](#) or from the CD furnished with BGI calibrators. The software is built with an Installation Wizard. Once you select the program it will install with minimal user effort. When complete, you will have a new Desktop Icon, BGI Open:



You will have the opportunity to create a automatic save data directory which will be explained under "System/Port Settings".

2.1 Connection

Connect your BGI flow calibrator to the computer containing the BGIOpenCal software. This will likely require a USB-to-Serial Adapter. Some of the inexpensive adapters are not consistently reliable. The Staples Model 18762 USB-to-Serial Adapter has been used reliably (Note: this is not a product endorsement).

When clicking on the BGIOpenCal icon the opening pane will appear:



Immediately check the area below the button bars:

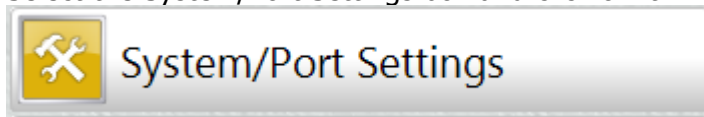


You should see a flashing green box which indicates incoming streaming data and the COM port being used. To the right are displayed the details of the calibrator to which you are connected. If you do not see this information displayed you are connected to a unit which does not have the letter **P** in the version number. You still have complete functionality.

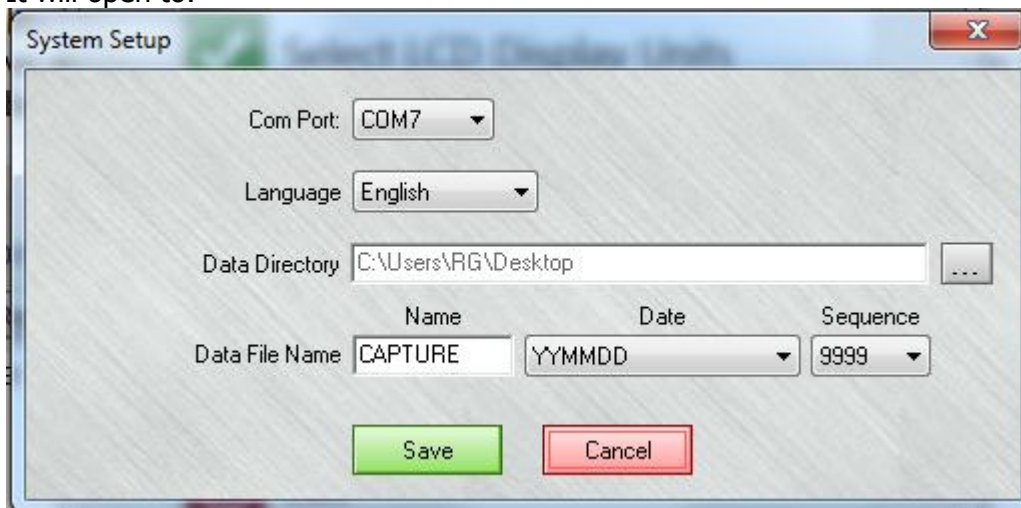
If you have not achieved connectivity there will be a red box and a reset box below the port number:



Select the System/Port Settings box and click on it:



It will open to:




Work down the list selecting (it will auto select) the active Com Port.

Language choices are English or Spanish.

The Data Directory is where saved data capture runs will be stored. The small icon to the right will open a list of available save directories.

The Data File Name presents various setup options for file storage and retrieval.

Now click on .

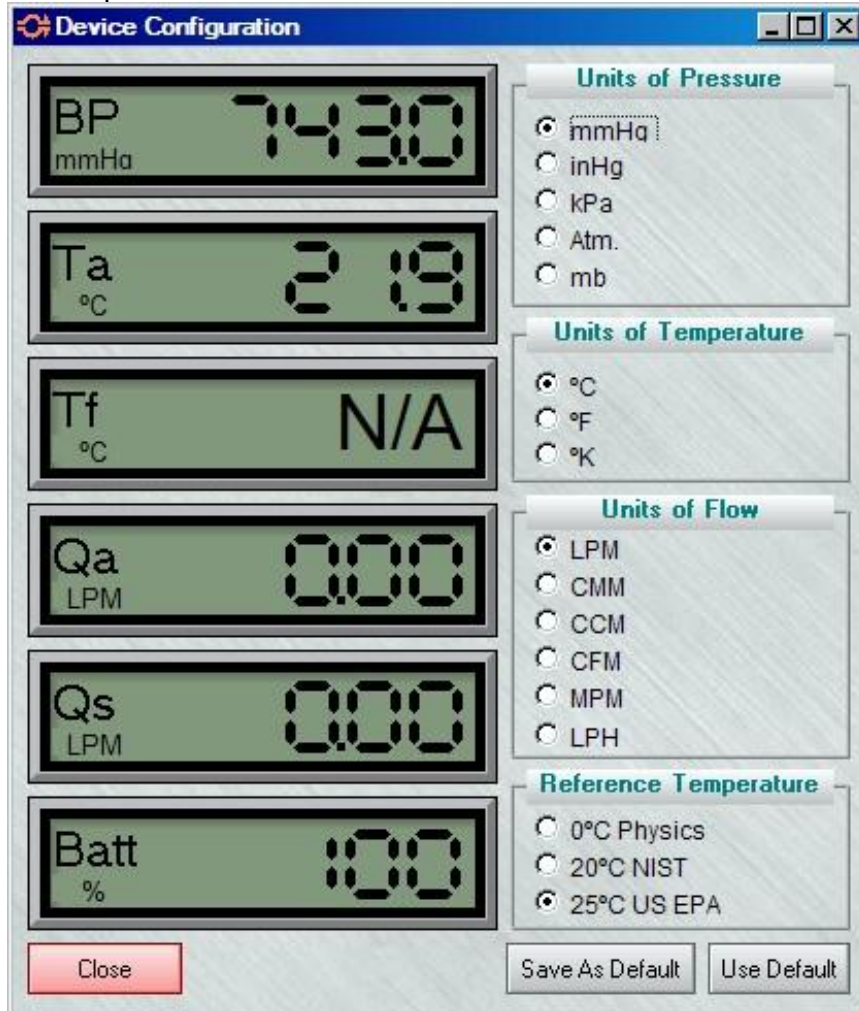
You will return to the main screen and click on . The green light will appear and if the calibrator is a **P** version the instrument data will also appear.

2.2 LCD Display Units.

Select the LCD Display units box:



It will open to:




This is an *active* screen it is showing what is actually happening on the calibrator screen. The view above is our standard default for all instruments except the HiVolCal.

At this point it is important to note that these parameters may all be changed while air is flowing through the instrument. This is a useful feature as it may aid the investigator to achieve a better "feel" for the most favorable units to utilize.

When a units selection is made it is changed in the calibrator right away.

When you have selected the various units and reference and you wish to use those

selections as a default click  to save those settings as a default setup.

The default settings can then be recalled by clicking on  at which time the settings in the unit will be changed to those saved.

Five choices of units of pressure are available. In the order presented they are:

- mmHg - millimeters of mercury (USEPA and Industrial Hygiene)
- inHg - inches of mercury (Industrial Hygiene)
- kPa - kilopascals (Europe)
- Atm - atmospheres (Physics and Engineering)
- mb - millibars (Traditional except for the Western Hemisphere)

Three choices of units of Temperature are available:

- °C - Celsius (Universal)
- °F - Fahrenheit (Limited Industrial Hygiene)
- °K - Kelvin (Physics and Engineering)

Five (or six) choices of flow rate units are available:

- LPM - Liters per minute (Universal)
- CMM - Cubic meters per minute (High Flow Europe)
- CCM - Cubic centimeters per minute (Low Flow)
- CFM - Cubic Feet per minute (USEPA High Flow)
- MPM - Moles per minute (Physics Base Units)
- LPH - Liters per hour (Universal) (available with firmware V3.41P and later)

The reference temperature is the "base" to which the Standard flow rate is presented. In the USA and other counties which directly utilize USEPA, the Standard temperature, when utilized, is **25°C**. For the rest of the World the "base" is **0°C**. Engineers and NIST use a base of **20°C** when expressing Standard flow rate. At one time it was popular to refer to standard flow as mass flow. This was common but, incorrect and is rapidly fading. It is best to confirm the Standard temperature requirements for your location and application and select the appropriate value.

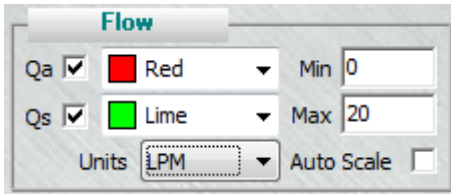
3.0 Graph Functions (Figure 1, page 3)

Up to 5 graphical functions may be displayed at one time. They may be "turned off" in the left hand column by use of the check boxes. Similarly each function may run as a settable range or "auto range" may be selected. *Any settings that are selected for a run or test may be saved as the default setup/values the next time the program is used.* In addition, starting with version 1.1.0.3 of BGIOpenCal software, you may click the "Use Device Units" button (see below...found between the Temperature and X Axis blocks) to automatically set the graphing units to those set in the attached BGI flow calibrator.



3.1 Actual Flow – Qa

This is the most fundamental measure of air flow rate. It presents the rate of air flow in liters/minute (lpm) at the prevailing Barometric pressure (BP) and ambient temperature (Ta). It is what is used for virtually all industrial Hygiene/Occupational Health measurements. It is also mandated in the USA for USEPA PM2.5 sampling procedures.



If Qa is not checked, the graph will not be shown. Auto Scale is the easy choice if your flow is stable, but may look "jittery" in some instances. It is always better to select and set a range if the information is available. This "Auto Scale" comment applies throughout.

3.2 Standard Flow – Qs

Standard Flow is often referred to as Mass Flow, because it is always taken to a Standard Temperature and Barometric Pressure. However, since it is read as units of volume/per unit time rather than units of mass/per unit time, this is incorrect, albeit common, usage. The BP is always sea level (760 mm of Hg, 29.92 in. of Hg, 1013.25 millibars/hectopascals). In engineering circles Ts has a value of 20°C. The USEPA and countries working to USEPA (PM10) methods use a temperature value of 25°C. Physicists, Chemists and Countries not using US EPA doctrine, take Standard temperature as 0°C. There are other temperatures that are occasionally utilized, but these are the primary values.

BGI Open has an option in **Device Configuration** which will permit the operator to set any of the 3 common values of Ts.

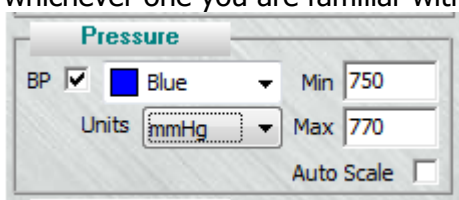
Table 1. Various Standard Temperatures - Celsius

Application	Std. Temp. - °C
Engineering	20
Physics	0
Chemistry	0
USEPA	25
Other Env. Agencies	0

One further value of Qs has been provided, Moles per min. When this unit is selected as your desired screen value Qa is not presented. It would be correct to set Ts as 20 C. This also has the imprimatur displaying flow in **Base Units**.

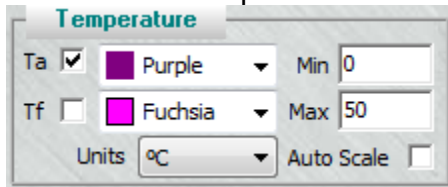
3.3 Barometric Pressure – BP

Device Configuration provides 5 units of Barometric Pressure. You may select whichever one you are familiar with or are required to use.



3.4 Ambient Temperature - Ta

Insofar as we are aware Celsius or Kelvin units now enjoy universal use, but the Fahrenheit unit is provided in the event of need.



The 'Temperature' dialog box contains the following controls:

- Ta**: A checked checkbox, a color selection dropdown set to 'Purple', and a 'Min' value input field set to '0'.
- Tf**: An unchecked checkbox, a color selection dropdown set to 'Fuchsia', and a 'Max' value input field set to '50'.
- Units**: A dropdown menu set to '°C'.
- Auto Scale**: An unchecked checkbox.

3.5 Filter Temperature - Tf

Filter temperature is measured by an extension probe provided with some calibrators. It is a short term audit function. In most cases it is just as well to deselect this graph and enjoy a larger ordinate view, on the remaining graphs.

3.6 Maximum Time on X Axis

All the graphs are displayed as one page. Select the maximum amount of time that you wish to be displayed. For diagnostic testing this could be as brief as 10 min. If you are running a sampling event it could be as long as the event plus delay time, if any. Normally *Auto Range* is the most convenient condition for the x axis. Deselecting this function will result in the intervals being equal to whatever units have been selected in **Device Configuration**. If you are uncertain always select Auto Range to start.

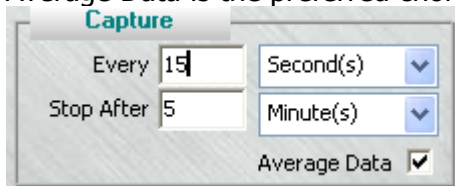


The 'X Axis' dialog box contains the following controls:

- Max**: A value input field set to '10'.
- Minute(s)**: A dropdown menu.
- Auto Scale**: A checked checkbox.

4.0 Capture Functions

Data will be captured in as much or as little detail as is desired. The time selections are seconds, minutes and hours. If the Average Data box is selected it will sample every second during the sample period, average those data points and display the result as one data point. If it is not selected it will display every data point received each second. Average Data is the preferred choice.

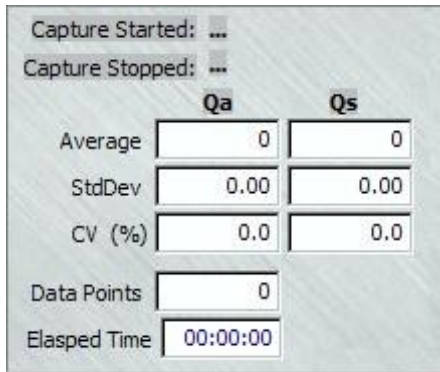


The 'Capture' dialog box contains the following controls:

- Every**: A value input field set to '15'.
- Second(s)**: A dropdown menu.
- Stop After**: A value input field set to '5'.
- Minute(s)**: A dropdown menu.
- Average Data**: A checked checkbox.

The above settings will display one data point every 15 seconds with that data point value the average of the 15 one second data samples.

5.0 Statistical Data



Capture Started: ...
Capture Stopped: ...

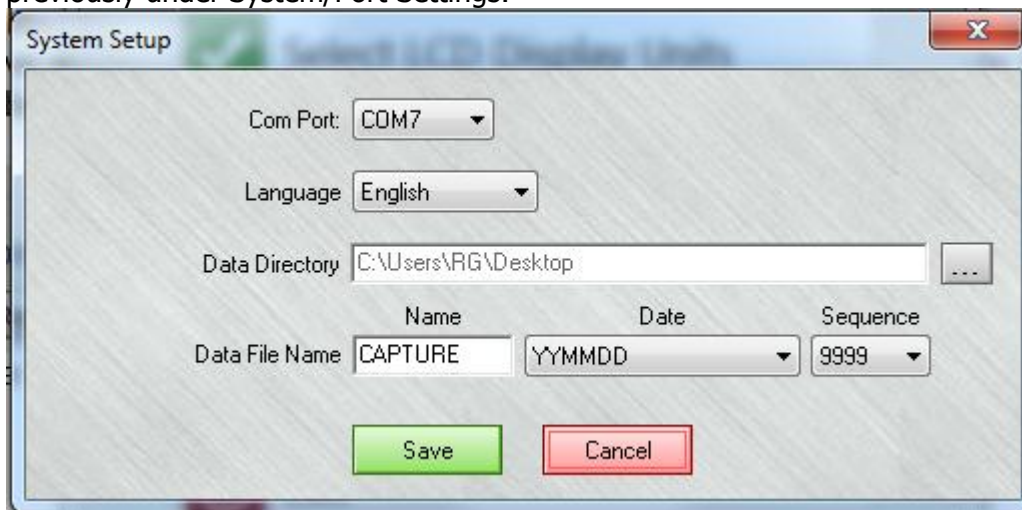
	Qa	Qs
Average	0	0
StdDev	0.00	0.00
CV (%)	0.0	0.0
Data Points	0	
Elapsed Time	00:00:00	

Once a test is begun the start time and stop time will be recorded. The Average flow rates (both Qa and Qs) will be displayed. The Standard Deviation of the flow rate is presented as well as the Coefficient of Variation (CV) which is called for by USEPA in PM2.5 sampling. The elapsed time is a measure of the total data capture time.

6.0 Controls



The Save button is used to record the information shown on the page. It will also save the tabulated numerical data to a directory and file name that you set up previously under System/Port Settings:



System Setup

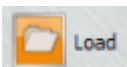
Com Port: COM7

Language: English

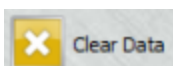
Data Directory: C:\Users\RG\Desktop

	Name	Date	Sequence
Data File Name	CAPTURE	YYMMDD	9999

Save Cancel



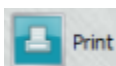
The load button is used to retrieve previously saved information. If you have unsaved data you be asked if you wish to save the data or discard it before opening a saved data file.



The clear button is used to clear the screens and data cache before beginning a new run.



Export is used to transfer captured data to a file as an Excel (.XLS), Comma Separated (.CSV), Tab Separated (.TXT), or Fixed Width (.PRN) document. If there is no external ("filter") temperature sensor used then that field will show as either a "n/a" or a "-99".



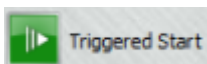
Print is used to send the page under view to a printer device. Header information will be printed as follows...

SN 1147					
Capture Every 1 Second(s) Averaged					
Capture Started at 02/20/13 08:31:01a and Stopped at 02/20/13 08:31:09a					
Qa Avg 0.00 StdDev 0.00 CV 0.0 Cnt 8					
Qs Avg 0.00 StdDev 0.00 CV 0.0 Cnt 8					
Elapsed Time 0:00:08					
Date/Time	Qa (LPM)	Qs (LPM)	BP (mmHg)	Ta (°C)	Tf (°C)
02/20/13 08:31:02a	0.00	0.00	745.0	20.0	n/a
02/20/13 08:31:03a	0.00	0.00	745.0	20.0	n/a

Note: Qa or Qs must be checked off on the Data Capture screen for either of these parameters to be displayed statistically in the header information.



The start button will begin the collection of data. It does not matter if air is flowing or not, collection will begin. If you have unsaved data you be asked if you wish to save the data or discard it before starting data capture.



The Triggered start button will begin the collection of data only when air begins to flow through a calibrator. Certain choices are available:

Triggered Data Capture

Data Capture will Trigger when

Qa > 1 LPM


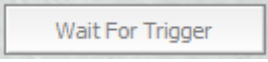
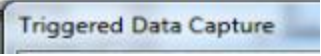
Delay After Triggered

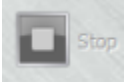
5 Seconds Before Starting Capture

Wait For Trigger Stop Cancel

Once air begins to flow the air sampling device may need time to achieve full flow and a flow rate figure close to the pump set flow should be selected.

Allow sufficient time after triggering before beginning data capture. This allows for the calibrator smoothing function to operate. Usually, it should not be more than 20 seconds.

The capture process will not begin until the  is pressed. After pressing the button will change color: . Once the capture begins the  screen will close.



The stop button may be used at any time to halt the data capture process.



The Exit button will close the program. If you have unsaved data you be asked if you wish to save the data or discard it.

7.0 Tabular Functions

In addition to the Graphical display, Tabular Functions are also provided for and are automatically recorded. They are viewed by selecting the **Data** tab at the top of the screen.

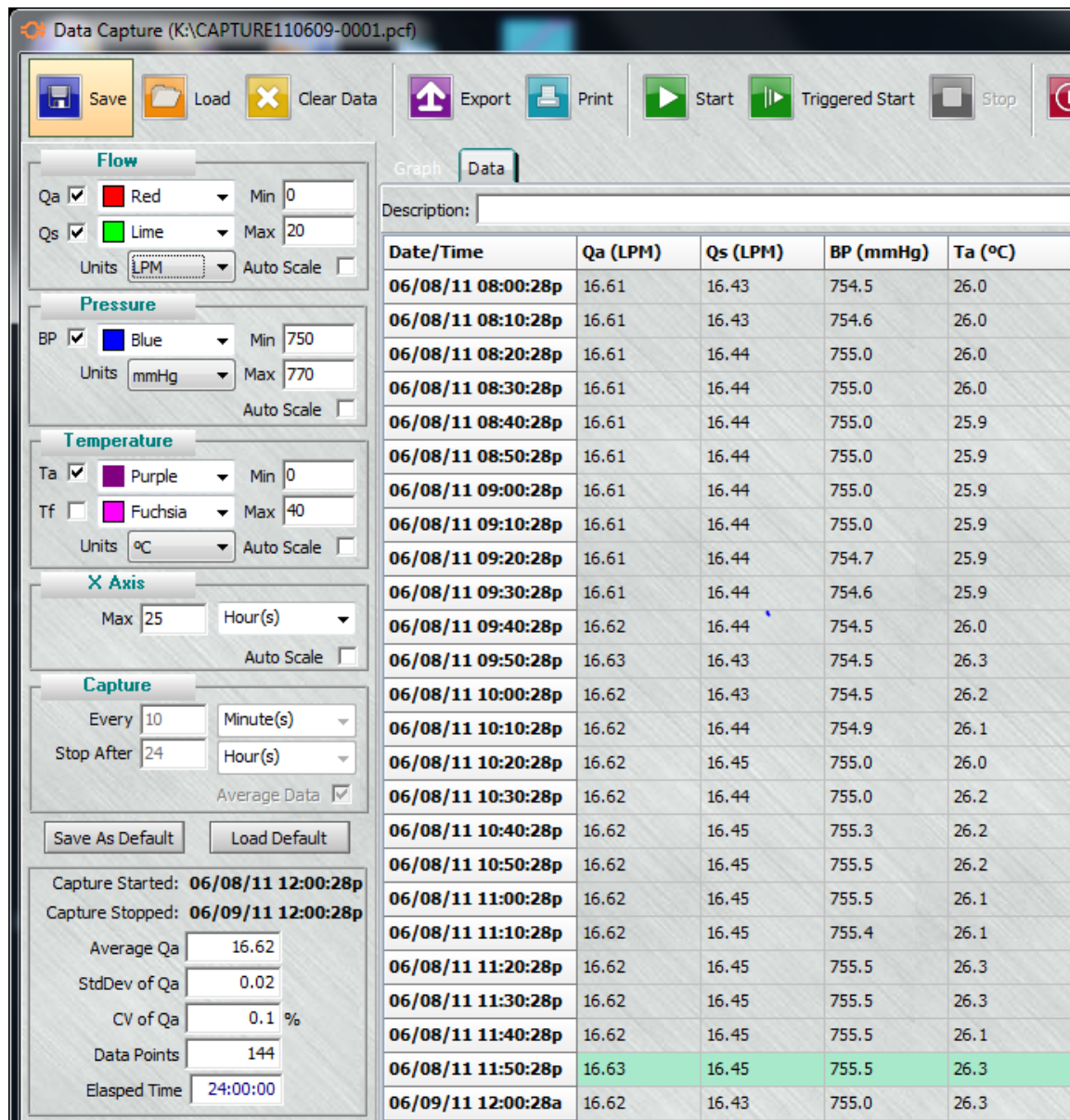


Figure 2. Data View

The date/time column is automatic. All the other columns are dependent upon what parameters have been selected (Figure 2). The interval between tabular data points was selected in the Capture Window. The various settings can only be changed while data is not being captured. The settings may be changed after data has been captured without affecting the actual data captured, only what is being displayed.

8.0 Glossary of Terms

The purpose of this compilation of is to permit users to gain an understanding of frequently used terminology, whose meaning may be obscure or not readily understood. BGI have created none of the definitions and all have been attributed. We are happy to expand the list and add further terms as contributed.

[Bernoulli Device](#) – A device based upon Bernoulli's principle used for the measurement of flow rate. In the simplest terms it is a constriction in a tube or duct, across which the pressure drop may be measured and related to the rate of flow by a mathematical expression.

[First Principle](#) – In Physics, First Principles means that a relationship is based upon established laws and not a model or fitted information.

[Primary Element](#) – In air flow measurement the Primary Element is that part of a flow meter where the measurement takes place. There are many makers of DP Primary Elements. DP stands for Differential Pressure (see Bernoulli Device).

[Primary Standard](#) – This is a measurement standard whose quantity value and measurement uncertainty are established using a primary measurement procedure.

[Primary Measurement Procedure](#) – This is a procedure used to obtain a measurement result without relation to a measurement standard for a quantity of the same kind.

[Venturi Prover](#) – A prover is any device that proves, i.e. measures a quantity. In flow it measures a quantity of fluid, generally per unit time. If a Venturi is used then it may be referred to a Venturi Prover.

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Revision History

1.0.0 First Release	May 2011
1.0.1 Revision Release	January 2012
1.0.2 Revision Release (includes BGIOpenCal V1.1.0.3 and later features)	February 2013