



Restek's ProFLOW 6000 Electronic Flowmeter

Users Manual
Version 5.4
for cat.# 22656



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The ProFLOW 6000
volumetric flowmeter.

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1.0 Introduction

Restek's ProFLOW 6000 Flowmeter is specifically designed for use with gas chromatography (GC) systems. The probe is applied directly to the gas flow stream and the measured flow rate is presented on the LCD screen. Units of flow are measured in mL/min.

This unit provides continuous real-time measurements of gas streams ranging from 0.50 mL/min to 500 mL/min. Because the technology uses volumetric flow measurement, the unit is compatible with all laboratory gases.

CAUTION: Do NOT exceed maximum operating flow rates. Recalibration may be required if the unit has been subjected to extreme flow rates.

Always use appropriate laboratory safety practices when operating this device. Wear laboratory safety goggles when operating this unit.

2.0 Specifications

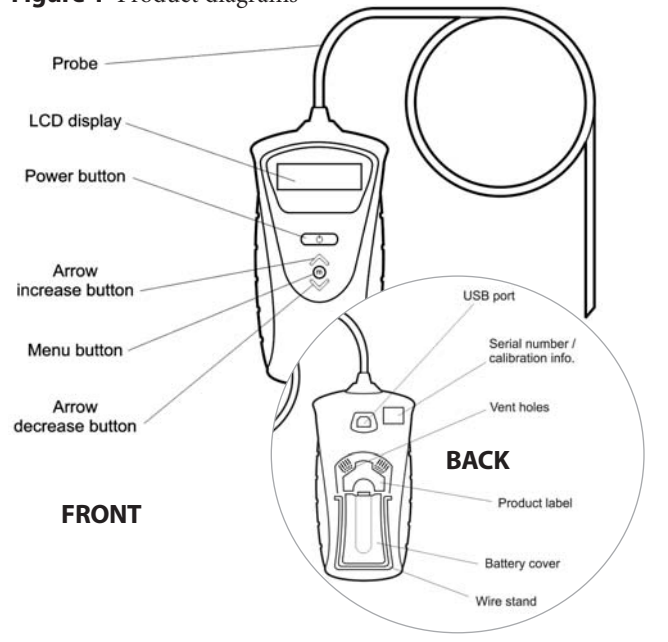
Table I

Type of measurement	Volumetric flow
Accuracy of measurements	$\pm 2\%$ flow or $\pm 0.05\text{mL/min.}$, whichever is greater
Power requirements	2 AA batteries
Operating flow range	[positive flow]: +0.50 to +500mL/min. [negative (vacuum) flow]: -0.50 to -500mL/min.
Operating temperature range	32°-120°F (0°- 48°C)
Humidity range	0-97%
Available communication	USB data port
Warranty	one year
Calibration	NIST traceable. Yearly recalibration is recommended.
Certifications	CE, Ex (see section 10.0)
Compliance	WEEE, RoHS (see section 10.0)

NOTE: There are no serviceable parts in this unit. Opening the device—other than to change the batteries—or tampering with the internal parts will void the factory warranty.

NOTE: To ensure accurate measurements and effective clearance of the flow gas from the unit, DO NOT obstruct the vent holes on the back of the unit.

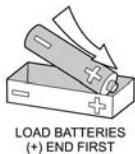
Figure 1 Product diagrams



3.0 Installing the batteries

This unit uses 2 AA batteries.

To install batteries, extend the wire stand. Open the cover. Insert the batteries with the polarity (⊕ and ⊖) correctly aligned. Close the cover. (Figures 2 and 3)



Precautions for battery replacement:

- Load the new batteries with their polarity (⊕ and ⊖) aligned correctly.
- Do not use rechargeable batteries.

4.0 Battery power consumption

4.1 Battery lifetime

The battery lifetime is dependant on the number of options the user has enabled. Table II describes estimated battery lifetimes based on feature settings.

The unit is shipped with the most energy demanding options disabled (Table III). In this state, the operating lifetime is approximately 45 hours.

The power saving functions can be changed.

- See Section 8.2: Adjust LCD Character Contrast (p.9).
- See Section 8.3: USB Activation (p.10).
- See Section 8.4: Adjust LCD Image Backlight (p.10).
- See Section 8.7: Adjust Auto Shutoff Duration (p.12).

4.2 Battery charge indicator

The unit includes a battery charge indicator. Replace batteries as needed.

- See Section 8.5: Show Battery Charge Indicator (p.11).

Figure 2 Extend the wire stand before opening battery door.



Figure 3
Insert the batteries as marked.

Table II Estimated battery lifetimes

Energy consumption	Settings	USB port	Estimated battery lifetime
Minimum	set to 0 (off)	disabled	45 hours of operation
Moderate	set to 3	disabled	35 hours of operation
Maximum	set to 5 (max)	enabled	23 hours of operation

Table III Default settings for the ProFLOW 6000

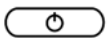
Auto shutoff duration	6 minutes
LCD backlight	0 (off)
LCD character contrast	5
USB port	disabled



5.0 Operating instructions

 **CAUTION: Do not exceed maximum operating flow rates. Recalibration may be required if the unit has been subjected to extreme flow rates.**

Connect the white probe end tip to the output of the gas flow line to be measured. Be sure the probe tip connection is completely sealed around the flow source outlet and is free of leaks (Figure 4).

Press and hold the  (power) button until the unit responds with a regular clicking sound. The ProFLOW will immediately begin to provide flow measurements (Figure 5). Wait for the measured values to stabilize. It takes a few seconds for the unit to reach a steady state with the gas flow line.

NOTE: Accurate baseline 'zero' values are achieved only when the ProFLOW 6000 is connected to the gas flow line with zero gas flow.

To power down the unit press and hold the  (power) button until the unit stops clicking.

The unit is equipped with a timed auto shutoff option (Default: 6 minutes).

→ See Section 8.7: Adjust Auto Shutoff Duration (p.12).

Figure 4 Probe connected to a GC gas outlet.



Figure 5 LED displays the measured flow value.



6.0 Interpreting results

6.1 Positive flow versus negative flow

The unit is capable of measuring both positive and negative (vacuum) flows. The unit automatically detects the flow direction and assigns a positive (+) or negative (-) flow value depending on the flow source (Figure 6).

The unit has an operating range of +0.50mL/min. to +500mL/min. and -0.50mL/min. to -500mL/min. (Figure 7). If the flow is less than 0.50mL/min (positive or negative flow) the display will read “under range”.

If the flow exceeds 500mL/min. (positive or negative flow) the display will read “over range”. Excessively high flow rates may damage this unit. If the flow rate is greater than 600mL/min., the unit will shut off, requiring the operator to reinitiate the measurement.

NOTE: units of mL/min. are equivalent to ccm.

6.2 Flow range display

The unit automatically adjusts the resolution of the display depending on the flow range being measured. Table IV shows the resolution of the flow ranges.

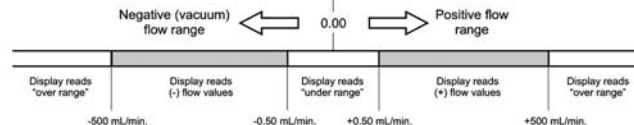
Table IV Display resolution vs. flow range.

Flow range (positive or vacuum)	Display resolution (mL/min.)
+/- 0.50 – 99.9	0.01
+/- 10.0 – 99.9	0.1
+/- 100 – 500	1

Figure 6 Example flow values.



Figure 7 Description of flow ranges.



7.0 Data collection on the PC

The ProFLOW 6000 provides you with a data stream of real time flow values via the USB port (Figure 1, p. 3). In order to use this feature, you must first install the appropriate FTDI Virtual Com Port (VCP) Driver available at:

<http://www.ftdichip.com/Drivers/VCP.htm>

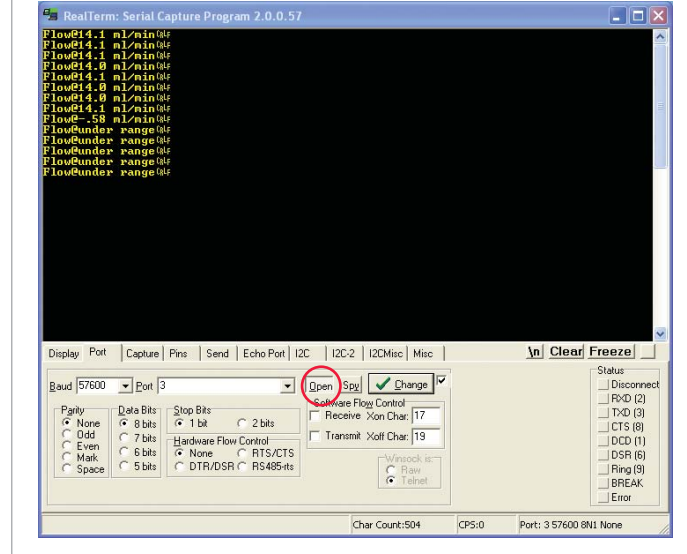
The VCP driver will cause the ProFLOW to appear as a standard RS-232 port. This will work on any operating system for which there is an FTDI VCP driver. After installing the driver, connecting the device, and determining which port it creates, you can access the data stream through any grammatical means, or by using any serial terminal software.

For Windows systems:

To determine which port the ProFLOW is using, go to the Control Panel and open System. Go to the Hardware tab and click the Device Manager button. Expand the Ports (COM & LPT) entry. Make sure the VCP driver is installed, then connect a powered ProFLOW 6000 to the USB port. You will see the new COM port appear. Open your serial terminal.

→ See Section 8.3: USB Activation (p.10).

Figure 8 Screen capture of data collection.



If you do not already have serial terminal software, free, open source options are available online (i.e. RealTerm, etc.). You can download RealTerm* software from:

<http://realterm.sourceforge.net/>

After installation, click the Port tab and set the following:

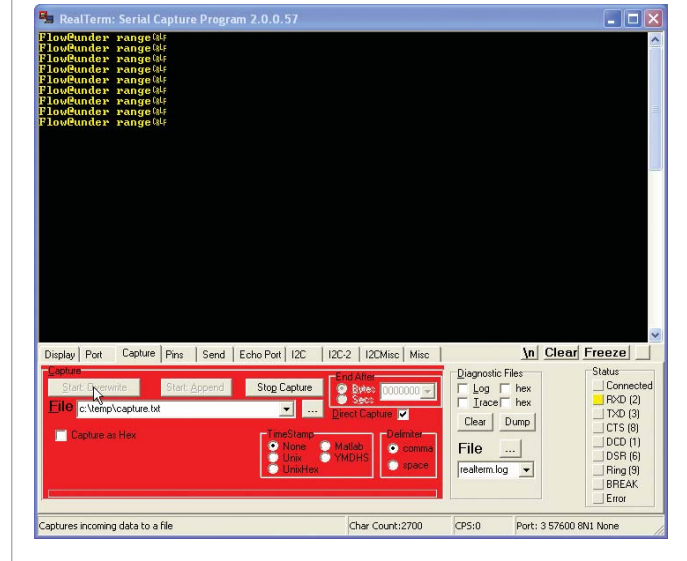
Baud: 57600
Port: the appropriate VCP for your ProFLOW
Parity: None
Data Bits: 8 bits
Stop Bits: 1 bit
HardwareFlow Control: None

Go to the USB menu entry in the ProFLOW and turn the transmission on. Finally, click **Open** on the Port tab in RealTerm and you will see the serial data stream begin in the terminal window (Figure 8).

If you would like to log the flow data, this can be done by clicking on the Capture tab. Set File to the name and location of the log file that you would like to save and click either the **Start: Overwrite** or **Start: Append** buttons appropriately (Figure 9).

**This software is not supplied or supported by Restek. User assumes all responsibility for the downloading and use of the program.*

Figure 9 Screen capture of data collection.



8.0 ProFLOW 6000 menu structure

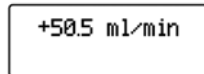
8.1 Unit power up/power down

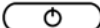
Press the  (power) button:

The LCD screen will display the device intro screen:



Followed by measured flow data:



To power off, press and hold the  (power) button:

Other messages encountered at power up

Calibration
-expired-


Appears temporarily if the unit's calibration has expired (>1 year).



→ See Section 14.0: Calibration and Service

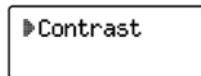
under range

If the unit is hooked up to a flow stream with a flow rate less than 0.50 mL/min. (positive flow or vacuum) the unit will report an "under range" status for the flow. This message will appear until the flow rate exceeds +0.50 mL/min. or -0.50 mL/min.



8.2 Adjust LCD character contrast


Press the  (menu) button.

Use the   (arrow) keys to select the contrast menu:




Press the  (menu) button again to enter the value select screen.



Use the   (arrow) keys to select the contrast value.
Contrast Values: 1 (lightest) and 5 (darkest).

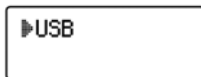
To return to the main menu screen, press the  (menu) button.

To exit and return to measuring flow, press the  (menu) button again.



8.3 USB activation


To enable the USB, press the  (menu) button.


Use the   (arrow) keys to select the USB menu:



Press the  (menu) button again to enter the value select screen.


Use the   (arrow) keys to toggle between USB 'on' and 'off'.



To return to the main menu screen, press the  (menu) button.

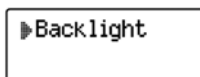
To exit and return to measuring flow, press the  (menu) button again.

→ See Section 7.0: Data Collection on the PC



8.4 Adjust LCD image backlight


Press the  (menu) button.


Use the   (arrow) keys to select the backlight menu:



Press the  (menu) button again to enter the value select screen.

Use the   (arrow) keys to select the backlight value.
Backlight Values: 0 (off) and 5 (maximum).

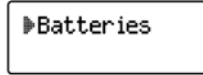
To return to the main menu screen, press the  (menu) button.

To exit and return to measuring flow, press the  (menu) button again.

8.5 Show battery charge indicator

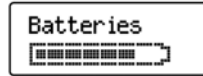
Press the  (menu) button.


Use the  (arrow) keys to select the Batteries menu:




Press the  (menu) button again.

The battery life is displayed.




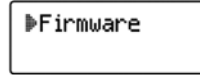
To return to the main menu screen, press the  (menu) button.

To exit and return to measuring flow, press the  (menu) button again.

8.6 Firmware version information

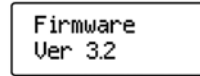
Press the  (menu) button.


Use the  (arrow) keys to select the Firmware menu:



Press the  (menu) button again.


The most recent version of Firmware is displayed.





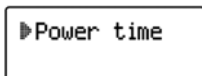
To return to the main menu screen, press the  (menu) button.

To exit and return to measuring flow, press the  (menu) button again.



8.7 Adjust auto shutoff duration


To conserve battery life, the unit automatically turns off after 6 minutes. To customize the auto shutoff setting, press the  (menu) button.

Use the   (arrow) keys to select the Power time menu:



Press the  (menu) button again to enter the value select screen.

Use the   (arrow) keys to select the auto shutoff setting.
Values: 1–60 minutes or 'constant on' (max.)

To return to the main menu screen, press the  (menu) button.

To exit and return to measuring flow, press the  (menu) button again.

9.0 Troubleshooting

Problem	Possible Cause(s)	Suggested Solution(s)
Decreased sensitivity	<ul style="list-style-type: none">• Probe clogged• Probe line compromised/disconnected• Weak battery• Unit is out of calibration	<ul style="list-style-type: none">• Clean the probe tip to remove any debris• Visually inspect probe line for holes or damage*• Replace AA batteries• Return the unit to Restek for recalibration*
Measured flow value does not match actual flow.	<ul style="list-style-type: none">• Unit is out of calibration• Value is being compared to a bubble flowmeter	<ul style="list-style-type: none">• Return the unit to Restek for recalibration*• See Section 12.0 for a discussion of the weaknesses of bubble flowmeters
Unit does not power up	<ul style="list-style-type: none">• Dead batteries	<ul style="list-style-type: none">• Replace with 2 new AA batteries
Flow value display is erratic/jumpy	<ul style="list-style-type: none">• The ProFLOW 6000 is very sensitive to small changes in flow	<ul style="list-style-type: none">• Allow more time for flow to stabilize
Meter is displaying a negative flow while under positive/zero flow conditions	<ul style="list-style-type: none">• Probe tube is not tightly connected to flow source	<ul style="list-style-type: none">• Secure probe to flow source even if the flow source is turned off

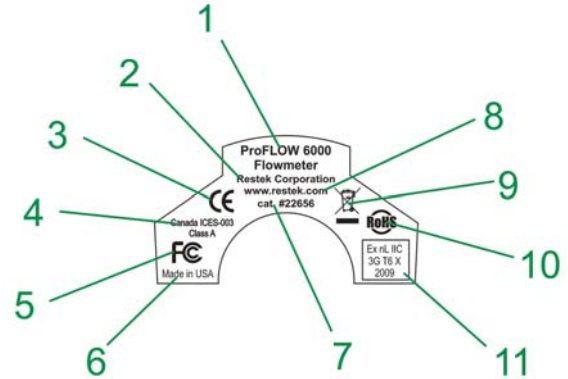
*Contact Restek or your Restek representative for return instructions for servicing a damaged unit. Additional charges may apply if the warranty has expired or the unit is damaged due to misuse.

Call Technical Service at 800-356-1688 or 814-353-1300, ext. 4 (or your Restek representative) if you have any questions about this product or any other Restek product.

10.0 Product back label legend

Description

- 1 Product name
- 2 Company name
- 3 This unit conforms to EU/EMC Directive 2004/108/EC; standards to which conformity is declared include 61326:1997 w/A3 Class A.
- 4 This Class A digital apparatus complies with Canadian ICES-003.
- 5 This complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
- 6 Country of origin
- 7 Product catalog number
- 8 Company web site
- 9 This unit is WEEE compliant.
- 10 This unit is RoHS compliant.
- 11



Ex nL	EN60079-0: 2006; Electrical apparatus for explosive gas atmospheres- Part 0: General Requirements. EN60079-15: 2005; Electrical apparatus for explosive gas atmospheres- Part 15: Construction, test and marking of type of protection "nL" energy limited apparatus.
IIC	Group II applies to areas above ground environments. Gas Group IIC relates to hydrogen and related gas types.
3G	Category 3 relating to gas analysis; normal safety measure. Sufficient safety during normal operation. Normal operation described as measuring flows of flammable or explosive gases in a nonflammable environment.
T6	During testing neither internal nor external elements exceed 85°C.
X	Additional information: Operating range: 32°F ≤ Tamb ≤ 120°F 0°C ≤ Tamb ≤ 48°C
2009	Year of product design release.



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11.0 Volumetric vs. mass flow measurements

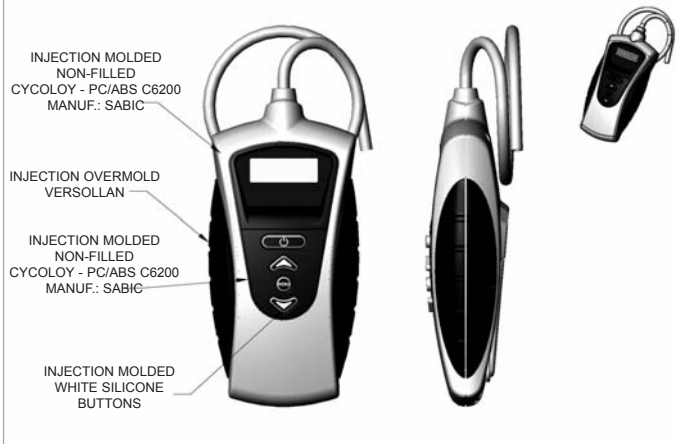
The Restek ProFLOW 6000 is a volumetric flow measurement device. Volumetric flow is the measurement of the volume of gas through a conveyance per quantity of time. Standard units of measure for this parameter are given in mL/min. The advantage of measuring volumetric flow is its independence to the composition of the flow gas. It is not necessary to correct the flow values based on the gas composition, as is required for mass flow devices.

Mass flow measures the weight of the gas flowing through the instrument per quantity of time. Mass flow units of measure are commonly g/sec.

12.0 Bubble flowmeter measurements

If you employ bubble flowmeters in your laboratory, you may find they give slightly higher flow rate values than the Restek ProFLOW 6000. This error is due to technology limitations inherent in the bubble flowmeter device; error from variances in air humidity within the bubble chamber and its direct contribution to the measured flow rate. In the event a bubble flowmeter is used to measure flow gas where the gas is at elevated temperatures, the error due to humidity contributions can be extreme. For the most accurate measurement of laboratory gas flow rates, we recommend using the Restek ProFLOW 6000 over bubble flowmeters.

13.0 Product case specifications



14.0 Calibration and service

The Restek ProFLOW 6000 comes factory calibrated and carries a one year warranty from time of purchase. All units are calibrated to NIST traceable standards.

Recommended schedule for recalibration is once every year from time of purchase. Customers will need to return the unit to Restek for recalibration. At that time, preventative maintenance services can also be performed. A fee will be charged for recalibration and servicing of the unit. Prolonged failure to recalibrate the instrument may result in increased error.

Call Technical Service at 800-356-1688 or 814-353-1300, ext. 4 (or your Restek representative) if you have any questions about this product or any other Restek product.

Please have the serial number available when calling Restek with any concerns you may have. Additional charges may apply if the warranty is expired or the damage is due to misuse.

This manual is also available in electronic format at www.restek.com.

