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# **BUCK**

*A.P. BUCK, Inc.*

## PDS™ PRIMARY FLOW DIAGNOSTIC SYSTEM INSTRUCTION MANUAL



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## Section 1

### PDS™ Quick Start Guide

#### **Quick Start Guide**

##### **PRECAUTIONS:**

- Do not attach sampling pump, vacuum or pressure source to PDS during startup “Auto Calibrate” sequence.
- Connect sampling pump to the **FLOW OUT Pump Connect** fitting only.
- Do not exceed 2 psig maximum inlet pressure.
- Do not exceed PDS unit flowrange.

*FLO MODE* (to verify sample flowrate)

- Turn PDS™ **ON**. Start Up displays will sequence. Unit will Auto-Calibrate: **DO NOT** attach sampling pump yet.
- Select FLO MODE: **FLO** will be flashing, press **ENTER**.  
Operating Menu will be displayed: Top line **D.P.** and **Temp./Batt. Capacity %**;  
Bottom Line **V.Flow** in cc/min.
- Sampling pump with media attached can now be connected to **FLOW OUT** fitting, and pump turned on. Flowrate and collection media D.P. will be displayed real time.
- To return to Main Menu, press **HOLD** and wait for 4 second countdown.
- To turn off, hold down **OFF** key. PDS unit will perform 4 second countdown, log data, display **POWERING DOWN**, and turn off.

#### **Pump Performance Verification**

- Ensure PDS™ *Bypass Back Pressure* Valve is turned to **OFF** and *Backpressure Adjust* Valve is turned counterclockwise (no backpressure).
- Turn PDS™ **ON**. Start Up displays will sequence and PDS™ will Auto-Calibrate: **DO NOT** attach sampling pump yet.
- Select FLO MODE: **FLO** will be flashing, press **ENTER**.
- Main Menu Display: **V.Flow** will be flashing, press **ENTER**.  
Operating Menu will be displayed: Top line **D.P.** and **Temp./Batt.%**, Bottom Line **V.Flow** cc/min.
- Connect sampling pump with media attached to **FLOW OUT** fitting. Turn on sampling pump, set flowrate as required and verify flowrate is constant. Collection media can also be connected to **FLOW IN** fitting to determine its backpressure.
- Turn upper *Bypass Back Pressure* Valve to **ON**.  
Turn lower *Backpressure Adjust* Valve **slowly clockwise** until D.P. increases up to maximum expected backpressure. Ensure sampling pump flowrate remains constant within required range.
- Turn *Bypass Back Pressure* Valve to **OFF** and disconnect sampling pump.

## Section 2

### PDS™ Introduction

#### **Principle of Operation**

The Primary Flow Diagnostic System (PDS™) is designed to accurately measure the flow rate of air at different altitudes and temperature. A sensitive differential pressure sensor measuring the pressure drop across an orifice in the air stream determines the flow. The flow orifice size determines the range of flow and several different ranges are available. The changes in pressures are compared to a lookup table in the PDS’s memory. These types of flow measurements are volumetric in their readings and are considered as a secondary flow standard. The accuracy of this device is  $\pm 2\%$  of any display reading. It may be calibrated within  $\pm 1\%$  of a specific flow.

Standard Temperature and Pressure (STP) Flow, also known as Mass Flow, is calculated with the Internal Barometric and Temperature sensors from the Volumetric Flow reading. Flows may be selected to display in STP or Volumetric Flow. The STP Flow is correct to a Barometric Pressure of 29.94 inches of Mercury and the Temperature to 77 degrees Fahrenheit. It can be displayed in English or Metric units.

The Volumetric Flow reading compares to the readings from volumetric flow calibrators, such as the mini-BUCK Calibrator™, a soap film flow measuring device. This type of Calibrator measures the flow rate based on a fixed volume per unit of time and is considered as a reference standard, commonly known as a Primary Gas Flow Standard. Also called true flow, the volumetric flow reading can be corrected to STP (mass flow) to achieve an accurate comparison of air volumes collected at different altitudes and temperature.

An optional accessory for the PDS™ is the PDS™ Flowcell, a soap film flow measuring device. The PDS™ becomes a Primary Gas Flow Calibrator when the PDS™ Flowcell is attached. It may be used to calibrate the flow readings of the PDS™ unit itself within the unit’s range of 500 – 5000 cc/min.

#### **Features**

The PDS™ is designed to be a support tool for any type of air sampling. Complete documentation of each step in an air sampling process can be recorded and printed for credibility. An internal Differential Pressure (DP) sensor (different from the flow-measuring sensor) allows measurement of backpressure up to 60 inches of water. This sensor may be used to determine pressure drops of various types of sampling media at specific flow rates. The two built-in valves allow increased backpressure to test pump capacity. Additionally, they can be used in setting the flow fault setting on a personal air sampling pump. The PDS™ unit will automatically turn off after approx. five minutes if no keypad entries are made.

The displays of the unit are divided into six Main Menu modes for simplicity of use.

The FLO Mode is selected from the Main Menu and remains as the default until another mode is selected by the user. Simply press the ENTER key after turning on the unit, while FLO is flashing, and real-time flow readings are obtained. Backpressure measurements can be made in FLO Mode by pressing the left Arrow key. Pressing ENTER at any time acts as a “backup” key (bringing the user to the previous menu) or as an exit key (held for 2-second countdown) from either the FLO or LogFlo Mode.

LogFlo Mode functions as a datalogging instrument and performs logging or storing of information. LogFlo Mode allows detailed documentation of flow by sample number as entered by the user. Sample numbers up to six digits may be entered and up to 150 sample numbers may be stored. Logged data includes: Date, Time, Log Event, Barometric Pressure, Temperature, Inlet Differential Pressure, Flow Rate, Elapsed Time, Total (cumulative) Volume, STP Volume, and Battery Capacity.

A sample may be attached to the “Pump Connect” inlet of the PDS™ to monitor the sampling process. In this configuration the elapsed clock will count sample flow duration, its backpressure, and calculate the total volume collected with STP correction, if needed. Pressing ENTER at any time during sampling produces a “Snapshot” of sample flow entry into the stored data.

Printed reports are in a fixed format. They can be printed directly to any standard printer with the printer interface and cable (APB-109054).

A soap film flowcell is an optional accessory, which turns the PDS™ into a Primary Gas Flow Calibrator. Samples may be measured under either FLO or LogFlo Mode and logged to the reports. Three models of flowcell are available: S-1 (0.1 – 300 cc/min), S-5 (1 – 6000 cc/min), and S-30 (100 cc – 30 LPM).

### Design of Equipment

The microprocessor controlled PDS™ has a two line 16 character Liquid Crystal Backlit Display. Internal to the PDS™ are solid state sensors to measure differential pressure (DP), Barometric Pressure (BP) and Temperature (T). These sensors are controlled by a microchip. This microchip sets the offset and gain and requires no adjustment by the user. The Main Menu display allows a choice of six main modes: FLO, FloLog, RESET, SETUP, PRINT, and CAL. Other menu options (under Setup) allow the selection of English or Metric units for the display of BP, DP and T. A full calendar clock shows the time and date which is used in both FLO and FloLog Modes. The battery power (percent) displays the time remaining in the nickel-cadmium batteries. Flows of one percent can be measured at any specific flow when calibrated against the mini-BUCK Calibrator or optional PDS™ Flowcell.

The dynamic range of the PDS™ is based on the size of the internal orifice. The flow display is auto ranging to provide readings of tenth (0.1) and hundredth (0.01) of a cubic centimeter per minute (cc/m) or liters per minute (lpm) depending on the PDS’s range. During flow measurements the display has continuous updating of V. Flow, DP and T. The T and DP sensors are located in the air streams to detect the temperature and differential pressure. The DP is referenced to the ambient pressure and detects the differential pressure of either the inlet or the entire PDS™ accounting for the orifice’s backpressure. The BP sensor is located internal to the case and measures the absolute pressure calibrated in inches of mercury to reflect Barometric Pressure. The BP is absolute pressure not corrected to sea level (note: broadcast Weather Stations and airports report corrected barometric pressure). The current BP and T used in the PDS™ corrections is displayed as part of the PDS™ power on startup menus if Startup Displays are activated under the Setup Mode function.

### PDS Correction Equation

Standard Temperature and Pressure (STP) refers to correcting the volumetric flow reading to a defined temperature and pressure. The BUCK PDS™ uses sea level, 760 mm of mercury (or 29.93 inches of mercury) and 25 degrees Celsius (or 77 degrees F) as STP. The following equation is used to display STP Flow based on the readings from the internal Volumetric Flow tables.

$$\text{STP Flow} = (\text{Volumetric Flow}) \times \frac{760}{(\text{BP-DP})} \times \frac{T+273}{298}$$

where:

BP = Barometric Pressure in mm of mercury  
DP = Differential Pressure in mm of mercury  
T = Temperature in Celsius

## Section 3 Operation Summary

### Basic Operating and Setup Instructions

**Caution:** Do not connect a flow source to the PDS  $\dot{a}$  that exceeds the flow range printed on the unit's back label. Connect sampling pump to the FLOW OUT Pump Connect fitting only. Do not attach sampling pump, vacuum or pressure source to PDS  $\dot{a}$  during startup "Auto Calibrate" sequence.

Connect the flow source to the PDS hose using vinyl tubing of ¼ inch ID. A flow source of suction, such as a sampling pump, would be connected to the Flow Out (Pump Connect) fitting of the device. The direction of the flow is critical to prevent damage to the unit. Observe the arrows on the front panel of the PDS™ for proper direction of flow.

Details on the menus and displays are presented in sections "Instructions for FLO Mode" (p.6) and "Instruction for FloLog Mode" (p.7) which are the two operational modes of the PDS™.

### Measuring Flow with a Differential Pressure

When connected in series with other devices (connected to the "Flow In" fitting) that can cause a differential pressure (backpressure), the internal DP sensor will display a reading in inches of water pressure. The maximum reading is 60 inches.

A practical use for the internal DP sensor is to check backpressure of various filters, sampling media, or other sample collection devices, at a constant flow. High backpressures can affect the run time of battery powered pumps. When necessary to know the entire pressure drop across the unit (including the unit's internal orifice), , press the left ◀ ARROW and observe the display showing total DP (tDP). An example of when tDP would be used is in the setting of the flow fault pressure switch on certain brands of personal sampling pumps that require periodic calibration.

### Factory Calibration of the PDS™

An annual calibration of the PDS™ unit (performed at the A.P. Buck factory) is recommended. The charge for calibration of all sensors and adjustment to original specification is \$175 (not including shipping). A Certificate of Calibration is provided, along with a label applied to the side of the PDS™ stating next calibration due date.

User calibration of the PDS is performed under the CAL Mode.

### Power Supply

The PDS™ operates from rechargeable nickel-cadmium batteries. An A/C wall charger (supplied) will recharge the cells in 16 hours. Operating time for a fully charged pack is approximately eight hours. The PDS™ may be operated continuously with the A/C adapter for the monitoring of flow. With no flow, the battery saving feature will turn the PDS™ off in approximately five minutes.

### Maintenance of PDS™

No routine maintenance is required other than charging the batteries. If reading becomes erratic or provides inaccurate data, please return to the factory for repair.

### Instructions for Primary Flow Diagnostic System

See the Appendix Section for Summary Charts on "Main Menu" Modes.

The summary below is of the FLO Mode (the most-often used mode). This is automatically displayed as the "flashing" mode in the six function Main Menu after unit turn on and Auto Calibration is completed. FLO remains as the default mode, while the arrow keys ◀ and ▶ are used to scroll to other modes. Scroll over to the mode of interest, and press ENTER to select.

The unit must be up-right, sitting on its base with controls facing up. Turn PDS™ on by pressing the "ON" key with NO FLOW attached. The unit will display a startup sequence and perform an "Auto-Calibration" process. When this process is finished, attach air flow. Flow measurements can now be made.

### Display Definitions

BP = Barometric Pressure (absolute pressure)

DP = Differential Pressure (the backpressure at the inlet) in inches of water

tDP = total Differential Pressure (barometric pressure plus orifice restrictor)

T = Temperature in the air stream through the PDS™

V.Flow = Volumetric Flow

STP Flow = corrected Volumetric Flow to Standard Temperature and Pressure

# Section 4

## Operating Instructions

### START UP DISPLAY

#### Start Up Instructions

Connect a flow source to the PDS using a vinyl hose of 1/4 inch internal diameter. A flow source, such as a personal sampling pump providing a suction, would be connected to the right side of the unit at the "Flow Out- Pump Connect" fitting. The direction of flow is critical to prevent damage to the PDS. Observe the direction of flow indicated on the front label.

**Caution: DO NOT connect a flow source to the PDS that exceeds the flow range printed on the back label.**

FLO	LogFlo	Reset
Setup	Print	Cal.

Main Menu DISPLAY

The ON key turns on the unit. The display presents startup screens, proceeds to "Auto Calibration", and ends with a six function Main Menu.

<b>FLO</b>	<b>LogFlo</b>	<b>Reset</b>
<b>Setup</b>	<b>Print</b>	<b>Cal.</b>

with FLO flashing as the default selection. The BP and T may be selected in English or Metric units under the Setup MODE; the selection remains as the default the next time the unit is turned on. Changing Time and Date is also under the Setup MODE. The Main Menu will remain for 5 minutes if no keys are touched. After that time the unit will turn off to preserve battery life.

### Instructions for FLO MODE

PRESS KEY  
ENTER  
OFF

DP: 5.01"	T 76F
V.FLOW: 2021cc/m	

Measurement Display

Press the ENTER key to begin measuring air flow. The top line displays the Differential Pressure (DP) in inches of water pressure or millimeters of mercury depending on the selection of English or Metric. The temperature is in Fahrenheit or Celsius depending on this selection. Battery capacity (%) is alternately displayed.

The bottom line displays the method of flow selected: Volumetric or STP FLOW in cubic centimeters per minute (cc/m). The STP flow uses the internal BP and T to correct to a mass flow reading from the Volumetric Flow reading.

tDP: 6.52"	T 76F
V.FLOW: 2021cc/m	

total DP with  
Flow measurement

PRESS KEY

Press the LEFT arrow to display the tDP indicating the total differential pressure across the unit including the flowmeter's internal pressure drop caused by the flow orifice.

STP MODE 67F 00:04
18.5L 2021 cc/m

STP Mode with  
Flow measurement

PRESS KEY

Pressing the RIGHT arrow key will bring up the STP Mode display. The top line indicates the DP and alternating T and Battery Capacity (%). The bottom line indicates Total (cumulative) Volume (in L: liters) and current sample Flow Rate in cubic centimeters per minute. (cc/m)

### Instructions for LogFlo MODE

Prior to using the LogFlo Mode become thoroughly familiar with the device by following the instruction for the LogFlo Mode. Summary of additional Modes are in the Appendix.

**The unit must be up-right and sitting on its base. Turn PDS unit on with No Flow attached. The startup display will indicated an Auto-Calibration process. When this process is finished, attach sample pump. Flow measurements may now be made in LoFlo Mode.**

FLO	LogFlo	Reset
Setup	Print	Cal.

START UP DISPLAY

The ON key will turn on the unit. After initial startup screens and A Calibration is completed, the Main Menu is displayed. Use RIGHT arrow key to scroll to LogFlo. Press ENTER to select LogFlo Mode.

Enter Sampling Number: 000000
----------------------------------

You must first enter a sample number (up to 6 digits) to identify each sample. The ENTER key moves the cursor. RIGHT and LEFT arrow keys increase or decrease each data entry. You may select no sample number by repeatedly pressing ENTER. Press ENTER once more to return to Main Menu. Use RIGHT arrow key to scroll over to FloLog.

No Flow 67F 00:00
0.0L 0.00 cc/m

Press the ENTER key to proceed to this display. This is the initial screen displayed in LogFlo with no sample flow. Top line displays alternating Battery Capacity(%) and NO FLOW condition, and Elapsed Time. Bottom line displays Total (cumulative) Volume (L) and sample Flow Rate (cc/m).

100% 67F 00:01
2.4L 2400 cc/m

These two screens show the alternating displays presented while LogFlo Mode is selected. Top line alternates between VOL MODE and Battery Capacity (%) with ELAPSED TIME (HH:MM) scrolling right to left. Bottom line displays Total (cumulative) Volume (L) and sample Flow Rate (cc/m).

VOL MODE 00:01
2.4L 2400 cc/m

DP 4.05"	T 67F
V Flow: 2400 cc/m	

Press the LEFT arrow key to display this screen. It displays the current DP backpressure of the PDS unit as measured at the "Flow In" fitting. Alternately, Battery Capacity (%) is displayed.

STP MODE 00:02
2.0 L 2380 cc/m

Press the RIGHT arrow key to display this screen. It displays the STP Mode information (L and cc/m) as calculated by the PDS using current BP and T values. Alternately, Battery Capacity (%) is displayed.

Writing Data For Snap Shot Flow
------------------------------------

Pressing ENTER at any time during FloLog Mode operation produces a "snap shot" log event of flow rate and associated parameters at that exact date and time. These "Snap Shot" log events are stored as individual line entries in the associated Sample Number's sample flow stored data.

Writing Data For Continuous Flow
-------------------------------------

The PDS will also automatically display this screen when writing a log event to memory at the chosen data collection frequency. This frequency is chosen under SETUP (Main Menu) as "History Report Logging Rate: XX". Use arrow keys to increase or decrease logging rate (1 to 59 minute intervals).

Print Report Flow History? Yes
-----------------------------------

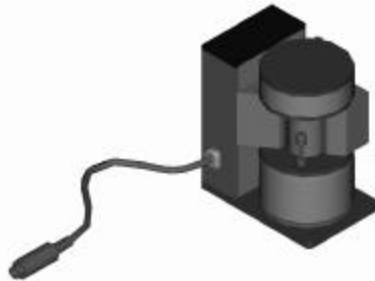
From the Main Menu, you may select PRINT to obtain a stored data printout direct to a printer. Use the arrow keys to select YES at this screen, then press ENTER. The PDS will then ask to delete all log entries? You may select YES or NO (note: entering "NO" results in all stored logs deleted from memory permanently).

## Section 5

### PDS™ Flowcell

#### PDS™ Flowcell

Accessory to the Primary Flow Diagnostic System



#### Principle of Operation

The PDS™ Flowcell is a soap film flow measuring device. It uses the principle of measuring the flow over a fixed volume in a unit of time. This technique is recognized as a Primary Gas Flow Standard. Two infrared sensors detect the soap film bubble passing up the center tube of the flowcell. The first sensor detects the film and begins a timer which continues until the second sensor stops the timer. The microprocessor then divides the “fixed volume” between the sensors by the elapsed time and presents the flow in cubic centimeter per minute (cc/m).

#### Operating Instructions

- 1 Soap is placed in the Flowcell at the lower hose connection. Excessive soap can be poured out by pointing the lower hose connection fitting downward. Only the excess soap solution will pour out- the height of the hose connection retains the correct amount of soap.
2. Connect the 6-pin connector cable to the PDS™ Flowmeter’s 6-pin connection on the right side of the case. This will power the PDS™ Flowcell and provide the required data connection.
3. Attach the hose from the flow source to be measured. The top hose connection is for suction, such as a personal air sampling pump. Connect to the bottom hose for pressure flows. ***Never connect the flowcell in series by using both hose connections at the same time. One hose connection must be opened to the atmosphere at all times to maintain the accuracy of the fixed volume calibration.***
4. Flow readings are made at two functions in the PDS™ . One is in the FLO Mode and presents the same display as the PDS™ uses when measuring flow. The second is in LogFlo Mode. When connected to the side of the PDS™ by the Flowcell cable and during one of these two functions, the auto-detect powers the Flowcell.

5. Observe the different look of the display for use as a Primary Gas Flow Calibrator. The top line, left side counts the number of bubble tests performed. The upper right side averages the tests while the bottom line shows the actual value of the last test.

# 0 Avg:	0.00
P Flow:	0.00 cc/m

6. Press the HOLD key to delete the last test from the average.

#### Calibrating the PDS™ with the Flowcell

Under the CAL. Mode (selected from the Main Menu), the calibration of the PDS™ will turn on the Flowcell. With hoses connected from the intake of the PDS™ (“Flow In”) to the top hose connection of the Flowcell, the flow may be read through both units simultaneously. Generate bubbles as normal with the PDS™ Flowcell. The Primary Gas Flow readings from each bubble are shown on the PDS™ display top line. Enter this reading on the bottom line using the arrow keys. This reading will be accurate to  $\pm 1\%$ .

Calibrator Flow	
Rate:	0000 cc/m

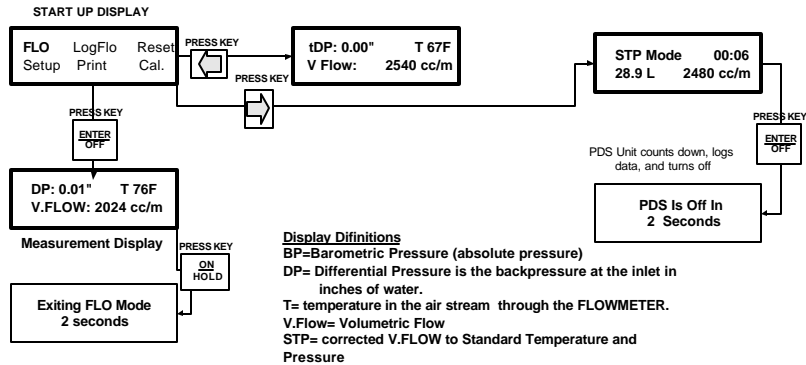
## Section 6

# Summary of Operational Modes Chart

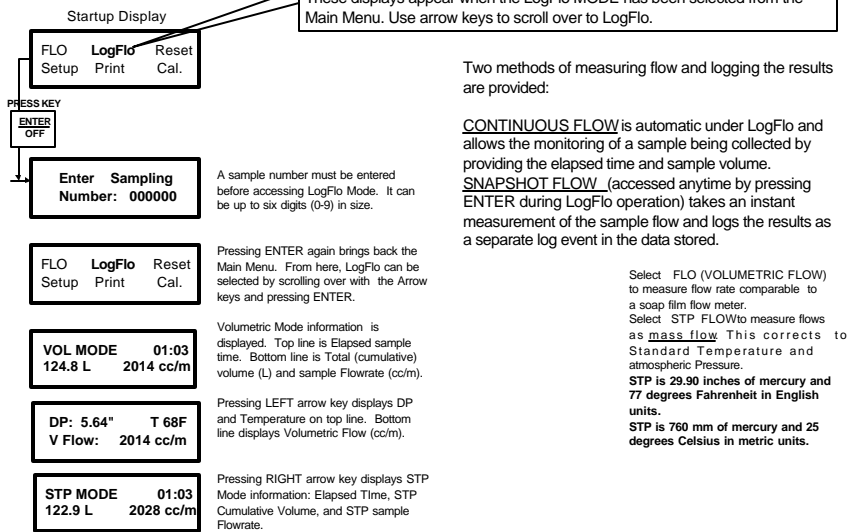
### PRIMARY FLOW DIAGNOSTIC SYSTEM SUMMARY OF OPERATIONAL MODES

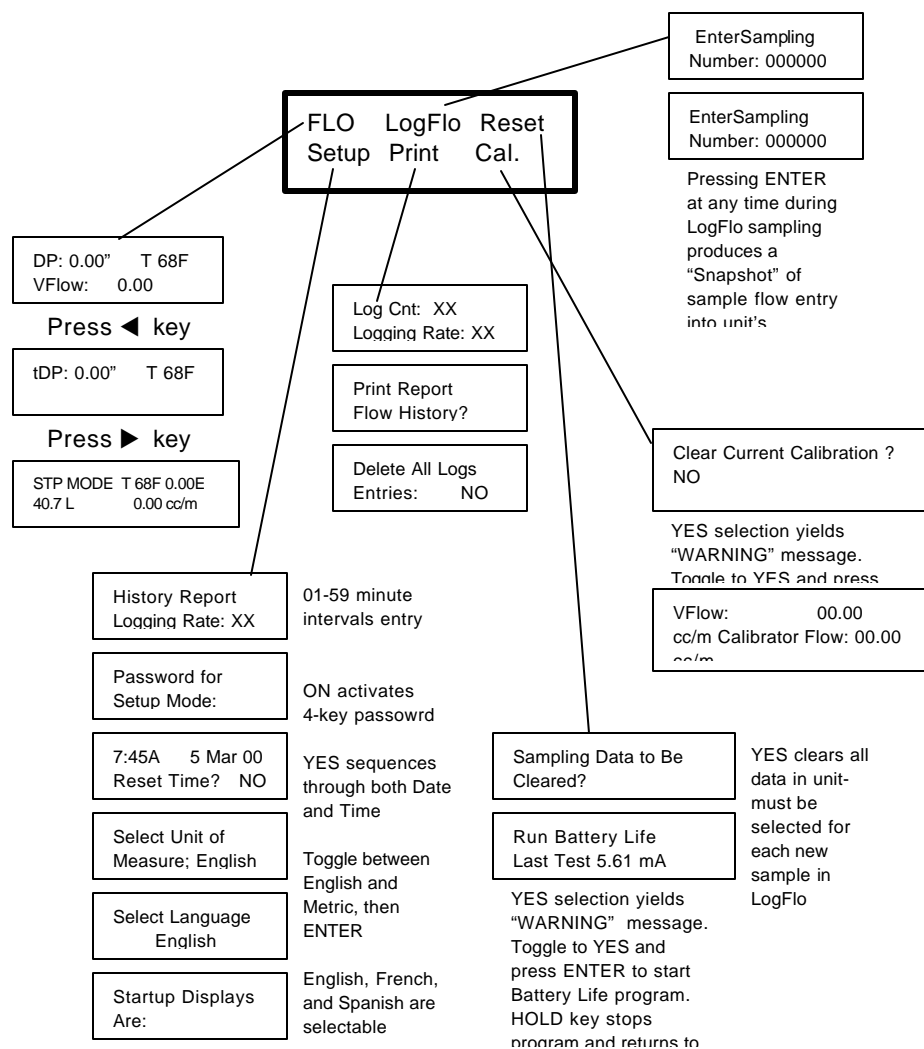
#### FLO MODE

This Operational Mode has three displays: FLO Mode display, tDP Display, and STP Mode display. Changing the display units of measure between Metric and English is done under the SETUP Mode. The FLO Mode is for when the PDS is used as a simple flowmeter; no storing of data or reports can be performed in this Operational Mode.



#### LogFlo MODE





## Glossary of Terms for PDS<sup>ã</sup>

### Volumetric Flow

Measurement of airflow, which make no correction for the air density or temperature. Commonly called true flow, volumetric flow is the flow reading obtained from rotameters and soap film calibrators, such as the mini-BUCK Calibrators. The PDS™ is a volumetric flow-measuring device when used with optional PDS™ Flow Cells.

### Mass Flow

The volumetric flow is corrected to a specific atmospheric pressure and temperature. This correction allows the comparison of air volumes collected in different conditions to be evaluated in an equal manner. The PDS™ has internal Barometric Pressure and Temperature Sensors, which perform the correction to mass flow. STP Flow, when selected for display, is mass flow.

### Primary Gas Flow Calibrator

A soap film bubble moving up a glass buret and timed over a fixed distance is considered as a primary air flow measurement technique. This method is known as a fixed volume per unit of time. These calibrators are accurate at any altitude and provide volumetric flow readings.

### Pressure Drop Measurements

A pressure sensor in the inlet of the PDS™ performs Differential Pressure (DP) or backpressure measurements. The DP reading is caused by the resistance to flow of any attachment to the inlet (Flow In) fitting of the PDS™. Differential pressure across the entire PDS™ from the orifice used to measure the flow and any resistance to flow on the inlet fitting is called total Differential Pressure (tDP). This is viewed by pressing the LEFT arrow ◀ key while measuring flow in FLO Mode.

### Menus of the PDS™

Two main operational Modes, the FLO Mode and the LogFlo Mode, are the first two entries of the Main Menu. The FLO Mode allows reading to be obtained for flow rates and pressures; it does no logging of data or reports. LogFlo Mode always associates the readings with a sample number from which reports are generated. The other four menus are: RESET (to clear sample data or run the Battery Life program), SETUP (to enter History Report Logging Rate, activate Password for Setup Mode, reset Date and/or Time, select English or Metric, select unit display Language, and activate unit Startup displays), PRINT (to print a sample history report direct to a printer, and/or delete all log entries), and CAL (to Clear Current Calibration and calibrate PDS™ unit against a primary standard mini-Buck or PDS™ Flowcell).

## Printer Reports

There is a fixed format “ PDS™ Sampling History Report” available at the PRINT Main Menu selection.

PDS SAMPLING HISTORY REPORT										
Collector: _____						Serial No: 12345678				
Sampling Site: _____						PDS Model: PDS-05				
Comments: _____						Report Date:				
03/01/01										
					Calibrator Serial No: _____					
					Calibration: 02/28/01 08:23a	2146 cc/min				
Sample No: _____	Lot No: _____	Cassette Size: _____								
Batch Number _____		Filter Pore Size _____								
Date	Time	Log Event	Elapsed	Vol	Total	Vol	Battery	DP	BP	Temp
			Time	Flow	Vol	(STP)			Measd	Measd Val

## Printer Interface and Cable

The PDS™ has a serial port similar to a Personal Computer. The interface module converts the signal to a parallel port, which is common to printers. The printer cable (APB-109054) is a special design to attach to the 6-pin connector on the PDS™ to a 9-pin connection for the interface module.

## Log Storage

The PDS™ can store up to 150 individual sample numbers before storage is full. Sample numbers can be up to six digits, numeric only. Up to 800 log events can be stored [depending on History logging rate (1 – 59 minutes) – settable under SETUP Mode in Main Menu.

## Pressure Conversion Constants to English or Metric

1 inch of mercury x 25.4 = millimeter of mercury

1 millimeter of mercury x 0.03937 = inches of mercury

1 inch of water pressure x 1.868 = mm of mercury

1 inch of water pressure x 0.073 = inches of mercury

1 atmosphere x 760 = mm of mercury

1 atmosphere x 29.92 = inches of mercury

1 psi x 51.71 = mm of mercury

## **Parts and Accessories**

- 1. Standard Charger**  
120VAC (APB-108010),  
230VAC (APB- 108012)  
Single Station Automatic One Hour Charger
- 2. PDS™ S-1 Flow Cells**  
(APB-907001) Range: 0.1 – 300 cc/min
- 3. PDS™ S-5 Flow Cells**  
(APB-907005) Range: 1 – 6000 cc/min
- 4. PDS™ S-30 Flow Cells**  
(APB-907030) Range: 100 cc/min – 30 LPM
- 5. Printer Cable w/Converter Adapter**  
(APB-109054) Allows PDS™ to print Sample History Reports directly to printer.
- 6. PDS™ Manual**  
(APB-907004)

## **WARRANTY**

The seller warrants to the Purchaser that any equipment manufactured by it and bearing its name plate to be free from defects in material or workmanship, under proper and normal use and service, as follows: if, at any time within 1 year from the date of sale, the Purchaser notifies the Seller that in his opinion, the equipment is defective, and returns the equipment to the Seller's originating factory prepaid, and the Seller's inspection finds the equipment to be defective in material or workmanship, the Seller will promptly correct it by either, at its option, repairing any defective part or material or replacing it free of charge and return shipped lowest cost transportation prepaid (if Purchaser requests premium transportation, Purchaser will be billed for transportation costs). If inspection by the Seller does not disclose any defect in material or workmanship, the Seller's regular charges will apply. This warranty shall be effective only if installation and maintenance is in accordance with our instructions and written notice of a defect is given to the Seller within such period. This warranty is exclusive and is in lieu of any other warranties, written, oral or implied; specifically without limitation, there is no warranty of merchantability or fitness for any purpose. The liability of the Seller shall be limited to the repair or the replacement of materials or parts as above set forth.

## **LIMITATION OF LIABILITY**

The seller shall not be liable for any claim for consequential loss or damage arising or alleged to have arisen from any delay in delivery malfunction or failure of the equipment. The Seller's liability for any other loss or damage arising out of or connected with the manufacture, sale or use of the equipment sold, including damage due to negligence, shall not in any event exceed the price of the equipment supplied by us.

A.P. Buck, Inc. reserves the right to make changes at any time, without notice, in prices, colors, materials, specifications, and models; and to discontinue models.

**Copyright@ 1990, 1998, 2000 A.P. Buck, Inc.**

## SERVICE INFORMATION

For all work not covered under warranty, A.P. Buck, Inc. will repair any instrument for the cost of parts and labor as quoted. If major components must be replaced, A.P. Buck, Inc. will notify the customer before proceeding with repairs.

When returning any instrument for service, please include a Purchase Order marked: "Repair – Cost Not To exceed \$250.00 without customer authorization". Please provide the following information with your instrument:

Company Name:

Address:

Telephone:

Fax:

Contact Name:

Serial Number(s):

Date of Purchase:

Service Required or Description of Problem:

You must obtain an RMA number prior to returning any product. Obtain your RMA number by calling **A.P. Buck, Inc. Customer Service at 800-330-BUCK or 407-851-8602**. To expedite service and repairs, have your Customer ID handy.

Please ensure that all products returned to A.P. Buck, Inc. contain no hazardous materials. Any obviously contaminated product received will be returned to the customer. All products scheduled for service must be received within 30 days of the RMA number issuance date. Unauthorized products will be returned to the customer.

## TECHNICAL SUPPORT SERVICES

Technical Assistance:	(407) 851-8602
Fax:	(407) 851-8910
Email:	apbuck @apbuck.com
Web site:	www.apbuck.com
Hours :	Monday – Friday 8:00 AM to 4:30 PM (EST)

If you need additional information or help during installation or normal use of this product, contact A.P. BUCK, Inc. Technical Support. Our customer support staff will attempt to answer your installation questions by phone or issue a service authorization number for repair or replacement of your product.

Unauthorized returns will not be accepted. When calling for support, please have your product serial number and product model available.

**NOTES:**