



A.P. BUCK, INC.

VSS-1
VSS-5
VSS-12

VALIDATED SAMPLING SYSTEM INSTRUCTION MANUAL



A.P. BUCK, INC.

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A.P. BUCK, INC.

MAN-VSS REV-E
10/2003

Manual Part No. APB-109095

NOTES:

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ETL SEMKO LISTING LETTER



March 22, 2000

Mr. Al Buck
A.P. Buck, Inc.
7101 Presidents Drive
Suite 110
Orlando, Florida 32809

Dear Mr. Buck:

Subject: CE/EX Marking

This is to certify that the Portable Air Sampling Pumps, Models VSS-1, VSS-5, BASIC-1 and BASIC-5 have been tested to all applicable EU Product Safety Standards under the following EU Directives and Standards:

Low Voltage Directive
EN 50020, 2nd Edition, August 1994
Electrical Apparatus For Potentially Explosive Atmospheres
EN 50014, December, 1992, Edition

EMC Directive
Radiated and Conducted Emissions
EN 61326
CISPR 16
CISPR 16-1

The products covered consist of battery powered personal air sampling pumps, which draws air from a work area onto a sampling media. The contaminants on the media are shipped to a laboratory for analysis, and not analyzed by the product itself. The product is portable, worn on the belt of a worker and contained with a plastic enclosure. A rechargeable 5-Volt Ni-Cad battery pack, which is charged in a non-hazardous area, powers the assembly. The product is deemed intrinsically safe for Class I, Groups A, B, C, D, Class II, Groups E, F, G, and Class III.

To establish that the product meets all EU Directives and Standards, it is necessary to determine that the CE, EX, and D Marks are affixed to the product at the time of manufacturing. Only those products bearing the appropriate EU Certification Marks should be considered as covered by the Intertek Testing and Certification Reports. Additionally, it is the responsibility of the manufacturer to maintain a Technical File for the Component Authority within the borders of the EU.

Thank you for using Intertek Testing Services, a Notified Body, and the world's largest product and commodities testing and certification organization in the world.

Best regards,

R. Scott Wilson
General Manager



Intertek Testing Services NA Inc.
4203 Vineland Road, Suite K-3, Orlando, FL 32811
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INTRINSIC SAFE LISTING LETTER



February 1, 2000

Mr. Al Buck
A.P. Buck, Inc.
7101 Presidents Drive
Suite 110
Orlando, Florida 32809

Dear Mr. Buck:

Subject: ETL/ETLc Listing Report J99023963-001

This is to certify that the Portable Air Sampling Pumps, Models VSS-1, VSS-5, BASIC-1 and BASIC-5 have been listed to all applicable safety standards under the following standards:

ANSI/UL 913: 1998 Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II, III, Division 1. Hazardous (Classified) Locations, Fourth Edition

CSA C22.2 No. 157-92, Intrinsically Safe and Non-Incendive Equipment for use in Hazardous Locations.

The products covered are a battery powered personal air sampling pump, which draws air from a work area onto a sampling media. The contaminants on the media are shipped to a laboratory for analysis, not analyzed by the product. The product is portable, worn on the belt of a worker and contained within a plastic enclosure. A rechargeable 5-volt Ni-Cad battery pack, which is charged in a non-hazardous area, powers the assembly. The product is intrinsically safe for Class I, Groups A, B, C, D, Class II, Groups E,F, G, and Class III.

To establish that the product is under the ETL Certification program, it is necessary to determine that the ETL Listing Mark is affixed to the product. Only those products bearing the appropriate Listing Mark and the company name, trade name, trademark, or other recognized identification should be considered as covered by the ETL Listing and Follow-Up Service.

Investigation and test data was conducted by Mr. Alan Geller, Sr. Staff Engineer and Mr. Antony Sadler, Project Engineer.

Thank you for using Intertek Testing Services a Nationally Recognized Testing Laboratory accredited by the Occupational Safety and Health Administration.

Best regards,

R.Scott Wilson
General Manager



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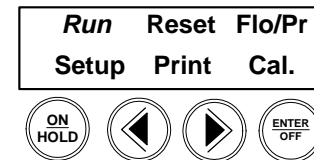


Section 1

Buck-VSS™ Series Keypad Functions

Note: You **MUST** have a filter cassette and tubing properly attached to pump before programming, setting Flow Rate, or calibrating. Failure to do this will result in improper operation.

Main Menu




The BUCK-VSS™ Series pumps have two multifunction keys that change their functions depending on what Menu or Sub-Menu you are in. You must first stop pump Operation with HOLD before you can turn the pump off with OFF. Also to Reset parameters or flow rate, change date or time, or access any of the other functions in the Main Menu. This gives you the programming and operational flexibility for changing media or flow rates, shift sampling, interrupted and ad hoc sampling and other situations where you may just want to pause the pump without actually turning it off.

Pressing ENTER at any flashing Menu or sub-Menu selection or value highlighted by a cursor enters or accepts that Menu selection or value and moves you to the next level in that Menu or sub-Menu

These arrow keys are scroll keys that allow you to move among the various flashing Main Menu and sub-Menu entries, and enter numbers (increase or decrease values) for date, time flow rate, toggle between “accept” (YES) or “decline” (NO) options and selections, etc.

Note: If the password control is activated (under Setup Mode), the Main Menu of “Reset, Flo/Pr, Setup and Cal.” are blocked. To enter these Menus, press the following keys at the prompt for a password.

1st ON, 2nd , 3rd , and 4th 

With these four keys, you can easily operate, program and control the BUCK-VSS™ Series Pumps.

Quick Start Tutorial

Manual Sampling—No Timing Routine

The following section is to allow a first time user to quickly operate the pump as a simple pump while learning of the many features available.

Easy Three Step Cassette Sampling. One time only configure pump settings.

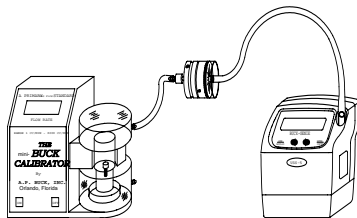
Use arrows to select, **ENTER** to accept.

At Main Menu, arrow to **SETUP**, press **ENTER**.


Use arrow to select and press **ENTER**.

Then select:

- “Deactivate” Timing Routines
- History Report, Press **ENTER**
- “Activate,” Flow Fault Mode
- “OFF” for Password
- Reset Time if incorrect
- Select “English or Metric”
- Select “Language”
- Start Displays are Deactivated



Main Menu – Sample Cassette and Hose Attached

Step 1  to Reset, Press **ENTER**, Yes to “Data to be cleared” or No, to run battery life test.

Step 2 “Run” press **ENTER**, arrow new flow rate and press **ENTER**

Step 3 “Run” press **ENTER** to begin sampling

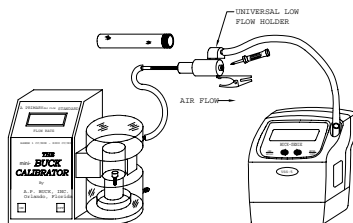
Easy Four Step Sorbent Tube Sampling

At Main Menu, arrow to **SETUP**, press **ENTER**.

Use arrow to select and press **ENTER**


Select:

- “Deactivate” Timing Routines
- History Report, press **ENTER**
- “Activate”, Flow Fault Mode
- “OFF” for Password
- Reset Time if incorrect
- Select “English” or “Metric”
- Select “Language”



Start Displays are Deactivated

Main Menu - Low Flow Tube Holder and Sorbent Tube Attached

Step 1  To Flo/Pr, Press **ENTER**, press arrow to “pressure” Flow Control

Step 2 “run: pres **ENTER** (at 6.5”) measure flow, adjust with screwdriver to desired flow, press **ENTER**

Step 3 Enter Calibrator flow using arrow keys into pump display, press **ENTER**

Step 4 “Run” press **ENTER** to begin sampling

SERVICE INFORMATION

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.

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:

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 8:00AM 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.

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 risen 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.

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Section 2

Design and Basic Features

2 A. Design and Basic Features

The *BUCK-VSS, Validated Sampling System™*, pumps are the most advanced personal sampling pumps available today. It's state-of-the-art design combines small size, light weight, data-logging, programmability, and intelligent functions into a constant flow package that's also easy to use. It is the first pump to provide a totally Validated Sample by linking pump identification, calibration information, operating information, and sample identification.

The main purpose of this battery-operated personal sampling pump is to draw contaminants from an air sample into, onto or through a sampling media such as adsorbent sample tubes, filters, impingers, gas sample bags, or long-duration color detector tubes to gauge personnel exposure to gases, vapors, particulates, aerosols, etc. Both the analytical method required for the contaminant and the type(s) of contaminants sampled determine the selection of sampling media. Many sampling methods specify the use of filters for collection. The pore size, filter diameter, and filter material affect the ability of the sample pump to draw air through the filter for contaminant collection. The various detailed capabilities of the *BUCK-VSS™* Models are presented in Section 2 and 3 of this Manual.

The *VSS-1 Constant Flow* range is 100 to 600 cc/min. The *VSS-5* is 800 to 5,000 cc/min. The *VSS-12™* has a Constant Flow range of 2 to 12 LPM.

All *BUCK-VSS™ Series* pumps have internal sensors to provide accurate flow control via keypad adjustment. Although the constant flow system has an accuracy of $\pm 3\%$ as read by the sample pump's display, good industrial hygiene practice is to verify the flow against a primary gas flow calibrator such as the *mini-BUCK Calibrator™*. Verification of sample flow should be conducted at intervals consistent with the user's or required standards.

The *VSS-5* and *VSS-12* can operate at lower flows of 5 to 800 cc/min. by operating in **Constant Pressure Mode** and using the Universal Low Flow Holder (P.N. 109030.). For use with the *VSS-1* only, flows of 5 to 80 cc/min. are performed with a Low Flow Holder (P.N. 109033) with the pump in Constant Pressure Mode.

BUCK-VSS™ Series pumps are designed to collect air samples using accepted industrial hygiene principles and techniques, with recommended routine maintenance and service as required. These pumps assure the highest degree of reliable end-of-day samples through their advanced design, rugged construction, and market-leading features. An on-board 16-bit microprocessor controls the pump's flow and volume calculations, provides programming access, and ensures reliable data storage an downloading, even printing direct from the pump to a printer.

For further information, see the **Appendix**.

2 B. Pump Operation

2. B. 1. Basic Features

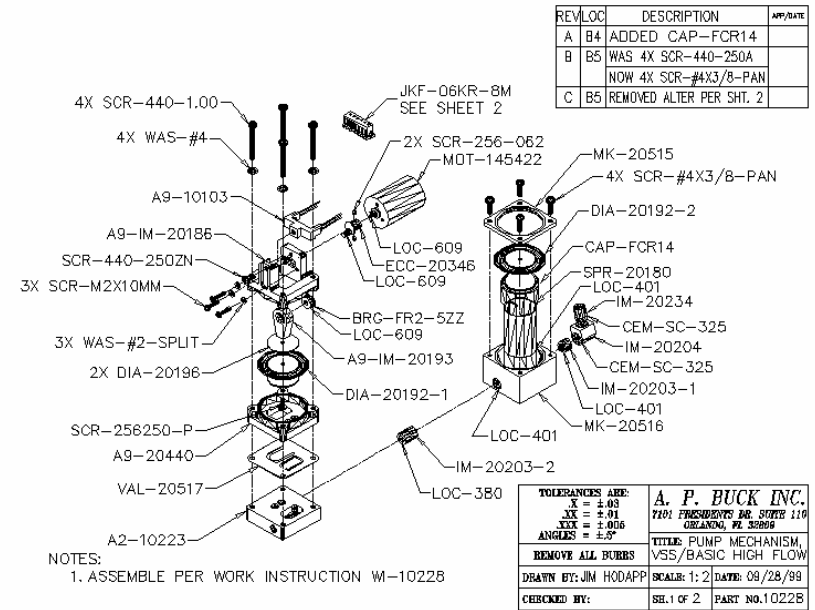
- Display.** Each *BUCK-VSS™ Series* pump uses a 16-digit, 2-line alpha/numeric backlit LCD display to show pump operation and programming. In general, the display will show a parameter or menu choice requiring a response (entry) from the user (YES, NO, ACTIVATE, etc.). Some displays scroll to present complete information.
- Keypad.** All four keys (**ON/HOLD**, **◀**, **▶**, **ENTER/OFF**) perform multiple functions:
 - ON/HOLD** turns pump **ON**, puts pump into **HOLD** mode via 4-second countdown, and serves as an “Escape” key in sub-MENUS.
 - ARROW** **◀** and **▶** keys let you scroll within various menus and enter values (numbers) for sample flow.
 - ENTER** key (a) accepts the current display message and (b) turns pump **OFF**.
- Menus.** A 6-function “Main Menu : (RUN, RESET, FLO/PR, SETUP, PRINT, CAL) provides the ability to select sample flow rate, clear previous data and pump settings, put pump on “HOLD”, and turn the pump off, all through direct entry or various sub-Menus. Additional Menus allow Timing Routines for “Delayed Start” and “Auto Off”, and types of Flow Control.

2. B. 2. Pump Control (Patent No. 5996422)

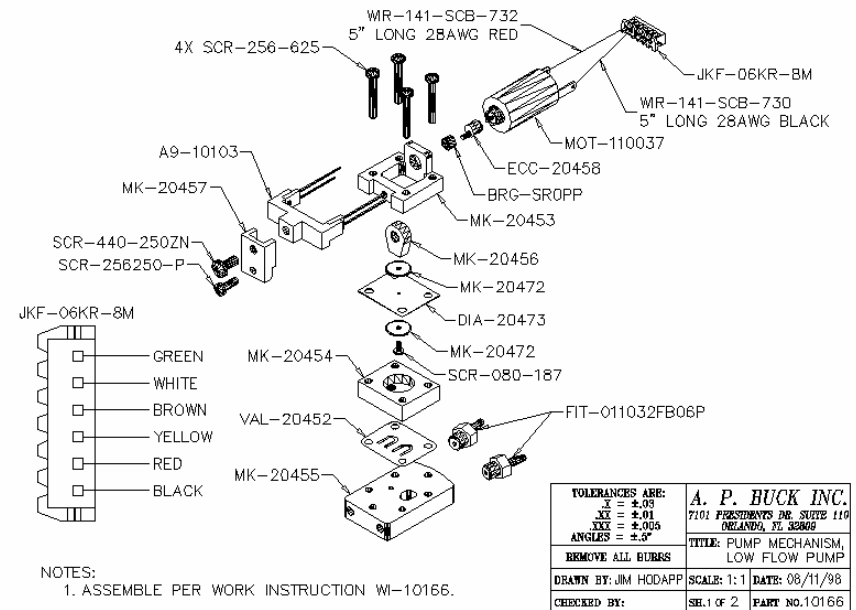
- Standard Temperature Pressure (STP) Flow System.** The system consists of a solid state Differential Pressure sensor located on the inlet suction hose and a revolution per minute (RPM) sensor on the pump. Data from these two sensors are used in flow tables established at different inches of differential pressure. By plotting the pressure and RPM, a "surface of flow" can be obtained through-out the constant flow range. Pump software calculates the flow instantly and adjusts the pump's speed to match the selected flow. Accuracy of flow is $\pm 3\%$ of any display. It may be re-calibrated by a primary gas flow calibrator to $\pm 1.0\%$ at any specified flow.

Two additional sensors installed in the pump are the absolute Pressure sensor for Barometric Pressure and a Temperature sensor monitoring the air discharged into the pump case. This data is used to provide STP correction for flow and volume.

VSS-12



VSS-1



B.4 Pump and Damper Mechanism

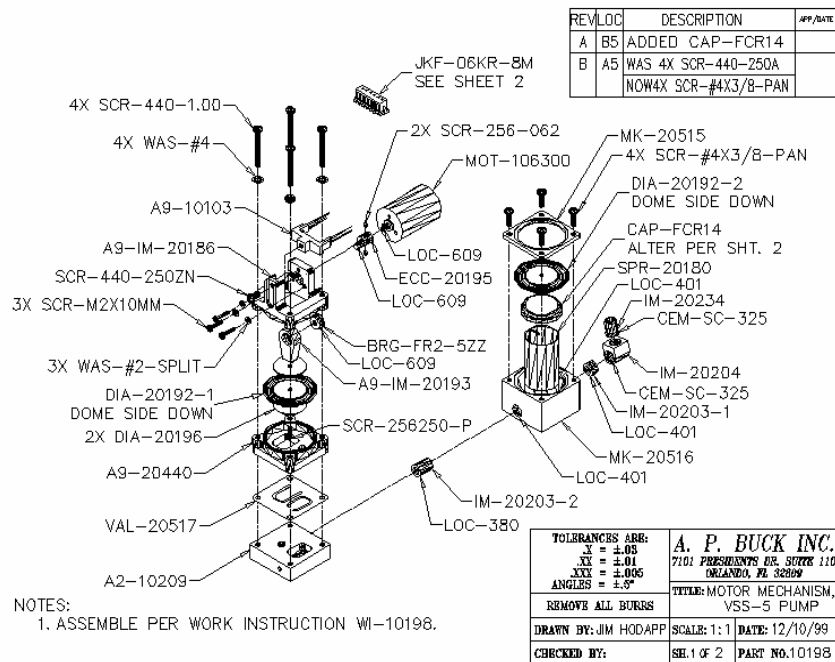
Overview of Pump and Damper all models

These mechanisms are single stroke diaphragm pumps. The valves are flapper style made of stainless steel. The motors are ball bearing shafts on each end.

Their speed or flow is controlled by monitoring the revolution per minute (RPM). The RPM sensors are located near the top of the pump's stroke. The sensors are infrared and rely on the beam blockage to provide a count of RPM.

The single stroke pump, require a damping chamber to smooth out the pulses, especially at slow speeds. The damper is spring loaded. The repairable chamber has a rubber diaphragm. See breakout drawing for details. The modules are best replaced their entirety. The tolerances are extremely close and can be difficult to repair. The valves seat on surfaces hand lapped with 600 grid sandpaper. Three Models are: VSS-5, VSS-12, VSS-1

VSS-5



2. B. 3. Standard Temperature and Pressure (STP) Equation

Standard Temperature and Pressure (STP) is defined as 25 °C and 760 mm of Mercury (Hg) [77 °F and 29.90 inches Mercury] as calculated by the following equation:

$$\text{VOLUME (STP)} = \text{VOLUME} \times \left\{ \left(\frac{P}{760 \text{ mm}} \right) \times \left[\frac{298 \text{ °K}}{(T + 273 \text{ °K})} \right] \right\}$$

Where : P = actual barometric pressure in millimeters Mercury (mm Hg)

T = actual temperature in degrees Celsius (°C)

Pressure changes of less than 250 ft. in altitude are ignored. This represents ± 1% accuracy. Altitudes from sea level up to 10,000 ft. are corrected to STP with a sensitivity of 250 ft. increments.

Temperature changes are performed in the range of 0 to 45 °C (32 to 113°F). The temperature readings are accurate to ± 0.5 °C (± .9 °F).

2. C. Constant Flow

The *BUCK-VSS™ Series* pumps have three flow control modes to select. They are:

- Constant Volumetric Flow
- Constant STP Flow
- Constant Pressure

2. C. 1. Constant Volumetric Flow (“Flo / Pr”) is the most common type of flow in personal air sampling pumps. The sample flow is measured by a *mini-BUCK Calibrator™* which establishes the flow rate based on a volume of air per unit of time. This flow is held constant by the pump’s differential sensor monitoring any change in the air flow entering the pump. Since this sensor has one side measuring the ambient atmosphere, the pump easily maintains a constant volumetric flow at varying altitudes.

2. C. 2. Constant STP Flow (“STP Conditions”) could also be called mass flow because the flow is maintained to collect a certain mass of air over the collection period. By using the absolute pressure and temperature sensors, the pump changes the sample flow rate accordingly. For example: a change in altitude from sea level to 10,000 feet with temperature constant at 77°F, would result in a flow change from 2,000 cc/min. to 3,000 cc/min. To see STP-corrected sample volume during pump operation, press **▶**. Pressing **ENTER** will return display to VOL Mode (Constant Volumetric Flow Mode).

2. C. 3. Constant Pressure Flow is utilized by the *VSS-1* and *VSS-5* to collect low flow samples such as charcoal tubes. The Constant Pressure operating mode (Flo/“PR”) is selected to operate the pump in conjunction with the *Low Flow Universal Tube Holder* (P.N. APB-109030), and sample flow rates from 5 to 800 cc/min. are easily achieved.

2. D. Data Storage

Static Ram for memory backup saves sampling information and is independent of the sample pump main battery pack. The data saved in memory includes: Real Time, Elapsed Time, Temperature, Flow Rate, accumulated Sample Volume based on actual flow rates, Barometric Pressure, Differential Pressure, and STP-corrected accumulated sample Volume. These parameters can be stored in the pump's data Log system available to upload to a PC via the **BUCK PCLINK EXPRESS™** computer program, or printed directly from the pump to a printer via "PRINT" in the Main Menu.

2. E. Battery Monitor

To ensure the pump has enough power for the entire sampling period, the **BUCK-VSS™ Series** pumps display battery capacity during the sampling run time. Based on a "fuel gauge" approach of 0 to 100%, the capacity is displayed during the initialization display, and during pump operation. To conserve battery life, the pump will turn itself off if inadvertently turned on and no keys are pressed for 5 minutes while in the Main Menu (Run, Reset, Flo/Pr, Setup, Print, Cal).

While selecting or adjusting the pump flowrate, "hours" of calculated sample time (based on Battery % and current drain due to the filter and flow rate being selected) appear in the upper right-hand corner of the display (XX.XX HRS). To observe the "calculated time left to operate the pump" (based on the selected flow rate and current drain) press the LEFT arrow key ◀ during sampling run.

2. F. Temperature Display

The **BUCK-VSS™ Series** Pumps have internal temperature sensors which average the temperature every minute during the sampling period. The "Temperature Range" is 0 to 70 °C (32 to 158 °F) and is displayed during pump sampling. Under Setup Menu, the default to Celsius (°C) or Fahrenheit (°F) is made by selecting either METRIC or ENGLISH.

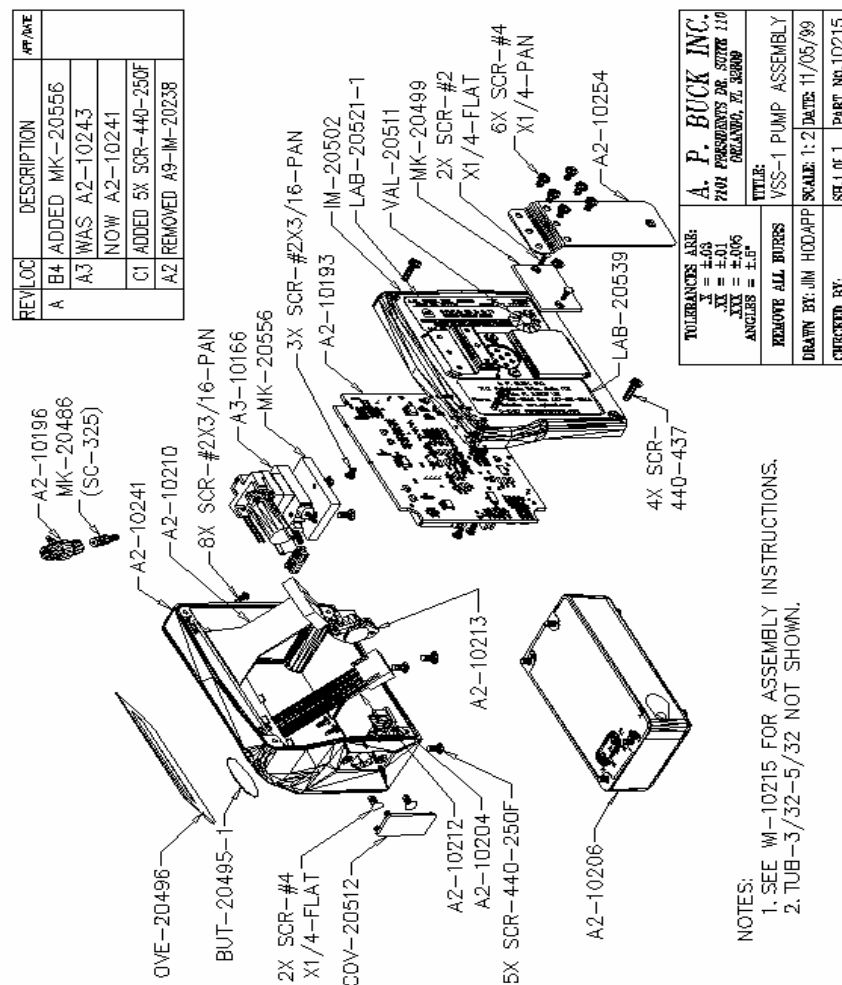
2. G. Flow Faults

Flow Faults consist of two different events (FILTER OFF [HOSE OFF] and FLOW INTERRUPT) which stop the pump. FLOW FAULT may be disabled while in the pump's Setup Mode.

- 2. G. 1. Filter Off (Hose Off).** This feature monitors both the pump differential pressure sensor and RPM sensor. At zero differential pressure i.e. tubing and/or filter have been pulled from the pump, "FILTER IS OFF!!, PRESS ENTER" is displayed. Reconnecting the tubing and pressing "ENTER" will automatically re-establish sample flow. During the "filter off" time, Elapsed Time clock will be halted and cumulative Volume will be frozen. Re-establishing sample flow re-activates these two parameters. This feature functions only when the pump is in the "RUN" (sampling) Mode.

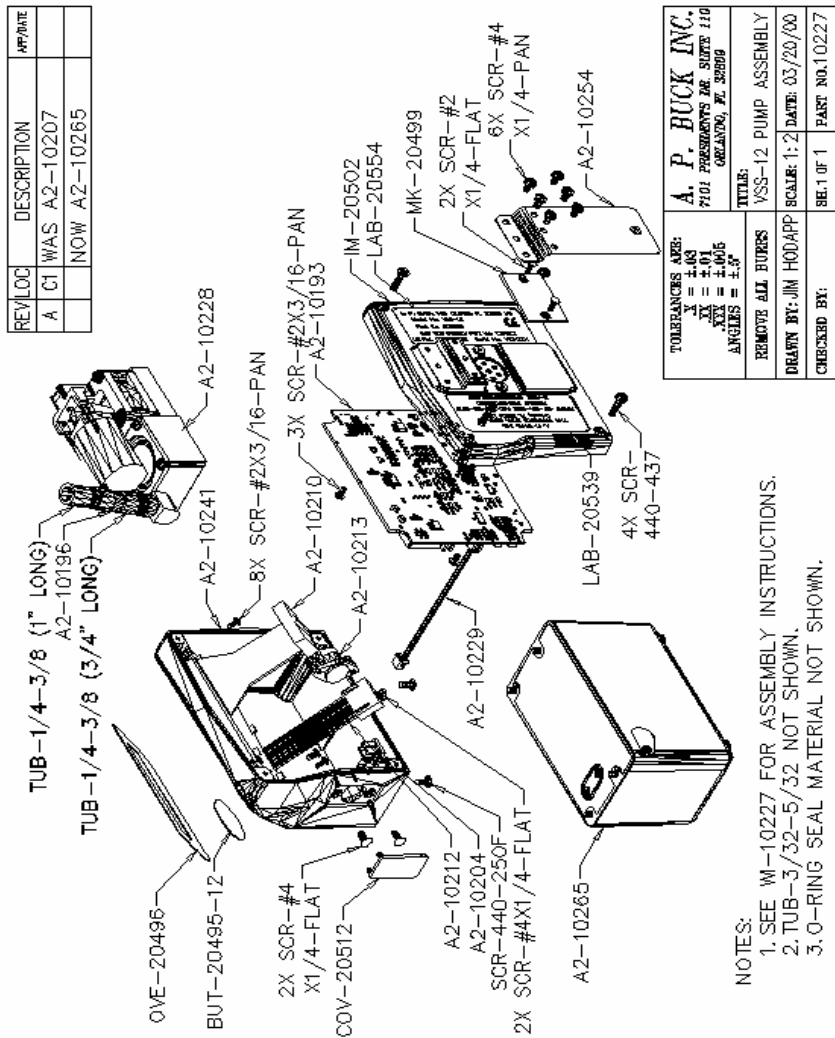
Breakout Drawings of Pumps (continued)

VSS-1



Breakout Drawings of Pumps (continued)

VSS-12



2. **G. 2. Flow Interrupt (Blockage).** At zero RPM i.e. sample flow has been blocked due to plugged filter, “ATTENTION, FLOW INTERRUPT” is displayed. The pump will automatically attempt to re-establish sample flow. The *BUCK-VSS™ Series* Pumps flow monitoring system detects hose kinking or disconnecting and filter tearing or displacement. It automatically resumes sampling after the user corrects either flow fault. If “FLOW INTERRUPT” occurs, the pump attempts to restart by testing for flow every few seconds. Gradually it decreases the attempts to one every minute until the flow interruption stops or the pump turns off due to low battery.

2. H. Diagnostic Tests

On start up, the *BUCK-VSS™ Series* pumps display pump Serial Number and checks for battery capacity and RAM memory. It also displays various system and operating parameters based on the last entered and current calculated information (e.g. Date, Time, Battery Capacity, Run Time, Cumulative Liters Sampled, Barometric Pressure, Temperature, Log Usage Rate, etc.). To speed up the turning on process, these information displays may be turned off under the Setup Menu.

2. I. Flow Adjustment

1. The *BUCK-VSS™ Series* pumps flow rate (cc/min.) is easily adjusted using the arrow keys ◀ or ▶ from the RESET sub-Menus (see **Quick-Start Guide** “TO CHANGE FLOWRATE?” for easy flow adjustment keystrokes). Once the desired flow rate is reached, press **ENTER** twice to begin sampling. To re-adjust flow, halt pump operation by pressing **HOLD** for 4-second countdown, then reset the flow rate again under the RESET sub-Menus.
2. Press **ENTER** at the calibration main menu to adjust the pump flow calibration. This location changes the internal flow tables by a factor throughout the entire operating range. Proceed only if an accurate flow reading device such as The *mini-BUCK Calibrator™* is available.

Warning: The sampling filter media must be attached to the inlet of the pump. If this menu is entered by mistake, press **ON/HOLD** key to escape. When clearing the current calibration, if YES is chosen, the factory calibration factor is cleared to allow a new calibration. If NO is chosen, the display will go to verify the flow with current calibration.

A specific flow may be selected for this calibration change. Once the appropriate flow is displayed, press **ENTER**.

Use arrows to enter the flow numbers to match an external flow calibrator. Press **ENTER** and the correction factor will now present a flow rate matching the external flow.

2. J. Pump Security

A single Password is selectable as Activated/Deactivated under Setup. The Password will secure all Main Menus except Run and Print. This security system provides the security necessary to collect a valid set of sampling results by ensuring the required sample flow rate is not tampered with after programming or in the field. The predefined code for this lock system is factory programmed and not changeable.

The “PASSWORD” a set of four keypad strokes. Press **ON/HOLD**, **◀**, **▶**, **ENTER/OFF**, in sequence.

2. K. Battery Pack

The *VSS-1* and *VSS-5 Series* Standard Battery Pack consists of four AUL nickel cadmium batteries. The batteries are rated at 1500 mA hour capacity. The *BUCK FastOne™* and *FastFive™* Battery Chargers connect to the back of each battery case; by lifting the protective rubber cover, the charger lead can be easily inserted. A Triple Battery Pack may be substituted for the standard battery pack to provide three times as much battery capacity for the *VSS-1* and *VSS-5*. When a Battery Pack or pump with Battery Pack is connected to a *FastOne™* or *FastFive™* Charger, a yellow LED (**CHARGING**) will indicate the charging cycle has begun. The charge cycle takes approximately 60 minutes for the single packs and 3 hours for the triple packs. When the charging cycle is completed, a green LED will light (**READY**) indicating end of cycle. Individual battery packs may be charged independently of the pump if required. The pump may be left connected to the charger in “trickle charge” indefinitely. Battery pack cases are connected to the pump case bottom with four self-retaining screws.

The *VSS-12* pumps are not intrinsic safe. A non-intrinsic safe version of a triple pack is standard for the *VSS-12* and must not be substituted on the *VSS-1* or *VSS-5*. Always compared the part numbers specified on any of the *BUCK-VSS™* pumps to match the part number of the approved battery packs. See the Appendix B.2 for the appropriate part numbers.

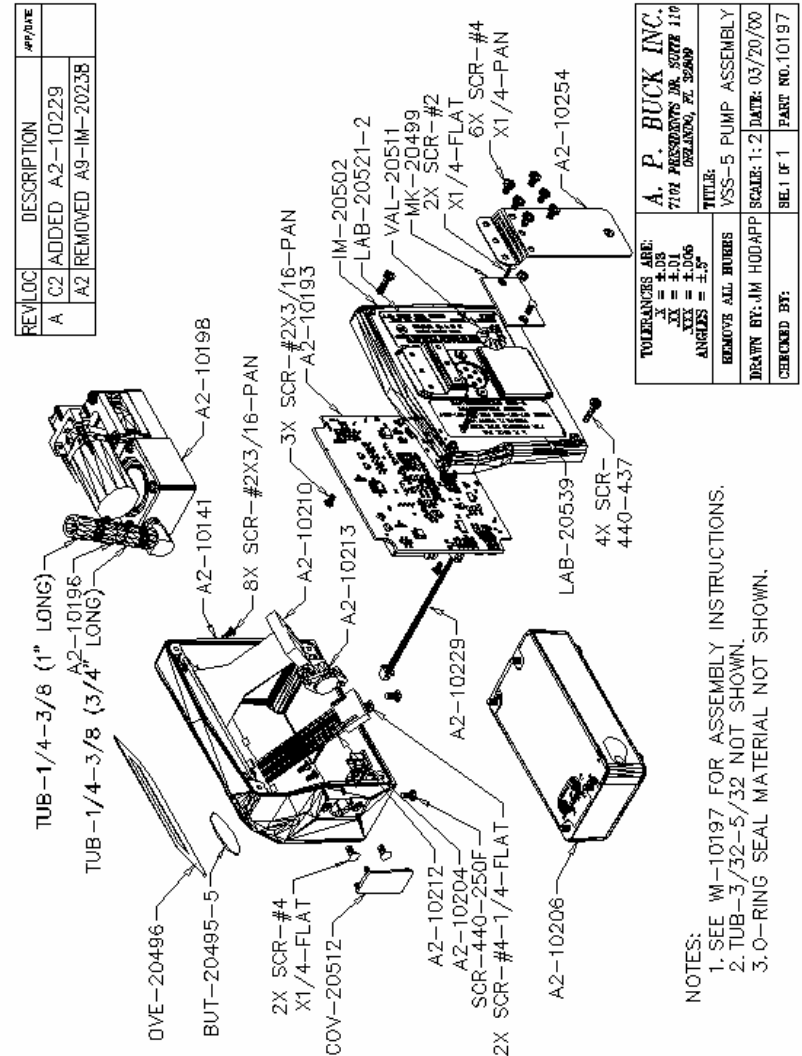
Caution: Never charge batteries in hazardous areas.

2. L. Continuous Sampling

The *BUCK-VSS™ Series* pumps are capable of running continuously (for IAQ, environmental and other applications) with the *A/C Power Supply* (P.N. APB-109056) attached to the Battery Pack and plugged into an AC source. The elapsed clock will convert 24 hours of sampling into days with the balance in minutes up to 99 days. The accumulated volume converts to kiloliters (KL) after 1000 liters. It displays up to 999.9 KL.

B.3 Breakout Drawings of Pumps

VSS-5 Pump



Parts List
(Continued)

Part No.	Description	Model VSS-1	Model VSS-5	Model VSS-12
DIA-20192-2	Damper Diaphragm		Yes	Yes
Cov-20513	Battery Charger jack cover	Yes	Yes	Yes
SCR-256250-P	Batt. Cover attaching screw	Yes	Yes	Yes
SCR-2051B	Single Battery Pack screws	Yes	Yes	Yes
SCR-20524	Triple Battery Pack screw	Yes	Yes	Yes
OR1-AS5668A-015	O-Ring for battery pack	Yes	Yes	Yes

***These numbers are manufacturing drawing numbers. To place an order for these batteries use the Sales Part No. referenced below**

Battery Pack cross reference numbers.

A2-10206	APB-129022
A2-10231	APB-129020
A2-10207	APB-129322
A2-10258	APB-129320
A2-10265	APB-109130

2. M. Digital Flow and Volume Display

The flow rate is $\pm 3\%$ accurate of any flow display. This flow factor is based on flow determined by the differential pressure sensor and the RPM flow tables. The sampled Volume in Liters is incremented every second and is accurate to 10 cc (0.010 Liters). **In Constant Pressure Mode, flows entered by the user at time of calibration will be displayed as a “set” flow rate. Volume is based on elapsed time multiplied by the flow rate entered by the user.**

2. N. Pump Case

The *BUCK-VSS™* rugged polycarbonate case is highly water and dust resistant. The inlet port is recessed for added protection and is barbed to help prevent sample tubing from being pulled off. The sample outlet (discharge) is internal as the pump exhausts into the case. This keeps the pump case always at positive pressure, preventing dust and particulate contamination. All exhaust air passes out the exhaust valve under the belt clip.

2. O. Shielding for RFI and EMI

CE Mark for EMC (Electrical Magnetic Conformity) was conducted and passed. The standard used was CENELEC Publication 61000-4-11-1994. Testing was for Electromagnetic Compatibility, Basic Immunity Standards for radiated, radio frequency electromagnetic field immunity.

This manual describes the basic operation of the BUCK-VSS™ Series Pumps. It does not detail how to sample or analyze collected samples, nor how to select methods for various airborne hazards. For this information, the best general application reference is to be found in the NIOSH Manual for Analytical Methods from the U.S. Government Printing Office. Additional reference sources may be found at the www.apbuck.com homepage on the World Wide Web.

Section 3

Quick Start Tutorial Manual Sampling—No Timing Routine

The following section is to allow a first time user to quickly operate the pump as a simple pump while learning of the many features available.

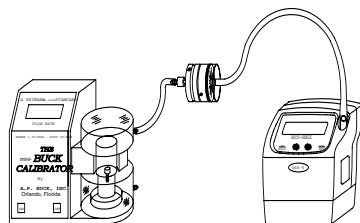
Easy Three Step Cassette Sampling. One time only configure pump settings.

Use arrows to select, **ENTER** to accept.


At Main Menu, arrow to **SETUP**, press **ENTER**.

Use arrow to select and press **ENTER**.

- Then select:
- “Deactivate” Timing Routines
 - History Report, Press **ENTER**
 - “Activate,” Flow Fault Mode
 - “OFF” for Password
 - Reset Time if incorrect
 - Select “English or Metric”
 - Select “Language”
 - Start Displays are Deactivated



Main Menu – Sample Cassette and Hose Attached

Step 1  to Reset, Press **ENTER**, Yes to “Data to be cleared” or No, to run battery life test.

Step 2 “Run” press **ENTER**, arrow new flow rate and press **ENTER**

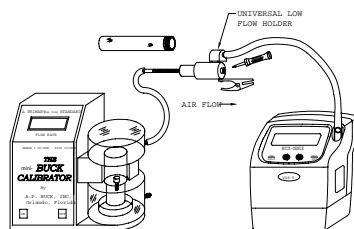
Step 3 “Run” press **ENTER** to begin sampling

Easy Four Step Sorbent Tube Sampling

At Main Menu, arrow to **SETUP**, press **ENTER**.


Use arrow to select and press **ENTER**

- Select:**
- “Deactivate” Timing Routines
 - History Report, press **ENTER**
 - “Activate”, Flow Fault Mode
 - “OFF” for Password
 - Reset Time if incorrect
 - Select “English” or “Metric”
 - Select “Language”



Start Displays are Deactivated

Main Menu - Low Flow Tube Holder and Sorbent Tube Attached

Step 1  To Flo/Pr, Press **ENTER**, press arrow to “Pressure” Flow Control

Step 2 “Run” press **ENTER** (at 6.5”) measure flow, adjust with screwdriver to desired flow, press **ENTER**

Step 3 Enter Calibrator flow using arrow keys into pump display, press **ENTER**

Step 4 “Run” press **ENTER** to begin sampling

B.2 Service Parts List

Part No.	Description	Model VSS-1	Model VSS-5	Model VSS-12
Drawing #	Select Battery No. appropriate for safety approval.			
A2-10206*	Battery Pack, single ETL, cETL, CE	Yes	Yes	
A2-10231*	Battery Pack, single EX, D, CE	Yes	Yes	
A2-10207*	Battery Pack, Triple ETL, cETL, CE	Yes	Yes	
A2-10258*	Battery Pack, Triple EX, D, CE	Yes	Yes	
A2-10265*	Battery Pack, Triple Not Intrinsically Safe			Yes
A2-10216	Circuit Board	Yes	Yes	Yes
A2-10210	Display with connector cable	Yes	Yes	Yes
A2-10212	Keypad CB with connector cable	Yes	Yes	Yes
OVE-20533	Overlay for display and keys	Yes	Yes	Yes
BUT-20525-1	Badge on front case of Model	Yes		
BUT-20525-5	Badge on front case of Model		Yes	
BUT-20525-12	Badge on front case of Model			Yes
A2-10204	Case Front Housing	Yes	Yes	Yes
IM-20502	Case Back Housing	Yes	Yes	Yes
A2-10254	Belt Clip	Yes	Yes	Yes
A3-10166	Pump Mechanism	Yes		
A2-10198	Pump Mechanism		Yes	
A2-10228	Pump Mechanism			Yes
DIA-20473	Diaphragm for Pump Mechanism	Yes		
DIA-20192-1	Diaphragm for Pump Mechanism m		Yes	Yes
VAL-20452	Valve for Pump Mechanism	Yes		
VAL-20517	Valve for Pump Mechanism		Yes	Yes
APB-109018	Update Code Package	Yes	Yes	Yes

APPENDIX B Service and Maintenance

B.1 Updating Code in VSS Pump

Equipment Needed:

1. Pentium-class personal computer (PC) with a 9-pin RS-232 communication port
2. Update Code Package, Part No. APB-109018 from A.P. Buck, Inc. which includes a black PC cable (6 ft) to connect the pump to the PC.
3. One Phillips screw driver (No. 2 size)

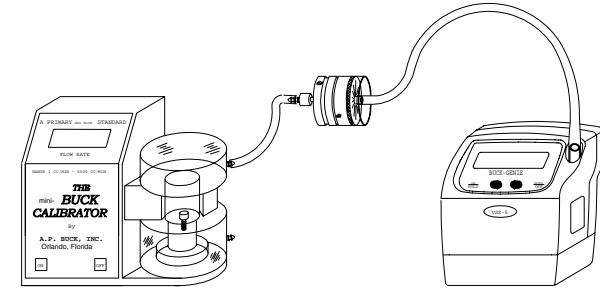
The Update Program will install software on the local PC hard drive. This program allows communication between the pump and the PC. Once communication between the two devices is established by seeing on the PC window the pump model and serial number, the software (firmware) for the pump can be uploaded. The firmware file will have a “.hex” extension for easy identification of which file is the pumps firmware. It is defaulted to install the .hex file shipped with the Update Program.

Instructions:

1. Download the program to the PC local drive. Pay attention to the location where the file is stored. Go to RUN under START of Windows and browse to the stored file and click on SETUP.exe file
2. Run the Setup program and follow the on screen instructions
3. Connect the black PC cable to the 9-pin RS232 port on rear of PC
4. Plug the opposite end of cable to the mini-DIN connector on the right side of pump case
5. Turn on the pump by pressing the **ON** key
6. On the PC, open the “Update Program “ (includes hex files)”
7. Click on the COM port button and observe which COM port selection displays the pump Model and Serial Number
8. Click on the update button on screen and observe the pump display, which should be “UPDATE FIRMWARE”. The PC window should have the progress bar showing the updating taking place
9. At conclusion, press the ENTER key on the pump. The pump will turn off. When restarted, the pump will display the version of firmware
10. Save disks and cables in the event future updating is necessary

Section 4

Programming and Timing Routines



4. A. Programming

4. A. 1. Three SAMPLING MODES.

These three modes are selectable under the Flo/Pr Main Menu.

1. **VOLUMETRIC CONSTANT FLOW MODE** is the most common method of sampling and is used for cassette filter cassette (Liter Per Minute) and other “high flow” sampling. Flow displayed is accurate to $\pm 3\%$ of the display. Pump calibration is performed under the “Cal” Menu to re-calibrate to any flow to within $\pm 1.0\%$ of reading using the *mini-BUCK Calibrator*TM. At least monthly flow verification is recommended.
2. **CONSTANT PRESSURE MODE** is used for low flow charcoal, tenax, etc. sorbent tube (cc/min.) sampling and requires (a) pump be placed in the “Constant Pressure” Mode (Flow/“Pr”), and (b) the Universal Low Flow Tube Holder must be used.
3. **STP FLOW MODE** is an automatic mass flow control using the pump’s internal Barometric and Temperature sensors. STP Mode can be displayed at any time from the Sampling (Run) display by pressing the **RIGHT** ► arrow key.

4. B. Timing Routines

4. B. 1. Purpose of Timing Routines. The Timing Routines allow the following features to be programmed by the pump's keypad. The timing is based on an internal clock accurate to one second per day. All timing programming is protected by the pump's internal battery backup system.

"Timing Routines" are accessed under the Setup Menu and must be set with ◀ or ▶ to "ACTIVATE" then ENTER in order to access the routines under the Reset Menu. They remain as a default as selected until changed under Setup. When selected as Deactivated, no displays associated with timing will appear.

Start/Stop sampling is set by a "Start" Time (Hr. Min), Day, Month and Year with "On" time and "Off" time programmable in 5-minute intervals per hour, and a "Stop" Time (Hr. Min), Day, Month and Year with "On" time and "Off" time programmable in 5-minute intervals per hour. This 5min/hr cycle feature allows the sampling to be interrupted for 5-55 minute intervals each hour of sampling. This reduces filter plugging yet still gives a full 8-hr Time Weighted Average (TWA) sample with only 4 hours of sampling (every other cycle is off).

Instructions to Program Timing Routines:

These Keystrokes will clear any previous programming

Note: You *MUST* have a filter cassette and tubing properly attached to pump before programming, setting Flow Rate, or Calibrating. Failure to do this will result in improper operation.

ON	Pump displays Start up information, then displays Main Menu (Run, Reset, Flo/Pr, Setup, Print, Cal).
▶ TO RESET	Scroll to Reset, enter "YES" selection to clear pump data; pump displays "Sampling Data To Be Cleared?"
ENTER RUN	pump displays "ARROWS TO SET FLOW"
◀ or ▶ to set FLOWRATE	"ARROWS TO SET FLOW"; this display will appear only if sampling data was cleared under the "Reset" Menu; increase ▶ or decrease ◀ flowrate based on application or requirements; flowrate change will speed up as you continue to hold arrow button
ENTER	enters new flow rate selected into pump memory.

Note: The next display will be the START TIME or DURATION if the option to activate the Timing Routines was performed under SETUP mode.

12. **Luer Adapter** (APB-109000) (pkg 10) Adapter (black) fits onto tubing to easily attach filter cassette inlet to tubing to aid in calibration.
13. **Sample Hose Clip** (APB-109020) (pkg 10). Clothing clip for attaching hoses and sampling heads to a worker's collar or shirt, with snap nylon strap for 3/8" O. D. hose.
14. **Multi Low Flow Manifold** (APB-109034). Poly-carbonate manifold allows connection of up to three sorbent tubes and Protective Covers for independent multiple low flow sampling with a single pump.
15. **Non-Adjustable Flow Sample Holder** (APB-109032). To be used with any model of Buck pump in Constant Flow.
16. **5-Pack Pump Case** (APB-109017). Designed to hold up to 5 VSS Series pumps, FastOne™ or FastFive™ charger(s), accessories, media, tubing, etc. Rugged design protects contents even when shipped by UPS™, air freight, etc.
17. **Communication Cable** (APB-109048). 6-pin RS232 connector for communication between the *BUCK-GENIE VSS Series Pump* and *BUCK PC Link Express™ Software* (APB-109100).
18. **VSS Printer Cable** (APB-109102) Allows Buck-Genie VSS Series Pumps to print reports directly to printer.
19. **BUCK-VSS™ Series Pump Manual** (APB-109114)

A.5 Parts and Accessories

1. **BUCK FastOne™ Charger** 120VAC/230VAC (APB- 601910) Single Station Automatic One Hour Charger for use with the *BUCK-GENIE VSS* Series Pumps.
2. **BUCK FastFive™ Charger** 120VAC/230VAC (APB-605900), Five Station Automatic One Hour Charger for use with the *BUCK-GENIE VSS* Series Pumps.
3. **BUCK Standard Charger** 120VAC (APB-603900) Designed to charge the *BUCK-GENIE VSS-1 and VSS-5 Series* Pump battery-pack (max 16 hours charge time). Not Recommended for VSS-12 or triple packs.
4. **BUCK "One Hour" Rechargeable Battery Pack ETL, cETL, CE** (APB-129022) for the *BUCK-GENIE VSS-1 and VSS-5 Series* of Pumps. These self contained packs may be charged independently from the pump and used as additional back up batteries in the field. Simple four screw changing operation.
5. **BUCK "One Hour" Rechargeable Battery Pack EX,D,CE** (APB-129020) for the *BUCK-GENIE VSS-1 and VSS-5 Series* of Pumps. These self contained packs may be charged independently from the pump and used as additional back up batteries in the field. Simple four screw changing operation.
6. **BUCK Triple Rechargeable Battery Pack ETL, cETL, CE** (APB-129322) for extended run time.
7. **BUCK Triple Rechargeable Battery Pack EX, D, CE** (APB-129320) for extended run time.
8. **BUCK Triple Rechargeable Battery Pack Not Intrinsic Safe** (APB-109130) for the *BUCK-GENIE VSS-12*.
9. **BUCK A/C Power Supply** (APB-109056) supplements battery pack to produce a continuous pump operation from 120V AC power source.
10. **BUCK Adjustable Universal Low Flow Tube Holder** (APB-109030). Desired flow may be precisely adjusted for flows of 5 to 800 cc/min. with the *mini- BUCK Calibrator™* and a screwdriver using the tube holder's built-in adjustable screw.
11. **Tube Cover** for Adjustable Universal Low Flow Tube Holder (Sorbent sample tube size determines cover size).

(APB-109022) NIOSH Charcoal; all standard 6mm O.D. x70mm (3" length)
 (APB-109024) All 8mm O. D. x 110 mm (4 - 5/8" in length)
 (APB-109026) All 10mm O.D. x 150mm (6 - 1/4" in length)
 (APB-109028) All 10mm O.D. x 220mm (8 - 15/16" in length)

The Pump has a “ sleep mode” and will turn” ON” to activate the Auto Start. Setting by Day is useful for indoor air quality sampling over extended periods using the *A/C POWER SUPPLY* (APB-109056).

Duration allows for daily sampling by entering a precise time to sample on command when user is ready. Duration does not allow selection of 5 minute per hour cycles feature.

Options under Setup Menu

◀ or ▶ to SETUP	“SETUP” Menu allows resetting of Timing Routines, History log rate, Flow Fault Mode, Password Lock, Reset pump clock time, Unit of Measure (English or Metric), Select Language and Start-UP Displays
ENTER	Displays “Timing Routines”; use ◀ or ▶ to select “Deactivated” or “Activated”
ENTER	Displays “History Logging Rate” ; use ◀ or ▶ to change data logging rate (eg. 10 for logging a “data event” every 10 minutes); min is 1, max is 59.
ENTER	Displays “Flow Fault Mode” ; use ◀ or ▶ to select “Deactivated” or “Activated”
ENTER	Displays “Password for Main Menus?”; use ◀ or ▶ to select “OFF” or “ON” for this feature; if “ON” is selected, the pump uses a set of four keypad codes to prevent entry and erasing of data and settings. (press ON/HOLD , ◀, ▶, ENTER/OFF , in sequence).
ENTER	Displays “Reset Time ?”; use ◀ or ▶ to select “NO” or “YES”
ENTER	Displays “Select Unit Of Measure” ; use ◀ or ▶ to select “English” or “Metric”; if “Metric” is selected, units displayed will be <u>mm Hg</u> for BP and <u>mm of water</u> for DP, and <u>°C</u> for Temperature
ENTER	Displays Select Language: English, Spanish, French, Dutch and German
ENTER	Start Up Displays may be deactivated to speed up starting of pump. Displays show pump current data values, Time, Bat %.

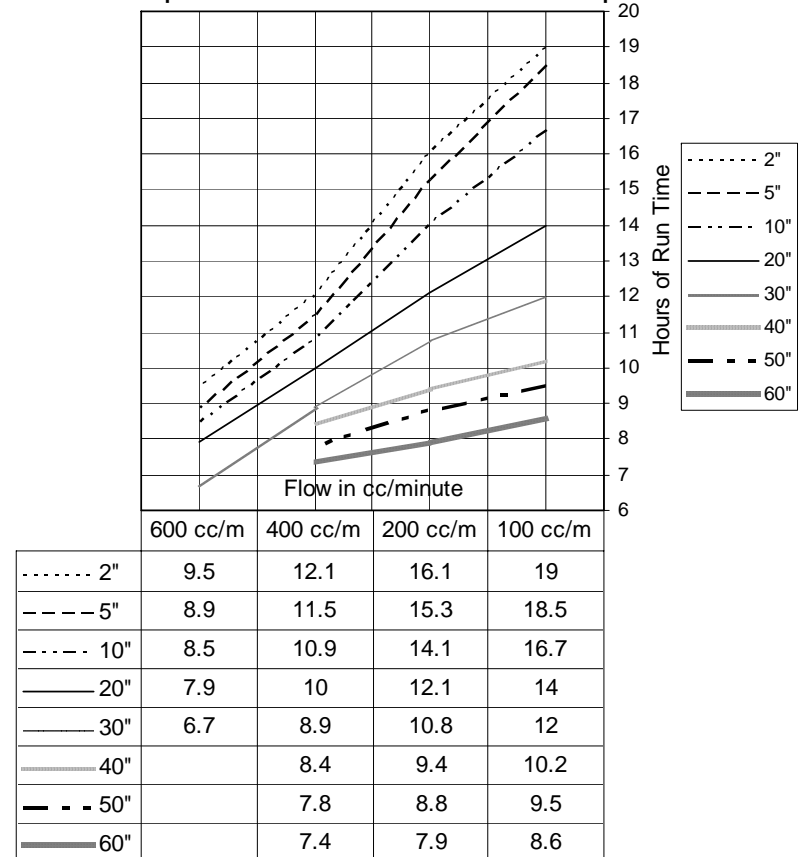
4. B. 2. Examples of Pump Programming with Timing Routines

- ON** Powers pump on and begins diagnostic routine. Main Menu is then displayed (Run, Reset, Flo/Pr Setup, Print, Cal).
- ENTER** **SETUP** displays “Timing Routine are:“ ; use ◀ or ▶ to select “Activated”; you must first “activate” Timing Routines before timing type can be selected and programmed.
- ENTER** Displays “Select Timing Type” use ◀ or ▶ to select “Duration” or “Start/Stop” type of sampling. Both types have cycles per minute feature available within the programming of Timing.
- ◀ or ▶ in Main to RESET
ENTER Timing programming is accessed from the RUN Menu if Sampling Data was cleared under Reset. Use ◀ or ▶ to select “YES” ; “ENTER START TIME” is displayed on top line alternating with actual time and date; enter the required “Start” time and date on the second line, finishing with **ENTER**; Next Cycles per minute, continue entering “Y” for “On” and “N” for “Off” using ◀ or ▶; use the **HOLD** key as a backup or escape key while entering data; each alpha character represents a 5-minute segment of a one-hour clock (12 segments total); **ENTER** continues programming by displaying “ENTER Stop Time” on top line alternating with actual time and date; enter the required “Stop” time and date on the second line, finishing with **ENTER**; pump then displays Main Menu.
(Run, Reset, Flo/Pr, Setup, Print, Cal); you may elect to ◀ or ▶ to “Run” to begin sampling by Timing Routine, or turn pump off for delayed starting.

Duration of sample is the same process as above except a time for length of sampling is entered. This allows the operator to start the sampling by pressing the **ENTER** key under the Run Mode and the pump runs until the time entered has been completed.

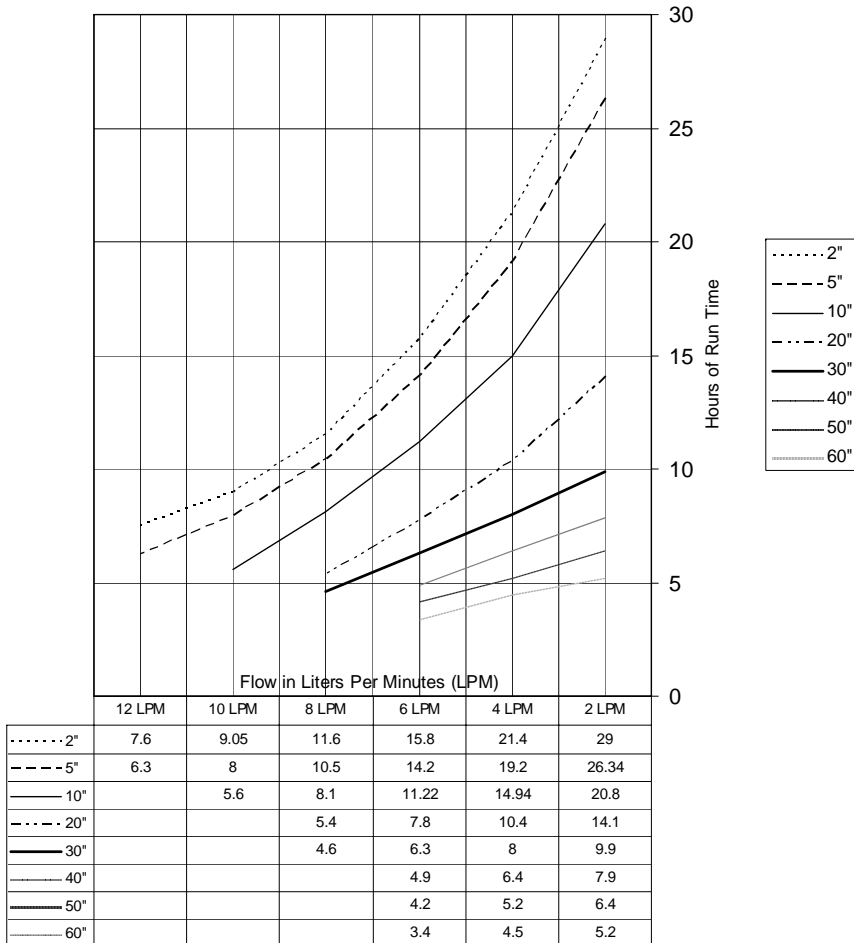
A. 4 Run Times and Back Pressure Capacity

VSS-1 Performance and Run Times
Graph Curves are Inches of Back Pressure



A. 4 Run Times and Back Pressure Capacity

VSS -12 Performance and Run Times
Graph Curves are Inches of Backpressure

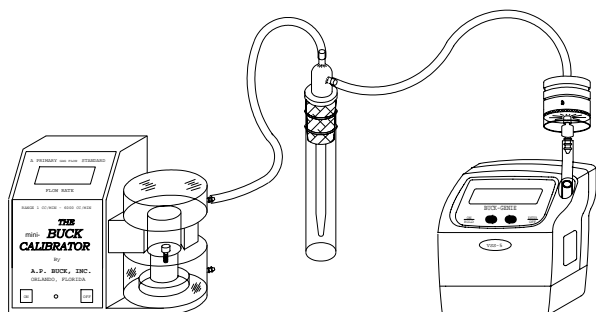


Section 5 Operating Menus and Sub-Menus

Main Menus	Sub Menus	Operating Modes
RUN	Select Flow Rate	Sample Collection: Elapsed clock, flow and accumulated volume are displayed
	None after flow rate has been selected	
RESET	Sampling Data Clear Clear Elapsed Time Change Flow Rate Reset Timing Routing	Clears all data and timing Only if activated under SETUP
	Run Battery Life Test	Cycles battery to full discharge (Does not recharge automatically)
FLO/PR	Flow Control Mode Select VOL or STP PR, Constant Pressure	Volumetric Flow or STP Flow Flow Pressure selectable in inches of water pressure 5 to 21
SETUP	Timing Routines History Report Logging Rate Flow Fault Mode Password for SETUP Mode Reset Time Select Unit of Measure Select Language	Activate/Deactivate 1 to 59 minutes Activate / Deactivate Hold, ◀, ▶, ENTER (keys of password) No/Yes Metric / English English, Spanish, French, Dutch, or German
	Start Up Displays	Activate/Deactivate
PRINT	Print Report Pump History Delete All Log Entries	Printing Logs Clears logs for new data. Max # of logs is 800. Number is displayed when Print is pressed
CAL	Sampling Flow Verify Current Data Clear last Calibration	Requires a Primary Gas Flow Calibrator

Section 6

Bubbler and Impinger Sampling



CAUTION:

FIRST SET THE FLOW WITHOUT SOLUTION IN BUBBLER. The default flow rate at 2000cc/min. or previously selected flow may be too fast and draw bubbler solution into the pump. Generally, 1,000 cc/min. is the flow of choice.

1. Connect a standard 37mm three piece filter cassette (with a 0.8 micron filter in place) close to the inlet of the pump. This serves as a protective trap to prevent any fluids from being drawn into the pump.
2. Attach a bubbler using desired length of hose to the input of the cassette, so the order of the sampling train from right to left (traveling upstream of the flow) is pump, cassette and then bubbler as shown in drawing. Set flow at 1,000 cc/min.
3. Next add solution to bubbler and reinstall flow tube to holder.
4. Press **ENTER** to begin sampling. Even though different brands of bubblers/impingers have varying amounts of flow resistance, the *BUCK-VSS™ Series* pumps will operate at the pre-selected flow. By pressing the **◀** arrow during sampling, the Differential Pressure DP (flow resistance) is displayed with the calculated “run time” (amount of time) the *BUCK-VSS™ Models* will operate at the selected sample rate and measured backpressure) of the battery pack.

A. 4 Run Times and Back Pressure Capacity

The *BUCK-VSS-12 Series PUMP*

Table of (Typical) Battery Life by Filter Type
Constant Flow Mode

Filter Type	Flow cc/min.	Hrs	Filter Type	Flow cc/min.	Hrs
37mm 0.8u	2000	29.5	25mm 0.8u	2000	20
MCE	3000	21.5	MCE	3000	13
	4000	15		4000	10
	5000	11.5		5000	7.5
	6000	8.5		6000	5.6
	7000	7		7000	4.6
	8000	5			

Filter Type	Flow cc/min.	Hrs	Filter Type	Flow cc/min.	Hrs
37mm	2000	30	47mm	2000	32
Fiberglass	3000	24	Fiberglass	3000	24.5
	4000	20		4000	19
	5000	16		5000	16.5
	6000	12		6000	14.5
	7000	11.5		7000	12
	8000	8.5		8000	10.5
	9000	7		9000	9
				10000	6.5
				11000	5.5

Backpressure Capacity of *BUCK-VSS-12 Series Pump*

2 to 60 inches of water pressure up to 5.6 LPM

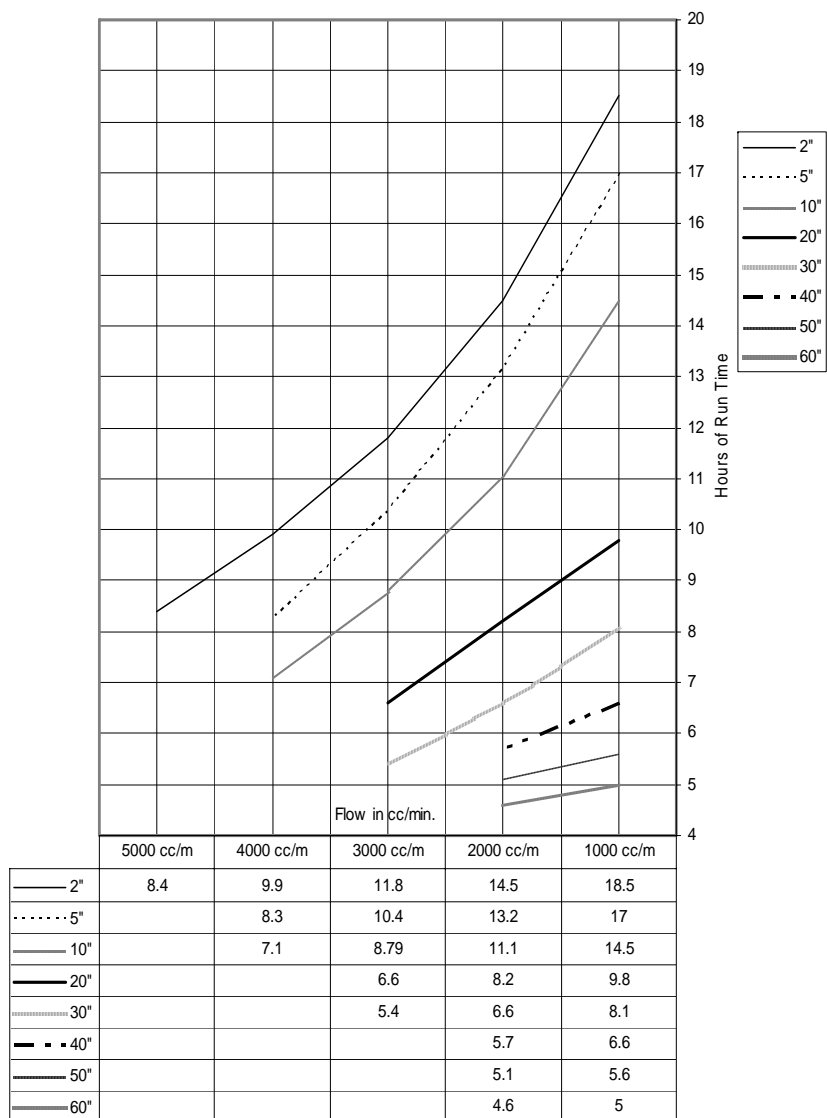
2 to 30 inches of water pressure up to 7.6 LPM

2 to 10 inches of water pressure up to 9.8 LPM

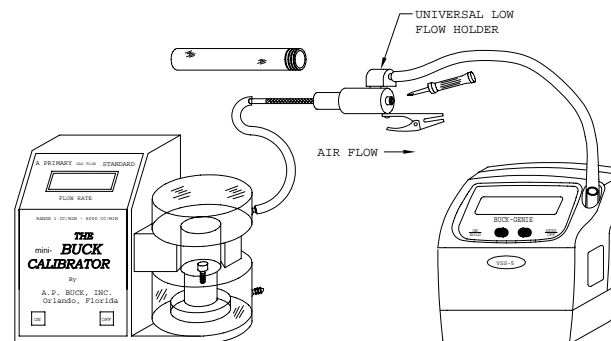
2 to 6 inches of water pressure up to 12 LPM

A. 4 Run Times and Back Pressure Capacity

VSS-5 Performance and Run Times
Graph Curves are in Inches of Backpressure
Single Battery Pack Data (Triple Pack Run Times are tripled)



Section 7 Low Flow Sampling (5 to 800 cc/min.)



SETUP:

Using the setup as shown above, flows of 5 to 800 cc/min. may be collected in sorbent tubes (charcoal, silica gel, etc.). Caution: first set up sorbent tube in Tube Holder with proper tubing before turning pump on.

Low Flow Sampling Procedure :

1. The pump must be in CONSTANT PRESSURE MODE (FLO/PR) selectable under the Main Menu. Use ◀ or ▶ to scroll to 'FLO/PR' and press ENTER. Use ◀ or ▶ to select Constant Pressure Mode ("PR"). Press "ENTER".
2. Press ENTER at the "RUN" Mode.
3. The default pressure of 6.5 inches of water will start the pump.
4. Using the *mini-BUCK Calibrator™ M1 (0.1 to 300 cc/min.)* or *M5 (1 to 6000 cc/min.)*, measure the flow through the adsorbent tube as shown above.
5. Use a screw driver to adjust the flow to the desired rate. If the desired flow cannot be obtained by adjusting the needle valve in the low flow holder, on the pump use the t or u arrows to increase the Pressure setting (DP). The top line is displaying the DP and hours (HR) of expected sampling time at the various pressure settings. Lower pressures give longer sample run times. Some new higher flow thermal desorption, higher backpressure tubes may be used in "Constant Flow" (FLO/PR) Mode with the **NON-ADJUSTABLE TUBE HOLDER** (P.N. APB-109032) for flow above 800 cc/min.
6. Once the sample flowrate has been set, press the "ENTER" key to enter the measured flow. An accuracy of flow of $\pm 5\%$ can be maintained throughout the sampling day.

Section 8

BATTERY CHARGERS

Note: The *BUCK FastOne™* and *FastFive™* Battery Chargers are designed to charge the battery packs for the *BUCK-VSS™* and *BUCK-Basic™* Series pumps.

8.1 *BUCK FastOne™* and *FastFive™* Battery Chargers

Description

The *BUCK FastOne™* and *FastFive™* Chargers are microprocessor-controlled battery chargers providing an entirely automatic battery charging cycle in approximately one hour. The *BUCK-VSS™* Series battery pack can be recharged with or without the pump connected. When inserting the charger lead into the battery pack socket, first lift up the protective rubber cover. The charger uses a voltage detection technique that provides a full recharge. When plugged in, the Yellow and Green LEDs light to indicate the microprocessor is functioning and the charging cycle is in progress (“Yellow”) and finished or ready (“Green”).

The *FastOne™* and *FastFive™* Chargers will charge a pump battery in approximately one (1) hour and 15 minutes. Three (3) hours and 45 minutes for the optional Triple Pack with a fully discharged pack. After a full charge, a trickle charge cycle (“Green” LED) will begin. Batteries can be left in trickle charge indefinitely.

The charger is designed to operate from a 115 or 230 VAC outlet. The charger begins operation automatically when plugged in to an AC source.

8.2 Operation

When plugged in, the “Charging” light will indicate Yellow (ON). When the green light turns ON and Yellow turns OFF, the batteries are fully charged.

The fast charging of the *FastOne™* and *FastFive™* Chargers prevent any of the "Memory Problems" previously associated with Nickel Cadmium batteries. *BUCK-VSS™* Series pumps batteries take advantage of improved chemistries in the cells' electrolyte and the high current charge rate. Any stagnation of the electrolyte or electrical corrosion is removed on charging.

The charger is designed to operate from a 115 or 230 VAC outlet. The charger begins operation automatically when plugged in to an AC source.

A. 4 Run Times and Back Pressure Capacity

The *BUCK-VSS-5 Series PUMP* WITH STANDARD BATTERY PACK

Table of (Typical) Battery Life by Filter Type
Constant Flow Mode

Filter	Flow	Hrs	Filter	Flow	Hrs
37mm 0.8u MCE	2000	9.0	25mm, 0.8u MCE	2000	7.5
	2500	8.0		2500	7.0
	3000	7.0		3000	6.5
	3500	7.0		3500	5.4
<hr/>					
Filter	Flow	Hrs	Filter	Flow	Hrs
37mm Fiberglass	2000	10.4	48mm Fiberglass	2000	10.4
	2500	9.0		2500	9.0
	3000	8.4		3000	8.1
	3500	8.0		3500	7.3
	4000	7.0		4000	7.0
	4500	6.4		4500	6.2
5000	6.2	5000	6.2		

Constant Pressure Mode

Inches of Water Pressure	Battery Life Flow from 5-800 cc/min.
5.5"	11.0 hrs
10.5"	7.8 hrs.
15.50"	6.6 hrs.
20.50"	5.2 hrs

Backpressure Capacity of *BUCK-VSS-5 Series Pump*

2-60 inches of water pressure up to 1.0 LPM

2-50 inches of water pressure up to 2.0 LPM

2-30 inches of water pressure up to 3.0 LPM

2-10 inches of water pressure up to 4.0 LPM

2 - 5 inches of water pressure up to 5.0 LPM

A.3 History Log Reports

Sample of Pump History Report

PUMP SAMPLING HISTORY REPORT

Collector: _____ Serial No: VU50204 Firmware V2.00
 Sampling Site: _____ Pump Type: VSS-05 Report Date: 11/01/01
 Comments: _____

Calibrator Serial No: _____
 Calibration: 10/08/01 10:38a 2000cc/min

Sample No: _____ Lot Number _____ Cassette Size _____
 Batch Number _____ Filter Pore Size _____

Date	Time	Log Event	Elapsed Hr:min	Vol cc/min	Vol Liter	STP Liter	Battery %	DP Water	BP Mercury	Temp Val
10/31/01	03:25p	Clear Data								
10/31/01	03:21p	Power down								
10/31/01	03:26p	Power up								
10/31/01	03:26p	Start Samp								
10/31/01	03:41p	Logged	0:15	1998	29.9	30.5	60%	4.3"	30.29"	71F
10/31/01	03:56p	Logged	0:30	1996	60.0	61.1	60%	4.3"	30.30"	71F
10/31/01	04:11p	Logged	0:45	1997	90.0	91.7	60%	4.2"	30.30"	71F
10/31/01	04:26p	Logged	1:00	2005	120.1	122.3	60%	4.3"	30.30"	71F
10/31/01	04:41p	Logged	1:15	1990	150.2	152.9	60%	4.3"	30.30"	71F
10/31/01	04:56p	Logged	1:30	2008	180.3	183.5	60%	4.3"	30.29"	71F
10/31/01	05:11p	Logged	1:45	2005	210.4	214.1	60%	4.3"	30.29"	71F
10/31/01	05:26p	Logged	2:00	1992	240.4	244.7	60%	4.3"	30.29"	71F
10/31/01	05:41p	Logged	2:15	1994	270.5	275.3	60%	4.3"	30.29"	71F
10/31/01	05:56p	Logged	2:30	2005	300.6	305.8	60%	4.3"	30.29"	71F
10/31/01	06:11p	Logged	2:45	2008	330.7	336.4	60%	4.3"	30.29"	71F
10/31/01	06:26p	Logged	3:00	2003	360.8	367.0	60%	4.3"	30.30"	71F
10/31/01	06:41p	Logged	3:15	2004	390.9	397.6	60%	4.3"	30.30"	71F
10/31/01	06:56p	Logged	3:30	2005	420.9	428.2	60%	4.3"	30.30"	71F
10/31/01	07:11p	Logged	3:45	2004	451.0	458.8	60%	4.3"	30.31"	71F
10/31/01	07:26p	Logged	4:00	2010	481.1	489.5	60%	4.2"	30.31"	71F
10/31/01	07:41p	Logged	4:15	2004	511.2	520.1	60%	4.3"	30.31"	71F
10/31/01	07:56p	Logged	4:30	2005	541.3	550.7	60%	4.3"	30.31"	71F
10/31/01	08:11p	Logged	4:45	2003	571.3	581.3	60%	4.3"	30.31"	71F
10/31/01	08:26p	Logged	5:00	2003	601.4	611.9	60%	4.3"	30.31"	71F
10/31/01	08:41p	Logged	5:15	1999	631.4	642.5	60%	4.3"	30.31"	71F
10/31/01	08:56p	Logged	5:30	1998	661.4	673.2	60%	4.3"	30.31"	71F
10/31/01	09:11p	Logged	5:45	2002	691.4	703.8	60%	4.2"	30.32"	71F
10/31/01	09:26p	Logged	6:00	1996	721.5	734.4	60%	4.3"	30.32"	71F
10/31/01	09:41p	Logged	6:15	1993	751.5	764.9	60%	4.2"	30.32"	71F
10/31/01	09:56p	Logged	6:30	2006	781.6	795.5	60%	4.3"	30.32"	71F
10/31/01	10:11p	Logged	6:45	2001	811.6	826.1	60%	4.2"	30.32"	71F
10/31/01	10:26p	Logged	7:00	1999	841.7	856.7	50%	4.3"	30.32"	71F
10/31/01	10:41p	Logged	7:15	2000	871.8	887.3	50%	4.3"	30.32"	71F
10/31/01	10:56p	Logged	7:30	2003	901.8	917.9	50%	4.3"	30.32"	71F
10/31/01	11:11p	Logged	7:45	1995	931.9	948.5	50%	4.3"	30.31"	71F
10/31/01	11:26p	Logged	8:00	1993	961.9	979.1	50%	4.3"	30.31"	71F
10/31/01	11:26p	Stop Samp								
10/31/01	11:31p	Power down								

Form No: APB-100

8.3 Standard Charger

The Standard Charger is designed to charge the *Buck-VSS™* and *BUCK-BASIC™* pump battery pack in 16 hours. The connection is made through the charge port on the rear bottom of the battery pack. The RED LED light on the A/C charger will light. After 16 hours, the pump batteries will be fully recharged for portable operation. The battery pack can be charged either on or off the *BUCK-VSS™* pump.

Note: The percent battery capacity display will not be accurate during charging. The percent is only accurate when the pump is on and running for a period of 10 minutes. At this time the battery chemistry is providing the voltage, and not a static charge on the electrodes of the battery.

A. A/C Power Supply (continuous sampling)

The *Battery Eliminator™*, an accessory for BUCK pumps, has been redesigned. No longer is it required to remove the battery pack and re-attach a special case with an A/C power cord.

Current design is called *A/C Power Supply™* and plugs directly into the battery already attached to the pump. This applies voltage through the battery pack and keep the batteries charged during normal sampling. In the event of a A/C power failure the batteries take over and will continue to operate the pump. Extreme loads or high flows shorten the time of this battery backup sampling feature.

The *A/C Power Supply™* is for universal for use from 90 to 240VAC, 50-60 Hz. Part No. is APB -109056.

8.4 Interchangeable Batteries

The *BUCK-VSS™* Series incorporates a unique system of interchangeable batteries to provide additional flexibility in sampling. The single packs are standard for the *VSS-1* and *VSS-5*. A triple pack is available for extended run times and has with all of the required intrinsic safe approvals. The *VSS-12* comes with a triple pack that is not intrinsic safe and can only be used on the *VSS-12*. All *BUCK-VSS™ Series* Pumps will recharged in 1 (one) hour with either the *BUCK FastOne™* or *FastFive™* Charger for the standard (single) and 3 (three) hours for the triple packs.

See Appendix A7 for a complete listing of the battery packs for each model.

Intrinsic Safety approval are listed at the rear of this manual from ETL.

APPENDIX

APPENDIX A

Performance, Accessories and Parts

Contents: Pump performances tables and run times, example of Log History Report, Update Firmware and Parts and Accessories.

APPENDIX B

Service and Maintenance

Contents: Pump drawings and part numbers

APPENDIX A - Performance, Accessories and Parts

A.0 Helpful Hints and Tips

The following steps may be used to observe pump sensors, clock and current drain. Pressing the HOLD key for 5 seconds in the Main Menu display with Run menu blinking. The hidden display will appear with the readings of BP, DP, T, Date and time and battery drain in mili-amperes. Press Enter key to leave this display.

A.1 Flow Calibration

Flow Calibration is a stable process and has shown with experience not to change. It is good practice to verify flow using an external CALIBRATOR on a routine basis (as often at start and again at end of sampling day). Experience has shown an interval of recalibration once a month will provide the creditable documentation. Creditable documentation would be a record of the “pump flow” showing the calibration date and flow. The consistent repetitive results verify a monthly interval is sufficient. However, calibration of the pumps flow should be conducted at intervals consistent with the user’s standards.

A.2 Battery Conditioner and Life Test

This option located under the Reset Mode will completely discharge a battery pack and automatically display the mili-ampere hours (maH) discharged, the Battery percentage (%) and elapsed time of test. To obtain the true purpose of this test, first charge the pack on the Fast One or Fast Five Charger. Then perform the Battery Conditioner and Life Test. The data at the end of the test will indicate whether the battery pack still retains its full 1,500 maH capacity or 4500 maH if it is a triple pack. The pack must be recharged after the test. This process, performed on a monthly basis, will extend the battery life and remove any potential for a memory problem.

A.3 History Log Reports

History Log Reports are printed directly to any parallel port printer with the special conversion (serial to parallel) cable, (APB-109102). Logs are stored at an interval selected under the SETUP Menu. The logging can be selected from 1 minute to 59 minutes per hour. **The total amount of logs are 800. Once full, the new data is lost.** Option to clear the logs can be found under the Print Menu. See “Sample of Pump History Report” on next page.