
The BUCK PUMPS

The BUCK I.H. PUMP™

The BUCK S.S. PUMP™

The BUCK H.F. PUMP™

The BUCK sH.F. PUMP™

Instruction Manual

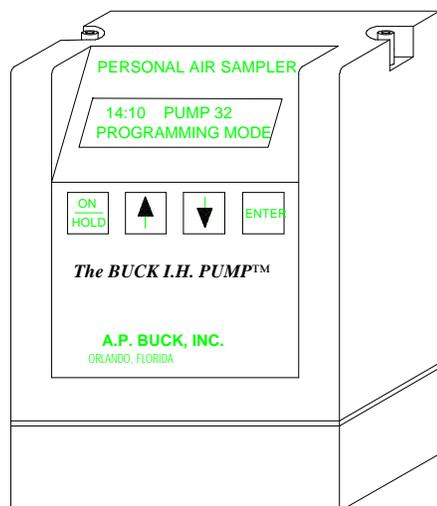


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Pump Features

The purpose of these battery-operated sampling pumps is to draw contaminants from the air on to sampling media such as adsorbent sample tubes, filters, impingers, gas sample bags, or long-duration color detector tubes. The analytical method and the type of contaminants being sampled determine the selection of sampling media. Many sampling methods specify the use of filters for collection. The pore size, diameter, and filter material affect the ability of the pump to draw air onto the filter for collection. The capabilities of each model is presented in the Appendix of this manual.

MODELS AVAILABLE	
PUMP TYPE	PUMP LABEL
IHUL PUMP Range: 5cc to 5000 cc/m Timing Routine	<i>The BUCK I.H. PUMP™</i> P.N. APB-921000
SS UL PUMP Range: 600 to 5000 cc/min* No Timing Routines	<i>The BUCK S.S. PUMP™</i> P.N. APB-922000
HF PUMP Range: 1 to 10 LPM* Timing Routines	<i>The BUCK H.F. PUMP™</i> P.N. APB-903000
sHF PUMP Range 1 to 10 LPM* No Timing Routines	<i>The BUCK sH.F. PUMP™</i> P.N. APB-904000

All models of the Buck pumps are capable of filling gas sampling bags. Flows from 5 to 800 cc/m are obtainable using the Universal Low Flow Tube Holder (P.N. APB-109030).

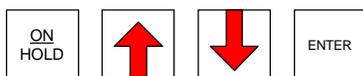
These pumps are designed to collect air samples using accepted industrial hygiene principles and techniques. They assure the highest degree of reliable end of day samples and incorporate unique features. Flexibility of setting the pump configuration allows from the simplest ON/OFF, DELAYED START, 5 minute cycles of ON/OFF and auto OFF. The sampling display of all pumps provide elapsed time, flow rate and sample volume collected. A 16 bit microprocessor controls the pump's digital flow and volume calculations. An internal clock with separate battery backup is used for all timing routines.

* All pumps have extended low flow sampling from 5 to 800 cc/m using the optional Universal Low Flow Holder (P.N. APB-109030).

Pump features (continued)

Pump Features in Detail

•**DISPLAY:** A 16-digit, 2-line alpha/numeric LCD displays the pump operation and programming. In general, the top line indicates pump information with the second line for information requiring a response from the user on the status of the pump. Some displays scroll to present complete information.

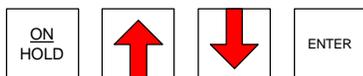


•**KEYPAD:** The four keys (ON/HOLD, ↑, ↓, ENTER) serve interactive roles. The ON/HOLD key also serves as an Escape key in sub-MENUS. The ARROW keys scroll with various menus and numbers for flow. The ARROW key also operates as a toggle switch to change commands to YES or NO. The ENTER key accepts the current display message.

•**MENUS:** A menu system provides the ability to set pump flow rate, enter calibrator flow rate, clear previous data and turn pump off. *The BUCK I.H.* and *The BUCK H.F. PUMPS™* have additional Menus to allow Timing Routines for delayed start and auto off.

•**PUMP CONTROL:** An internal RPM (revolution per minute) sensor maintains constant flow and monitors for changes in flow, battery voltage, gradual filter plugging, flow interruption, hose disconnect, and filter tearing or displacement. The pump flow rate is adjusted using the arrows and observing the Power Bar Graph display for the amount of power being sent to the pump motor. A percentage of the pump's power range is displayed at the lower right of the Bar Graph. This feature is provided to allow a fast return to a desired flow rate.

•**DATA STORAGE:** RAM memory backup system saves sampling information and is independent of the pump battery pack power. The data saved includes: elapsed time, temperature, flow rate and calculated sample volume based on actual flow rates.



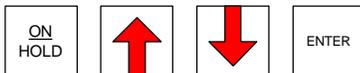
•**BATTERY MONITOR:** To ensure an ample power supply for the sampling period, the pump displays battery capacity during the sampling run time. Based on a fuel gauge approach of 0 to 100%, the capacity is displayed during sampling, at the QUIT display, and during start-up. To conserve battery life, the pump will turn itself off if inadvertently turned on and no keys are touched for 5 minutes.

Pump features (continued)

•**TEMPERATURE DISPLAY:** The pump has an internal thermistor which averages the temperature every minute for the sampling period. The temperature range is 0 to 45°C or 32° to 120°F. It is displayed during sampling and at ending display. Under Configure Mode, the default to Celsius or Fahrenheit degrees is selectable.

•**CONSTANT FLOW (600 to 5000 cc/m):** In addition to flow monitoring, the pump maintains a constant speed using a tracking algorithm continuously to adjust the power to the motor once every 6 seconds. A mathematical formula is used to track every second of the pump speed to monitor battery power decrease and filter plugging. Filter plugging causes a reduction in pump efficiency and requires an increase in the RPM to maintain the desired flow. Both events are controlled to hold the flow at $\pm 3\%$ of selected flow. Any loading on the filter that is greater than 10% in a 1-second interval will cause FLOW INTERRUPT, and would not be a valid sample. The pump is capable of responding to increased back pressure (clogging the filter) every minute to over 500% in one hour, i.e., four inches of back pressure to 20 inches while maintaining flow of $\pm 3\%$ or less.

ATTENTION
FLOW INTERRUPT



FILTER OFF
PRESS ENTER

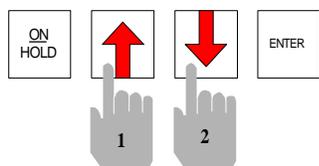


•**FLOW BLOCKAGE (INTERRUPT) OR HOSE OFF (FILTER OFF):** This feature tracks the pump's speed every second. A threshold variance of 10% above or below the desired speed stops the pump and elapse time until the desired speed can be maintained. The flow monitoring detects hose kinking or disconnecting and filter tearing or displacement. The pump resumes sampling after correcting either situation. If the flow is interrupted, 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. The FILTER OFF feature stops the pump, elapse clock and changes the display to FILTER IS OFF, press ENTER. Reattaching the filter and pressing ENTER will resume sampling. This feature functions only when in the SAMPLING MODE.

•**DIAGNOSTIC TESTS:** On start up, the pump displays pump serial number and checks for battery capacity and RAM memory. The pump does not monitor the speed sensor during diagnostic testing; only during adjust flow display.

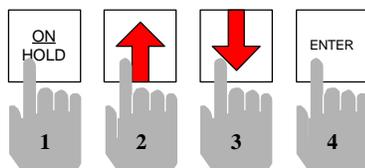
Pump features (continued)

ADJUST FLOW WITH ARROW KEYS
 20%

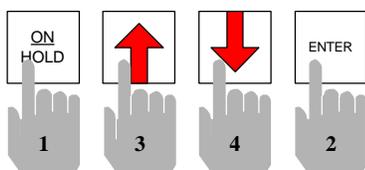


•**FLOW ADJUSTMENT AND CALIBRATION:** The pump flow rate is adjusted using the arrow keys while at the Power Bar Graph Display. Once the desired flow is determined by a mini-BUCK calibrator, the flow is entered establishing the true digital flow factor for the filter in use.

KEYPAD CODE LOCK SYSTEM



•**SAMPLING MODE (Keypad Lock):** Four keypad entries release the lock which stops the pump during sampling.



•**CONFIGURE MODE (Security Code Lock):** The pump uses a different set of codes to prevent entry and erasing of data. These two systems provide the security necessary to collect a valid set of sampling results. Both lock systems have the options of being activated or not. The predefined codes are not changeable.

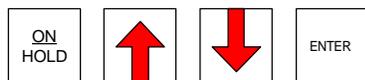
•**BATTERY POWER:** The pump battery pack consists of four sub-C nickel cadmium batteries. The batteries are rated at 1800ma hour capacity. When a battery pack or pump with battery pack is placed in **The BUCK "Auto-Quik" Charger™**, a red light will indicate (after a 3-second delay) the cycle has begun. The charge cycle takes approximately 60 minutes. Individual packs may be charged independently. The pump may be left in trickle charge indefinitely.

CONTINUOUS SAMPLING: The pump is capable of running continuously with the battery eliminator P.N. APB-109008 attached to the pump. The UL intrinsic safe models cannot use the battery eliminator in hazardous areas.

•**DIGITAL FLOW AND VOLUME DISPLAY:** The flow rate is 2% accurate of any display. A flow factor is created when the actual (True) flow rate, measured by *The mini-BUCK CALIBRATOR™*, is entered into the pump display. This flow factor is displayed as flow every second based on the RPM of the pump. The volume is added to a running number of Liters every second. The volume is accurate to 10cc or 0.010 Liters. When using the Universal Low Flow Holder for flows less than 800cc/m, the pump displays a set flow rate; and the volume is simply a multiplication of the elapse time and the set flow rate.

NORMAL SAMPLING DISPLAY

100% 80F ELAPSED 0:00
 0.01L 1986 cc/m



Pump features (continued)

•PUMP CASE: The rugged polycarbonate case is highly water resistant. Inlet and outlet ports are recessed for added protection. By removing the protective cover plate on the right side of the pump case, an overnight battery charger may be connected. The battery pack must be attached to the pump for overnight charging. Four self retaining screws on the bottom of the pump allow for removal of the battery pack.

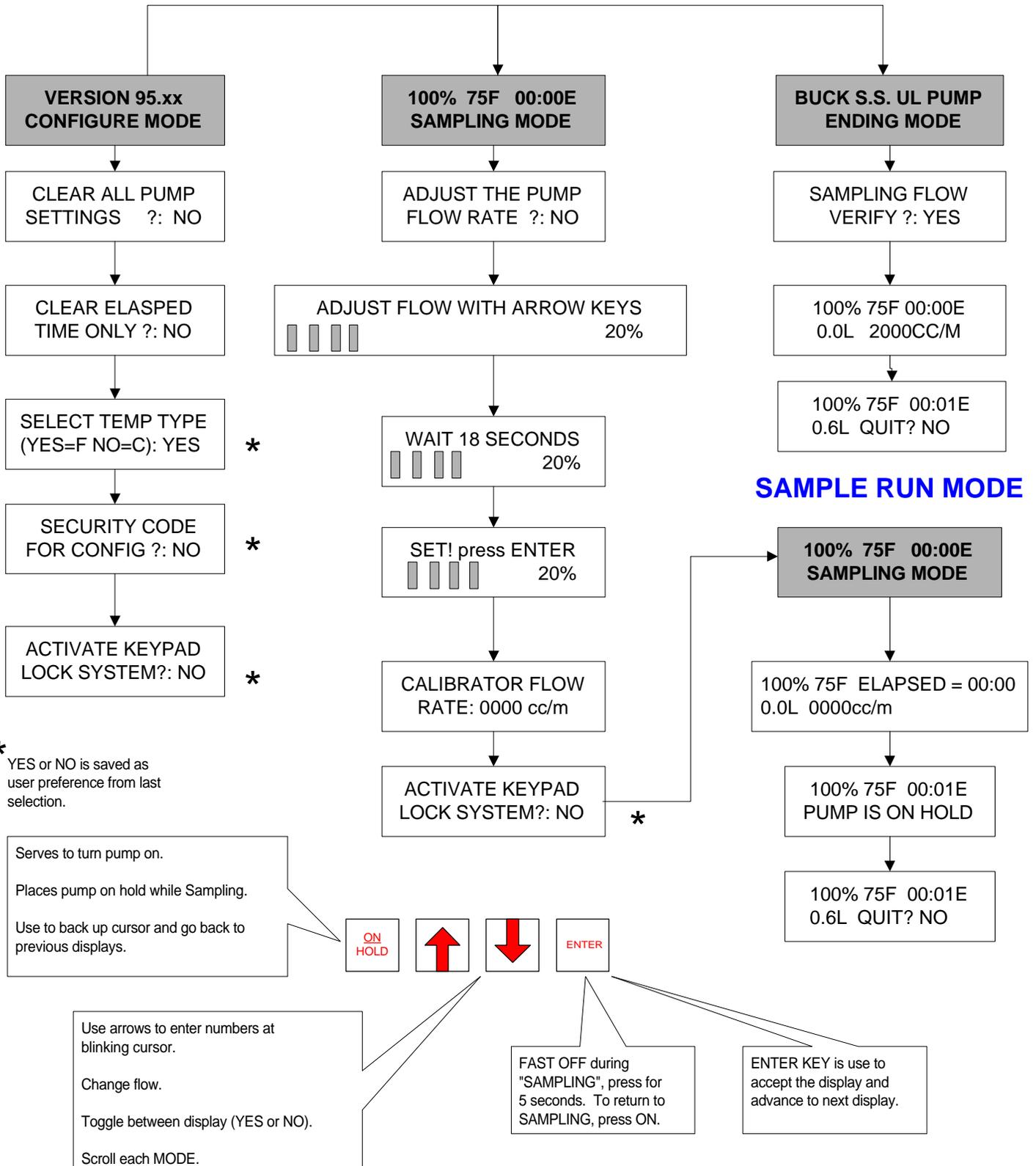
•SHIELDING FOR RFI AND EMI: The BUCK line of digital pumps are inherently immune to RFI and EMI. They meet the test criteria of other pump manufacturers with shielded cases. See Appendix for more details.

This manual describes the operation and maintenance of the pump. It does not detail sampling and analytical techniques. For this information, one of the best general reference is the **NIOSH Manual for Analytical Methods** from the U.S. Government Printing Office.

Section 1

S.S. AND sHF PUMPS

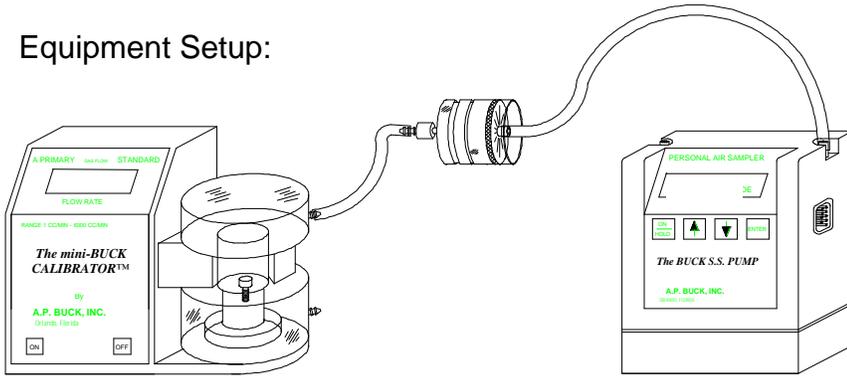
VERSION 95



Section 2

QUICK REFERENCE GUIDE TO SAMPLING FOR S.S. and sH.F. PUMPS

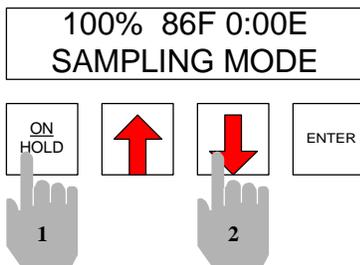
Equipment Setup:



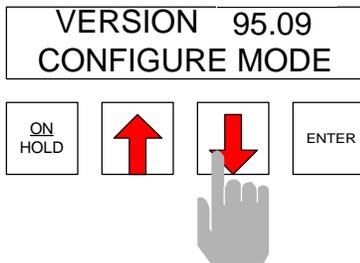
Equipment:

- ◆ mini-BUCK Calibrator with soap
- ◆ Pump, any model fully charged
- ◆ 37 mm 0.8u filter cassette
- ◆ Three feet vinyl tubing
- ◆ 1 Luer Hose adapter

THE FOLLOWING STEPS ARE TO CLEAR ANY PREVIOUS PROGRAMMING



Turn on the pump. This display will appear. *The BUCK I.H.* and *The BUCK H.F. PUMPS™* will alternate to display Pump System Time. Down arrow to CONFIGURE MODE.

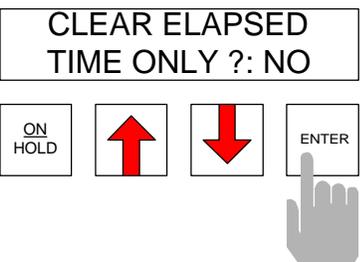
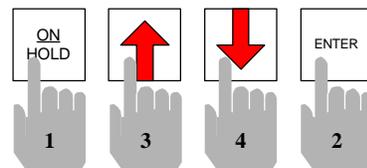


Enter CONFIGURE MODE by pressing ENTER. If the Security Code for Configure Mode is ON, the next display will appear. If not, CLEAR ELAPSED TIME ONLY display will appear.



If Security Code is ON, the display will look like this.

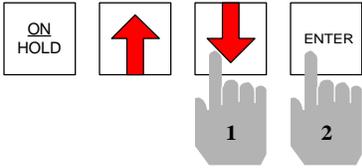
Code sequence



Leave at NO by pressing ENTER or YES by pressing an arrow key.

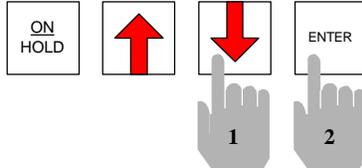
This function only erases the elapsed time, average temperature, and true volume.

CLEAR ALL PUMP SETTINGS ? : NO



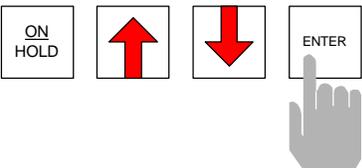
Press arrow key to YES, and then press ENTER. ***This clears all settings.***

SELECT TEMP TYPE (YES=F NO=C): YES



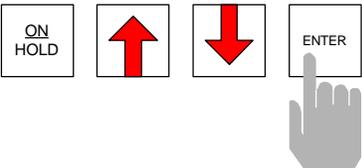
Select appropriate Temperature
F = Fahrenheit Degrees
C = Celsius Degrees

SECURITY CODE FOR CONFIG ? : YES



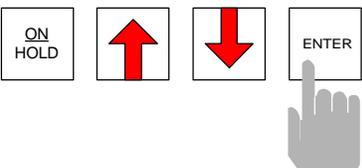
By leaving YES, it will prevent changing displays under CONFIGURE MODE unless the code is entered.

ACTIVATE KEYPAD LOCK SYSTEM?: YES



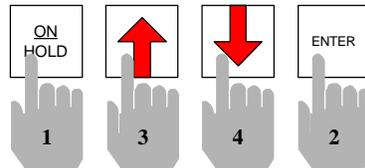
Leaving YES will leave keypad lock on during SAMPLING. To unlock keypad and stop pump, press in sequence:1,2,3,4.

BUCK S.S. PUMP UL ENDING MODE

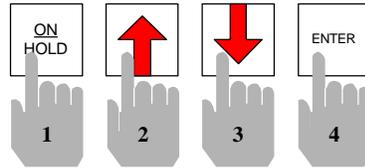


Press ENTER to QUIT or Down Arrow to SAMPLING MODE.
(The pump model will display on the top line)

The BUCK S.S. PUMP™ UL
The BUCK sHF PUMP™



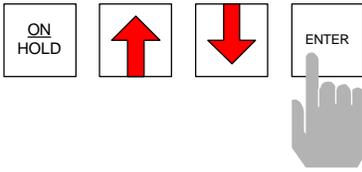
Code sequence



Code sequence

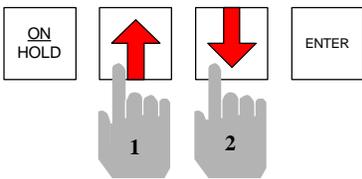
THE FOLLOWING 6 STEPS SET THE BASIC REQUIREMENT FOR SAMPLING

100% 80F 0:00E
SAMPLING MODE



Enter the SAMPLING MODE.

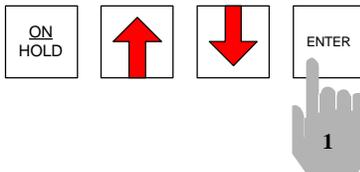
ADJUST FLOW WITH ARROW KEYS
20%



The POWER BAR GRAPH advances to the right as more power is sent to the pump motor. The 20% advances to match the BAR GRAPH. The default of 20% is the approximate flow of 2000cc/m with a 37mm 0.8u filter.

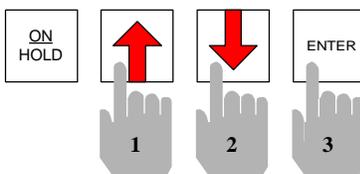
Measure the flow with *The mini-BUCK Calibrator*TM. A countdown clock will appear to allow time for the setting of the flow control after the keys have not been touched for four seconds.

SET! press ENTER
20%



Once the pump control is set this display appears, press ENTER.

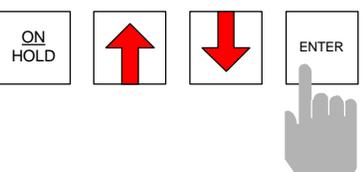
CALIBRATOR FLOW
RATE: __ 0 cc/m



Enter the measured flow to match the display of *The mini-BUCK Calibrator*TM.

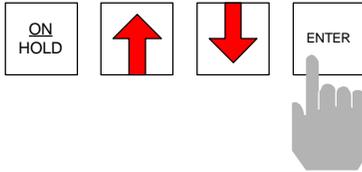
- ◆ ARROW keys adjust the numbers.
- ◆ ENTER accepts and moves to next digit.
- ◆ The ON / HOLD key moves back for editing.
- ◆ ENTER at last digit advances to next display.

ACTIVATE KEYPAD
LOCK SYSTEM?: YES



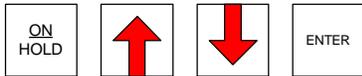
Change to YES will activate the keypad lock under SAMPLING MODE.

100% 80F 0:00E
SAMPLING MODE



Press ENTER.
Sampling will start or Arrow key to ENDING MODE to quit.

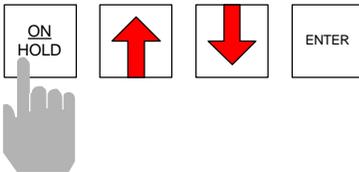
100% 80F ELAPSED 0:00
0.01L 1986 cc/m



Normal Sampling Display.
Battery Power, Average Temperature, Elapsed time are on the top line! True Volume and Actual Flow is on the bottom line.

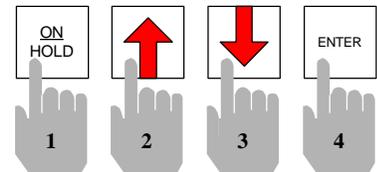
TO STOP SAMPLING AND TURN OFF PUMP

ENTER CODE TO
UNLOCK KEYPAD



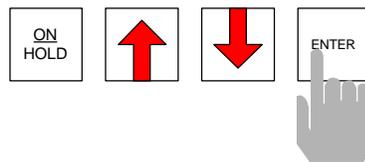
Press ON/HOLD Key,
Enter Keypad Lock Code if activated

ENTER CODE TO



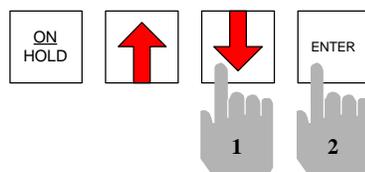
The sequence of pressing the keys must be done in this order while the display states ENTER CODE TO UNLOCK KEYPAD. Display stays active for 15 seconds to allow time to enter code.

60% 80F 6:09E
PUMP IS ON HOLD



Press ENTER.

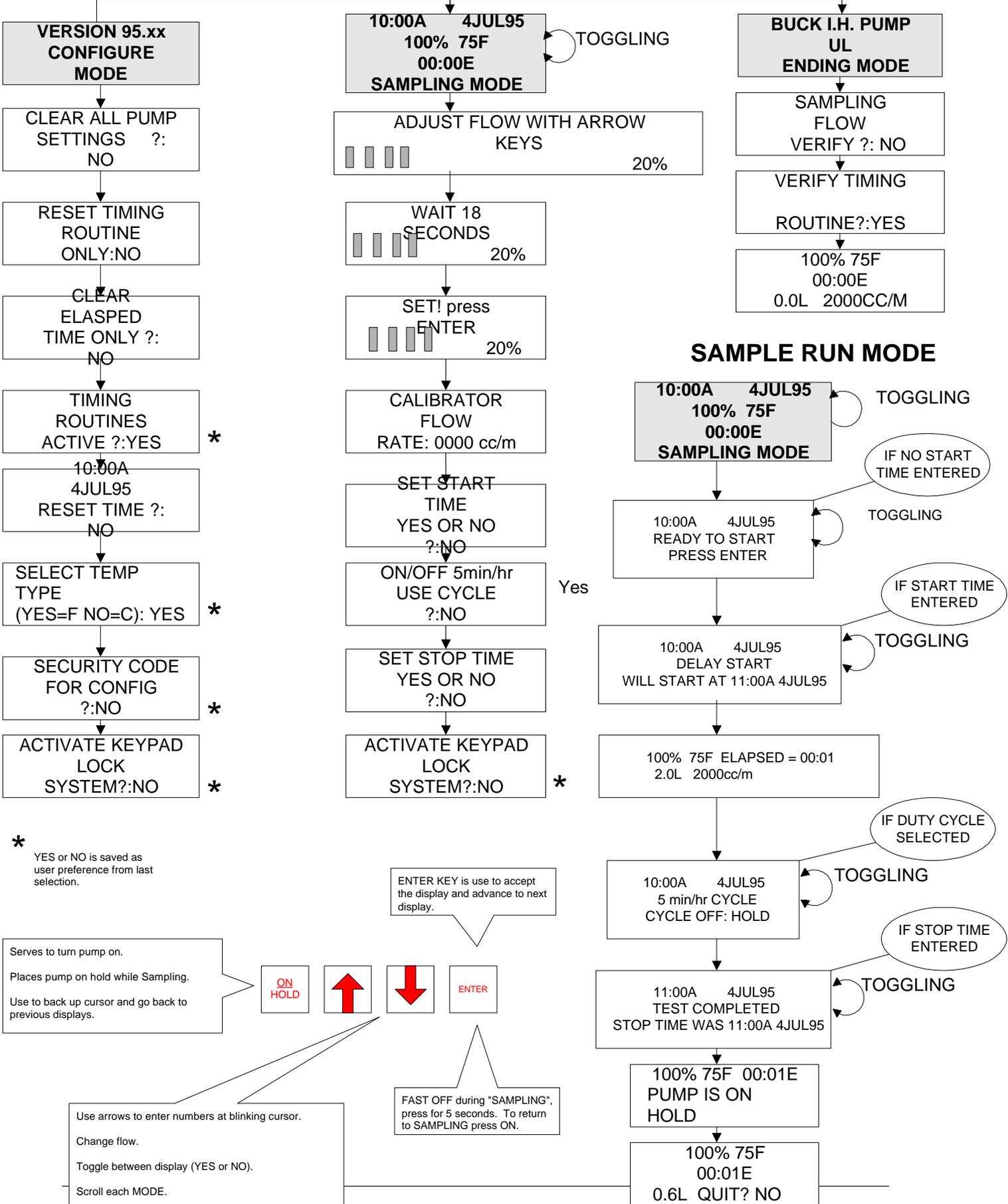
60% 80F 6:09E
320.8L QUIT?: NO



Change NO to YES and press ENTER.
Turning pump back on will go to SAMPLING MODE.
Press ENTER to resume sampling.

Section 3

I.H. AND HF PUMPS VERSION 95



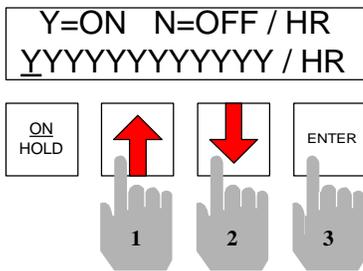
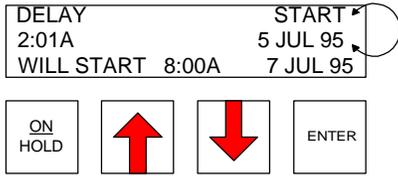
Section 4

Programming with Timing Routines for *The BUCK I.H.* and *The BUCK H.F. PUMPS™*

Purpose of Timing Routines:

The TIMING ROUTINES allow the following features to be programmed by the I.H. and H.F. pump keypad. The timing is based on an internal clock accurate to one second per day. It has its own battery backup system.

1. A Delayed Start and Auto Stop of sampling is set by Time, Day, Month and Year. This allows for daily sampling by entering a precise time or *none* to Start and Stop on command when user is ready. The pump must be turned ON to activate the Auto Start. Setting by Day is useful for indoor air quality sampling over extended periods using the battery eliminator (P.N. APB-109008) for all models of BUCK pumps.
2. ON/OFF 5 min/hr. cycle feature allows the sampling to stop for 5-55 minute intervals each hour of sampling. This allows for reduced filter plugging but still gives a full 8 hour Time Weighted Average (TWA) with only 4 hours of sampling (every other cycle is off in this statement).

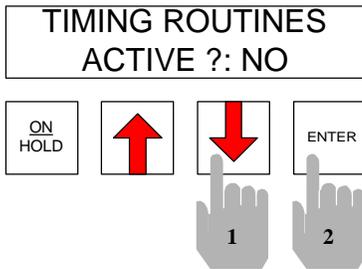


Operation of Timing Routines

Each of the pump's modes plays a roll in using the ROUTINES.

CONFIGURE MODE

Allows the option of Timing Routines to be ON or OFF. When selected to OFF no displays associated with timing will appear. The System Internal Clock is set under CONFIGURE MODE. To modify a Timing Routine after sampling has started, return to CONFIGURE MODE to reset.



SAMPLING MODE

The programming of the START CYCLES and STOP displays appear after setting the pump flow rate. The option to put in NO for each gives the user the ability to start and stop on their command if no times are entered.

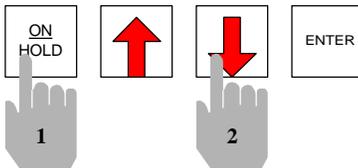
ENDING MODE

The ENDING MODE serves as the MODE to VERIFY FLOW and TIMING ROUTINE SETTINGS and to QUIT and turn the pump off. When VERIFY TIMING ROUTINES is selected as YES, the next displays will appear for the programmed START CYCLES and STOP as set under SAMPLING MODE.

When using the delayed start feature, the pump must be ON under SAMPLING MODE with the *display stating the START TIME.*

INITIAL SET UP FOR CONFIGURE MODE

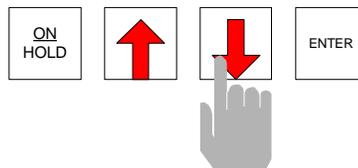
100% 86F 0:00E
SAMPLING MODE



Turn on the pump. This display will appear.

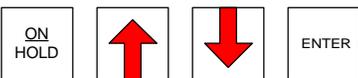
Down arrow to CONFIGURE MODE.

VERSION 95.09
CONFIGURE MODE



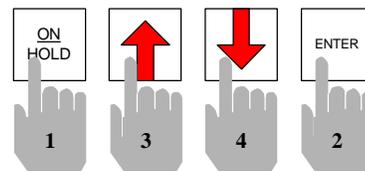
Enter CONFIGURE MODE by pressing ENTER. (If the Security Code for Configure Mode is ON, the next display will appear; if not CLEAR ELAPSED TIME display will appear).

ENTER SECURITY
CODE TO PROCEED

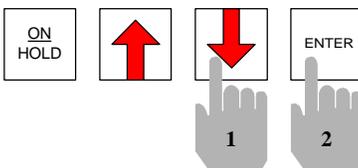


If Security Code is ON, the display will look like this.

Code sequence

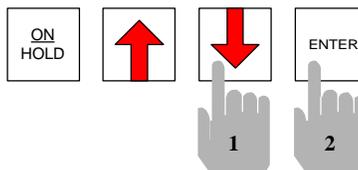


CLEAR ALL PUMP
SETTINGS ? : NO



Press arrow key to YES, and then press ENTER. ***This clears all Preprogrammed settings if desired. Leave NO if only certain setting need to be reset.***

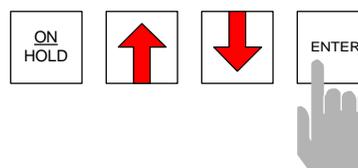
TIMING ROUTINES
ACTIVE ? : NO



Change to NO if not desired.

The selection is saved and will return to user preference each time.

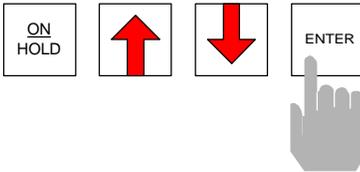
CLEAR ELAPSED
TIME ONLY ? : NO



Leave at NO by pressing ENTER or YES by pressing an arrow key.

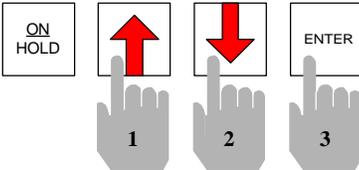
This function only erases the elapsed time, average temperature, and true volume.

10:08A 4 JUL 95
RESET TIME?: NO



This display is the pump system clock. If correct leave at NO. To adjust change to YES.

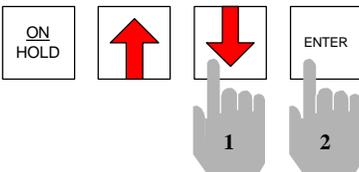
10:11A 4 JUL 95
10:11A 4 JUL 95



UNDERLINED DIGITS INDICATE BLINKING TEXT

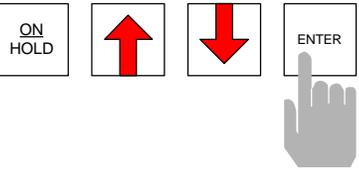
To adjust, use the arrow keys to change. ENTER key will advance across the display for hours, minutes, day, month, and year. The ON/HOLD key will move blinking display back for correcting previous selections.

SELECT TEMP TYPE
(YES=F NO=C): YES



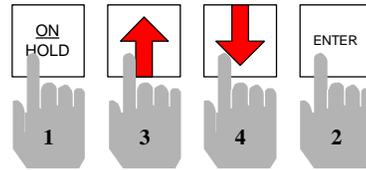
Select appropriate Temperature
F = Fahrenheit Degrees
C = Celsius Degrees
The selection is saved and will return to user preference each time.

SECURITY CODE
FOR CONFIG?: YES

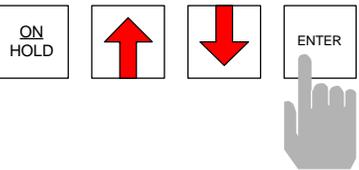


By leaving YES, it will prevent changing settings under CONFIGURE MODE unless the code is entered.

Code sequence

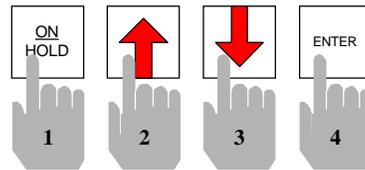


ACTIVATE KEYPAD
LOCK SYSTEM?: YES

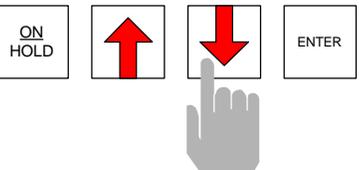


Leaving YES will leave keypad lock on during SAMPLING. To unlock and stop pump, press in sequence: 1,2,3,4.

Code sequence

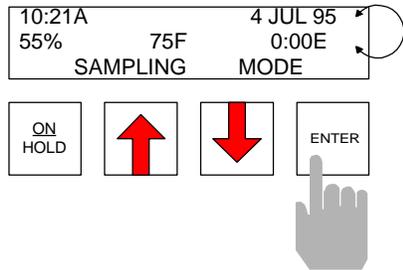


BUCK I.H. UL PUMP
ENDING MODE

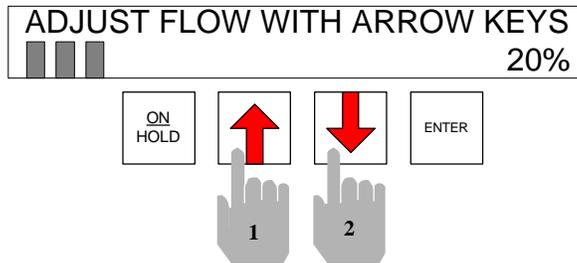


Down Arrow to SAMPLING MODE or press ENTER to quit.
(The pump model will display on the top line.)

BEGIN PROGRAMMING PUMP WITH TIMING ROUTINE

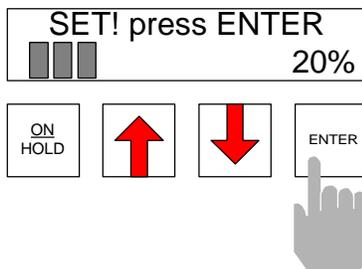


Top line will alternately display time and date with battery %, temperature and elapsed time. Press ENTER to begin setting the pump to sample.

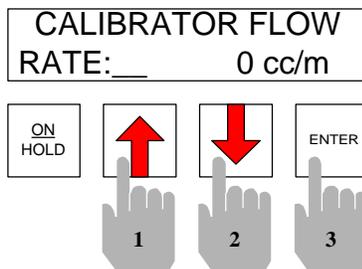


The POWER BAR GRAPH advances to the right as more power is sent to the pump motor. The 20% advances to match the BAR GRAPH. The default of 20% is the approximate flow of 2000cc/m with a 37mm 0.8u filter.

Measure the flow with *The mini-BUCK Calibrator*TM. Once a desired flow has been measured by *The mini-BUCK Calibrator*, press ENTER. A countdown clock will appear to allow time for the setting of the flow control after the keys have not been touched for four seconds. This countdown clock may recycle and start to count down a second time. This is normal as the program monitor for RPM counts must be accurate before advancing to the next display.



Once the pump control is set, this display appears. Press ENTER.

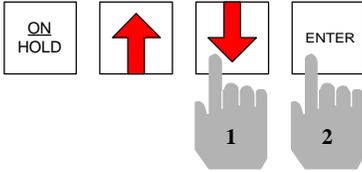


Enter the measured flow to match the display of *The mini-BUCK Calibrator*.

- ◆ ARROW keys adjust the numbers.
- ◆ ENTER accepts and moves to next digit.
- ◆ The ON / HOLD key moves back for editing.
- ◆ ENTER at last digit advances to next display.
- ◆ **The pump will stop.**

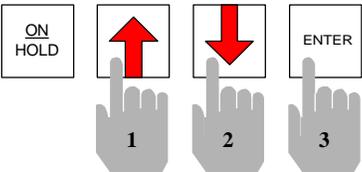
The next displays will appear only if TIMING ROUTINES are selected to be ON under CONFIGURE MODE.

SET START TIME
YES OR NO ? : YES



Press ENTER or use arrows to change to NO if none desired.

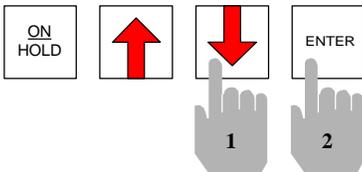
ENTER START TIME
10:29A 4 JUL 95
08:00A 5 JUL 95



This display defaults to 8:00A blinking to allow setting in comparison to the Pump System Time being displayed on the top line.

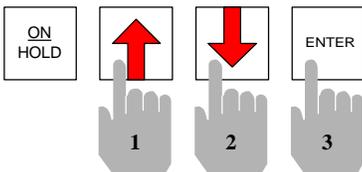
Arrows scroll up or down through all times, month, day and year. ENTER key advances the blinking display. The ON/HOLD key will back up blinking digits for revision.

ON / OFF 5min / hr
USE CYCLE ? : NO



This display is the opportunity to have the pump cycle OFF and ON at 5 minute intervals during each hour. Changing to YES will give the following display.

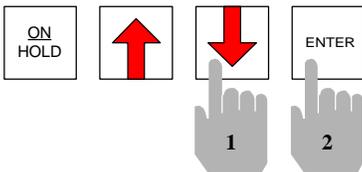
Y=ON N=OFF / HR
YYYYYYYYYYYYYY / HR



There are 12 Y's each representing 5 minutes (12x5) the equivalent of 60 minutes/hour. The arrow keys change each 5 minutes to N (no) for OFF or Y (yes) for ON at each 5 minute interval.

ENTER key advances across the 12, 5 minute intervals. The ON / HOLD KEY backs up the blinking Y or N.

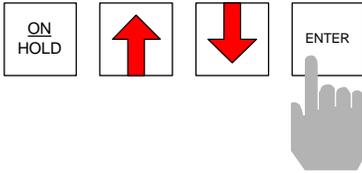
SET STOP TIME
YES OR NO ? : YES



Press ENTER to set desired time for pump to STOP and turn OFF.

Changing to NO will cause the pump to sample until turned off by the user or the batteries are depleted.

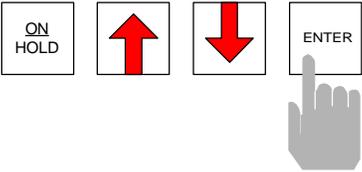
ACTIVATE KEYPAD
LOCK SYSTEM?: YES



Changing to NO will deactivate the keypad lock under SAMPLING MODE.

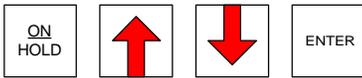
Keypad Lock ON during sampling is the recommended practice. This prevents accidental touching of the HOLD key and stopping the pump.

7:00A 5 JUL 95
90% 73F 5 JUL 95
SAMPLING MODE



After programming, the SAMPLING MODE appears. The user may arrow to ENDING MODE to turn pump off or press ENTER to continue with sampling.

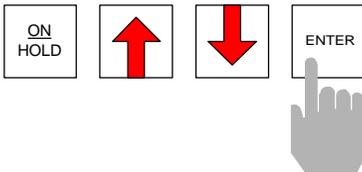
DELAY START
2:01A 5 JUL 95
WILL START 8:00A 7 JUL 95



This display will appear when a delayed start time was set. If no time was entered, "PRESS ENTER" will appear with the top line alternately displaying the pump system time. The system time is displayed as the START TIME when the ENTER key is pressed and sampling starts.

The following displays appear under ENDING MODE when the timing routines are active.

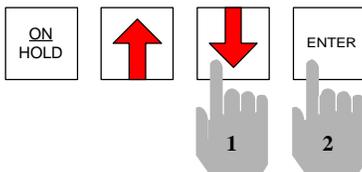
BUCK I.H. UL PUMP
ENDING MODE



The pump model is displayed on the top line. ENDING MODE allows:

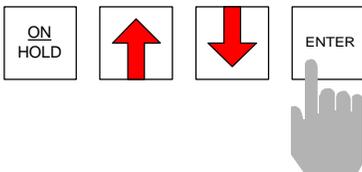
1. Verify flow with elapsed timer OFF.
2. Verify timing routines as set initially under sampling.
3. QUIT to turn pump off.

SAMPLING FLOW
VERIFY?: NO



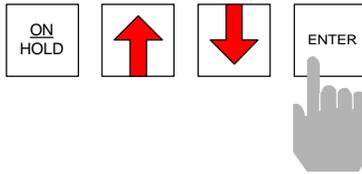
Change to YES and press ENTER to measure the current flow of pump.

VERIFY FLOW
55% 85F 0:10E
5.68L 2009 cc/m



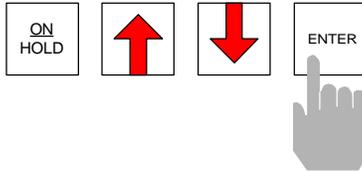
Top line alternates. The bottom line displays volume of sample (L) and flow in cc/m.

VERIFY TIMING
ROUTINE ?: YES



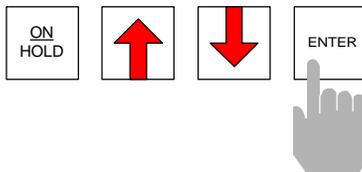
YES allows a review of TIMING ROUTINES.
Change to NO and press ENTER to skip.

PROGRAMMED: START
12:16P 4 JUL 95



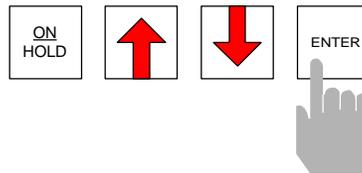
The start time is initially entered under the SAMPLING MODE. If no time was entered, the pump system time is entered when the pump begins to sample.

PROGRAMMED: CYCLE
NONE ENTERED



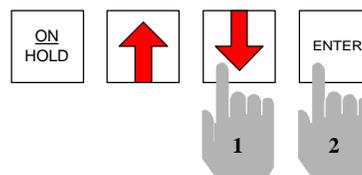
Cycles per hour were not selected in this example.

PROGRAMMED: STOP
NONE ENTERED



The display is depicting that no stop time was entered. The pump will run until stopped by user or the batteries have been exhausted. To change STOP TIME once the pump is sampling, go to CONFIGURE MODE.

55% 85F 0:10E
5.68L QUIT? NO



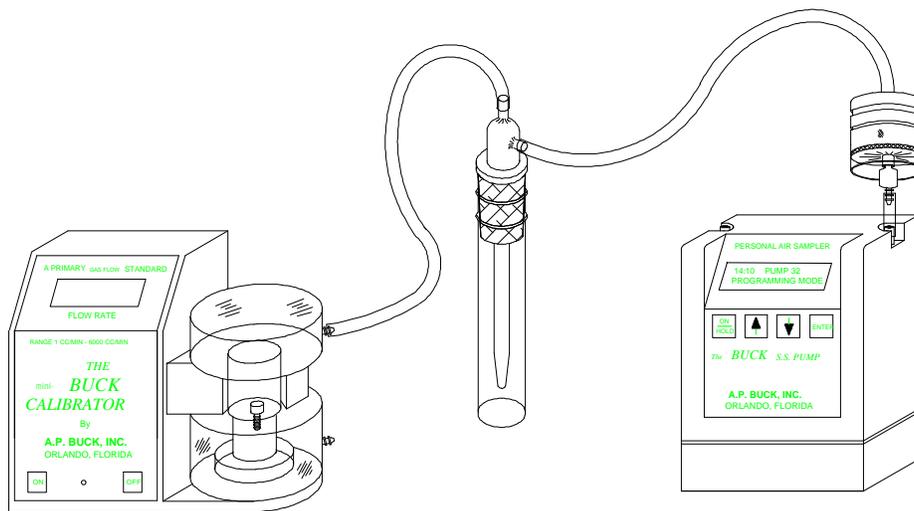
Arrow key to YES and press ENTER to quit.

Section 5

Bubbler and Impinger Sampling

SETUP:

By connecting the bubblers with solution (two or more) in series directly to the pump, adjust the power bar graph until the desired flow is reached. The actual flow is entered under CALIBRATOR FLOW rate to calculate the volume in liters.



1. Connect a standard 37mm filter cassette (with a 0.8 micron filter in place) close to the inlet of the pump. This serves as a trap to prevent any fluids from entering the pump.

2. Attach a bubbler using desired length of hose to the input of the cassette. The order of the sampling train is pump, cassette and bubbler as shown in the drawing.

3. Adjust the power bar graph with the pump ON while measuring the flow into the bubbler. Enter the measured flow and proceed to sampling.

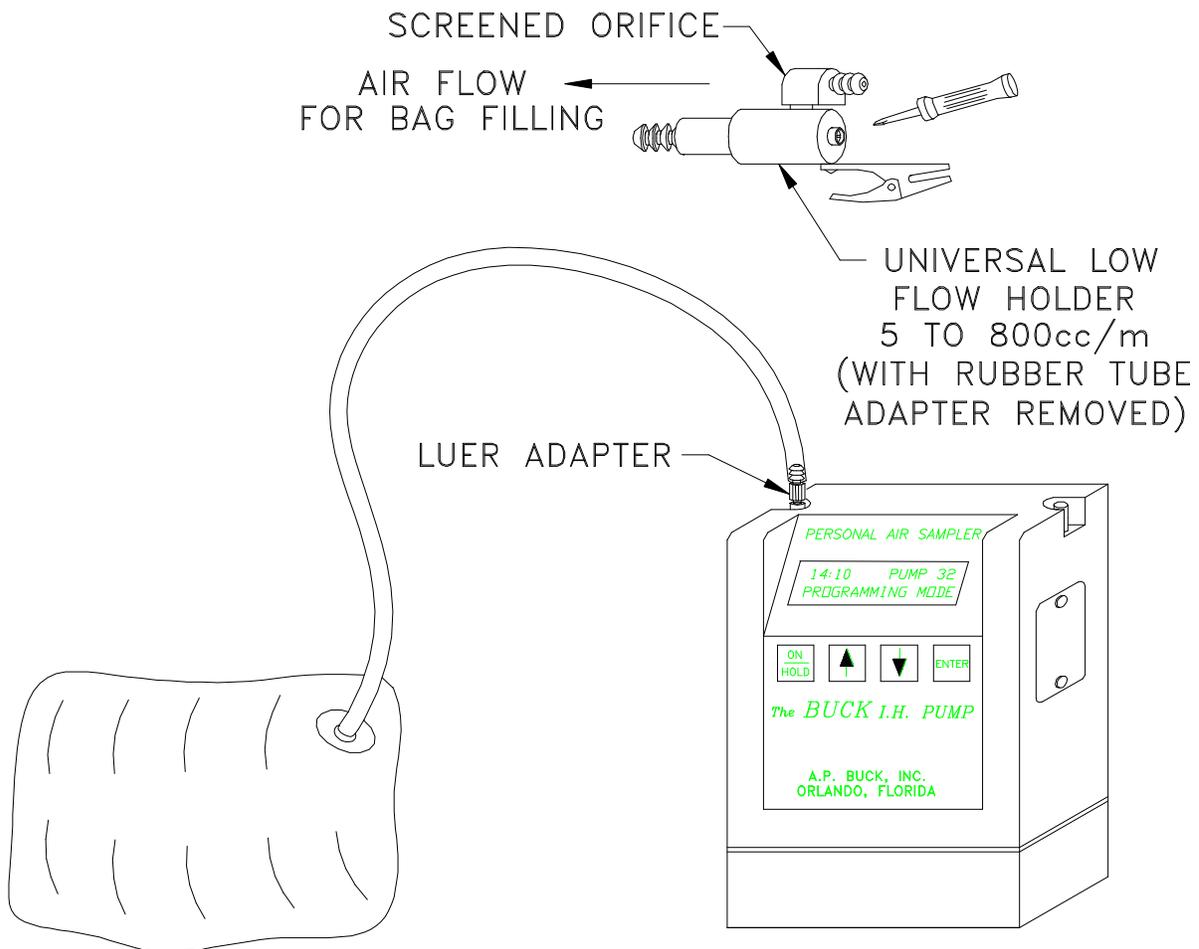
Different brands of bubblers have varying amounts of flow resistance which effect the battery life. Because of the patented flow control system of the BUCK pumps, blockage of the flow to the bubbler will not cause the motor to rapidly speed up. Other pumps speed up to overcome the blockage; and when the blockage is removed, the bubbler solution is sucked into the pump. This common occurrence will ruin a sampling pump. This cannot occur with the BUCK pumps.

Section 6

Gas Bag Filling

The *BUCK I.H., S.S., sH.F. and H.F. PUMPS™* can be used to fill a sampling bag. The outlet port is connected internally to the pump discharge. The internal materials to which a gas sample would be exposed are: vinyl tubing, acrylic, latex rubber, aluminum, stainless steel and Buna-N rubber diaphragm.

To fill a bag, remove the hex screw on the left side and use the luer/hose connector (P.N. APB-109000) with the luer inserted into the outlet of the pump. Use ¼ I.D. tubing from the connector to the gas bag. The use of the Universal Low Flow Holder (P.N. APB-109030) inserted in-line with the tubing to the bag will be necessary for flows from 5 to 800cc/m. A hose may be connected to the inlet of the pump to direct the sample into the pump.



Section 7

USING THE BUCK PUMPS WITH ADSORBENT TUBES A Quick Reference Guide

This is a quick reference guide for getting started with the pump in low flow sampling. Certain portions are repeated from other sections of the manual to provide continuity in preparing the pump for sampling. It highlights the various functions of the pump, the basic start-up steps, and use of the pump with solvent desorption and thermal desorption air sampling tubes. *It does not encompass all the details and capabilities of this pump.* Review other sections of this manual if necessary.

Because operations are menu driven, the BUCK I.H., S.S. and sH.F. PUMPS are very easy to operate. The menus are similar to many computer controlled devices. Select a menu item (using the arrow keys ↑ ↓ and the ENTER key) and answer the questions when prompted. To proceed to the next option, press ENTER. The only tools required to set the pump for sampling at a desired flow rate would be a small regular screw driver as shown on the drawing on page 25.

The pump cannot be damaged in any way by pushing any of the keys in any combination. Experiment with the pump while reading these instructions to become familiar with its operation. Display flow charts are on pages 6 and 11 for these pumps.

PUMP OPERATION

The main menu consists of three items: SAMPLING MODE, CONFIGURE MODE, and ENDING MODE. Activate the pump with the ON/HOLD key. Initially the pump serial number will be displayed. The pump then automatically cycles to the SAMPLING MODE display of the main menu. The display on the top line alternates between the time and date (these are factory set but can be changed by the user in the Configure Mode section) along with the charge status of the battery (in percent*), the temperature, and the elapsed measurement time. The bottom line indicates the main menu item (SAMPLING MODE).

*Allow the pump to be on for 10 minutes to obtain an accurate percentage of the battery. If the charge status is less than 60%, the unit should be recharged before use. When the charge drops to 30%, the display LOW! replaces the percent value.

Low Flow Sampling (5-800 cc/min)

The low flow sampling typically is used with adsorbent-containing air sampling tubes of either the solvent-desorption or thermal-desorption type (see table below). The maximum air flow this pump can draw through a particular adsorbent tube depends on the backpressure created by the tube.

Typical Maximum Flow Rates That Can Be Sustained for 8 Hours of Sampling, Using the Buck Pumps and Air Sampling Tubes*

Type of Adsorbent	Flow Rate (cc/minute)
carbon	200-400
charcoal	500-800
Florisil®	500
hopcalite	400
silica gel	400-600
Supelpak™	400-800
Tenax®	600-800
LpDNPH s 10 cartridge	1000**

Thermal desorption tubes with inside diameter \geq 4 mm: 100-200cc/minute

*Pump in Low Flow Mode, Low Flow Holder installed. Data is for older models and the new Universal Low Flow Holder.

**Flows greater than 800cc/m may need optional Non-Adjustable Low Flow Tube Holder (P.N. APB-109032).

High Flow Sampling (800-5000cc/min)

The high flow sampling typically is used with filters, impingers, bubblers, sampling bags, and large capacity adsorbent tubes.

Pumps manufactured with S.N. I001000 or higher utilize a newly designed adsorbent tube holder called the Universal Low Flow Holder (P.N. APB-109030).

The Universal Low Flow Holder will allow the pump to operate without being switched to a “Low Flow Mode”, a built in internal bypass system which was on older models. This holder is capable of operating from 5 cc/m to 800cc/m for low flow sampling by adjusting the needle valve screw head located in the center of the holder. A bypass orifice is built into the holder hose barb elbow, and a metal mesh screen protects this fixed bypass orifice. By adjusting the power scale (pump speed), back pressures up to 25 inches of water pressure can be created across an adsorbent tube. Earlier versions of the IH pump may use the Universal Low Flow Holder without switching to “Low Flow Mode”. The universal tube holder will provide constant tube flow within a maximum of 5% error of the desired flow rate.

Pumps manufactured with S.N. 3984 or lower that do not have the Universal Low Flow Holder are required to switch to Low Flow Mode for low flow sampling with the Standard Low Flow Tube Holder.

These versions of the I.H. pump have two flow rate modes: the Low Flow Mode and the High Flow Mode. The pump software remains the same in both modes.

To change between the Low Flow Mode and the High Flow Mode:

- 1 Remove the 4 screws from the bottom of the pump, then detach the battery pack.
- 2 Move the LOW FLOW OFF/ON lever in the base of housing of the pump to the ON position.
- 3 Carefully realign the pins in the base of the pump housing with the socket on the battery pack and reinstall the battery.

Use of the Universal Low Flow Tube Holder eliminates switching to Low Flow Mode on these pumps. Simply attach the Universal Low Flow Tube Holder to the pump and operate in the High Flow Mode.

Step One: Set pumps optional features, clock time and date and clear any previous programs.

CONFIGURE MODE

Pump functions such as time, temperature, keyboard lock, configuration lock, and timer operation are programmed in the CONFIGURE MODE. From the SAMPLING MODE enter the CONFIGURE MODE by using the ↑ or ↓ arrow key, then the ENTER key.

- 1 When you enter the CONFIGURE MODE, the pump display will ask CLEAR ALL PUMP SETTINGS? Use the arrow keys to display NO or YES and confirm by pressing ENTER. On initial start up, choose YES. All calibration data and timer settings will be cleared.
- 2 The display will advance to the next question: TIMING ROUTINES ACTIVE? Answer YES (use the arrow keys and ENTER) if you want to program the pump with a start time, a sample cycle, or a stop time (the sampling program will be established in the SAMPLING MODE). If you answer NO, you must start and stop the pump manually for a sample collection period.
- 3 RESET TIME? is now displayed. Use this option to set the current time and date. Select YES and ENTER. A time and date will be displayed. The hour and A or P (for AM or PM) will be flashing. Use the arrow keys to set the hour. Confirm with ENTER. Subsequently, the minutes, then the day, the month, and the year will flash in sequence. Set each value, using the arrow keys and ENTER. If you make a mistake, use the ON/HOLD key to back up from the year to the month from the month to the day, etc. When all entries are correct, advance to the next question by pressing ENTER.
- 4 The next option is to choose the temperature scale. Use the arrow keys to choose YES for Fahrenheit or NO for Celsius, then press ENTER.
- 5 The next two questions, SECURITY CODE FOR CONFIG? and ACTIVATE KEYPAD LOCK SYSTEM? are options that can be used for data security. You can secure the configuration of the pump (START and STOP time, DATE, and TIME settings) and lock the keypad. Activate either option by entering YES, and confirm your programming with ENTER. To unlock the keyboard and configuration menu, you must use specific key combinations that are built into the pump memory.

Deactivating the Configuration Lock

If the configuration mode lock was activated when the pump was initially programmed, under CONFIGURATION MODE, the display will read: ENTER THE SECURITY CODE TO PROCEED. To deactivate the lock, press the following four keys in sequence:

ON/HOLD, ENTER, ↑, ↓

You can now modify the pump configuration data, but the configuration lock remains active. To remove the lock, enter the CONFIGURATION MODE and answer NO to SECURITY CODE FOR CONFIG?.

Step Two: Establish the sampling train and set flow rates with a Calibrator.

EQUIPMENT SETUP:

UNIVERS
FLOW HOLDER

AIR FLOW →

SAMPLING MODE

Calibrations and sampling are performed from the SAMPLING MODE.

To calibrate the flow rate through the pump:

Connect an air flow calibrator (such as a simple bubble meter or a mini-BUCK Calibrator) to the inlet end of the adsorbent tube (an arrow on the tube indicates the direction of air flow during sampling). Connect the outlet end of the adsorbent tube to the hose barb on the end of the Universal Low Flow Holder . Use the clear plastic tubing provided with the pump to connect the hose barb on the low flow holder to the inlet of the pump (see drawing above). The arrow on the adsorbent tube should be pointing toward the Low Flow Holder.

Sampling Mode (continued)

Select SAMPLING MODE and confirm by pressing ENTER. The pump will begin to draw air through the air flow calibrator and adsorbent tube. On the pump display panel a bar graph and a percent value will indicate the level of power at which the pump is operating. The air flow calibrator will indicate the air flow rate through the adsorbent tube. Use the arrow keys and the screw adjustment on the low flow holder to adjust the flow through the tube in this manner:

First, remove the red cap from the low flow holder, to reveal the screw that controls the amount of air allowed to pass through the holder. Turn the screw 8 turns counterclockwise from the closed position. Next, use the arrow keys on the pump to increase or decrease the power until the flow is at approximately the rate desired. Finally, use the screw on the low flow holder to fine tune the flow rate. Turn the screw clockwise to decrease the flow, or counterclockwise to increase the flow. When the air flow calibrator indicates the flow desired, wait for the prompt and then press ENTER.

NOTE: *The lower the percentage of pump power used, the longer the pump will run before it must be recharged.*

When trying to maintain a low flow rate (less than 100cc/minute) establish a pump power of approximately 25% and turn the screw on the low flow holder clockwise to nearly the closed position. This will provide a steady, low flow through the adsorbent tube during sampling.

- 1 After you establish the flow and press ENTER, the display will indicate CALIBRATOR FLOW RATE: 0000 cc/m and the first 0 will be flashing. Use the arrow keys to scroll in the flow measured on the calibrator.
- 2 After entering the flow, the pump will display SET START TIME YES OR NO? Enter YES to set the start time. Set the start time in the same manner as for the time and date in the CONFIGURE MODE section (in Step One, no. 3). Select NO START TIME to turn pump on manually.
- 4 With the start time set, the pump will display ON/OFF 5 min/hr USE CYCLE? Entering YES will enable cycling the pump on or off for 5 minute per hour intervals. The display shows 12 "Y"s on the bottom line. These represent the 12 five minute ON or OFF cycles in one hour. Using the arrow keys, select either Y to activate the pump or N to keep the pump off for each of the 12 intervals. Use ENTER to advance to the next interval. Normally all five minute cycles are left to Y (ON) for routine continuous sampling.
- 5 Next the display will read SET STOP TIME YES OR NO? Set the stop time in the same manner used to set the start time. Select NO START TIME to turn pump on manually.

Next the display will read: LOCK KEY PAD YES OR NO? The keyboard will be locked if you choose YES and ENTER. After making this entry the display will return to the main menu; the display will read SAMPLING MODE.

Step Three: Start the Sampling Process

To Start the Sampling Process

Remove the air flow calibrator. Replace the adsorbent tube used to establish the flow rate with a new tube from the same lot of manufactured tubes. Initiating sampling with the tube used for calibration introduces the possibility of contamination. Press ENTER to begin sampling or arrow to ENDING MODE and turn the pump off to save battery power. If using the timing functions, the pump will enter a state of readiness and will begin sampling at the programmed time. The pump's timing routines allow for DELAYED START and AUTO OFF times. They will not start the pump from OFF.

To Stop During Sampling

With keypad lock deactivated

Press ON/HOLD to put the pump on hold. Press ON/HOLD again to resume sampling. When the pump is on hold, pressing ENTER, rather than ON/HOLD, will bring you to the ENDING MODE menu (see ENDING MODE).

With keypad lock activated

Press ON/HOLD. The display will read ENTER CODE TO UNLOCK KEYPAD.

To deactivate the keypad lock, press the following four keys in sequence:

ON/HOLD ↑ ↓ ENTER

Continue as described for *With keypad lock deactivated above*.

ENDING MODE

Use the ENDING MODE to modify or interrupt a sampling and to turn off the pump.

Without active timing routine

Use the arrow keys to display ENDING MODE, then press ENTER. The top line of the display will indicate, from left to right, the battery charge percent, the temperature, and the elapsed sampling time. The bottom line will indicate the total volume of the sample and the option QUIT? YES or NO. Select YES to shut off the pump (the display will go blank). Selecting NO will return the display to ENDING MODE.

With Active Timing routine

Use the arrow keys to display ENDING MODE, then press ENTER. The display will indicate SAMPLING FLOW VERIFY? Select YES and ENTER to verify the flow rate through the pump with the adsorbent tube and the air calibrator in place. This enables you to confirm that the flow rate was maintained throughout the sampling time. To advance to the next display, press ENTER. The display indicates VERIFY TIMING ROUTINE? Select YES and ENTER to observe the start/time and sampling cycles which occurred throughout the sampling time. After the stop time is displayed, the top line of the display will indicate, from left to right, the battery charge percent, the temperature, and the elapsed sampling time. The bottom line will indicate the total volume of the sample and the option QUIT/ YES or NO. Select YES to shut off the pump (the display will go blank). Selecting NO will return the display to ENDING MODE.

Section 8

One Hour Auto-Quik™ Battery Charger

The BUCK “Auto-Quik” Charger™ and “Auto-Quik5” Charger™ are designed to charge only the battery packs for the BUCK pumps.

Description

The BUCK “Auto-Quik” Chargers are microprocessor controlled making the battery recharge process automatic. The battery pack can be recharged with or without the pump connected. When inserting the pump into the charging pocket, the two electrodes on the bottom of the pump battery pack must align with the two pins in the charging pocket. The charger uses a voltage detection technique that provides a full recharge. Red and Green “LED” lights at each pocket indicate the charge and trickle charge process. When turned on, the Red and Green LED’s blink to indicate the microprocessor is functioning and the charging pocket is operational.

The “Auto-Quik’s will charge a pump battery in approximately 1 hour (2 hours for sH.F. and H.F.). After a full charge, a trickle charge cycle (green light on) will begin. Batteries may be left in trickle charge indefinitely. After a long period (days) the green LED may blink to indicate trickle charge is OFF. Trickle charge will restart when the battery pack voltage drops.

The charger is designed to operate from a 115 VAC outlet (a 100 VAC and 220 VAC versions are available). The charger is turned on by a switch located near the power cord. A three ampere slow blow fuse serves to protect the unit.

Operation

When turned on, the POWER light will indicate red ON and the station charge and trickle lights will flash through all stations to indicate the microprocessor is functioning correctly. Place the pump into a charging pocket. After three seconds, the red LED should stop blinking and stay on. If this does not occur, lift pump out of pocket and reinsert. Repeat if necessary until red light stays ON.

When the green light turns ON and red is OFF, the batteries are fully charged. If after one hour the red light is still on, remove the pump to prevent damage. **Do not use this pocket until it is repaired.**

The pump should not be turned on during the charge process. If this happens accidentally, the pump will automatically turn itself off to prevent high voltage damage.

Note: The fast charging of the Auto-Quik Charger prevents any of the old “Memory Problem” previously associated with Nickel Cadmium batteries. The reason is improved chemistry in the cells’ electrolyte and the high current charge rate. Any stagnation of the electrolyte or electrical corrosion is removed on charging.

Section 9

Standard Charger for use with all Buck Pump's

The Standard Charger is designed to charge the BUCK pump battery pack in 16 hours.

The connection is made through the A/C adapter on the right side of the pump under the cover plate*. The red LED light on the A/C charger will light. After 16 hours, the pump batteries will be fully recharged for portable operation. Note: The battery pack must be connected to the pump to charge.

The % battery capacity will not be accurate during charging. The % 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, not a static charge on the electrodes of the battery.

*An adapter (P. N. 603002) to the RS-232 port on the I.H. and H.F. pump is required when using the Standard Charger.

Extended Run Time

•CONTINUOUS SAMPLING: The pump is capable of operating continuously with the battery eliminator (P.N. APB-109008) attached to the pump. The UL intrinsic safe models cannot use the battery eliminator in hazardous areas.

Elapsed time will count to 256 hours (10.6 day). The timer will reset at 00:00 hours at each 256 hour interval.

The volume of the samples will calculate to 76,800 Liters or the maximum flow of 5.0 LPM x hrs. x 60 min/hr. This is 10.6 days of sampling. The volume is displayed under the ENDING MODE and during sampling.

Appendix

Helpful Hints and Tips for Pump Operation

1. A “quick” OFF feature is provided by pressing the ENTER key for four seconds during sampling. To return to sampling, press the ON key. This feature will allow a worker to turn the pump off temporarily and back on without being trained on pump operations.
2. Set flow rates will remain in calibration day after day if the same filter type and size are used. Clear only the Elapsed Time for this feature under the CONFIGURE MODE.
3. Preprogrammed stop times can easily be changed by going into CONFIGURE MODE and changing the time.
4. The Cali-Logger will operate with Version 95 Software. Several noticeable differences will be observed by experienced users. To prevent having to change Cali-Logger software, commands in the pump have been programmed to recognize the Cali-Logger commands. This will require some keypad functions on the pump while setting the Cali-Logger.

RFI and EMI Shielding of Personal Air Sampling Pumps

The concern about Radio Frequency Interface (RFI) and Electro-magnetic Interference (EMI) on personal air sampling pumps originates from the method used to run the pumps direct current (DC) motor.

A problem was identified in 1988 that hand held radios could disrupt the flow control on the vast majority of pumps on the market. These pumps use “amplitude control” to maintain the pump’s speed. The RFI would induce a spike of voltage and severely affect the pump’s speed.

Because BUCK pumps are completely digitally controlled, RFI does not cause any influence on the pump’s settings. A Pulse Width Modulation (PWM) is used to control the motor and the spikes of voltage are not induced. A comparison would be the difference in an AM radio or FM radio in a lightening storm. Amplitude Modulation (AM) and Frequency Modulation (FM) are a good analogy to this DC motor issue.

The circuit boards in these pumps have analog and digital grounds that are coupled to one internal ground plain of the four layer circuit board.

The EMI can effect relays which are usually latched ON or OFF by a DC magnetic field. A strong EMI could affect this process. The BUCK pumps use a latching double pole, double throw permanent magnet type of relay that are highly resistant to outside forces.

The BUCK line of pumps are basically immune to RFI and EMI under reasonable circumstances. They meet the same test criteria claimed by other manufacturers using shielded cases.

The BUCK H.F. & sH.F. PUMPS™ WITH STANDARD TRIPLE BATTERY PACK

TABLE OF (TYPICAL) BATTERY LIFE BY FILTER TYPE

MINIMUM POWER FOR LPM

FLOW RATE	HOURS		HOURS	HOURS	
	25 mm		37 mm 0.8μ	37 mm Fiber Glass	47 mm Fiber Glass
	0.45μ	0.8μ			
2.0	7.0	14	22	>24	>24
3.0	5.5	11.5	17	23	>24
4.0	9		13	18	23
5.0			11	15	19
6.0			9.5	12	15
7.0				10	13
8.0				8	11
9.0					8

OPERATING RANGE OF PUMP

- 50 inches of water pressure up to 4.5 LPM
- 40 inches of water pressure up to 5.3 LPM
- 30 inches of water pressure up to 6.3 LPM
- 20 inches of water pressure up to 7.3 LPM
- 10 inches of water pressure up to 8.7 LPM
- 5 inches of water pressure up to 9.6 LPM

The BUCK I.H. & S.S.PUMPS™ WITH STANDARD BATTERY PACK

TABLE OF (TYPICAL) BATTERY LIFE BY FILTER TYPE

HIGH FLOW SAMPLING

FLOW RATE Liters/Minute	HOURS		HOURS	
	25 mm 0.8μ	37 mm 0.8μ	37 mm Fiber Glass	47 mm Fiber Glass
2.0	6.4	10.5	14	14
2.5	5.4	9.5	13	13
3.0	4.2	8.0	12	12
3.5		7.0	11	11.5
4.0			10	11
4.5			9	10
5.0				9.5

LOW FLOW SAMPLING

Inches of Water Pressure	Battery Life Flow from 5-500 cc/m
2"	12.9 hrs.
5"	11.3 hrs.
10"	9.2 hrs.
15"	7.8 hrs.
20"	6.9 hrs.
25"	6.2 hrs.

OPERATING RANGE OF PUMP

50 inches of water pressure up to 1.6 LPM

40 inches of water pressure up to 2.2 LPM

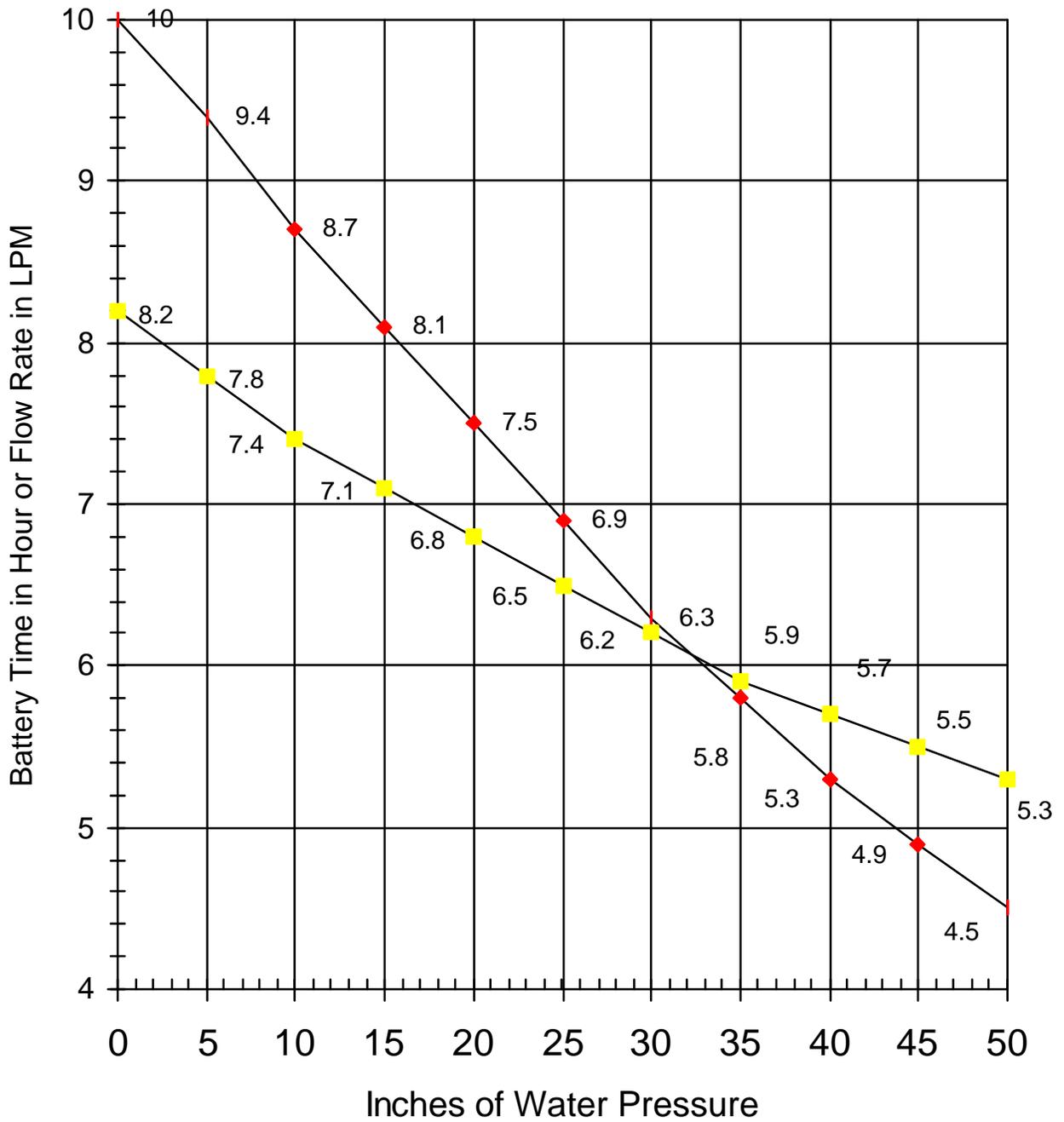
30 inches of water pressure up to 2.6 LPM

20 inches of water pressure up to 3.2 LPM

10 inches of water pressure up to 4.2 LPM

5 inches of water pressure up to 5.0 LPM

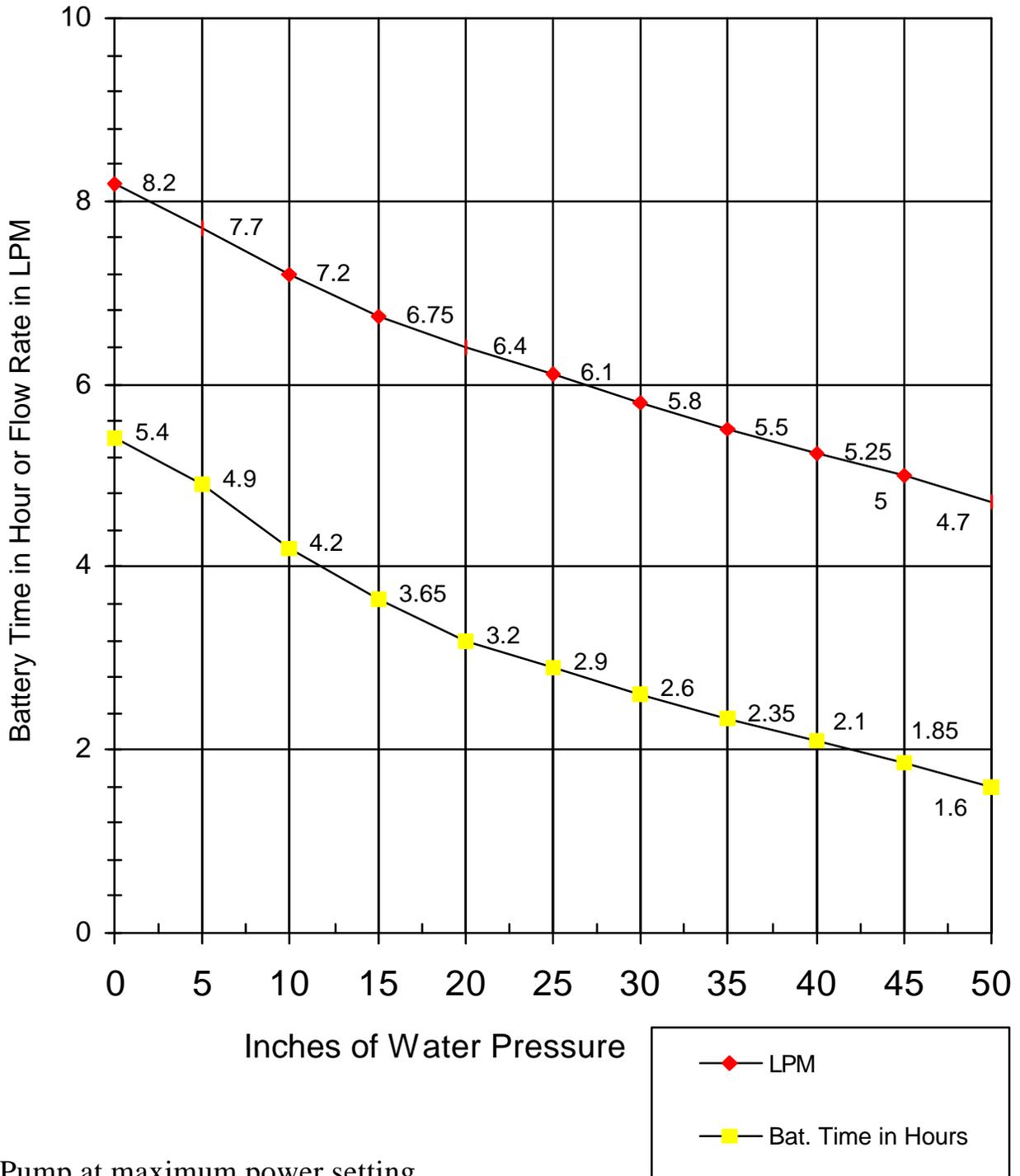
Battery Life with Maximum Flow Vs. Pressure Drop
 Model: *The BUCK H.F. PUMP™* & *The BUCK sH.F. PUMP™*



Pump at maximum power setting
 5/15/95



Battery Life with Maximum Flow Vs. Pressure Drop
 Model: *The BUCK I.H. PUMP™* & *The BUCK S.S. PUMP™*



Pump at maximum power setting
 5/15/95

PARTS LIST & ACCESSORIES

1. ***The BUCK “Auto-Quik” Charger™*** (APB-601000)
Single Station Automatic One Hour Charge / Discharge Charger for use with ***The BUCK I.H. PUMP™***.
2. ***The BUCK “Auto-Quik5” Charger™*** (APB-605000)
Five Station Automatic One Hour Charge / Discharge Charger for use with ***The BUCK I.H. PUMP™***
3. ***Adapter to convert RS232 port to charging jack port*** (APB-603002)
For ***The BUCK I.H. PUMP™*** when using standard single or 5 station chargers.
4. ***BUCK Standard Charger / Adapter*** (APB-603000)
Designed to charge ***The BUCK I.H. PUMP™*** battery pack in 16 hours.
5. ***The BUCK “One Hour” Rechargeable Battery Pack™*** for ***The BUCK I.H. PUMP™*** (APB-109010)
These self contained packs may be charged independently from the ***BUCK I.H. PUMP™*** and used as additional back up batteries in the field. Simple 4 screw changing operation.
6. ***BUCK “Universal Low Flow Sample Holder”*** (APB-109030)
Desired flow may be precisely adjusted for flows of 5cc to 800cc with ***The mini- BUCK CALIBRATOR™*** and a screwdriver using the built in adjustable screw.
7. ***Protective Cover for Universal Low Flow Holder*** (Adsorbent sample tube size determines cover size.)
(APB-109022): NIOSH CHARCOAL; all standard 6mm O.D. x 70mm (3” in length)
(APB-109024): All 8mm O.D. x 110mm (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)
8. ***Luer Adapter*** (APB-109000) (PKG. of 10)
Adapter fits outlet port on ***The BUCK I.H. PUMP™*** for bag filling or to connect filter to ¼” I.D. tubing.
9. ***Sample Hose Clip*** (APB-109020) (PKG. of 10)
Clothing clips for attaching hoses and sampling heads to a worker’s collar. Snap nylon strap for 3/8” O.D. hose.
10. ***Multi Low Flow Tube Holder*** (APB-109034)
Acrylic manifold allows connection of up to three low flow holders for independent multiple low flows with a single pump
11. ***BUCK “Non-Adjustable Low Flow Sample Holder”*** (APB-109032)
12. ***Protective PUMP Pouch*** (APB-109042)
Nylon carrying pouch for ***The BUCK I.H. and S.S. PUMP™***. Belt loop and shoulder strap designed to protect the pump during sampling and for worker comfort.
13. ***Multi-Pump Case*** (APB-109016)
Convenient carrying case designed to accommodate up to 5 pumps, ***The BUCK “Auto-Quik”***

Charger[™] and *The mini-BUCK CALIBRATOR*[™] or *The BUCK Cali-Logger*[™]. The design is flexible to allow variation of accessories with pumps.

14. *Single-Pump Case* (APB-109018)
Convenient carrying case designed to accommodate 1 pump with accessories and standard charger / adapter.
15. *Communication Cable* (APB-109014)
9 pin, RS-232 connectors for communication of *The BUCK I.H. PUMP*[™] to *The BUCK Cali-Logger*[™]. (NOTE: Cable may also be used with the Serial Port Communication Program available for the BUCK Cali-Logger[™].)
16. *Pump Manual* - For all Version 95 pumps. (APB-109095)
17. *Pump Field Service Manual* (APB-109037)

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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SERVICE POLICY

For all work not covered under warranty, A.P. BUCK, INC. reserves the right to proceed with repairs up to a maximum cost of \$250 without notifying the customer. If major components must be replaced, A.P. BUCK, INC. will notify the customer before proceeding with repairs.

When the instrument(s) is returned, please include a purchase order marked "Repair-Cost Not To Exceed \$250 Without Customer Authorization." Also include name and telephone number, serial number(s), date of purchase, and description of problem.

Return to: **A.P. BUCK, INC.**
7101 PRESIDENTS DRIVE
SUITE 110
ORLANDO, FL 32809
ATTENTION: CUSTOMER SERVICE

You must obtain an **RMA** number prior to returning any product. Obtain your RMA number by calling Customer Service at **(407) 851-8602** (have your purchase order # ready for service). All returned products must be received within 30 days of the RMA number issuance date. Products returned late will be returned to the customer.

Service Warranty:

The calibration of the mini-BUCK Calibrators is warrantied for a period of one year from date of calibration.

All other repairs are warrantied for a period of 90 days from date of service.

TECHNICAL SUPPORT SERVICES

Phone Assistance: 407-851-8602 - If calling from outside the continental USA dial local international access code first.

Fax: 407-851-8910

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.

Hours: Monday - Friday.....8am - 4:30pm
Eastern Standard Time

Extensions:

#3 - Customer Service

#4 - Technical Service

