Manning
ENVIRONMENTAL INC.

Operating and Instruction Manual

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MODEL PSB4 PORTABLE, SELF CONTAINED PERISTALTIC SAMPLERS

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Installation and Operation

INTRODUCTION

Congratulations on the purchase of a Manning Model PSB Sampler. The model selected is the latest in a long line of state of the art equipment produced for over twenty five years by Manning Environmental Inc. There are Manning samplers still used in regular service today that are over twenty years old. It is almost impossible to find an organization with the commitment of producing equipment with such a history of reliability, dependability, quality and value as exhibited by Manning samplers. Even so, improvement is a never ending goal at Manning. We are always interested in the perceptions and experiences of our users. If there are any suggestions or comments on our equipment, this manual, or anything Manning does, please feel free to contact us.

The PSB is a portable peristaltic pump based model which can automatically collect and hold non-toxic samples from a liquid source. The unit was designed from the ground up with active user participation to ensure the features and options that are important to field use were incorporated into the unit. It employs a peristaltic pump to draw the samples. Backed by Manning's reputation for quality and dependability, it will provide years of reliable service.

Even if the sampler will not be used immediately upon receipt, unpack and examine it. This will help to familiarize the user with the equipment. Verify that all of the parts have been received and that no damage has occurred in shipment. If damage is noticed, immediately report the extent of it to both the transportation company and to Manning. In addition, check the packing list to verify that it matches the items sent and that all accessories ordered are included with the shipment. Manning strives for 100 percent accuracy in the delivery of our equipment, but even with the most stringent quality assurance, mistakes do occur. Omissions, damage, or mistakes must be reported to Manning within 10 working days of receipt of the shipment.

This manual is designed to communicate a complete understanding of the equipment, its operation, maintenance, and functions. Manning recommends this manual and the equipment be examined completely before placing the unit into service. Manning is committed to producing reliable, top quality products, but the possibility of breakdown or malfunction always exists. This manual should enable the diagnosis and solving of many potential problems. If the problem cannot be solved, please feel free to call our service department at 1-800-863-9337 to obtain help. Our first priority is making sure the experience with Manning equipment is an excellent one. In almost all instances the difficulty can be addressed over the phone, but in the rare instance it cannot, the equipment may need to be sent back to Manning for service. Please contact our customer service department at 1-800-863-9337 to obtain a Return Authorization Number. We recommend the following steps before attempting to use the sampler:

1. Review this manual. **Read the errata sheets at the end of this manual for the latest updates.**
2. Follow the instructions beginning on page 1-8 to assemble the PSB.
3. Set the time and activate a test cycle.
4. Program the PSB.

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HARDWARE

FUNCTIONAL SPECIFICATIONS :

Size	With carrying handle vertical: 16.75"H (42.545cm) by 20.5"W (52.07cm) by 8.5"D (21.59cm) with 2 gallon composite container
Weight	Dry Weight: 21.5 lbs. (9.6kg) with 7aH sealed lead acid battery
Environmental Protection	Nema 4X housing around electromechanical components.
Temperature Limits	0°C to 50°C (32°F to 122°F).
Sample Pump	Peristaltic, tri roller design with impact and corrosion resistant plastic pump body.
Pump Tubing Tube Life	1/4" ID pump tubing. Recommended maximum of 1000 pump hours@ 250RPM based on a standard sample. A standard sample equates to 5ft of head, 10 foot PVC intake tube, and 200 ml sample size.
Maximum Lift	29 ft (8.8392 m).
Practical Lift	24 ft (7.3152 m).
Transport Velocity	Minimum of 1.7 ft/s at 3 ft of lift.
Sample Volume Accuracy Repeatability	Programmed directly in increments of 1 milliliter up to a maximum of 9,999 ml. ± 10ml or ± 10% of the programmed volume, whichever is greater. ± 10ml or ± 10% of the average largest and smallest sample volume in a sample set, whichever is greater.
Liquid Sensor	Non-fouling wetted
Controller Membrane Switch Internal Clock Internal Battery	100% solid state 12VDC microprocessor based 1 board system which controls all functions of the unit. Ergonomically designed, hermetically Sealed, 24 key, multiple function, with 2 line by 20 character alphanumeric backlighted display. Indicates real time with ± 1min/month accuracy. 5 year internal lithium battery to maintain program logic, RAM memory, real time clock and date.
Power	STANDARD - 12 volt 7aH hour battery OPTIONAL - 115/220VAC power supply, Car Adapter, Larger amp hour external batteries. (WARNING: When connecting an AC power supply to the unit, all batteries must be removed from the power loop)
Optional Analog Input	4-20 mA.
Optional RS-232 Port	Optional port for downloading of logged data

SUBASSEMBLIES

The sampler consists of two major subassemblies: the electronics enclosure, the case. As a unit these subassemblies form an environmentally resistant enclosure.

Electronics Enclosure

The electronics enclosure includes the microprocessor-based controller, the peristaltic pump, and the liquid sensor.

The Controller

The controller electronics consists of 1 board, a membrane key switch and a liquid crystal display. The board operates from a 12VDC source and controls the input/output signals associated with the sampler. It also contains a Z180 microprocessor, RAM and ROM memory, and interfaces for the keyboard, the display, analog, and I/O ports. The user communicates to the sampler via a 24 key multiple function membrane switch. The keys are clearly marked with their designated functions. An internal battery maintains the program logic, RAM memory, and the controller's real-time clock and date function. The electronics are mounted on the back of the controller.

Peristaltic Pump

The Manning Model PSB employs a tri roller peristaltic pump. The pump is driven by a 12VDC gear motor. It utilizes a clam shell design constructed of clear polycarbonate plastic which is impact and corrosion resistant and allows for easy visual identification of pump parameters, such as tube alignment, and spindle and roller operation. It securely holds the pump tubing in place by firmly clamping the two halves of the pump case together. The pump is capable of vertical lifts of up to 24 feet and produces a sample transport velocity in excess of 1.7 feet per second at 3 feet of vertical lift.

Liquid Sensor

The Model PSB utilizes an in-line liquid sensor, located near the entrance to the peristaltic pump, which is capable of detecting the presence of source fluid as it approaches the pump inlet. The liquid enables the sampler to rinse the intake line and makes it possible for the sampler to deliver precise, repeatable samples even in changing lift conditions.

Sampler Case

The sampler case is constructed of impact, and corrosion resistant structural resin. When latched, it meets Nema 4X, 6P standards.

Wetted Parts

Wetted parts are those pieces of the sampler that come in direct contact with the sample liquid. The main components of the wetted parts for the Manning Model PSB are the intake hose and strainer, the pump tubing, the discharge tubing, the bottle full sensor and the sample bottle. All parts that touch the liquid are either PVC (Polyvinyl Chloride), medical grade silicone rubber, or Stainless Steel.

Intake Hose

The 1/4" ID intake hose is constructed of PVC (Polyvinyl Chloride) with a weighted strainer at the end. Standard hose length is 10 feet (3.05 meters). Longer hose lengths can be ordered.

Strainer

The 1/4" ID strainer is PVC. By placing holes no larger than 1/4" ID along the length of the strainer, the intake of large particles that can plug the hose or any part of the sampler is prevented. Since the strainer is also weighted, it keeps the hose inlet at the desired level in the source liquid.

Pump Tubing

The pump tubing Manning supplies for the Model PSB is Pharmed®.

Discharge Tubing

1/4" ID discharge tubing is supplied.

Bottle Full Sensor

The bottle full sensor is a positive mechanical float switch. Once the water level has risen, the float will rise, closing a switch which sends a signal to the controller indicating the bottle is full. This ends the sampling cycle

Sample Bottles

The bottles are constructed of HDPE (high density polyethylene). The HDPE containers are used in Non-Toxic applications.

Single Bottle Sampling
One (1) - 2 gallon plastic bottle

ASSEMBLY

ASSEMBLING THE MODEL PSB SAMPLER

The unit is shipped already assembled.

DISTRIBUTION ASSEMBLY INSTALLATION

Single Bottle Sampling
The sample bottle must be located in the bottom of the sample case (see picture) with the spout facing the control unit. The unit can also be oriented in a vertical position with the addition of an optional suspension handle. In the vertical position, the bottle will be oriented with the bottle lid facing the control unit. The carrying handle is then attached directly above the control unit on the outside of the case. This position allows the placement of the sampler in narrow spaces such as manholes less than 18" in diameter.

INSTALLING THE SAMPLER
Position the sampler, preferably on a firm level surface, adjacent to the sampling point or add the optional suspension handle for suspending the sampler. The preferred orientation is with the built in carrying handle facing vertically (as shown). Attach the intake hose to the liquid sensor, program the unit, and then latch the

sampler case. The unit will execute the programs and fill the bottle automatically until a bottle full condition is achieved or the pre-set number of samples desired has been reached.

Power Options

The PSB sampler was designed with components which operate on 12 VDC power. The unit has an internal 12VDC 7aH battery which will provide approximately 36 standard samples (A standard sample equates to 5ft of head, 10 foot PVC intake tube, and 200 ml sample size taken at one-hour intervals).
An On/Off switch is located on the control panel to turn the sampler on or off. The unit also comes standard with an external power input circular connector which allows the operator multiple options when deciding how to power the system. Additional connectors are available from Manning:

115/220VAC - This is an optional external power supply for the PSB. The user removes the 12VDC battery from inside the control unit, and then plugs the external power supply into the 2 pin circular connector labeled "POWER" near the built in carrying handle. The power connector is differentiated from the contact closure input connector in that it is a male connector versus a female connector for the contact closure input.

WARNING: The internal 12VDC sealed lead acid battery must be disconnected and removed from the system, before plugging in an external power supply (The black charger supplied with the system IS NOT A POWER SUPPLY, it is solely a battery charger) . Failure to do so could lead to serious injury to the equipment and to personnel.

External Battery - The user removes the 12VDC battery from inside the control unit, and then plugs the external battery into the 2 pin circular connector labeled "POWER" near the built in carrying handle (mating connectors are available from Manning). The power connector is differentiated from the contact closure input connector in that it is a male connector versus a female connector for the contact closure input.

WARNING: It is highly recommended that the internal 12VDC Sealed Lead Acid battery be disconnected and removed from the system, before plugging in an external 12VDC battery. Failure to do so could lead to serious injury to the equipment and to personnel.

Car Adapter Plug - The user removes the 12VDC battery from inside the control unit, and then plugs the Car Adapter Plug into the 2 pin circular connector labeled "POWER" near the built in carrying handle (mating connectors are available from Manning). The power connector is differentiated from the contact closure input connector in that it is a male connector versus a female connector for the contact closure input.

WARNING: It is recommended that the internal 12VDC Sealed Lead Acid battery be disconnected and removed from the system, before plugging in an external 12VDC Car Adapter Plug. Failure to do so could lead to serious injury to the equipment and to personnel.

Battery Charger - The 115 or 220 VAC battery charger supplied with the unit can used to constantly trickle charge the internal 12VDC battery or to recharge the battery when the unit is not drawing

power. The operator plugs the battery charger into the 2 pin circular connector labeled "POWER" near the built in carrying handle. The power connector is differentiated from the contact closure input connector in that it is a male connector versus a female connector for the contact closure input. It is recommended that the charger not be left charging the battery for extended periods of time.

WARNING: The battery charger IS NOT a power supply. Utilizing it directly in line with the sampler can lead to serious damage to the circuit boards and void the warranty. The battery charger is intended solely to recharge the battery. It must not be used in any other manner.

Sample Intake Line

The exterior case for the PSB, when latched, conforms to NEMA 4x,6 standards. To maintain this rating with a hose passing through the case wall and to facilitate the changing and removal of the intake hose, a short piece of intake tubing is utilized. This hose is run from the liquid detector, through a water tight bulk head fitting, and through the wall of the case. It has a quick disconnect outside the exterior wall to make connecting and disconnecting to the exterior intake hose quick and easy.

Intake Hose Placement

Place the strainer end of the intake hose directly in the channel flow, not in an eddy or at the edge of the flow. In channels with debris, provide deflection to prevent clogging of strainer holes. The weight supplied with the intake hose is usually sufficient to prevent the intake from being pulled to the surface of a fast channel.

The correct vertical position of the strainer depends on the type of sample being taken. Placing the strainer at the bottom of the flow results in a heavier concentration of solids in the sample, while placing the strainer at or near the top of the flow results in heavier concentration of oils, fats, and other floating or suspended contaminants.

The intake hose should be positioned so the hose can drain between sample cycles and no low spots exist which would trap water.

RUNNING A TEST CYCLE

While it is not mandatory to run a test cycle, it is recommended to assure proper operation and to become familiar with the various functions and modes of operation.

1. Turn the main power switch to the "ON" position.

2. Submerge the strainer of the intake hose in a container of clean water. The amount of water should be enough to keep the strainer covered completely for several test cycles.

3. Press the TEST CYCLE key on the keypad to initiate the test cycle.

THE SAMPLING CYCLE

There are two types of sample events. The first is time-based. In this type a time interval is defined and the sampler places a sample in the bottle based on that time interval.

The second type of sample event is flow-based. In this type an external flowmeter provides one of two types of signals: a contact closure when a specified amount of liquid has flowed past the measurement point; with the analog option, an analog signal proportional to flow rate.

Whether the sample event is triggered by a flowmeter or by a time interval, the actual sampling cycle is the same. Next, the sampler turns on the peristaltic pump. The pump begins rotating counter-clockwise causing air to be forced out of the intake tubing. This clears the intake hose of any contents or obstructions that may inhibit proper sample collection. After the set amount of purge time has elapsed, the unit will then reverse the pump so the rollers are now moving in a clockwise direction. This causes vacuum to be created in the tube, which causes the source liquid, to begin traveling up the intake line. If the unit was programmed to rinse, as the source liquid rises in the intake line it will reach the liquid sensor. The sampler will immediately recognize fluid has reached the inlet to the pump. It will instantaneously reverse the direction of the pump (rollers will be moving in a counter-clockwise rotation), sending the water that had been drawn up back out of the intake line. This in effect rinses the line. If the unit was not set for a rinse or upon completion of the last rinse, source liquid will again be drawn up the intake line. The system monitors the flow of liquid and when the preset amount has passed through, the pump will reverse operation again (rollers moving counter-clockwise). This purges excess fluid out of the pump and clears the intake line. Depending on how the unit is programmed or configured, after completing the post sample purge, the sampler will now stop operation or continue performing those functions which it has been programmed. For a complete description of programming the sampler see the programming section in this manual.

SAMPLE RECOVERY

Immediate sample recovery is not required since the sampler will automatically shut down when the sample container is full or when the program is complete. However, sample analysis may require quick recovery to maintain sample freshness or to add chemicals.

EXTERNAL CONNECTIONS

DANGER: Turn the sampler off at the power switch and unplug the power supply before making connections.
Injury can result if the power is present when making connections.

Bottle Full/Liquid Sensor

The Model PSB utilizes both a Bottle Full Sensor and a Liquid Sensor. The connections for the Bottle Full Sensor and the Liquid Sensor are hard wired into the controller. The bottle full sensor is located in the top of the bottle cap. It is critical the bottle cap be in a vertical orientation when the sampler is operating as otherwise, the unit will believe the bottle is full and not operate.

Contact Closure

This enables the sampler to accept a contact closure from, an external device. The parameter to be measured is set, recorded, and totalized by the external device. When the set limit is met, a contact closure will be sent to the sampler. This in turn will initiate the sample collection process. To connect the external device to the sampler follow the steps listed below:

A) Locate the circular connector on the outside of the exterior case which is labeled "CONTACT IN". This will have a 2 pin female plug. Cables are not included with the sampler. Cables and/or connectors are available from Manning for making these connections. Please contact the Manning parts department.

B) Wire the leads to the external device's contact closure output.

C) Re-connect the circular connector to the "CONTACT IN" plug.

This should complete the installation of the contact closure. Test the connection by initiating a closure through the external device to verify the wiring is correct and the sampler is initiating a sampling cycle when a closure is received.
NOTE: The device generating the contact closure MUST NOT be wired to any other device. Splitting of the signal in this manner will cause the sampler to not perform properly.

Analog Signal Option

With this option, the sampler can accept an external flow rate signal. This 4-20 mA signal is proportional to flow rate. The flow volume is internally totalized by the sampler s controller. The analog option is not available as a field retrofit. Contact the Manning Parts Department to discuss a factory modification.

This completes the set-up of the sampler. The unit should now be operational. Programming the PSB is covered in the next section.

Programming

INTRODUCTION

The sampler is controlled by a microprocessor that can execute a wide variety of time and flow sampling programs. Entries are made through a keypad with prompts displayed on a 2 line by 20 character backlighted LCD (Liquid Crystal Display).

SAMPLER CONFIGURATION

For the sampler to function properly, it must be set-up for the specific application in which it will be used. The Program 99 Function configures the sampler. Configuration defines multiple variables that do not usually change between different applications. These are such things as the draw time and purge time. Instructions for configuration of the sampler begin on page 2-5.

SAMPLING PROGRAMS

The sampler has two basic programming means for taking samples: Time and Flow. (NOTE: While referred to as a Flow program, the sampler can trigger a sample to be taken based on signals from any external device. What device or why the device is supplying the contact closure is transparent to the sampler. The sampler simply registers a contact closure, so actuation can occur based on pH, ORP, Level, Flow, or other parameters. Time programs are based on a preset time period that must expire before a sample is taken. The standard controller (contact closure option) allows sampling based on contact closures from an external device. Instructions for programming begin on page 2-14.

Programs
All General Programs (Basic Time and Flow)
Program 02 Flow - Time Interval Override
Program 03 Flow - External Event
Program 04 Time - Multiple Intervals
Program 05 Flow- Totalizing Analog
Program 06 - Analog Level Mode
Program 07 Flow - Time Interval Delay
Program 09 Hydrologic Event Mode

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DISPLAY & DISPLAY FUNCTIONS

Key	Function
<RESET>	Functions as a warm reset (a soft boot in computer terms) for the sampler and clears the current Program, but saves configuration parameters
KEYPAD COLD START	User initiated "Cold Start" which clears all user set values out of memory and loads factory default values. Press and hold <CLEAR> while turning power on, or enter <PROG> 98 and <ENTER>.
<PROG>	Used to select the program to run.
<PROG> 14	Clears the logged data without having to go into Program 91. This program only works when "SAMPLER READY" is shown on the display.
<PROG> 50	Shows the current software version.
<PROG> 40	Resets the pump table. This program should only be done after consultation with the factory since it reset the draw table to default values and clear any calibration data.
<TEST CYCLE>	Allows the user to check the sampler for correct mechanical operation and to ensure accurate sample volumes by taking a physical sample. The user will be prompted for the number of samples to be taken. The sample volume is determined by the sample volume & draw height parameters entered by the operator.
<CLEAR>	Clears invalid and incorrect entries before <ENTER> has been pressed. Also allows the user to step the cursor back 1 movement, clearing entries each time the key is pressed. Also clears error <EEEE> messages.
<CLOCK>	Sets the real time clock. To set, press RESET, press CLOCK, enter the date (year, month, day), time and then press <ENTER>. NOTE: <u>All times are entered and displayed in 24 hour HH:MM format. For example, 6 hours would be entered as 0600 and a time of 3:30 p.m. would be displayed as 15:30</u>.
<DISPLAY>	Shows current program or configuration information. The information displayed depends on whether the sampler is in or out of a program. If the sampler is out of a program, pressing <DISPLAY> will show the configuration settings input in Program 99. If the user is in a program (e.g. a TIME, FLOW, or other program), pressing <DISPLAY> will show the current time and other information specific to the current program.
EEEE	Indicates an error condition has occurred. Press <CLEAR> to reset, and re-enter the data.

KEY NOT ACTIVE	Indicates the key pressed is not active at the current time.
UNKNOWN PROGRAM	The user has entered a program which is not recognized by the sampler.
RPM SENSOR FAIL	The sampler has a problem with the system that detects the rotation of the pump.
POWER GLITCH	The sampler has detected a momentary drop in the power (voltage). This could be caused by a weak battery.
POWER FAIL **LOW POWER**	The sampler has a weak battery (battery voltage is low). Sampler operation is halted until proper power restored (i.e., charged battery).

DISPLAY INFORMATION

The Manning sampler is capable of displaying a wealth of information through the 2 line by 20 character display. The following describes the functions and how they can be of benefit to the user:

DATE AND TIME The time of day and date are displayed in the bottom right hand corner of the display. The format is a 24 hour clock HH:MM:SS, and the date is MM/DD. This display alternates between the time and date every two seconds. If the display is not showing the seconds being counted up, the controller may have quit functioning. Press <RESET> to warm boot the system. If this does not clear the problem, perform a keypad cold start. If the controller is still non-responsive, please call Manning at 1-800-863-9337.

PROGRAM STATUS The bottom left hand corner of the display is used for miscellaneous program and functional information. The information displayed varies depending on the operational status of the active program. The following details the function of the display in different programs:

Sampler Ready: Shows time of day in HH:MM format (24 hour clock)

Programming: In programming situations, the display is used for entering the data required by the particular program that is being programmed.

Active Program: The information displayed depends on the type of program and the status of that program. When a time is shown in this section of the display it is signified by a flashing colon. The time shown may signify time to sample, time override, purge time, draw time, or other times associated with the program. All time displays are in HH:MM format, except for configuration function times (draw time and purge time) and Program 07 DELAYED SAMPLE EVENT PROGRAM which are shown in MM:SS format. Non time displays are characterized by a 4 digit display which does not posses a flashing cursor. The information displayed here will be the number of samples taken.

SAMPLER CONFIGURATION FUNCTIONS

There are 5 major configuration functions the user must be concerned with (Program 99, Program 20, Program 19, <Sample Volume>, and <Draw Height>). Step-by-step programming instructions and descriptions of each function are detailed in the pages that follow :

Program 99

Program 99 allows the user to set the sampler's configuration. For proper operation, it is critical the unit is correctly configured. The memory comes preset with the sampler's defaults. These defaults can be reviewed or changed by entering the configuration program (explanations and step-by-step instructions are given below). Once entries have been made in Program 99, re-entering the configuration program is not necessary unless changes in the data are needed.

Display on LCD	Explanation
SAMPLER READY **10:04**	This display shows the sampler is ready to program. It displays the current time. From here the user can enter any TIME, FLOW, or Program. Press the <PROG> key to access the desired program.
ENTER * MODE — —	Prompts the user to enter either a program or the configuration function. Press 99 and <ENTER> to configure the sampler.
SAMPLE VOLUME? — — — —	Sets the sample volume (in milliliters), to be collected per sample. Default is 100mL.
TUBE LENGTH? — — — —	Sets the length of the sample intake tube in feet. Default is 10 feet.
DRAW HEIGHT? — — — —	Sets the draw height or lift height of the sampler in feet. Default is 5 feet.
RINSES PER SAMPLE? — — — —	Sets the number of rinses (0-5) the sampler will perform per sample cycle. Default is 0.

PURGE TIME?
— —

Length of time (3-99 secs) the intake line is purged before a sample is taken. Press <ENTER> to accept the default purge time or input a new 2-digit number. If air bubbles are not coming out of the intake line, or if fluid is visible in the line after the purge has been completed, increase the purge time.

DRAW TIME?
SSS

Time window during which a sample is drawn. Press <ENTER> to accept the displayed draw time or input a new draw time as a 3-digit number and then press <ENTER>. If the sample fluid does not reach the fluid sensor, increase the draw time. The maximum time is 3 minutes and 60 seconds.

BOT VOLUME?, LITERS
—

Enter the volume of the sample container in liters.
Default is 10 liters.

AUTO RESTART?
—

Sets the auto restart program:
0 - No auto restart;
1 - auto restart activated (default).
This option will restart the sampler and continue the program that was running, if power fails. It stores parameters, ensures orderly shutdown, and stores enough energy to complete any stepper motor steps in progress.

TEST CYCLE?
—

Sets the test cycle. Press <ENTER> to accept the default or input a new number corresponding to the manner in which test samples are to be taken:
0 - Only when the sampler is not running a program.
1 - In a program, but the sample does not count in the program.
2 - In a program, and the sample counts in the program.

BACKLIGHT?
—

Sets whether the display backlights:
0 - Backlight is never on. This is good if power conversation is critical.
1 - Backlight comes on when a key is pressed. The light will automatically turn off after 10 seconds if another key is not pressed (default).
2- Backlight comes on when a key is pressed and also at the start of a sampling cycle. The light will automatically turn off after 10 seconds if another key is not pressed or another sampling cycle is not initiated.
3- Backlight is always on. This choice will quickly run down a battery.

ENTER PASSWORD
— — — —

Creates a password to stop unauthorized access. There are 2 options:

A. Press <ENTER> to accept no password - 0000 (default shown)

B. Enter a 4-digit number at the prompt and press <ENTER>. The user will be prompted to verify the password. Enter the same 4 digits and press <ENTER>. This sets the password. **RECORD** the numbers. To change a password, enter Program 99 and input the 4 digit numeric password at the PASSWORD PROTECTION prompt. Press <ENTER>. The user can now go into Program 99 and at the ENTER PASSWORD prompt, create a new password.

Note: Use a TEST CYCLE setting of 0 if TEST CYCLE is to be password protected while a program is running.

If the password is forgotten, call the Manning Service Department at (800)-863-9337.

After finishing the Configuration Program, the sampler will return to the Sampler Ready prompt and the current time will be displayed. Configuration is now complete, and the sampler is ready for programming.

Calibrate- <CALB> Volume Calibration

(Program 20)

Program 20 calibrates the unit. On the PSB4, pressing the <CALB> key on the keypad puts the sampler into the Program 20 calibration mode. Calibration is critical to ensure the sampler is drawing the correct volume of sample fluid each sample event. Failure to calibrate the unit could lead to potentially inaccurate sample volumes that can adversely affect the accuracy of the analysis. The sampler should be calibrated any time parameters that could affect the performance and accuracy of the unit are changed. This includes changing the pump tubing, changing the draw height, changing the sample volume, varying the intake hose length, changing the sampling location, etc. Built into the software is a draw table containing information necessary to draw an accurate sample. The accuracy of the sample is significantly influenced by the length of the discharge tube. The sample volume contained in the tube from the fluid sensor to the end of the discharge tube is the DEAD TUBE VOLUME (DTV). Changing the DTV will effect the accuracy of the sample volume and calibration. During calibration insure the DTV is the same as the DTV during regular sampling. To run the calibration follow the detailed instructions below. There are a few important items to remember about the Program 20 Mode:

1) A device to measure liquid volume is required. Direct the discharge side of the pump tubing into the liquid measurement container so the sample will be collected with no spillage. Measure the sample as accurately as possible as the sampler will only be as accurate as the sample volume entered into the system.

2) The unit is programmed to collect a sample volume entered by the operator each time a calibration is run. The operator is prompted to enter a sample volume each calibration. **NOTE:** The sample volume entered by the operator during calibration becomes the active sample volume once regular sampling is resumed. Thus the sample volume can be changed by the calibration routine. Once the volume collected is equal to the sample volume entered by the operator the calibration is complete and the sampler is ready to program.

3) It is best to calibrate the unit at the site where sampling is to take place. This ensures that site parameters, which can affect the accuracy of the sample volume, are accounted for by the unit. If this is not possible, simulate the conditions as closely as possible, before putting the unit into service.

After entering the Program 20 Mode, the system will prompt the user to enter a sample volume. The operator will enter the sample volume desired for the site. The software will then prompt the user to push <START> to start the calibration cycle. After pressing <START> the unit will automatically perform the functions necessary to collect a sample. Make sure the discharge hose is directed into a measuring container. Once the unit has deposited the sample, measure it very precisely, and then enter the sample volume into the system at the CALIBRATION VOLUME prompt. If the sample size is equal to the operator entered sample volume calibration is complete. If it is not, re-run the calibration entering the amount of liquid collected into the system each time until the unit collects the correct volume. If the unit is not able to draw the user entered volume, check the parameters in Program 99 Mode to verify parameters that could affect the accuracy of the sample volume are entered correctly (i.e., Draw Height, Intake Hose Length, etc.). If they are confirmed accurate, call the Manning Service Department for assistance. The unit

will return to the SAMPLER READY prompt after calibration.

Display on LCD	Explanation
SAMPLER READY **04/30 04:30:02**	This display shows the sampler is ready to program. It displays the current time. From here the user can enter any TIME, FLOW, or * Mode. Press the <CALB> key to access the calibration mode.
SAMPLE VOLUME? **— — — —** **04:30:02**	Prompts the user to enter a sample volume. The volume is in the range of 10 to 9999mL
-START- TO CALIBRATE **— —** **04:30:02**	Press <START> to begin the calibration sequence. The unit will purge the line to clear it of any obstructions and to remove residual fluid. It will then begin drawing the sample. Make sure to have the discharge side of the pump tubing directed into a measuring container. The sample will be deposited, and the unit will again purge the line. Measure the sample as precisely as possible.
CALIBRATION VOLUME? **— — — —** **04:30:02**	The sampler will now prompt the user to enter the amount of liquid (in mL) collected in the container. If the calibration volume entered by the user is equal to the desired volume the calibration is complete. If the amount collected is not equal to the desired volume, enter the collected amount and re-run the calibration sequence. The sampler uses this information to adjust itself to draw the desired volume. If after running the calibration several times, and the sample volume is still not the desired volume, check the parameters in Program 99 Mode to verify parameters that could affect the accuracy of the sample volume are entered correctly (i.e., Draw Height, Intake Hose Length, etc.). If they are confirmed accurate, call the Manning Service Department for assistance. The unit will return to the SAMPLER READY prompt after calibration.

NOTE: The user can also adjust the active sample volume in the <TEST CYCLE> routine.

Sample Volume - <Sample Volume>

<Sample Volume> sets the volume (in milliliters) the sampler collects each sample cycle. This is the same parameter set through <Prog> 99, but in order to expedite the changing of the sample volume, this "Hot Key" is available directly on the keypad. The sample volume can be changed in program modes and in the sampler ready mode. All changes in sample volume are recorded and can be reviewed through the data logging function.

Display on LCD	Explanation
SAMPLER READY **12:48**	The user can change the sample volume (in mL) at program modes and in the sampler ready mode. Press the <Sample Volume> key to change the sample volume.
SAMPLE VOLUME? — — — —	Sets the sample volume of the sampler in milliliters. Enter the sample volume to be collected and press <ENTER>. The sampler will return to the display that was shown previous to pressing <Sample Volume>.

Draw Height - <Draw Height>

<Draw Height> sets the height and horizontal distance (in feet) the sampler will draw the sample(s). This is the same parameter that is set through <Prog> 99, but in order to expedite the changing of the draw height, this "Hot Key" is available directly on the keypad. The draw height can be changed in program modes and in the sampler ready mode. Draw height is an important parameter as it helps to ensure accurate and repeatable sample volumes which are critical in the collection of composite samples. All changes in draw height are recorded and can be reviewed through the data logging function.

Display on LCD	Explanation
SAMPLER READY **12:48**	The user can change the draw height at program modes and in the sampler ready mode. Press the <Draw Height> key to change the draw height.
DRAW HEIGHT? — — — —	Sets the draw height or lift height of the sampler in feet. Enter the actual feet and press <ENTER>. The sampler will return to the display that was shown previous to pressing <Draw Height>.

Program 19

(Reset Tube Life Count)

Program 19 resets the tube life pump count. A peristaltic units ability to operate and perform to specifications, such as transport velocity and lift height is, to a certain extent, determined by the pump tubing used in the system. The characteristics of the tubing change as it wears. It becomes less resilient, less able to maintain its shape, develops pinch points on the outside edge of the tube, and as such is not capable of the performance it had when it was new. To maintain optimum performance, it is necessary to monitor the wear on the tube. Program 19 does this by enabling the operator to set a maximum number of pump revolutions, the tube currently in use, will be allowed to accumulate. This, in effect, determines the tube's useful life. Manning recommends not exceeding 1,500,000 pump counts for a singular tube as, by this time, there is risk that the tubing could fail causing a variety of problems. Program 19 should be used every time the pump tubing is changed. The user will be alerted to change the tubing, when the tubing reaches the number of counts set. The warning will appear, every time the user executes a Program, by pressing <START>. Since all programs are initiated by pressing <START> the warning will always appear, if appropriate, before the program is initiated. This allows the user the opportunity to exit the program and change the tubing. Once the tubing is changed, the user can re-calibrate the sampler, re-enter the program and begin sampling.

When the pump tubing is to be changed, the user will enter into Program 19, just like entering any of the other Programs. The sampler will prompt the operator to clear the current pump count by pressing 1, or to maintain the current count by pressing 0. It is advisable to reset the pump counts when changing the tubing so an accurate accounting of the number of revolutions, the tube in the pump has experienced, can be obtained. At this juncture the user will be asked to enter a number for the tube life warning which represents the number of revolutions the current tube will be allowed to accumulate before a warning is issued. Once entered, the system will return to the sampler ready prompt and the system will be ready to program.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display shows the sampler is ready to program. It displays the current time. From here the user can enter any TIME, FLOW, or a Program. Press the <PROG> key to access the Program.
ENTER * MODE **— —**	Prompts the user to enter a Program. Press 19 and <ENTER> to proceed.

0=MAINTAIN 1=CLEAR
—

This prompt is asking the user to determine how the system will handle the current accumulation of revolutions:

0 - Maintains the current revolution count. This is useful if the operator wishes to increase the number of revolutions the current tubing can accumulate before a tube life warning is issued. For example, assume the current tubing has 200,000 revolutions. The operator really wants the warning to come on at 400,000. The 0 key would be pressed instead of 1 to maintain the history the tubing has already generated. The user would then enter 0400 (for 400,000) at the TUBE LIFE WARNING prompt (see below).

1 - Resets the current revolution count. This is necessary if the user is going to be placing brand new tubing into the system. With the counter reset the user knows exactly how many counts it will take for the sampler to issue a warning to change the tubing.

TUBE LIFE WARNING
— — — —

Enter the maximum number of counts the tubing will accept before the sampler issues a pump tube warning. The number entered is in terms of thousands (in other words it adds 3 0's to the end of the number entered) so if 0500 is entered, the sampler would see it as 500,000. Entering 4000 equals 4,000,000 and 0060 would be 60,000, etc. The sampler will then issue a tube life warning when the pump revolutions meet or exceed the set number of pump counts entered in Program 19.

<PROG> 21 DISABLE/ENABLE THE FLUID SENSOR

Program 21 allows the operator to disable or enable the fluid sensor (if it has been previously disabled). Under normal conditions the sampler uses the fluid sensor to detect the presence of fluid at the pump and then counts pump revolutions to determine sample volume. Under some sampling situations, the standard continuity probe fluid sensor will not operate correctly. A film may build up between the two sensor probes, causing the fluid sensor to short. The sampler displays "CLEAN FLUID SENSOR" before drawing, and when the sampler is reset. Conversely, the fluid sensor probes may not detect the presence of fluid when fluid is actually flowing through the sensor. This ca be the result of an insulating film building up on the sensor probes, or the fluid is self is not a good enough conductor of electricity for the sensor to function correctly (i.e., de-ionized water). The ultrasonic fluid sensor is immune to these problems, but it may not function correctly if the fluid being sampled has air bubbles in it.

By disabling the fluid sensor using Program 21, the sampler takes samples based on time. When the calibration program is run with the fluid sensor disabled, the calibration routine adjusts the pump count required to draw the sample based on time factors.
With the fluid sensor disabled, the sampler immediately counts down the pump count at the beginning of the draw portion of the sample cycle. Therefore, the beginning pump count value determines how long the sampler will draw, and how much sample is deposited. As long as sample volume, intake hose length, and draw height are not changed, the sample volume delivered will be fairly consistent.

Rinses are not allowed while the fluid sensor is disabled. The sampler ignores the number of rinses entered in Program 99 Setup.

Display on LCD	Explanation
SAMPLER READY **12:00 12:00:00**	This display shows the sampler is read to program. Press the <PROG> key.
ENTER * MODE **— —**	Prompts the user to enter a Program. Press 21 and <ENTER> to proceed.
USE FLUID SENSOR? **—**	Enter 0 to disable the fluid sensor or 1 to enable the fluid sensor and then press <ENTER>.
SAMPLER READY **12:01 12:01:00**	The sampler is now ready to be calibrated.

Program 91 Data Logging

Program 91 is the data logging function for the Manning Environmental Inc. sampler family. The data logging function is always active, and will continuously record events and sampler activities as they occur. The system performs a bound checking function on entries. This ensures that entries which exceed the limits placed in the system are not accepted. If this happens a EEEE will appear on the display. The user simply presses <CLEAR> to remove the EEEE and is then able to continue to enter numbers. The unit holds up to 512 entries in battery backed RAM, so in case of power loss the unit will not loose recorded events. If a 513th entry occurs, the unit will display a LOG FULL message and that entry and subsequent events and activities will not be recorded until the log is cleared. The unit will display the collected information upon the 2 line by 20 character backlighted LCD display. The data is displayed in a coded format so the maximum amount of information is available on the screen. The codes are explained in the view menu. Program 91 can only be entered from the SAMPLER READY prompt. The user can reach this screen from any location by pressing <RESET> <RESET>.

Display on LCD	Explanation
SAMPLER READY 1**2:48**	This display shows the sampler is ready to program. It displays the current time. From here the user can enter any TIME, FLOW, or a Program. Press the <PROG> key to access the Program.
ENTER * MODE **— —**	Prompts the user to enter either a program or the configuration function. Press 91 and <ENTER> to view the data logging menu.
ID = 1 VIEW = 2 EXIT = 3 **DOWNLOAD = 4 CLEAR = 5**	This menu shows the options available in the data logging menu. It is displayed momentarily (3 seconds) before the selection menu is brought up. ID Menu -Allows the user to set Site ID information. VIEW Menu - Allows the user to review logged data. EXIT Menu - Takes the user out of the Data logging menu and back to the Sampler Ready prompt by executing a warm start. DOWN LOAD Menu - Downloads data to a printer, DTU, or PC. CLEAR Menu - Clears all logged data, except Site ID, from memory.
ENTER MENU SELECTION **—**	Enter the number coinciding with menu to be accessed and press <ENTER>. The following sections will explain each of the sub-menus:

ID MENU

The ID menu allows the user to identify a site at which the events have been logged and a corresponding date associated with the events at that site. This is represented by a 4 digit number which the user enters in the ID Menu (see below). The system only allows for one site ID at a time. For example, the user enters 1234 as a site ID number and logs 100 samples at that site. Later the sampler was moved to a different site. If the operator enters a new site ID number (5678), the original site ID (1234) will be overwritten with the new site ID number (5678). The operator should download the data before changing site ID numbers in this scenario.

ENTER MENU SELECTION —	At this prompt input a 1 and press <ENTER>
ENTER 4 DIGIT ID # — — — —	The user enters a 4 digit number that corresponds to the site at which the samples will be taken. Only one site number can be used at a time. Entering a new site number, overwrites all stored site numbers.
ENTER MONTH MM # — —	This display asks the user to enter the current month in 2 digit format. For example 03 = March, 11 = November, etc...
ENTER DAY DD # — —	The user enters the 2 digit number corresponding to the current day. The first day of the month being 01, the last being 30 or 31.
ENTER YEAR YYYY # — — — —	The operator enters the current year in 4 digit format.

VIEW MENU

The view menu allows the user to review logged events and activities. The information recorded is not limited to sampling events. Activities such as power failure, warm starts, cold starts, etc.. are also recorded to allow the operator a fuller and more comprehensive understanding of the activities of the unit. The information in the VIEW menu is shown in coded format to allow the maximum amount of information to be displayed in the smallest amount of space.

TIME: Twenty four hour clock in HH:MM:SS format.

EVENT #: An "E" marks the beginning of information related to Event # and is separated from the Time by a comma. The event number represents the sequential order of the events that have been logged since the operator last pushed <START>. For example E001 would be the first logged event with E512 being the last since the unit logs a maximum of 512.

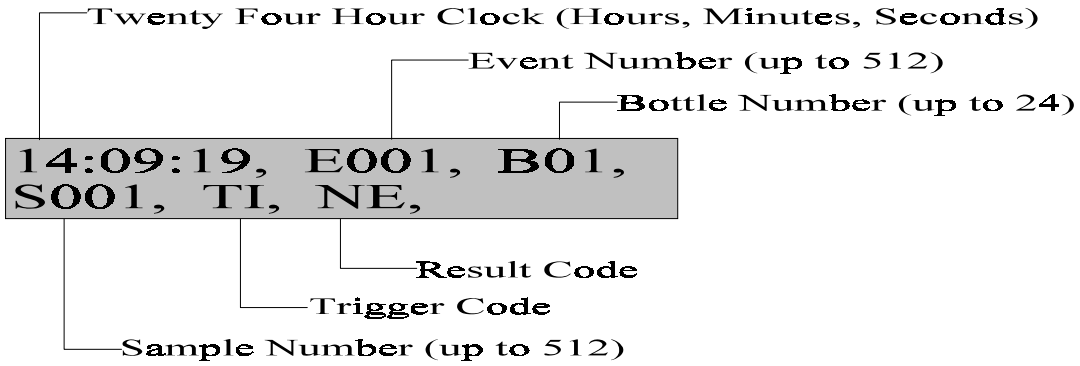
BOTTLE #: Preceded by a "B", the Bottle # is separated from the Event # by a comma. Bottle number indicates the Bottle that the sample was placed into.

SAMPLE #: This is the first entry on the 2nd line of the display. It is indicated by an "S".

RPM COUNTS: This the last entry and indicates the number of pump revolutions that were necessary to collect the programmed sample.

TRIGGER CODES: The trigger code shows the operator what triggered or initiated the sample to be taken. The following shows the letter corresponding to the sample trigger:

TI = Time Interval TO = Time Override
CC = Contact Closure TC = Test Cycle (In a program)
TY = Test Cycle (Not in a program)



RESULT CODES: The result code indicates whether the unit was successful or unsuccessful in

collecting the sample. If the sampler was successful, the unit will indicate this with a NE. If the unit did not collect the sample either a BF or NF will be displayed. The codes are as follows:

NE = No Error NF = No Fluid
BF = Bottle Full

ACTIVITY LOG: The unit also logs information about non sampling events such as power failures, sample volume, draw height, start sequences, reset occurrences, etc.. This data is displayed in a different format than the event entries. Time is displayed in twenty four hour format, and the activity (in this example START):

16:04:44, START

Each time the particular activity is executed (in this case START), the information will be stored in the log. This also applies to reset's, power failures, etc... The storage of this information increases the users ability to understand the sampling events and how other activities might have effected the sampling program.

ENTER SELECTION
__

At this prompt input a 2 and press <ENTER>

 # OF EVENTS = __ __ __

Shows the operator the number of events recorded. The sampler holds a total of 512 events. This is a momentary display (3 seconds).

ENTER THE START #
__ __ __

The operator is then prompted to enter the point (event #) at which they want to begin the display of recorded events. Input the starting point as a 3 digit number and press <ENTER>

ENTER THE COUNT #
__ __ __

The user is then prompted to enter the number of events they wish to view. Input the number of events to be viewed as a 3 digit number and press <ENTER>. This feature allows the user to view all the logged events, a section of the logged events (300 to 400 for example), or a single event.

ENTER SCROLL SECONDS
— —

To set the scroll seconds, enter a 2 digit number representing the amount of time, in seconds, you wish the display to show a recorded event before advancing to the next screen. After inputting press <ENTER>

The sampler displays recorded events in one of two ways:

A. By entering the scroll seconds, the sampler automatically advances sequentially through the recorded events, showing each event for the set number of scroll seconds. This will continue until the event entered in the COUNT # is displayed. The sampler will then return to the ENTER SELECTION prompt within Program 91.

B. The user can also manually review the logged events, although scroll seconds still have to be entered. To manually examine the logged events press <DISPLAY> once for each event to be reviewed. If <DISPLAY> is not pressed, the unit will default and use the entered scroll time to advance the display.

PUSH THE DISPLAY KEY FOR NEXT EVENT

This is a momentary display (3 seconds) to remind the user that they can manually advance the log review or that the unit will do it automatically based on the time set at the scroll seconds prompt.

_ _:_ _:_ _ , E_ _ _ , B_ _
S_ _ _ , _ _, _ _ , F_ _ _ _

This display is divided into multiple sections to communicate information about the logged sample.

1st Line

1st section - Time at which the sample was collected.
2nd section - Headed by a capital "E", indicates the event number.

3rd section - Headed by a capital "B" represents the bottle number.

2nd Line

1st section - Headed by a capital "S" indicates the sample number.
2nd section - Trigger Codes - This is a 2 letter code that specifies what initiated the sample. For a complete list of codes, refer to page 11 - TRIGGER CODES.
3rd section - The last section signifies result code. This tells the user whether the sampler was successful or unsuccessful in collecting a sample and why.

To quit viewing data, simply press <RESET> once. This takes you to the beginning of the menu selection in the Data Logging menu. The unit will continue to show the events either based on the scroll time or by pressing <DISPLAY> until the STOP # is reached. At this point the unit will return the operator to the ENTER SELECTION prompt.

EXIT MENU

This menu allows the user to exit back to the SAMPLER READY prompt from which other programs or functions can be entered. The only other way to exit the data logging menus is to press <RESET> <RESET>. However, this will be recorded as an activity, whereas using the exit menu will not.

ENTER SELECTION —

At this prompt input a 3 and press <ENTER>. The unit will execute a warm start and return to the SAMPLER READY prompt.

DOWNLOAD MENU

NOTE: THIS OPTION REQUIRES THE USE OF A SERIAL PORT IF THIS WAS NOT ORDERED WITH YOUR SYSTEM, PLEASE CONTACT MANNING FOR ORDERING INFORMATION.

The download menu is intended to allow the operator to make either a hard copy (by sending the information to a printer) or an electronic copy (by sending the information to a PC or a Data Transfer Unit). The information is in ASCII format and is comma delimited for easier interface with commercially available spreadsheet programs. The Baud Rate is fixed at 9600 with 8 bits no parity and 1 stop bit. The download menu is identical to the VIEW menu. The only difference is that when the data is reviewed, it is also being downloaded to the device of choice.

ENTER SELECTION —	At this prompt input a 4 and press <ENTER>
# OF EVENTS = — — —	Shows the operator the number of events recorded. The sampler holds a total of 512 events. This is a momentary display (3 seconds).
ENTER THE START # — — —	The operator is then prompted to enter the point (event #) at which they want to begin the display of recorded events. Input the starting point as a 3 digit number and press <ENTER>
ENTER THE COUNT # — — —	The user is then prompted to enter the number of events they wish to view. Input the number of events to be viewed as a 3 digit number and press <ENTER>. This feature allows the user to view all the logged events, a section of the logged events (300 to 400 for example), or a single event.

ENTER SCROLL SECONDS
— —

To set the scroll seconds, enter a 2 digit number representing the amount of time, in seconds, you wish the display to show a recorded event before advancing to the next screen. After inputting press <ENTER>

The sampler displays recorded events in one of two ways:

A. By entering the scroll seconds, the sampler automatically advances sequentially through the recorded events, showing each event for the set number of scroll seconds. This will continue until the event entered in the COUNT # is displayed. The sampler will then return to the ENTER SELECTION prompt within Program 91.

B. The user can also manually review the logged events, although scroll seconds still have to be entered. To manually examine the logged events press <DISPLAY> once for each event to be reviewed. If <DISPLAY> is not pressed, the unit will default and use the entered scroll time to advance the display.

PUSH THE DISPLAY KEY FOR NEXT EVENT

This is a momentary display (3 seconds) to remind the user that they can manually advance the log review or that the unit will do it automatically based on the time set at the scroll seconds prompt.

_ _:_ _:_ _ , E_ _ _ , B_ _
S_ _ _ , _ _, _ _ , F_ _ _ _

This display is divided into multiple sections to communicate information about the logged sample.

1st Line

1st section - Time at which the sample was collected.
2nd section - Headed by a capital "E", indicates the event number.

3rd section - Headed by a capital "B" represents the bottle number.

2nd Line

1st section - Headed by a capital "S" indicates the sample number.
2nd section - Trigger Codes - This is a 2 letter code that specifies what initiated the sample. For a complete list of codes, refer to page 11 - TRIGGER CODES.
3rd section - The last section signifies result code. This tells the user whether the sampler was successful or unsuccessful in collecting a sample and why.

The unit will begin to scroll through the entries one at a time either based on the default or on the user pressing the <DISPLAY> key. The information being displayed is also being sent to the data collection device attached to the sampler (i.e. printer, PC, DTU).

CLEAR MENU

The sampler is capable of holding up to 512 events or activities in memory. Once the databank is filled, the unit will not store any additional information until the event log is cleared. Once the log has been cleared the information that had been stored there is permanently erased. If the information is critical please review the DOWNLOAD menu above for information on how to save the logged events and activities in either electronic format or hard copy.

ENTER MENU SELECTION —	At this prompt input a 5 and press <ENTER>
CLEAR LOG DATA **NO = 1 YES = 2**	This display is shown momentarily to orient the user to the upcoming menu selection.
CLEAR?? NO = 1 YES = 2	Enter your selection at the prompt: 1 This does not clear the data and will take you back to the ENTER SELECTION prompt. 2 This will clear all data. If there is any data that needs to be retained, make sure a backup exists. Once the data has been deleted it is unrecoverable. After the data is cleared, you will be taken back to the ENTER SELECTION prompt.

ANALOG OPTION PROGRAMMING

This section explains how to program the sampler if the unit has the optional analog controller. If it was not ordered, it is not necessary to read this section. The analog option allows the sampler to accept an analog signal (4-20mA) from an external device.

When using any of the analog programming Modes (<Prog>05,<Prog>06, <Prog>09), the sampler will prompt the user to enter an upper and a lower limit. These limits can refer to flow or level depending on the program. The limits are important because of the Analog to Digital converter in the PSB4. The converter allows an analog signal to be divided into 256 (0 to 255) divisions which digitizes the signal. The lower limit will correspond to the lowest signal level (4mA) sent from the external device. The higher limit will correspond to the highest signal level (20mA) sent from the external device. The difference between the lower limit and the higher limit is the span. The processor divides the span into 256 evenly spaced steps.

For example, with a 4-20mA signal, if you set the lower limit to equal 4 ft and the upper limit to equal 44 feet the following values would automatically be assigned to each:

Analog Signal	Level	A/D Digital Value
4mA	4ft.	0
8mA	14ft.	63
12mA	24ft.	127
16mA	34ft.	180
20mA	44ft.	255

The following are examples of information displayed on the LCD during an analog program with various analog inputs. This example uses the same settings as the previous chart with the lowest limit as 4 and the upper limit as 44.

Analog signal	Display 1	Display 2	Display 3
4mA	1	000	4
8mA	2	063	14
12mA	3	127	24
16mA	4	180	34
20mA	5	255	44

In this example, when the controller receives a 4mA signal (the lowest possible from a 4-20mA device) the LCD will display 1 (standing for the number of samples taken), the second number displayed will be 000 (standing for the digital number, 0-255, assigned to the signal), and finally the third number displayed is 4 (standing for the height or flow in this example). These displays can be used to diagnosis problems with the analog option and to monitor the height or flow during the sampling cycle.

Totalizing

When the volts or amps of a signal vary, corresponding to a flow, then the signal can be used to totalize the flow. Each time the analog signal is read, a value is obtained that can be converted into a flow. For example, (using a 4-20mA signal) when the analog signal is 12mA, then we know that the flow rate is half of the total. If maximum flow is 100 and minimum is 0, then the flow rate is 50. The volume units of the number are determined by the volume units of the maximum and minimum flows. If they are in liter then the flow is in liters, if they are in gallons then the flow is in gallons. Flow is volume per unit time, and though the volume unit can be anything the time units cannot. Except for 1 condition the flow unit should be volume unit per minute (gallon/min, L/min, etc), and the interval to check the analog signal should be 1 minute. The exception is when the sampling sequence (time to take and deposit a sample) takes longer than 1 minute. In this case, the time interval between analog signal checks must be increased. When the time interval between analog signal checks is greater then 1 minute, the volume that triggers a sample must be divided by the value of the time interval to function properly.

<Prog> 08- Analog Display Mode

Program 08 is a diagnostic mode used to test the sampler analog to digital converter. In this mode, the sampler continuously reads the input 4-20mA signal and displays it a Binary Coded Decimal (BCD) value (0 to 255), a milliampere value (4mA to 20mA) and a voltage (1VDC to 4.99 VDC). This mode is useful in troubleshooting current loop problems.
To use this mode, make sure that the sampler is connected to the 4-20mA transmitter (i.e., flowmeter, calibrator, etc.). With the sampler displaying the SAMPLER READY prompt, press <Prog>, 0, 8, <ENTER>. The sampler then displays the input 4-20mA signal as described above. To exit this program, press and hold the <RESET> key until the sampler resets.

ADD-ON PROGRAMMING FUNCTIONS

Delay Start

Delay Start works in conjunction with TIME and certain Programs to expand the capabilities of the sampler. It is not a stand alone program and cannot be used with Program Start, and FLOW Programs. Delay Start works by allowing the user to add a period of time to the beginning of a TIME or Program to delay the start of the program. This time period must elapse before the program can begin to operate. **NOTE:** Some programs already have a Delay Start in the program negating the user's ability to add an additional Delay Start. The user selects the program of choice and enters the required information. The PUSH START/OPTIONS prompt will then appear on the display. At this cue press <DELAY START> and enter the amount of time (in HH:MM format) the sampler is to wait before beginning the program. Once the Delay Start has elapsed, the program will start. For example, if the sampler were programmed with a 9.5 hour Delay Start and a 1.5 hour Time Interval, the sampler would wait for 11 hours until the first sample is taken, (9.5 hours of Delay Start and 1.5 hours for the Time Interval). The sampler would then take a sample every 1.5 hours until a bottle full condition occurs.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program. Delay Start - Time is not a stand alone program. It works in conjunction with TIME, and certain Programs. In this example <TIME> was pushed as the program of choice.
ENTER INTERVAL TIME __ __:__ __	Enter the time interval as a 4-digit number (HH:MM format) and then press <ENTER>.
PUSH START/OPTIONS	The program can then be started by pressing <START> or other functions can be added on such as Delay Start - Time. In this example <DELAY START> was pressed.
ENTER DELAY START __ __:__ __	This display prompts the user to enter a Delay Start time (in HH:MM format). This is the amount of time the sampler is to wait before starting the regular program (in this case TIME program).
PUSH START/OPTIONS	The sampler is now ready to begin operation. Press <START> to begin the Delay Start countdown.
DELAY START TIME __ __:__ __	This display shows the time remaining on the Delay Start.

TIME TO NEXT SAMPLE __ __:__ __	Once the Delay Start has counted down to zero, the Interval Time entered earlier will begin counting down. This display shows the time left to take a sample. As mentioned above, Delay Start - Time works with TIME, and certain Programs.

Program 15 - Active Sampling

This mode allows the operator to program active sampling periods for each day of the week. The operator enters the days to sample and an active time period (start time to stop time) for each day that sampling is to occur. The operator also chooses if the sampler will restart sampling (clears program parameters) or resume sampling (keep the program parameters from the last active period) when a new active day and time is started. In order for Active Sampling (Program 15) to work correctly, the sampler clock must be correctly set, and a sampling program must be entered.

If an end of sequence event (such as a bottle full) occurs before the active sampling period expires, then the active time period will have no effect. If the active time period expires while a sample is in process the sample will be completed and no more samples will be taken. After active sampling is set up in Program15, the operator then programs the sampler with whatever time or flow-paced program is required. During the active time period of an active day of the week, the sampler collect samples based on the sample program that is running. At the end of the active time period no more samples are collected until the next active day/time period.

If Active Sampling is programmed, The right-most position (position 20) on the top line of the LCD display indicates the Active Sampling status. A blinking "A" indicates that the sampler is in an active time period and sampling is allowed. A blinking "I" indicates that the sample is in a inactive time period and no sampling is allowed. If the last active period of the week has passed, the second line of the display indicated "NO MORE", meaning that no more sampling will occur that week. A week starts on Monday and ends on Sunday. Active sampling is turned turn off by entering the Program15 mode and entering a 0 at the ACTIVE SAMPLING? prompt.

The major use of the active sampling period will be in industrial monitoring situations where (as dictated by the EPA) a valid sample period cannot be longer than a specified period of time (i.e., 24 hours), or in sampling situations were sampling is only required for a certain part of the week (i.e., Thursday 8:00AM until Sunday 8:00PM).

Display on LCD	**Explanation**
SAMPLER READY **04/30 04:30:02**	This display indicates the sampler is ready to program and alternately displays the current time and date. Press the ***** key to begin programming.
ENTER *MODE __ __ **07/30FRI**	The sampler is now prompting for a star mode to be input. Enter the numbers which represent the star mode of choice, in this example 15, and press <ENTER>.

ACTIVE SAMPLING? **0** **04:30:02**	The sampler then asks if Active Sampling is to be turned on. Enter a "1" and press <ENTER>
RESTART=0 RESUME=1 **0** **04:30:02**	The sampler then prompts for selection of RESTARTING sampling at the beginning of each active period (enter "0") or RESUME sampling at the beginning of each active period (enter "1")
ENTER DAYS OF WEEK **Mo Tu We Th Fr Sa Su**	The display prompts to enter the days of the week that you want to sample. This information is displayed for only 5 seconds.
1 2 3 4 5 6 7	The display then changes to numbers on the bottom line which represent the days of the week (1=Monday, 2=Tuesday, etc.) Press number key(s) on the keypad that corresponds to the day(s) that you want to sample.
Mo Tu Fr **1 2 3 4 5 6 7**	For each day that was selected as a active sampling day, the name of the day will appear above its corresponding number on the first line of the display. If you press the number key of a day that is active, it will become inactive an the name of the day will disappear from the first line of the display. After all the active days have been selected, press <ENTER> to continue.
Mon. START TIME **__:__** **04:30:50**	For each day that was selected as an active sampling day, the sampler asks for a start time in HH:MM format. To start at the beginning of the day, enter 00:00. Enter the start time and press <ENTER>.
Mon. STOP TIME **__:__** **07/30FRI**	The sampler then asks for the sop time in HH:MM format. Enter the stop and press <ENTER>. To stop at the end of the day, enter 24:00. This step and the previous one are repeated for each day that was selected to be an active sampling day.
SAMPLER READY A **04:30** **04:30:03**	After the final stop time has been entered, the display will change to SAMPLER READY. If the present day and time is in an active sampling period, the display will have a blinking "A" in the upper right-hand corner. If the present day and time is not in an active sampling period, the display will have a blinking "I" in the upper right-hand corner.

Once the active period has been setup using Program15, you can then enter a sampling program.

GENERAL PROGRAMS

Time - Program Start

Program START is a unique program. It is unlike any other program in that it automatically programs the unit to take a sample every hour. Simply press the <PROG> key and then <START>. As soon as <START> is pressed, the sampler begins counting down 1 hour. At the end of that hour the sample sequence will be initiated. The sampler will draw the sample, and place it in the bottle. The time interval will reset as soon as the sample cycle starts. At the end of the second another sample will be taken and deposited. This will continue until a bottle full condition occurs. The sequence will then be finished and the unit will stop operation waiting for the same or a new program to be entered.

Display on LCD	Explanation
SAMPLER READY **10:04**	This display indicates the sampler is ready to program and displays the current time. Press the <PROG> key to begin programming.
ENTER * MODE **— —**	At the ENTER PROGRAM # prompt, press <START> to begin the Program Start Program.
TIME TO NEXT SAMPLE **01:00**	The sampler is automatically programmed and the display will show the time (in HH:MM format) until the next sample.

Time - Single Time Interval

This program is similar to Program START except the user sets the Time Interval instead of having it automatically set to 1 hour. The user enters a time in HH:MM format from 1 minute to 99 hours and 59 minutes. This time interval is used to initiate each sampling sequence in this program until the sampler ends its cycle and/or is re-programmed. After the time interval is entered and the program has been initiated by pressing <START>, the sampler will begin counting down the time interval. When the interval has elapsed, the unit will draw a sample and place it in the bottle. The timer will reset as soon as the sample cycle starts and will immediately begin counting down the same time interval again. After the interval has elapsed again, another sample will be taken and deposited. This will continue until a bottle full condition occurs. For example, if the time interval is set for 1 hour 30 minutes, the sampler would count down 1 hour and 30 minutes, take the first sample, and reset the timer. After another 1 hour and 30 minutes the sampler would take another sample and reset the timer, etc.

Display on LCD	Explanation
SAMPLER READY **10:04**	This display indicates the sampler is ready to program and displays the current time. Press <TIME> to begin programming.
ENTER INTERVAL TIME **__ __:__ __**	Enter the time interval as a 4-digit number (HH:MM format) and then press <ENTER>.
PUSH START/OPTIONS	The program can then be started by pressing <START> or other functions can be added. In this example, <START> is pressed.
TIME TO NEXT SAMPLE **__ __:__ __**	The display will show the time until the next sample.

Flow Program

Flow Programs differ from Time Programs in that instead of taking a sample after a time interval has elapsed, the unit will take samples after receipt of a contact closure from an external device. Whether those contact closures are based off Flow, pH, Level, ORP, DO, etc. is transparent to the sampler. The unit simply acknowledges a contact closure was received and that in turn triggers the sample collection process. In FLOW Program the sampler does not control totalization, logging, or the meeting of certain parameters, etc. so they must be done by the external device. Once the parameters have been met, a contact closure will be output to the sampler. Every time a contact closure is received, the sample collection process is initiated. The sampler will draw a sample and place it in the bottle. It will then wait for the next contact closure while displaying a running tally indicating the number of samples taken to that point. This will continue until a bottle full condition occurs which ends the program. NOTE: If the contact is closed at the end of the sample cycle, the controller will take another sample.

Display on LCD	Explanation
SAMPLER READY **10:04**	This display indicates the sampler is ready to program and displays the current time. Press <FLOW> to begin programming.
PUSH START/OPTIONS	The program can then be started by pressing <START> or other functions can be added. In this example, <START> was pressed.
FLOW MODE **— — — —**	The sampler is now waiting to accept contact closures to trigger the sample collection process.

Flow Program - Contact Closure Accumulation

FLOW Program - Contact closure Accumulation operates the same as FLOW Program except instead of taking a sample after every contact closure, a sample is taken after a set number of contact closures (from 2 - 9,999) have been accumulated. **NOTE:** This program uses <DELAY START> for setting the number of contact closures to be accumulated. The display will show the number of contact closures the sampler is programmed to accumulate before taking a sample. Every time a contact closure is received, the sampler will decrease the number needed on the display by one. This shows how many more contacts have yet to be accumulated before a sample is taken. Once the set number of contact closures are received, the sampler will draw a sample and then place it in the bottle. It will then wait for the next accumulation. This will continue until a bottle full condition occurs. If this occurs, the sampler ends the program. NOTE: If the contact is closed at the end of the sample cycle, the controller will take another sample.

Display on LCD	Explanation
SAMPLER READY **10:04**	This display indicates the sampler is ready to program and displays the current time. Press <FLOW> to begin programming.
PUSH START/OPTIONS	To set the number of contacts to be accumulated in FLOW Program - Contact closure Accumulation, press <DELAY START> and then the <START> button.
DELAY IN PULSES? — — — —	The user is now prompted to set the number of contact closures the sampler will accumulate before taking a sample (2 - 9,999). Until it is changed or ends its cycle, it will always accumulate the same number of contact closures before taking a sample.
PUSH START/OPTIONS	Unless add-on options to the program are desired, press <START>.
FLOW MODE — — — —	This display shows the number of contact closures remaining before a sample will be taken. As contact closures are received the sampler counts down until it reaches 0. It will then take a sample and reset to accumulate the entered number of contact closures again.

SAMPLING PROGRAMS

Program 02 Flow Program - Time Interval Override

Program 02 operates much like basic FLOW program except a time override is added. The override time ensures a sample is collected, after a set amount of time has elapsed, if a contact closure has not been received. Once the program has been started the sampler will immediately begin counting down the override time. The sampler is also concurrently waiting for contact closures. Every time a contact closure is detected the sampler will draw a sample, and then place it in the bottle. It will then wait for the next contact closure while displaying a running tally indicating the number of samples collected to that point. If there have been no contact closures by the end of the override time the user specifies, the sampler draw a sample and then place it in a bottle. The override timer will then reset and immediately start counting down again while waiting for the next contact closure. This will continue until a bottle full condition occurs. If this occurs, the sampler ends the program. NOTE: If the contact is closed at the end of the sample cycle, the controller will take another sample.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program and displays the current time. Press the <PROG> key to begin programming.
ENTER * MODE — —	The sampler is now prompting for a Program to be input. Enter the numbers which represent the Program of choice, in this example 02, and press <ENTER>.
TIME OVERRIDE? — — : — —	Input the maximum time the sampler will be allowed to wait to receive a contact closure, understanding that if the unit has not received a closure in this time, it will automatically take a sample. Press <ENTER> after inputing.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
FLOW MODE (*02) — — — —	The sampler is now ready to receive contact closures and is independently counting down the Time Override.

Program 03 Flow Program - External Event

Program 03 is used for monitoring intermittent events by combining portions of Flow and Time programs. Program 03 differs from regular flow programs based on the way the sampler interacts with the contact closures it receives. In normal flow program the sampler receives a momentary closure from an external device, and this initiates a sampling cycle. In Program 03 the sampler also initiates a sample cycle based off the initial contact closure it receives. Once it has received that initial closure, the contact must remain closed for Program 03 to operate as intended. By the contact remaining closed, the time portion of the program is brought into effect and the unit will take samples based off a user set time interval. For example, assume the user has an external device with a relay that is normally open. The user sets a high and low trip point within the device. If an event takes place based on the high or low set point, the unit will send a closure to the sampler. This causes a sampling cycle to take place. If the contact does not remain closed, the unit will act as if it were programmed for a regular flow program, and simply take samples each time a contact closure is received. If the relay remains closed, however, the unit will then start to count down the user set time interval and once that interval has elapsed, take a sample. Each time the interval elapses, the unit will perform a sampling sequence. This will continue until a bottle full condition occurs. If the contact opens before this occurrences the sampler will suspend operation until it once again receives a contact closure that remains closed. After receiving another contact that remains closed the sampler will begin where it left off from the last contact closure.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program and displays the current time. Press the <PROG> key to begin programming.
ENTER *MODE __ __	The sampler is now prompting for a Program to be input. Enter the numbers which represent the Program of choice, in this example 03, and press <ENTER>.
ENTER TIME INTERVAL __ __:__ __	Input a time interval in HH:MM format.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program. NOTE: DELAY START does not work with Program 03.
FLOW MODE (*03) __ __ __ __	The sampler is now ready to receive contact closures and is independently counting down the Time Override.

Program 04 Time - Multiple Intervals

The Program 04 allows programming of up to 12 DIFFERENT non-uniform time intervals (1 min to 99 hours and 59 minutes). Non uniform time intervals refer to each interval being different from the previous or next interval. Once an interval is entered, the user is given the option of repeating the interval or entering a new interval. To repeat the interval, press <ENTER> once for each time the user wants the same interval repeated. The display will show the COUNT increasing, indicating the same interval is being logged multiple times. An interval can be the same as a previous interval as long as there is a DIFFERENT interval between them. For example if 01:00 was entered for the first interval, 02:00 for the second, and then 01:00 was entered again, this would be counted as THREE different intervals. After the program is initiated, the sampler will begin counting down the first interval. Once that interval has elapsed, the unit will start the sample taking sequence and will immediately start counting down the next interval. The sampler will draw and place a sample in the bottle. The sampler will repeat the operation each time an interval expires. The sampler will continue this pattern until all the intervals entered have expired or a bottle full condition occurs. Data entry can be ended at any time by pressing the <PROG> key.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program and displays the current time. Press the **<PROG>** key to begin programming.
ENTER * MODE __ __	The sampler is now prompting for a Program to be input. Enter the numbers which represent the Program of choice, in this example 04, and press <ENTER>.
ENTER FIRST INTERVAL __ __ :__ __	The user is prompted to input the first time interval in HH:MM format. Once the entry is complete press <ENTER>. The sampler considers this the FIRST time interval.
INTERVAL:1 COUNT: 1 **01 :00**	The display is now indicating it has recorded 1 interval (up to 12 different ones can be entered) and the interval has not been repeated. In this example the user entered an interval of 1 Hour. The user must now input a new interval or repeat the current interval.
INTERVAL:2 COUNT: 1 **02 :00**	The user inputs a new interval (0200) representing 2 hours. The display indicates the new interval has been logged by showing a (2) after the interval.
INTERVAL:2 COUNT: 2 **02 :00**	The user decides to duplicate the last interval. Press <ENTER> once for each time the current interval should be repeated. THIS DOES NOT COUNT AS A NEW INTERVAL as shown by the 2 after the COUNT.
INTERVAL:2 COUNT: 3 **02 :00**	In this example, the user has pressed <ENTER> again to log another interval of the same length. This is the third interval of 2 hours.

INTERVAL:3 COUNT: 1 **01 : 00**	The user has now logged a third DIFFERENT interval. Even though this is the same as Interval 1, it is considered a different interval since it is not the same as the previous interval. An interval that has been entered before can be repeated as long as there is a different interval between intervals of like time. If 12 different intervals are logged the PUSH START/OPTIONS prompt will appear. Otherwise data entry can be terminated at any point by pressing the <PROG> key.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
TIME TO NEXT SAMPLE **01:00**	The sampler displays the first time interval to be counted down.

Program 07 Flow - Time Interval Delay

Program - 07 operates much like a basic FLOW program except a time interval delay is added after a contact closure has been received. Just like in a FLOW program, the sampler waits for receipt of a contact closure. Once that closure has been taken, the unit immediately begins counting down a user set time interval delay. Once the delay has counted down, the unit performs a sampling sequence. It will then wait for the next contact closure while displaying a running tally indicating the number of samples collected to that point. Upon the next closure the unit will once again count down the user set interval and then take a sample. This will continue until a bottle full condition occurs. If this occurs, the sampler ends the program.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program and displays the current time. Press the <PROG> key to begin programming.
ENTER *MODE **__ __**	The sampler is now prompting for a Program to be input. Enter the numbers which represent the Program of choice, in this example 07, and press <ENTER>.
TIME DELAY? **__ __ : __ __**	Input the time the sampler is to wait, after receipt of a contact closure. Press <ENTER> after input.
PUSH START/OPTIONS	Press <START> to begin the program.
FLOW MODE (*07) **__ __ __ __**	The sampler is now ready to receive contact closures.

ANALOG SAMPLING PROGRAMS

<Prog>05 Flow Mode - Totalizing Analog

The <Prog>05 mode works much like FLOW mode except instead of relying on a contact closure, the sampler integrates and totalizes an analog signal (4-20mA from an external device which represents flow rate. For more details on how analog signal processing works, refer to the analog programming section on page B-21. Since the sampler does not ask for a definition of the volume unit of the flow rate, ANY can be used, i.e. cubic feet, liters or gallons. The time rate used must be *per minute*. This means that if the flowmeter is calibrated to output a 4-20mA signal representing gallons per day, then the flowmeter's minimum an maximum rates must be divided by 1440 (the number of minutes in a day) to get the proper flow rates for entry into the sampler. Once the unit is programmed, it begins reading the analog signal once per minute to internally totalize and keep track of the volume. When the totalized flow rate matches the Sample Trigger Volume entered by the user, the sample collection process is initiated. The unit will advance the spout, take a sample and deposit it in the first bottle. Every time the totalized volume matches the Sample Trigger Volume, the sampler will take a sample and deposit it, and then move to the next bottle in sequence. The sampler will continue this pattern of depositing a sample in each bottle, until the total number of bottles the unit is configured for (set in <Prog>99) each have a sample placed in them or a bottle full condition occurs.

NOTE: In order for the sampler to correctly scale the analog signal being output from the external device, the parameters (in this case maximum and minimum flow) set in the sampler and the external device must be the same. This is to ensure that if the external device is reading 100,000 gallons and outputting a 4mA signal, the sampler will also know that 100,000 gallons is equal to 4mA. If the parameters do not correspond there is a risk that the sampler will potentially not scale the analog signal correctly and will subsequently not take samples at the anticipated or correct instances.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program and displays the current time. Press the <PROG> key to begin programming.
ENTER * MODE — —	The sampler is now prompting for a star mode to be input. Enter the numbers which represent the star mode of choice, in this example 05, and press <ENTER>.
MAXIMUM FLOW RATE? — — — —	Input the 4 most significant digits of the Maximum flow rate in *units per minute.* Since the unit of measurement is generic it can stand for any volume. If the flow rate is 40, it is entered as 0040.
MINIMUM FLOW RATE? — — — —	Enter the 4 most significant digits of the Minimum flow rate in *units per minute.* The same criteria apply to this input as to Maximum Flow Rate.

Display on LCD	Explanation
FLOW MULTIPLIER? — — — —	The Flow Multiplier is used to scale the Maximum & Minimum Flow Rates. If the Max flow rate is 40,000, enter it as 4000 (first 4 significant digits). The user would then enter a Flow Multiplier of 10 (4000 x 10 = 40,000) to have the unit scale the flow rate as 40,000.
SAMPLE TRIGGER? — — — —	Enter the 4 most significant digits that tell the sampler at what accumulation of totalized flow a sample should be taken. If the user wanted to take a sample at 150,000 units, the entry would be 1500.
TRIGGER MULTIPLIER? — — — —	The Trigger Multiplier is used to increase, if necessary, the Sample Trigger. Using the example above, if 150,000 units is the Trigger point, the Trigger Multiplier would be 100 (1500 x 100 = 150,000).
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
FLOW MODE (*05) — — — —	The sampler is now waiting to take samples.

<Prog>06 Analog Level Mode

The <Prog>06 mode expands the capability of the sampler by allowing it to collect samples based on changing level parameters. The sampler is used in conjunction with an external device which outputs an analog signal (4-20mA) representing level (for more details on how analog signal processing works, refer to the analog programming section on page B-21). The sampler does not ask for a definition of this level unit, so ANY can be used, i.e. feet, meters, or inches. Once the unit is programmed and started, the sampler integrates the analog signal once per minute to internally track the water level. When the source water level rises above or falls below a Sampling Level, the sample collection process is initiated. The sampler will advance the spout, take a sample and deposit it in the first bottle. Every time a Sample Level is exceeded or passed after that, the sampler will take a sample, deposit it, and then move to the next bottle in sequence. The sampler will continue this pattern of depositing samples in each bottle until the total number of bottles the unit is configured for (set in <Prog>99) each have a sample placed in them or a bottle full condition occurs.

To use the <Prog>06 mode, the following entries must be entered:

UPPER LEVEL LIMIT: This is the highest anticipated level of the source liquid. It acts as a ceiling. If the water ever rises above the Upper Level Limit, the sampler considers the level as temporarily fixed at the highest Sampling Level (once the level falls below this point, normal program operation resumes). It is important to make sure the Upper Level Limit is high enough to prevent this from occurring.

LOWER LEVEL LIMIT: This is the lowest anticipated level of the source liquid. It acts as a floor. If it is possible for the level to drop below the Lower Level Limit, and it does, the sampler considers the level as temporarily fixed at the Lower Level Limit (once the level rises above this point, normal program operation resumes). It is important to make sure the Lower Level Limit is low enough to prevent this from occurring.

SAMPLING LEVEL (1-32): These are the levels at which samples will be taken (up to 32 levels can be programmed). Enter the level as a 4-digit number. Remember the decimal point is implied, and must be consistent with previous ones. The unit of measure is generic so it can be feet, meters, etc. The <Prog> key will end data entry at any time if all 32 levels are not going to be entered.

The difference (delta) between the Upper Level Limit and the Lower Level Limit is called the span (or distance). In figure 2-2, the Upper Level Limit is 37 and the Lower Level Limit is 2.5, so the span is 34.5. The controller divides the span into 256 equal steps, with each step equal to 0.39% (1/256) of the total. The sampler will always display the next acceptable level. A level that is greater can be entered or the user can accept the displayed entry.

The lowest Sampling Level, must be greater than the Lower Level Limit and each successive level must be greater than the previous level. In figure 2-2, the Lower Level Limit is 2.5 and Sampling Level 1 is 4.0. The highest sampling level can be equal to the Upper Level Limit, although this is not necessary. If it is

equal to the Upper Level Limit, it must be entered separately. In figure 2-2, the highest sampling level is equal to the Upper Level Limit so it is entered as Sampling Level 7. Press <START> to begin the program.

NOTE: In order for the sampler to correctly scale the analog signal being output from the external device, the parameters (in this case Upper Level Limit and Lower Level Limit) set in the sampler and the external device must be the same. This is to ensure that if the external device is reading 10 feet and outputting a 4mA signal, the sampler will also know that 10 feet is equal to 4mA. If the parameters do not correspond, there is a risk that the sampler will potentially not scale the analog signal correctly and will subsequently not take samples at the anticipated or correct instances.

The Dots Represent Sample Events.

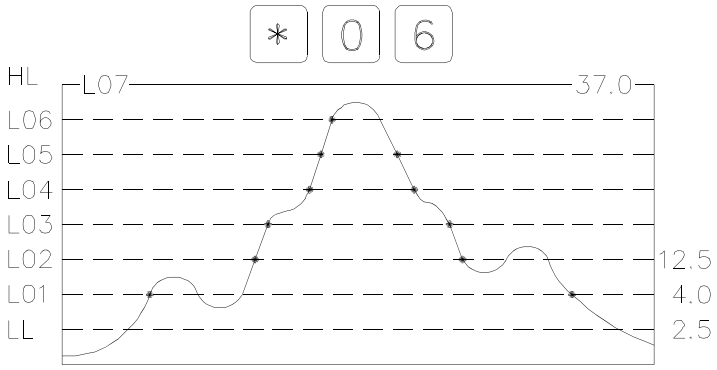


Figure 2-2 The Totalizing Analog Level Mode.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display indicates the sampler is ready to program and displays the current time. Press the **<PROG>** key to begin programming.
ENTER * MODE — —	The sampler is now prompting for a star mode to be input. Enter the numbers which represent the star mode of choice, in this example 06, and press <ENTER>.
UPPER LEVEL LIMIT? — — — —	Enter the Upper Level Limit as a 4-digit number. Remember the decimal is implied in this program and the unit of measure is generic, so if the user wants 10 feet/meters/inches/millimeters, it could be entered as 0010, 0100, or 1000. Make sure to be CONSISTENT in entries throughout the program.
LOWER LEVEL LIMIT? — — — —	Enter the Lower Level Limit as a 4-digit number. Remember to be consistent with the implied decimal from previous entries.
SAMPLING LEVEL 1? — — — —	Enter the first level as a 4-digit number remembering to put in the implied decimal point. Sampling Level 1 must be greater than the Lower Level Limit.

SAMPLING LEVEL 2? — — — —	Continue to enter 4-digit numbers for Sampling Levels (up to 32 levels) remembering that each subsequent level must be greater than the proceeding one and that the decimal point is implied and must be consistent with previous entries. The user can end data entry at any point by pressing the <Prog> key.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
FLOW MODE (* 06) — — — —	The sampler will immediately begin reading the analog signal.

<Prog>09 Hydrologic Level Event Mode
(Storm Water Sampling)

The *09 mode is used primarily for Storm Water Sampling, although it can be used to sample in any situation where there are rising and falling levels. The sampler is used in conjunction with an external device which outputs an analog signal (4-20mA) representing level (for more details on how analog signal processing works, refer to the analog programming section on page B-21). The sampler does not ask for a definition of this level so ANY can be used, i.e. feet, meters, or inches. After the unit has been programmed and started, it reads the analog signal once per minute to internally track the water level. Sampling does not begin until the source water level reaches Sampling Level 1. Once this has occurred, a sample is taken and the Time Override for Sampling Level 1 begins counting down. After Sampling Level 1 is reached, *09 Mode has 3 ways to trigger a sample:

1) When the analog signal corresponds to a Sampling Level.
2) The rise or fall of the water level by a user set amount (Rising or Falling Delta).
3) When the Time Override has elapsed if there has not been a large enough increase or decrease in water level or another Sampling Level has not been reached.

If any of these occur, the sampler will advance the spout, take a sample and deposit it in the first bottle. The sampler will continue this pattern of depositing samples in each bottle, until the total number of bottles the unit is configured for (set in *99) each have a sample placed in them or a bottle full condition occurs. If either of the first two triggering conditions is met (the analog signal corresponding to a Sampling Level or a Rising or Falling Delta), the Time Override is reset, and begins counting down again. A different Time Override can be set for each level entered. Each Time Override is only active in that portion or range of the total span that corresponds to its Sampling Level. Time Override 4 is active from the start of Sampling Level 4 to the beginning of Sampling Level 5.

The following entries are required. See figure 2-3 for an example.

Upper Level Limit	Maximum Analog Level (hydrologic high point) 100% of span.
Lower Level Limit	Minimum Analog level (hydrologic low point). 0% of span. The difference between the Upper Level Limit and the Lower Level Limit is the span.
Rising (positive) Delta	Rising change in water level, resulting in a sample. NOTE: The user can enter only 1 Rising Delta for the duration of the program.
Falling (negative) Delta	Falling change in water level, resulting in a sample. NOTE: The user can enter only 1 Falling Delta for the duration of the program.
Sampling Level 1	Water level at which the first sample will be taken, and which is associated with Time Override 1.
Time Override 1	Time Override to the next sample in the range. Causes a sample to be taken if the Rising or Falling Delta, or Sampling Level 2 has not been met within the override time. It will reset after a sample is taken.
Sampling Level 2-6	Subsequent higher levels at which samples will be taken.

Time Override 2-6 Subsequent Time Overrides that correspond to the equivalent Sampling Level.

The difference (delta) between the Upper Level Limit and the Lower Level Limit is called the span (or distance). In figure 2-3, the Upper Level Limit is 65 and the Lower Level Limit is 4, so the span is 61. The controller divides the span into 256 equal steps, with each step equal to .39% (1/256) of the total. If a level which is not a multiple of 1/256 is entered, the controller will indicate an acceptable entry. Up to 6 levels can be entered, however data entry can be stopped at any time by pressing the * key. After the * key is pressed, the LCD will prompt the user to either start the Program or add-on other options.

NOTE: In order for the sampler to correctly scale the analog signal being output from the external device, the parameters (in this case Upper Level Limit and Lower Level Limit) set in the sampler and the external device must be the same. This is to ensure that if the external device is reading 10 feet and outputting a 4mA signal, the sampler will also know that 10 feet is equal to 4mA. If the parameters do not correspond, there is a risk that the sampler will potentially not scale the analog signal correctly and will subsequently not take samples at the anticipated or correct instances.

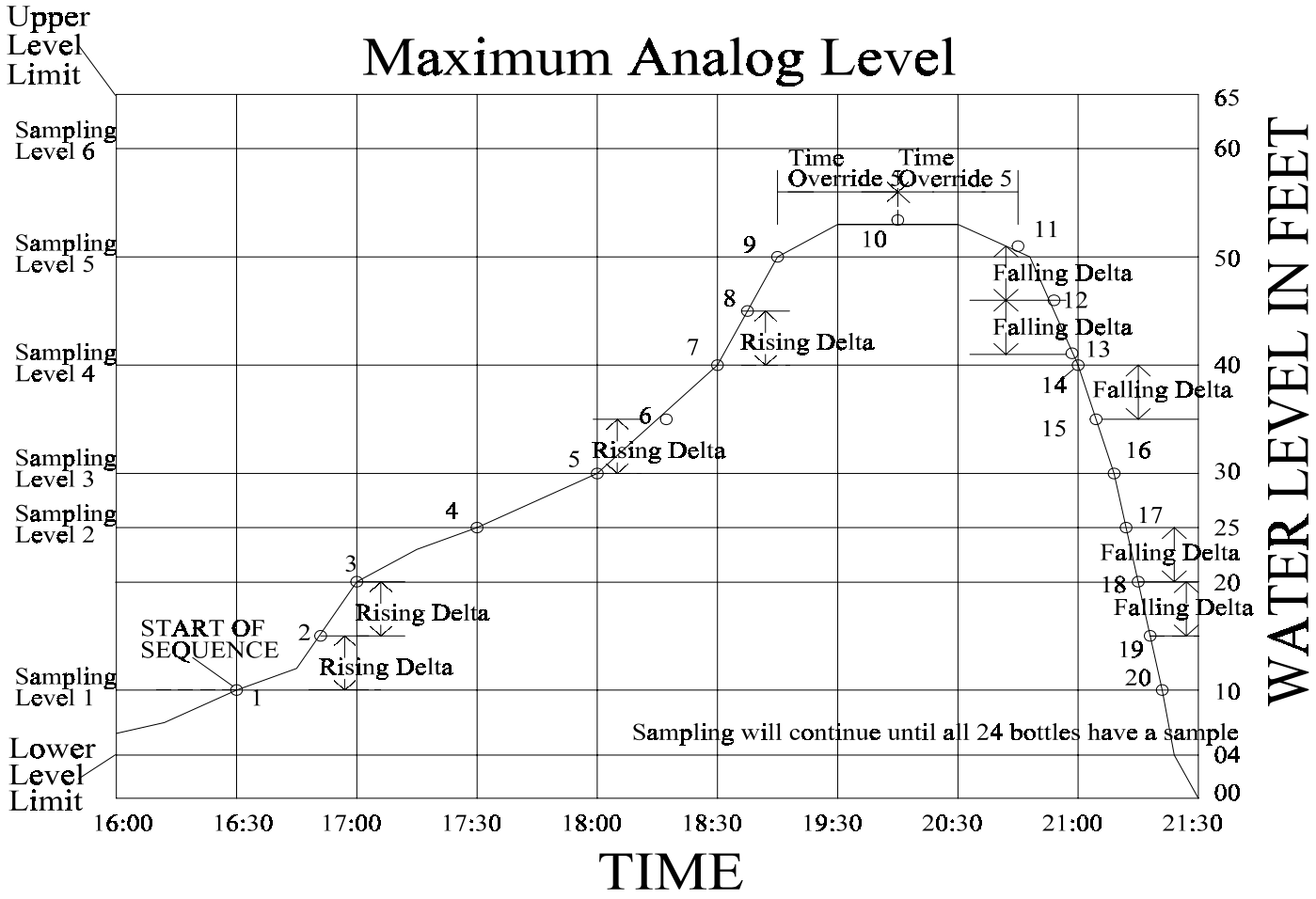


Figure 2-3 The *09 Storm Water Sampling Mode

Display on LCD	Explanation
SAMPLER READY **04:30 04:30:02**	This display indicates the sampler is ready to program and displays the current time. Press the <PROG> key to begin programming.
ENTER * MODE **— —** **04:30:02**	The sampler is now prompting for a star mode to be input. Enter the numbers which represent the star mode of choice, in this example 09, and press <ENTER>.
UPPER LEVEL LIMIT? **— — — —** **04:30:02**	Enter the Upper Level Limit as a 4-digit number. Remember the decimal is implied in this program and the unit of measure is generic, so if the entry were to be 10 feet/meters/inches/millimeters, it could be entered as 0010, 0100, or 1000. Be CONSISTENT in all entries throughout the program.
LOWER LEVEL LIMIT? **— — — —** **04:30:02**	Enter the Lower Level Limit as a 4-digit number. Remember to be consistent with the implied decimal from previous entries.
RISING DELTA? **— — — —** **04:30:02**	Enter a 4-digit number which represents the rising change in water level that will trigger a sample to be taken. If the rise of the water is equal to or greater than this number a sample will be taken.
FALLING DELTA? **— — — —** **04:30:02**	Enter a 4-digit number which represents the falling change in water level that will trigger a sample to be taken. If the fall of the water is equal to or greater than this number a sample will be taken.
SAMPLING LEVEL 1? **— — — —** **04:30:02**	Enter a 4-digit number that represents the lowest level at which a sample is to be taken. Must be greater than the Lower Level Limit. Remember to be consistent with the implied decimal from previous entries.
TIME OVERRIDE 1? **— — : — —** **04:30:02**	Enter a time in HH:MM format. This is the amount of time after Sampling Level 1 during which the sampler waits for an event (Rising or Falling Delta, Sampling Level 2 reached, etc.). If no event occurs before the interval is done, a sample will be taken. If an event occurs, the Time Override will reset, or move to Time Override 2 if Sampling Level 2 has been reached.
SAMPLING LEVEL 2? **— — — —** **04:30:02**	Enter a 4-digit number representing the next level at which a sample should be taken, keeping consistent with the implied decimal point in previous entries. A sample will be taken when the water level rises to this point. Must be greater than Sampling Level 1.
TIME OVERRIDE 2? **— — — —** **04:30:02**	Enter a time in HH:MM format. Operates on the same principal as Time Override 1.

Display on LCD	Explanation
SAMPLING LEVEL 3? **__ __ __ __ 04:30:02**	Enter a 4-digit number. Operates the same as previous Sampling Levels.
TIME OVERRIDE 3? **__ __ __ __ 04:30:02**	Enter a time in HH:MM format. Operates on the same principal as Time Override 1. Continue to enter Levels and Times for up to 6 levels. Data entry can be ended at any time by pressing the * key. The last level can be equal to the Upper Level Limit but it is not necessary. If it is equal it must be entered separately.
PUSH START/OPTIONS **04:30:02**	If no add-on options are desired, press <START> to begin the program
FLOW MODE (*09) **__ __ __ __ 04:30:02**	The sampler will immediately begin reading the analog signal.

Maintenance and Troubleshooting

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MAINTENANCE

The PSB sampler requires only minimal maintenance to ensure proper and reliable operation.

PERISTALTIC PUMP

The peristaltic pump used in the Manning PSB is designed for long life and trouble free service. The following is a list of routine maintenance items:

Lubrication	The peristaltic pump requires no regular lubrication.
Pump Tubing	See Below.
Pump Case	Manning recommends occasional cleaning to remove particulates that if caught between the wall and the tube, can cause increased wear of the pump tubing.
Pump Rollers	Manning recommends occasional cleaning to ensure smooth rolling and less wear of pump tubing.

Replacement of Pump Tubing

WARNING: Always disconnect the power to the sampler before opening the pump to replace the tubing. Failure to do so may lead to serious injury.

The peristaltic pump used on the Manning Model PSB has been designed to facilitate the changing of pump tubing. The unit is mounted in a horizontal position to allow the user not only to see how the tubing should lie within the pump, but to remove the cumbersome task of manipulating the tubing while the pump is in a vertical position. Perform the following steps to change the pump tubing:

WARNING: The orientation of the intake and discharge hoses must not change when replacing the tubing. If the orientation changes, the unit will operate in reverse of its proper operating procedure. This means it will try to draw a sample out of the sample container instead of out of the source liquid.

1) Verify there is no power being applied to the unit.

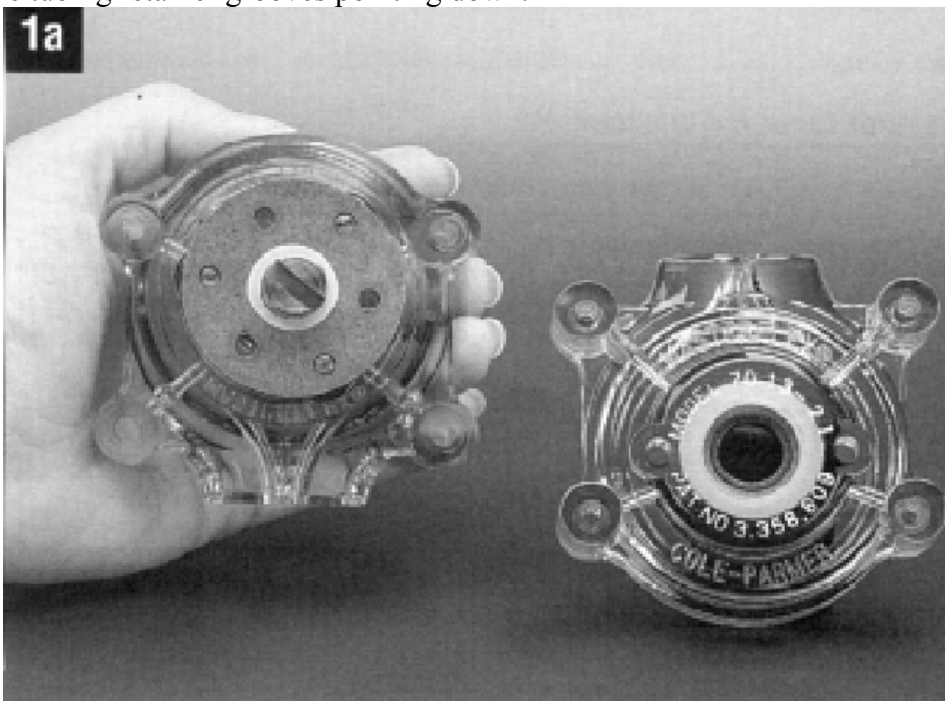
2) Remove the 4 thumb screws which hold down the top of the pump assembly. Lift off the top.

3) Remove the tubing from around the rollers. There are no designated ends on the tubing so the orientation (which end is placed on the inlet side and which end is placed on the outlet side) does not matter.

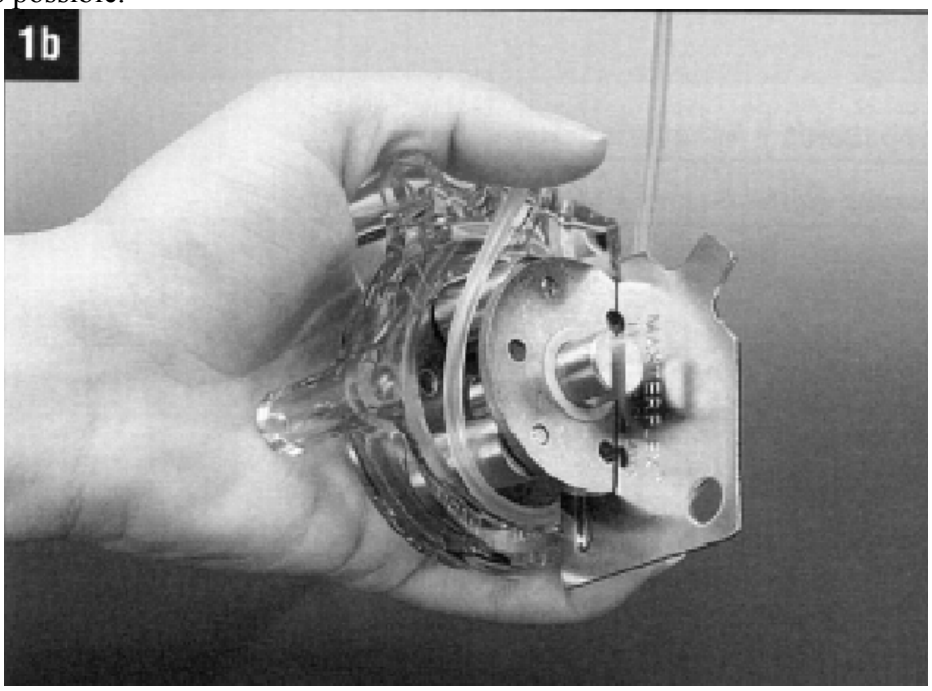
NOTE: Use only MASTERFLEX precision tubing with MASTERFLEX pumps to ensure optimum performance. Use of other tubing may void applicable warranties.

NOTE: The tubing loading key supplied with the unit is highly recommended for assembly.

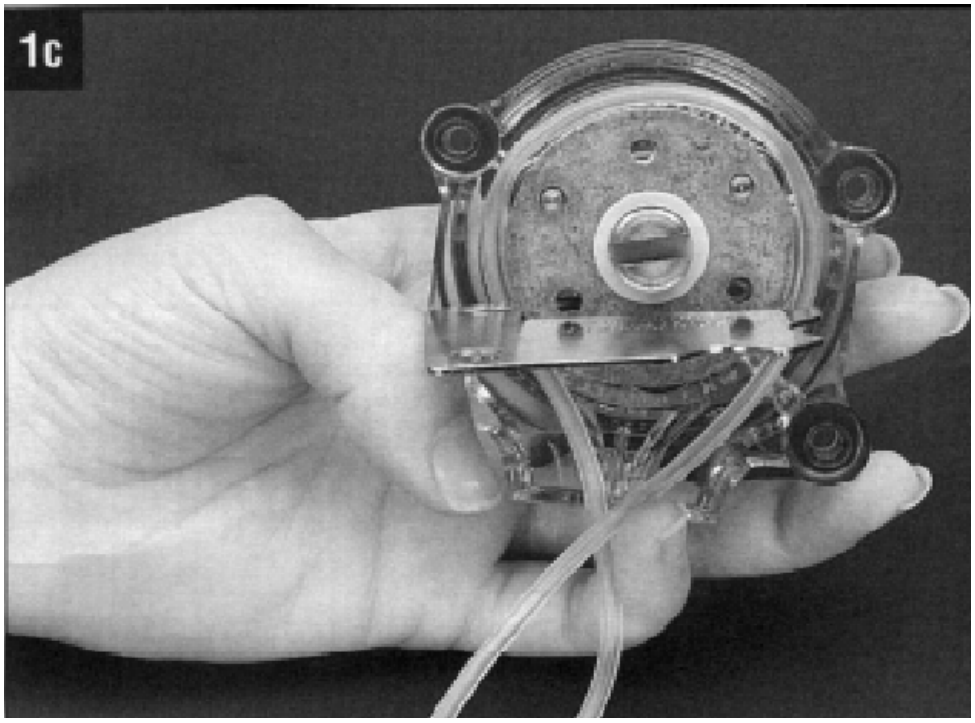
4) Ensure that the end bells (the pump head halves) are separated. Hold the end bell containing the rotor as shown with the tubing retainer grooves pointing down.



Place tubing in the right groove and against the first two rollers. Hold tubing with thumb. Near groove, insert smaller prong of the loading key between the top of the rotor and tubing. Push key in as far as possible.

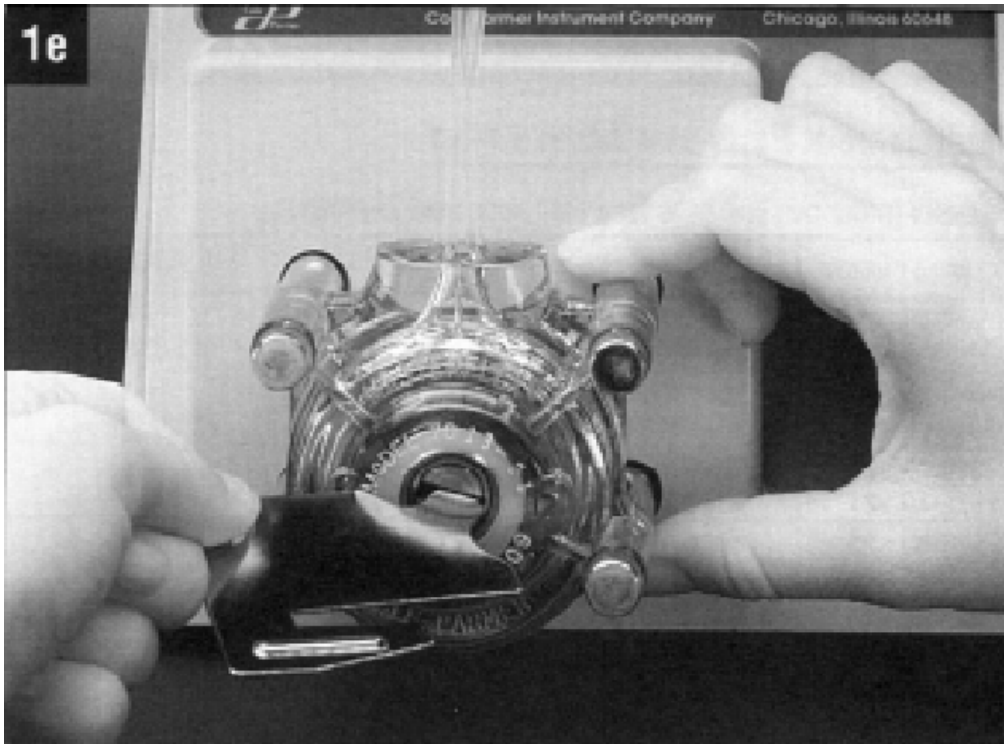


Push down and turn key counterclockwise (ccw) completely around the rotor. The key will push the tubing uniformly into the end bell assembly. Hold the second end of the tubing. Remove the key.



Position the other end bell on top and press the end bells together. Be careful not to pinch the tubing. If end bells do not snap tightly together, reload tubing. If necessary, turn key in slot on rotor shaft to adjust tubing.

With key in slot on rotor shaft, turn key to align tang on rotor shaft with slot in motor drive shaft. Point tubing retainer grooves up. Shift the pump head slightly until it snaps on the alignments pins (if present). Secure with four provided screws. Tighten with fingers only.



6) Reset the tube life pump count in *19. A peristaltic units ability to operate and perform to specifications, such as transport velocity and lift height is, to a certain extent, determined by the medical grade silicone rubber pump tubing used in the system. The characteristics of the tubing change as it wears. It becomes less resilient, less able to maintain its shape, develops pinch points on the outside edge of the tube, and as such is not capable of the performance it had when it was new. To maintain optimum performance, it is necessary to monitor the wear on the tube. *19 does this by enabling the operator to set a maximum number of pump revolutions, the tube currently in use, will be allowed to withstand. This, in effect, determines the tube's useful life. Manning recommends not exceeding 1,000,000 pump counts for a singular tube as, by this time, there is risk that the tubing could fail causing a variety of problems. *19 should be used every time the pump tubing is changed. The user will be alerted to change the tubing, when the tubing reaches the number of counts set. The warning will appear, every time the user executes a Program Mode, by pressing <START>. Since all programs are initiated by pressing <START> the warning will always appear, if appropriate, before the program is initiated. This allows the user the opportunity to exit the program and change the tubing. Once the tubing is changed, the user can re-enter the program and begin sampling.

When the pump tubing is to be changed, the user will enter into *19 Mode, just like entering any of the other * Modes. The sampler will prompt the operator to clear the current pump count by pressing 1, or to maintain the current count by pressing 0. It is advisable to reset the pump counts when changing the tubing so an accurate accounting of the number of revolutions, the tube in the pump has experienced, can be obtained. At this juncture the user will be asked to enter a number for the tube life warning which represents the number of revolutions the current tube will be allowed to accumulate before a warning is issued. Once entered, the system will return to the sampler ready prompt and the system will be ready to program.

Display on LCD	Explanation
SAMPLER READY **12:48**	This display shows the sampler is ready to program. It displays the current time. From here the user can enter any TIME, FLOW, or * Mode. Press the * key to access the * Mode.
ENTER * MODE? — —	Prompts the user to enter either a program or a * Mode. Press 19 and <ENTER> to proceed.
0=MAINTAIN 1=CLEAR —	This prompt is asking the user to determine how the system will handle the current accumulation of revolutions: 0 - This maintains the current revolution count. This is useful if the operator wishes to increase the number of revolutions the current tubing can accumulate before a tube life warning is issued. For example, assume the current tubing has 200,000 revolutions. The operator really wants the warning to come on at 400,000. The 0 key would be pressed instead of 1 to maintain the history the tubing has already generated. The user would then enter 0400 (for 400,000) at the TUBE LIFE WARNING prompt (see below). 1 - This resets the current revolution count. This is necessary if the user is going to be placing brand new tubing into the system. With the counter reset the user knows exactly how many counts it will take for the sampler to issue a warning to change the tubing.
TUBE LIFE WARNING? — — — —	Enter the maximum number of counts the tubing will accept before the sampler issues a pump tube warning. The number entered is in terms of thousands (in other words it adds 3 0's to the end of the number entered) so if 0500 is entered, the sampler would see it as 500,000. Entering 4000 equals 4,000,000 and 0060 would be 60,000, etc. When the number of revolutions meet or exceed the pump counts set by the user, a pump life warning will be issued.

CLEANING THE CONTROL PANEL

Use a mild cleaning solution and wipe with a soft, lint-free cloth.

CAUTION: Do not use harsh cleaners (detergents, solvents, etc.) which can damage the panel surface. Do not use abrasives which can scratch the panel and fog the window above the LCD display.

CLEANING THE WETTED PARTS

Note: Solvents and solvent contaminated fluids must be disposed of according to approved procedures.

Manning Environmental Inc. recommends instituting a cleaning regime for the sampling equipment. The following are a few of the many reasons why a cleaning regime is important:

1. It validates that the samples taken will be as free as possible from constituents that are not contained within the sample itself.

2. It contributes to ensuring that the statistical validity of the samples being examined will be maximized by reducing systematic error, if the regime is followed very closely.

3. It contributes to the longevity of the sampling equipment.

4. It provides documentation for challenged results.

For a detailed description of a cleaning protocol refer to U.S. Environmental Protection Agency Publications EPA-600/4-77-039 ("Sampling of Water and Wastewater" by Dr. Phillip E. Shelley), or consult with the facility that will do the actual testing of the samples. They could probably assist in setting a cleaning regime that will help produce the most accurate results possible.

The following procedures are very general outlines of procedures for cleaning certain parts of the sampler:

Intake Hose

The sampler was supplied with PVC intake hose. PVC intake hose is used for general purpose sampling (Non-Toxic) applications.

1. Remove the intake hose. Remove the strainer if necessary.

2. Wash the intake hose and strainer using a cleaning solution appropriate for the application. The use of methylene chloride or other solvents may leave a residue that could contaminate the sample. Use a test tube brush to scrub the internal surfaces of the strainer. Pull the brush through the hose with a wire to clean the internal surfaces of the hose.

3. Rinse the hose and strainer thoroughly in clean water (warm water is best) and reassemble.

It may be easier and more convenient to simply use a new hose for each sample configuration. This eliminates cleaning and disposal of potentially hazardous regulated chemicals.

Sample Containers

1. Wash with the appropriate cleaning solution. Use a test tube brush to clean the internal surfaces.

2. Rinse thoroughly in clean water (warm water is best).

3. Do not autoclave plastic bottles or caps since they are constructed of polyethylene.

TROUBLESHOOTING

Troubleshooting instructions are based on a logical sequence of events leading to a malfunction. If trouble occurs, look for the simplest solution first such as whether the power supply is connected. Are any connections loose or wires broken? Review the problem, normal operating procedures, and then check one possibility at a time starting with the easiest to verify. If the malfunction continues, call the Manning Service Department. We can often assist over the phone. We can also advise on whether or not certain repairs are best done in the field or in our factory.

Note: Follow instructions in the Maintenance section when removing the controller (page 3-4)

Problem	Possible Cause	Remedy
System Non-Responsive	**Loose Connection**	**Check power connections. Tighten if necessary.**
	Controller Lock-Up	**1. Press <RESET> <RESET> - if still not working** **2. Press <TEST CYCLE>, <RESET>, <CLEAR> all at the same time - if still not working** **3. Push the hard RESET button located on the lower left side of the processor board. Note: Re-enter configuration data (<PROG>99)**
	Electronics Failure	**Contact Manning**
Works Inconsistently	**Faulty Wiring**	**Check wiring, starting with power connections.**
	Electronics Failing	**Check <Prog> 91 for missed for information on missed samples, etc...and contact Manning.**
Weak Draw	**Intake Hose Pinched**	**Check hose for pinch or damage. Replace if damaged.**
	Hose or Line Clogged	**Flush with water to clear clog.**
	Air Leak	**Check pump tubing for damage and check fittings for leaks and tightness of connection.**
	Peristaltic Pump Failing	**Check pump for proper operation including: Rollers are rotating freely, Impediment in pump tubing, Motor not humming.**
Pump Operates but No Fluid	**Hose or Line Clogged**	**Flush with water to clear clog.**
	Peristaltic Pump Failing	**Check pump for proper operation including: Rollers are rotating freely, Impediment in pump tubing, Motor not humming.**
Pump Rotor Does Not Rotate	**Peristaltic Pump Failing**	**Check pump for proper operation including: Rollers are rotating freely, Impediment in pump tubing, Motor not humming.**

Sample Does Not Enter Container	**Deposit Line Blocked**	**Clear the line and ensure draw time is long enough to get water to the sample container.**
Purges Constantly	**Electronics Failure**	**Remove and replace main board.**
Low Sample Volume	**Fluid Detector Malfunctioning** **Excessive Tube Wear**	**Check calibration of Fluid Sensor or replace the Fluid Sensor.** **Replace pump tubing.**
Excessive Sample Volume	**Fluid Sensor Malfunctioning** **Excessive Tube Wear**	**Check calibration <PROG> 20. Clear and/or replace fluid sensor** **Replace pump tubing.**
Controller Does not Respond to Command	**Password Active**	**Enter the password at prompt.**
Blank Display	**No Power** **Display Failure**	**Check to make sure sampler has power.** **Check connections and possibly replace display.**
Keypad Inoperative	**Membrane Switch Failure**	**Remove and replace membrane switch.**
***99 Self Test Indicates Error**	**Electronics Failure**	**Contact Manning**

Appendix A
How to Return Equipment

Call or write the Manning Environmental Service Department before returning any equipment for repair. Many problems can be diagnosed and resolved over the telephone. Manning will issue a Return Material Authorization (RMA) number if it is deemed necessary to return the equipment for repair.

If you do need to return equipment, follow these guidelines:

- Pack equipment carefully, preferably in the original carton.
- Enclose specific information about the problem.
- Enclose a contact name and phone number in case our Factory Service Department needs additional information.
- Enclose a purchase order authorizing repairs.
- Ship the equipment to the address below. Our Receiving Department will not accept collect shipments.

The Service Department phone number is (800) 863-9337. The Service Department will notify you of the type of repair and an estimate of the cost of the repair. Manning will ask for your authorization before proceeding.

Address For Repairs:

Service Department
Manning Environmental, Inc.
1968 S. Austin Ave
Suite 101A
Georgetown, Texas 78626 USA

PSB4 Parts List- 04/23/12

Pump Tubing, Intake Hose, Strainers, and Fittings

Part Number	Description	U/I	Qty
MS889924	Pump tubing, 18" length, ¼" intake Pharmed	Ea	A/R
MS566909	Discharge tubing, silicone ¼"	In	A/R
MS566927	Pump tubing, bulk, Pharmed	Ft	A/R
MS566925B	Tubing, silicone (for use with ultrasonic fluid sensor)	Ft	A/R
MS552104	Female quick-disconnect hose fitting (April 2012 and earlier)	Ea	A/R
MS552105	Male quick-disconnect hose fitting (April 2012 and earlier)	Ea	A/R
MS552112	¼" Male hose coupling (May 2012 and later)	Ea	A/R
MS552113	¼" Female hose coupling (May 2012 and later)	Ea	A/R
MS552063	3/8" to 5/16" reducer, barb to barb	Ea	A/R
MS566926	Bulk clear PVC hose, ¼" ID	Ft	A/R
MS889146	Strainer, PVC, ¼" intake	Ea	A/R
MS579595	Strainer, stainless steel, 1/4" intake	Ea	A/R

Batteries, Power Supply, and Chargers

Part Number	Description	U/I	Qty
MS690539	Battery, 12VDC, 8Ahr	Ea	1
MS690536	Battery, 12VDC, 18Ahr	Ea	1
MS885401	Charger, Battery PSB 750mA 110/220VAC input	Ea	1
MS889828	High-output battery charger, PSB 1.8A, 110/220VAC input	Ea	1
MS889926	Power supply, PSB sampler, 110/220VAC input, 12VDC output	Ea	A/R

Bottles

Part Number	Description	U/I	Qty
MS687550	2 Gallon square plastic bottle with lid	Ea	A/R
.MS564240	Lid, 2 Gallon square plastic bottle, no holes	Ea	A/R
MS885008	Lid, 2 Gallon square plastic bottle, with holes	Ea	A/R

Mechanical Parts and Miscellaneous Accessories

Part Number	Description	U/I	Qty
MS783027	Zerust vapor capsule	Ea	1
MS889040	Suspension harness, PSB4 sampler	Ea	A/R
MAN-PSB	Manual, PSB sampler	Ea	A/R
MS818016	Contact/pulse/analog input cable, 3’ long	Ea	A/R
MS818018	Contact/pulse/analog input cable, 10’ long	Ea	A/R
MS810059	Serial out patch cable, 6” long	Ea	A/R
MS885502	Fluid sensor, continuity, field replacement w/quick-disconnect fittings	Ea	1
MS885033	Fluid Sensor, Continuity, field replacement w/barbed fittings	Ea	1
MS638560	Float switch, magnetic (bottle full)	Ea	1

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Errata for the PSB4 Sampler Manual.

This document contains changes and corrections to the Operating and Instruction Manual for the Model PSB4 Manning Portable Peristaltic Sampler, Revision 0-600. .

Contents.

1. Revision 3 Ultrasonic Fluid Sensor.
2. Fluid Sensor Types..
3. Connecting the Sampler to an External Device.
4. Serial Out Option.
5. New Hose Couplings.
6. PSB4 Theory of Operation.

Revision 3 Ultrasonic Fluid Sensor.

The Revision3 ultrasonic fluid sensor uses updated electronics to improve reliability of the sensor. Unlike the earlier versions, it is not necessary to apply grease to the sensor body.

The fluid sensor is located on the inlet side of the peristaltic pump, mounted to the sampler with a bracket. A 6" piece of silicone tubing passes through the sensor and is connect to the inlet hose (left side, not shown) and the pump tubing (right side) with quick-disconnect fittings. The tubing is held in place in the sensor block by a hinged cover and two screws. See Figure 1.

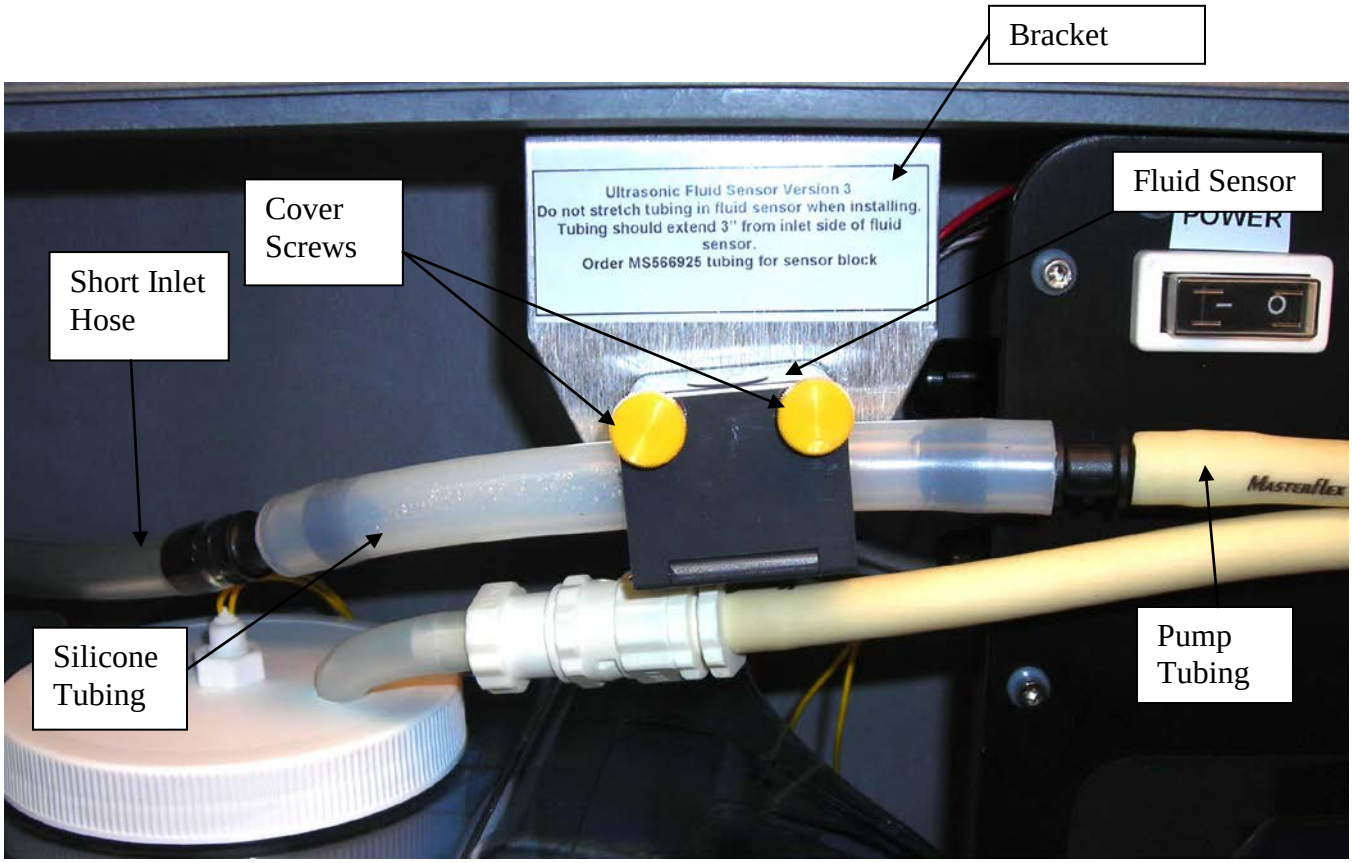


Figure 1.

To remove the silicone tubing from the sensor, first remove the two screws from the cover and then open the cover up. Disconnect the tubing from the pump tubing and the short inlet hose. See Figure 2.

To install the silicone tubing in the fluid sensor, first connect the inlet end of the tubing to the short inlet hose (Note: Order part number MS566925 for bulk tubing if replacing the tubing). Then connect the other end of the silicone tubing to the pump tubing. Insert the silicone tubing into the fluid sensor body; making sure it is firmly seated. Do not stretch the tubing. There should be 3" of tubing on the inlet (left) side of the fluid sensor. Close the hinged cover on the fluid sensor and secure it with the two screws.

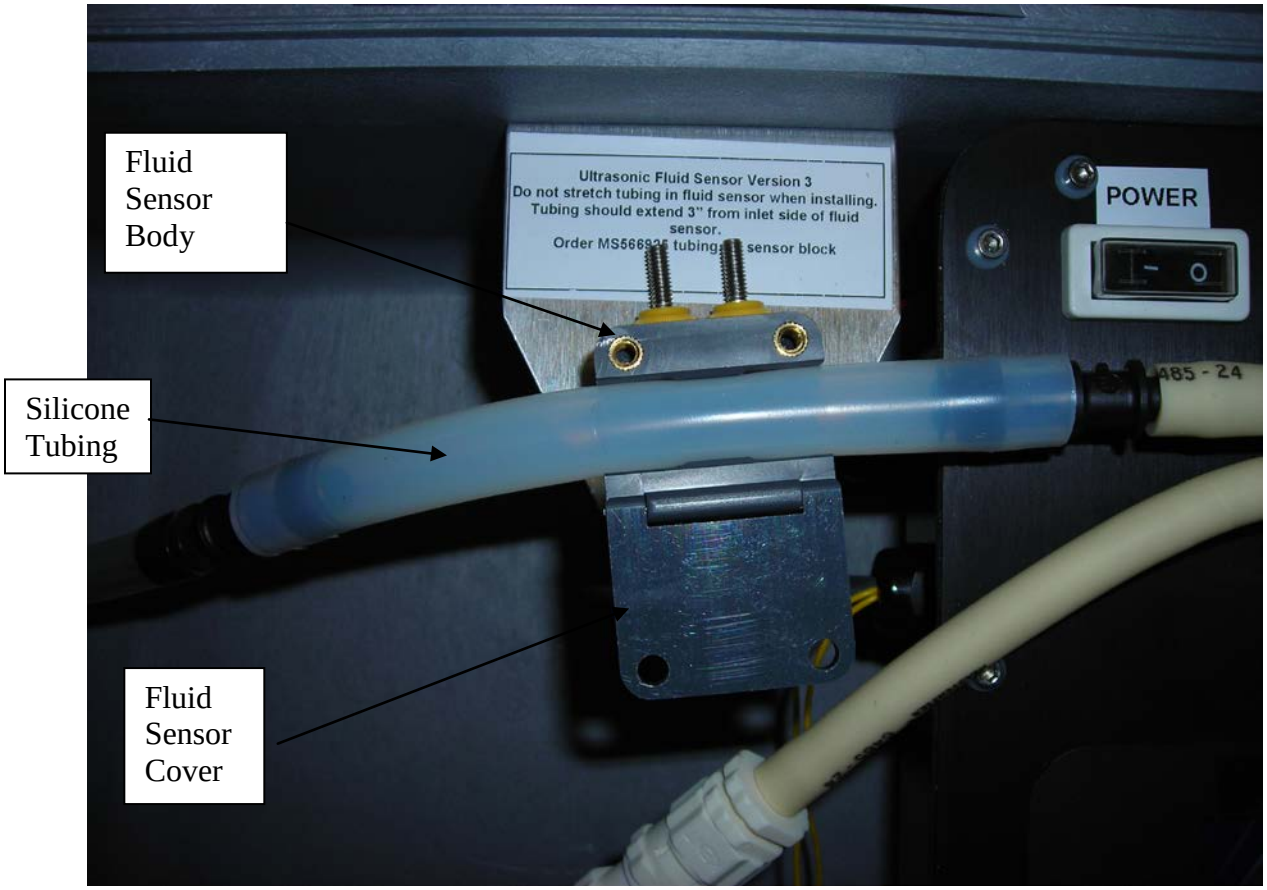


Figure 2.

Fluid Sensor Types.

Manning offers two different types of fluid sensors on its peristaltic samplers. The continuity fluid sensor detects the presence of fluid by passing an electric signal between two probes in the sensor, using the fluid as a conductive medium. The continuity fluid sensor works in a wide range of applications, as long as the fluid being sampled is sufficiently conductive enough. Also, if the fluid causes the inside of the sensor body to be coated, the sensor may not properly detect the presence fluid.

The ultrasonic fluid sensor detects the presence of fluid by transmitting sound waves through the fluid. Because sound travels better through a fluid than through air, the sensor can detect if fluid is present or not. The ultrasonic fluid sensor works in most applications. It does not make physical contact with the fluid, and is not affected by the fluid's conductivity or temperature. Air bubbles in the

fluid can cause the sensor to not detect fluid reliably, as they reduce how well sound travels through the fluid.

Connecting the Sampler to an External Device.

Manning samplers can be operated using inputs from external devices such as flow meters and Programmable Logic Controllers (PLC's) to trigger samples. A 4-pin female panel connector is located on the sampler chassis and is used in conjunction with a cable to make the connections.

Samplers come standard with a 3-foot cable. A 10-foot cable is available as an option.

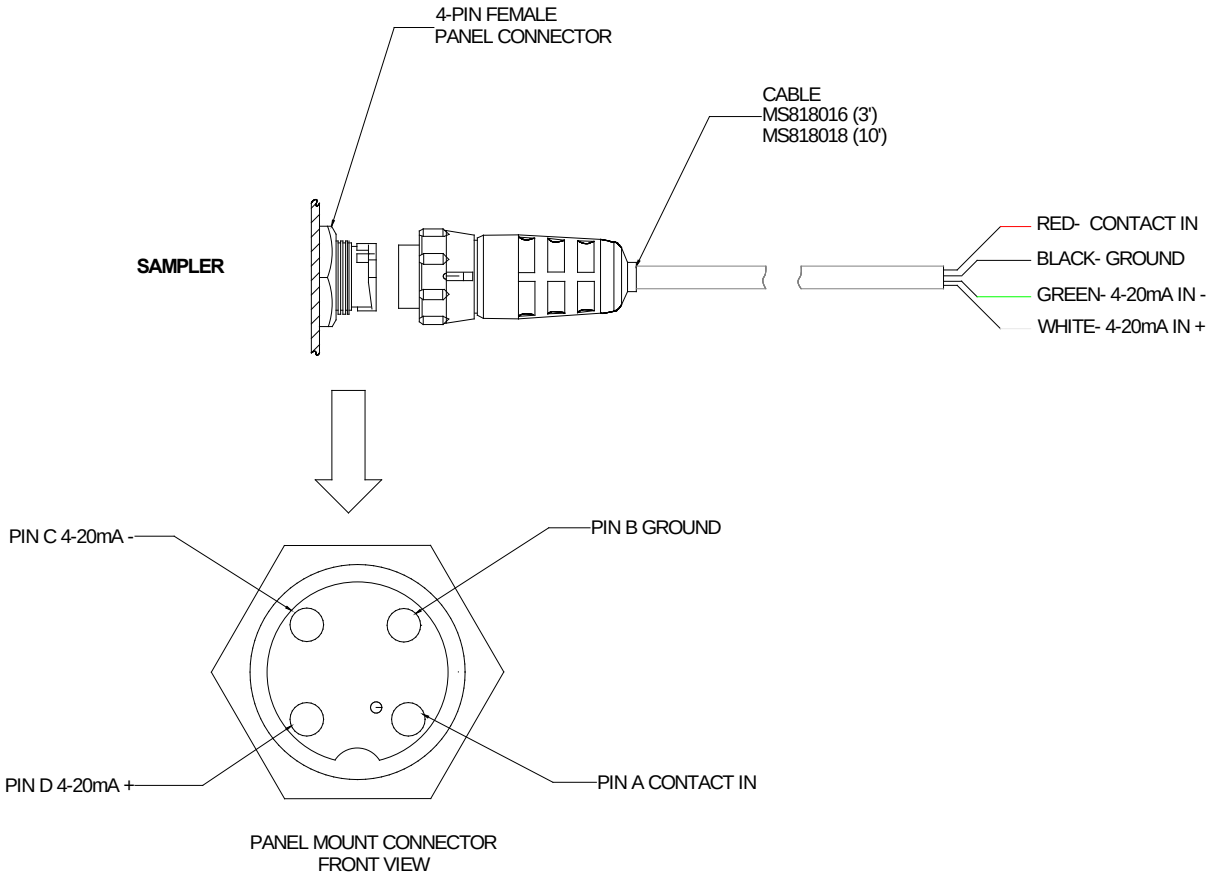


Figure 5.

To use a contact closure, connect your device to the red and black wires on the cable. For a 4-20mA input, connect your device to the green (negative) and white (positive) wires. The contact closure must have a minimum duration of 250 milliseconds. Most devices that provide the contact closure are not polarity sensitive. If your device is, connect the positive side up to CONTACT IN (red wire on cable). In order to insure proper operation of the sampler, it must be the only device connected to the contact closure output. See Figure 5.

The sampler places a 250-Ohm load on the 4-20mA circuit. In areas where electrical storm activity is possible, Manning recommends connecting surge suppressors by the transmitting device and by the sampler to help prevent damage to the equipment.

For a pulse input, connect your device to the red (positive) and black (negative) wires on the cable. The pulse must have a minimum duration of 1 millisecond. The pulse circuit will work with pulses in the +5 to +15 VDC range, with +12 VDC being the preferred voltage.

Note: The sampler comes configured from the factory for either the contact input or the pulse input. To re-configure the sampler, please contact Manning Technical Support for assistance.

Serial Out Option.

The serial out option proves a way to download the sampler's data log to an RS-232 compatible device such as a computer. A 2-pin female connector on the sampler chassis is provided, along with a serial patch cable, to connect the sampler to the external device. See Figure 6.

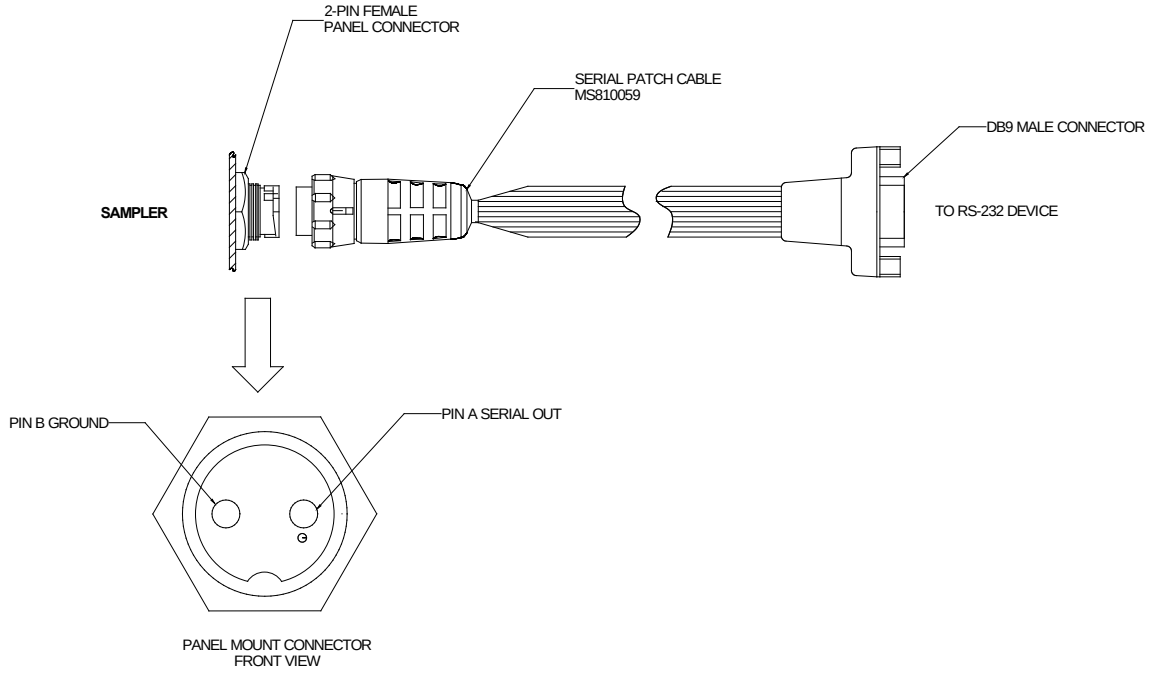


Figure 6.

The user-supplied serial cable that connects the computer or other external device must have a female DB9 connector on the end that will connect to the sampler's patch cable. This cable should be a standard cable, and not a null-modem type.

The serial output from the sampler is fixed at 9600 baud, 8 bits, no parity and 1 stop bit. The data log is output as ASCII text, comma delimited. *91, option 4 is used to download the data log from the sampler. If using a computer to record the data log output from the sampler, a terminal program must be running on the computer.

New Hose Couplings

Manning has replaced the MS552104 female and MS552105 male quick-disconnect hose couplings used on the PSB4 sampler effective April of 2012. See the table below.

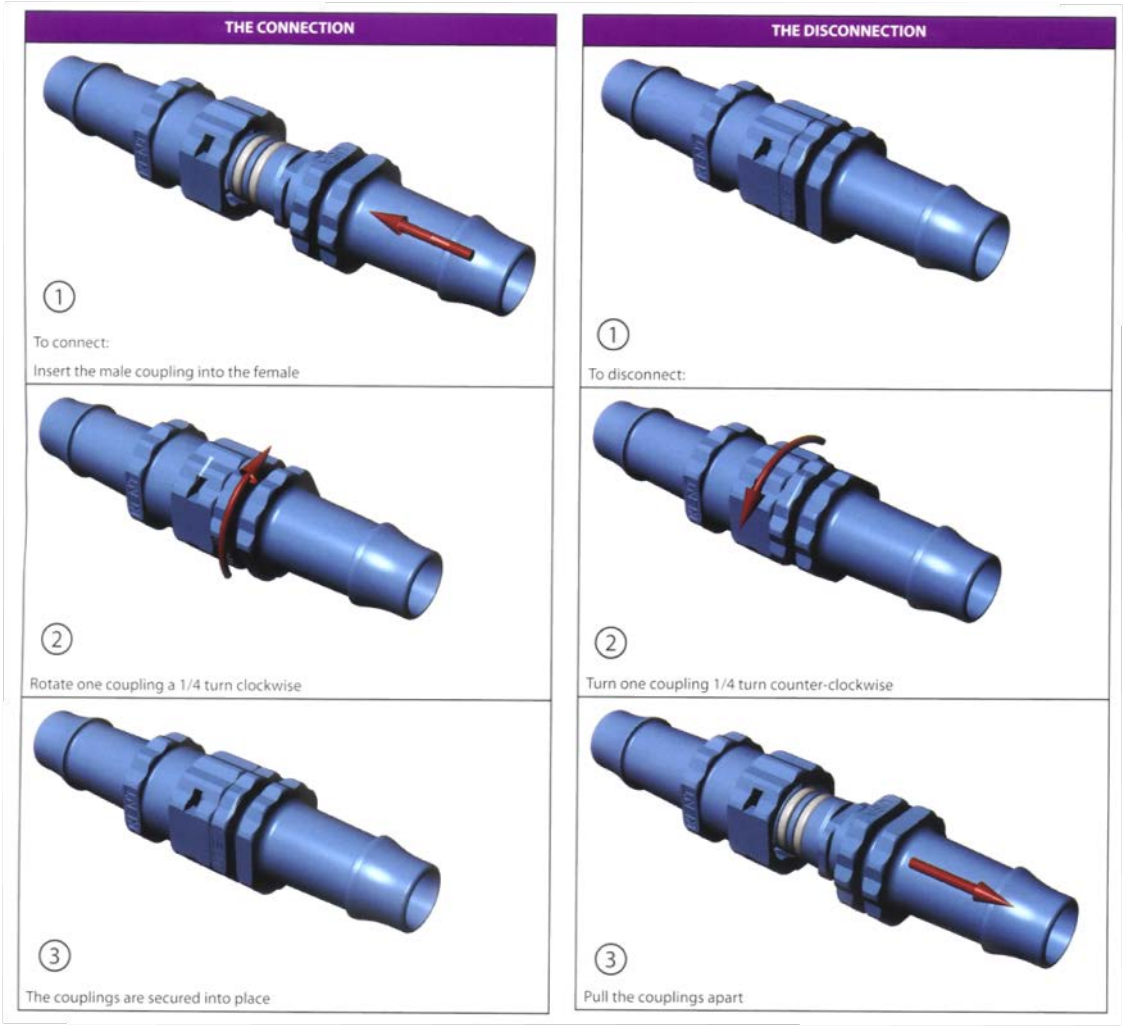
Old Part Number	New Part Number
MS552104 female quick-disconnect coupling	MS552113 ¼" female coupling
MS552105 male quick-disconnect coupling	MS552112 ¼" male coupling

The new ¼" couplings are white in color. The new couplings are more robust, and feature a quarter-turn locking design. The female couplings rotate 360 degrees to help prevent hose kinks. . See the pictures below and on the next page.

Manning is also converting some hose and tube connections to barb fittings. New continuity fluid sensors with barbed fittings have been developed to replace the ones that use the MS552105 male quick-disconnect coupling. The new continuity fluid sensor with barbed fittings is MS885033, replacing the MS885502 continuity fluid sensor. PSB4 samplers with the ultrasonic fluid sensor now use MS552063 3/8" to 5/16" barb to barb reducer fittings.

Left- old style quick-disconnects
Right- ¼" couplings

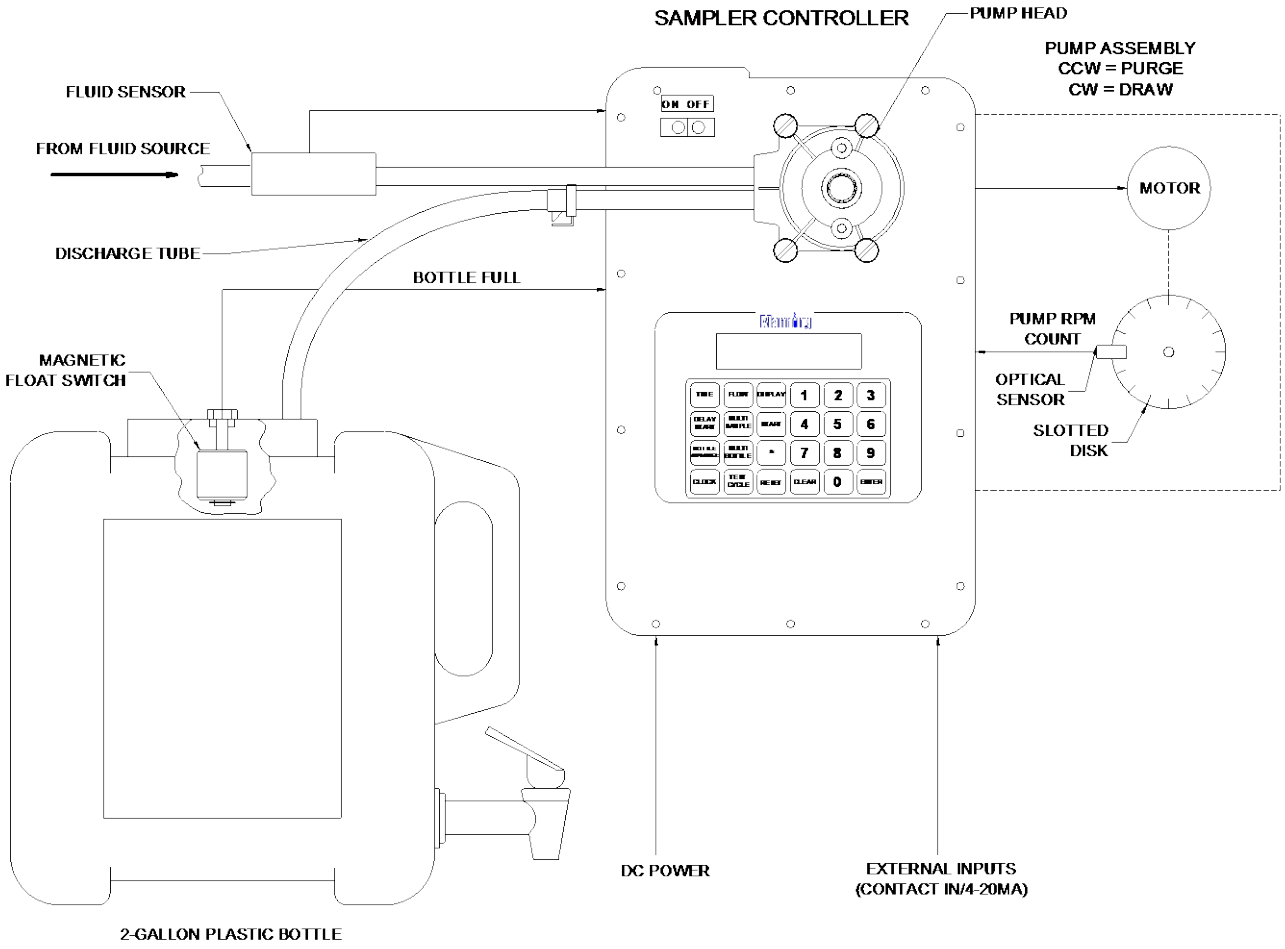
Top- Continuity Fluid Sensor with quick-disconnect couplings.
Bottom- PSB4 Continuity Fluid Sensor with barbed fittings.



Coupling Operation

The MS552104 and MS552105 quick-disconnect fittings, as well as replacement continuity fluid sensors with the MS552105 male quick-disconnects, are still available and will remain so for the foreseeable future. For more information contact Manning Technical Support at (800) 863-9337.

PSB4 Theory Of Operation.



PSB Sampler Functional Block Diagram.

The sampler uses a peristaltic pump the draw the fluid being sampled into the collection bottle. The peristaltic pump produces suction to draw the sample and purges the intake line by squeezing sections of the pump tubing against the inside wall of the pump body using three rotating rollers.

The sampler controller includes the processor circuit board, display, and keypad. It provides the logic and processing circuitry to operate the peristaltic pump and associated sampler hardware. It also processes external inputs to the sampler (i.e., contact closure, pulse, or optional 4-20mA input)

The peristaltic pump is mounted to the sampler control panel.. The pump body is visible from the outside. The pump motor, RPM sensor, and associated hardware are mounted inside of the housing.

A 12VDC battery or a power supply provides power for the sampler. The pump motor receives power from the controller to turn the rollers through set of gears. The pump rotates in a Counter-clockwise direction (as viewed from the top of the pump) to purge the fluid line and in a Clockwise direction to draw fluid.

The pump also contains an RPM sensor consisting of a slotted disk that rotates with the pump rollers and an optical sensor. The RPM sensor sends pulses to the controller when the pump rollers are rotated. Each pulse represents $1/16^{th}$ of pump revolution. The RPM sensor pulses are used to measure the amount of fluid being deposited into the sample collection bottle(s). The sampler controller also records the pump revolutions to provide a warning to the operator that the pump tubing is wearing and may need to be replaced. A secondary purpose of the RPM sensor is to provide feedback to the controller that the pump is actually turning. If the sampler received no signal from the RPM sensor when the pump should be turning, the controller turns power to the pump motor off to prevent further damage, and displays a **RPM SENSOR FAIL** message.

Located on the intake side of the sampler pump tubing just before the pump is a fluid sensor, which detects the presence of fluid in the intake line. The controller uses this information to rinse the sampler intake line and to draw the actual sample. The fluid sensor is either a continuity type or an ultrasonic type.

A magnetic float switch, attached to the collection bottle lid signals the controller that the bottle is full. When the controller senses that the bottle is full, samples are no longer taken.

The sample cycle starts by first purging the intake line to clear it of any residual fluid. If rinses are programmed, the sampler draws fluid up to the fluid sensor and then purges the line. This is repeated for the number of rinses programmed. The sampler then draws the sample and deposits it into the sample container, using the fluid sensor and RPM sensor to obtain the desired volume of fluid.