



Operating and Instruction Manual

Manual No. VSR
Revision 0-600 w/ % : YV & % Errata

**MODEL VSR
STATIONARY
VACUUM SAMPLERS**
(Refrigerated)



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Manning Environmental, Inc.
101 Bar T Drive
Florence, Texas 76527-4445
Phone: 254-793-9955, Fax: 254-793-9965.

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Installation and Operation

INTRODUCTION

Congratulations on the purchase of a Manning Environmental, Inc. Model VSR-1000 Sampler. The model selected is the latest in a long line of state of the art equipment produced for over twenty three years by Manning Environmental Inc. Based on this experience, if there is one thing Manning can claim it is that we know samplers. 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 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 high speed, peristaltic pump to draw the samples and an industrial grade refrigeration unit to cool and maintain them at the EPA recommended 4°C. 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 Environmental Inc. 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 Environmental Inc. 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's commitment to producing reliable, top quality products is legendary, 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. Then follow the shipping instructions that will be given. Please note the malfunction on the paper work so a diagnosis and a solution to the problem can be arrived at with the least amount of delay.

We recommend the following steps before attempting to use the sampler:

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

Note: The VSR sampler is available in either 3/8" intake (VSR3) or 5/8" intake (VSR5). The VSR3 uses 3/8" ID intake hose while the VSR5 uses 5/8" ID intake hose. Other components and accessories are different between models, based on intake size.

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HARDWARE

FUNCTIONAL SPECIFICATIONS:

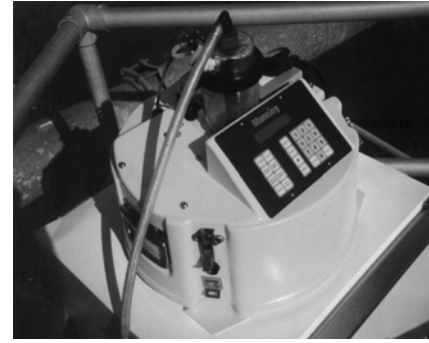
Size	Height: 56.6 in. (145cm) Width: 23.8 in. (61cm)
Weight	Dry Weight: 160 lb (72 kg) with refrigerator
Environmental Protection	Nema 4X,6 housing around electromechanical components.
Sample Cooling	Industrial Grade refrigeration unit.
Temperature Limits	0/C to 50/C (32/F to 122/F) without optional enclosure and heater.
Sample Pump	Diaphragm vacuum compressor pump.
Maximum Lift	26 ft (7.9 m).
Transport Velocity	Minimum of 5 ft/s at 3 ft of lift (1.52 m/s at 1 m) and 2.5 ft/s at 20 ft of lift (0.76 m/s at 6.1 m).
Sample Volume	Set directly in milliliters. Sample chamber is capable of holding 500ml at one time. A maximum of 2000ml can be collected using multiple chamber fills (maximum of 4)
Accuracy	$\pm 0.5\text{ml}$ or $\pm 0.5\%$ of the set volume, whichever is greater.
Repeatability	$\pm 0.5\text{ml}$ or $\pm 0.5\%$ of the average largest and smallest sample volume in a sample set, whichever is greater.
Controller	Microprocessor based 2 board system which controls all functions of the unit.
Membrane Switch	Ergonomically designed, hermetically Sealed, 24 key, multiple function, with 2 line by 20 character alphanumeric backlighted display.
Electronics	100% Solid State.
Internal Clock	Indicates real time with $\pm 1\text{min/month}$ accuracy.
Internal Battery	5 year internal lithium battery to maintain program logic, RAM memory, real time clock and date.
Power	STANDARD - 115 volt AC, 60 Hz. OPTIONAL - 220 volt AC, 50 Hz .
Optional Analog Input	4-20 mA

SUB-ASSEMBLIES

The sampler consists of three major sub-assemblies: the top chassis, the refrigerator and the sample intake line (either a hose or flow-thru cell). As a unit, these sub-assemblies form an environmentally resistant enclosure. The sampler also has a wetted parts kit (type chosen by customer).

Top Chassis

The sampler top chassis includes the microprocessor-based controller, system electronics, the sample measuring chamber, and the vacuum pressure control components.



VSR Top Chassis

The Controller

The controller electronics consists of 2 boards. An Input/Output or I/O board, a CPU board, and a micro board. The I/O board converts outside power to the appropriate internal use and controls the input/output signals associated with the sampler. The CPU board contains a Z180 microprocessor, RAM and ROM memory, and interfaces for the keyboard, the display, and analog, and I/O boards. 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.



VSR Keypad

Refrigerator

The refrigerator is an industrial grade unit with the ability to cool and maintain samples at the EPA recommended 4°C. Modifications have been performed on the refrigerator that enable it to withstand even the harshest environments. The condenser has been baked dip-coated with enamel and the copper refrigerant lines are coated with asphalt cork tape to prevent hydrogen sulfide gas from attacking the copper lines and the brazed joints. The thermostat is located inside the refrigerator which affords it additional protection from the environment. The evaporation coils and cabinet both have two coats of baked on acrylic enamel with the cabinet having the additional protection of an iron phosphate pre-treatment. Both the fan motor and the compressor are designed for greater durability and resistance to atmospheric attack. The unit boasts extensive insulation for maximum cooling retention, and a full perimeter magnetic door gasket with a urethane coating to resist corrosion and seal the cold inside. The door is also available with an optional locking hasp to prevent unauthorized entry. The sample containers, suspension plate, and distributor arm for multiple bottle operation are located within the environmentally controlled chamber of the refrigerator.



VSR Refrigerator

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 VSR are the intake hose and strainer, the measuring chamber, the discharge tubing/spout, the bottle full sensor and the sample bottles. If the source liquid to be sampled is a non-priority pollutant (Non-Toxic) then all parts that touch the liquid are either PVC (Polyvinyl Chloride), medical grade silicone rubber, ABS (Acrylonitrile Butadiene Styrene) plastic, or Stainless Steel.

Intake Hose

The 3/8" ID by 5/8" OD or 5/8" ID by 7/8" OD intake hose is constructed of PVC (Polyvinyl Chloride) 3/8" ID PTFE intake hose is also available. A weighted strainer is normally attached at one end.



Intake hose with strainer

Strainer

The strainer is available in stainless steel or PVC for either 3/8" ID or 5/8" ID hose. By placing holes no larger than 3/8" 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.



Strainers

Measuring Chamber

The measuring chamber is made of PVC for Non-Toxic applications.



Measuring Chamber

Discharge Tubing/Spout

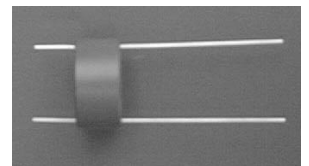
The 3/8" ID by 5/8" OD pinchg/discharge tubing is supplied on both Single Bottle and Multiple Bottle samplers. With Multiple Bottle samplers, the discharge hoses extends into a spout which is constructed of PVC. The Single Bottle units have the tube descend directly into the sample bottle. The discharge hose supplied is always medical grade silicone rubber.



PVC Spout

Bottle Full Sensor

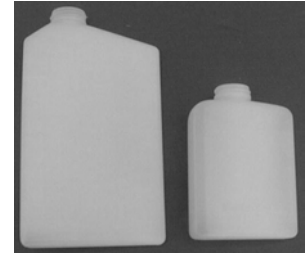
The bottle full sensor is only used on single bottle applications. It is a PVC cylinder with a hole in the middle for the discharge tube to pass through. Two stainless steel probes in the sensor body are used to detect when the fluid level in the bottle has reached the maximum level allowed by the user. The sensor uses the conductivity of the fluid to detect when the fluid is in contact with the probes.



Bottle full sensor

Sample Bottles

The bottles are constructed of either polyethylene or glass.



NOTE: The sampler is field convertible from single bottle to multiple bottle or multiple bottle to single bottle. Contact the Manning Environmental Parts Department for assistance.

Single Bottle Sampling	Multiple Bottle Sampling
One (1) - 5 gallon polyethylene carboy One (1) - 4 gallon Polyethylene carboy One (1) - 2.5 gallon polyethylene carboy One (1) - 2.5 gallon glass bottle	24 - 1000mL polyethylene bottles 24 - 500mL polyethylene bottles

ASSEMBLY

ASSEMBLING THE VSR SAMPLER

The unit is normally shipped assembled with accessories packed inside the refrigerator.

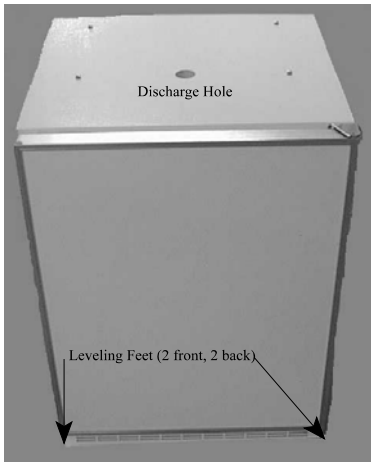
Refrigerator

There are several things to keep in mind before installing the refrigerator. The location is important. It is best to locate the unit out of direct sunlight and away from heat sources. It is best to locate the unit at least two inches away from any kind of wall. Ventilation is required from the bottom front section of the unit. Keep this area open and clear of any obstructions. It is recommended not to use a power cord to power the unit. It is best if the unit can be plugged directly into the appropriate power supply outlet. The refrigeration system is equipped with a power supply cord that has a three-pronged grounded plug. It must be plugged into a mating grounding type receptacle in accordance with the National Electrical Code and applicable local codes and ordinances. If the circuit does not have a grounding type receptacle, it is the responsibility and obligation of the customer to exchange the existing receptacle in accordance with the National Electrical Code and applicable local codes and ordinances. The third ground prong should not under any circumstances, be cut or removed. All U.L listed refrigerated products are equipped with this type of plug, except hazardous location models which are to be wired to comply with the National Electrical Code, Article 501-4 for Class I Divisions 1 and 2

Things to remember about the refrigerator:

- A. Allow 24 hours for your refrigerator to reach a new temperature setting.
- B. The motor will start and stop often. It must do this to maintain the temperature you select.
- C. Keep your refrigerator as level as possible
- D. Unplug the refrigerator before working on anything with the electrical system.
- E. Exercise caution when sweeping, vacuuming or mopping near the front of the unit. Damage to the grill can occur.
- F. For all cleaning of the refrigerator, mix 2 tablespoons baking soda into 1 quart warm water or use mild soap. Do not use strong cleaners or scouring powders or pads.
- G. Keep all flame or sparks away from flammable material storage refrigerators when opening the door to remove or store commodities.
- H. Disconnect electrical power before removing electrical plug

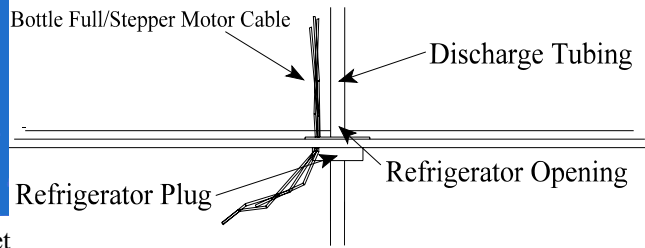
Unpack the refrigerator by removing the bands at the top and bottom of the refrigerator box and lifting the box off of the refrigeration unit. Open the refrigerator door and check for various components that might be inside the refrigerator. Items are often packed inside the unit to minimize shipping space. Check the items you have received against the packing list. Call Manning immediately if you cannot match the packing list to the items shipped. Manning strives for 100% accurate shipments, but mistakes do happen, so please call Manning immediately if there is a discrepancy.



VSR Refrigerator



Refrigerator Grommet



Refrigeration Hole Placement

1. Once you have unpacked the unit, locate the four feet for the refrigerator (they are in a small plastic bag inside the refrigerator, with the refrigerator owners manual).
2. With the refrigerator empty, carefully tip it and screw a foot into the threaded hole in the bottom of each corner.
3. Adjust the feet so the refrigerator is level and does not rock.
4. Plug the refrigerator in and begin the cooling the unit down. Manning recommends using a water proof thermometer and a liter of water to monitor the temperature of the water within the refrigerator. This will give a more accurate representation of the actual temperature of the samples once sampling begins. You should allow at least 24 hours for the refrigerator to reach a stable condition.

NOTE: Be careful not to scratch any painted surfaces. The surfaces are painted with corrosion resistant paint. Scratches in the paint minimize this protection.

Top Chassis

1. Remove the screws and lock washers from the top surface of the refrigerator.
2. On the VSR top chassis there will be a catch three catch plates. Supplied with the unit there will be three "hooks". The hooks will bolt to the refrigerator and "catch" the catch plate so the top chassis is firmly held to the refrigerator.



VSR Top Chassis

3. Place the refrigerator plug into the discharge hose in the refrigerator, and thread the silicone rubber discharge hose through the plug, along with the stepper motor/bottle full sensor cable. You may find it easier to thread these items through the plug before placing it into the refrigerator. Press the grommet down into the enclosure hole so the grommet flange rests on the bottom of the enclosure

4. Place the hooks into the catches on the top chassis and line up the hole in the hook plate with the corresponding plus nut in the refrigerator. Replace the screws and washers and tighten the screws snugly.

Distribution Assembly Installation

Single Bottle Sampling

1. Center the sample bottle in the refrigerator.
2. Run the discharge hose through the Bottle Full sensor ring and then place it at the desired height in the bottle. To adjust the position simply slide the bottle full sensor either up or down the discharge hose.
3. Connect the male 4 pin connector on the Bottle Full sensor cable to the female from the top chassis. Then connect the sensor probes to the female connectors on the cable.

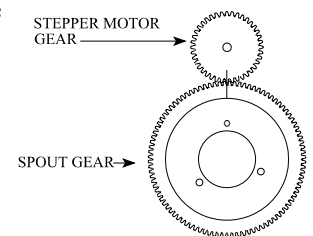
Multiple Bottle Sampling

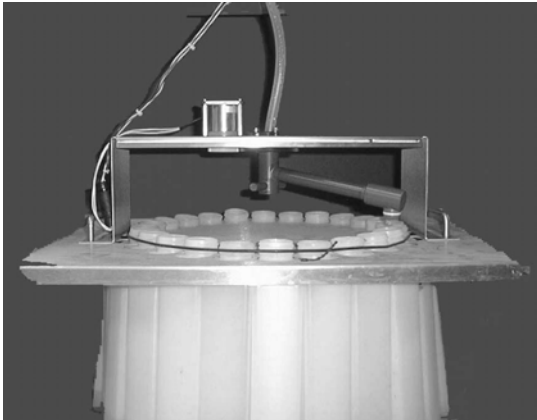
Suspension Plate Installation

Position the suspension plate so the handles are on the sides. Slide the plate onto the top rails in the refrigerator. The plate should be flush with the front of the refrigerator so it does not interfere with the drain trough in the rear.

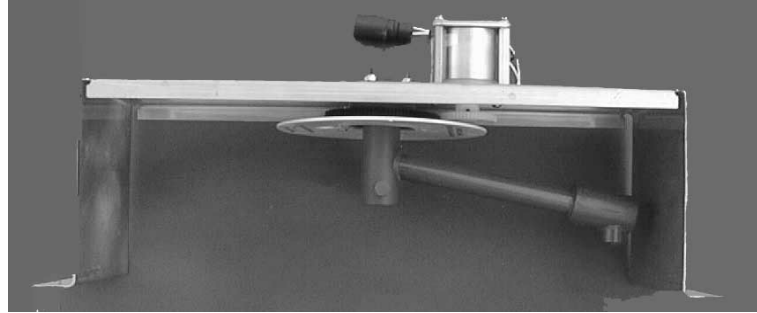
Distribution Assembly

1. Verify that the spout is aligned correctly. The spout should be centered along the distribution bracket when rotated to one side.
2. Place the distribution assembly on the suspension plate with the plate handles poking through the slots in the distribution assembly.
3. Insert the pinch tube into the upper union. The pinch tube must be flush against the union to prevent leaking.
4. Mate the black rubber connectors. (Applying non-conductive grease will help if disassembly is required later.)

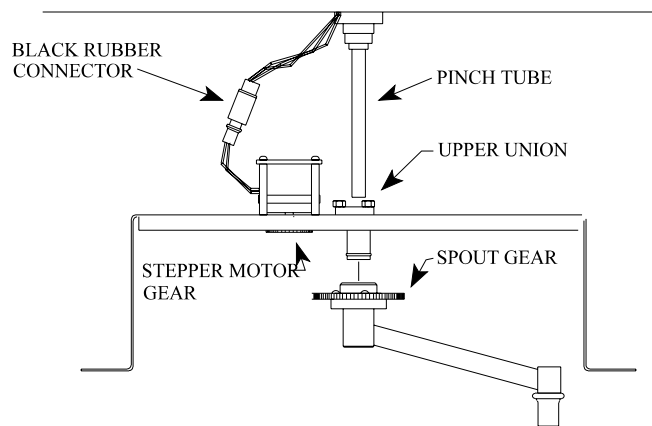




Bottle suspension plate with distribution assembly in place



Distribution assembly with spout



There are wire racks inside there refrigerator so the distribution assembly can be parked out of the way when removing the suspension plate and/or bottles. This makes it unnecessary to remove the pinch tube from the spout union or to de-mate the connector when removing the plate.

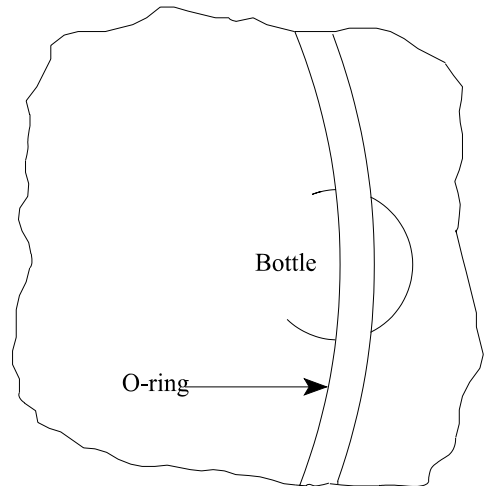
Bottle Installation

The bottles can be installed with the suspension plate in the refrigerator, or the plate can be removed, the bottles installed, and the plate positioned back in the refrigerator.

Follow the instructions below for the type of bottles being installed.

One Liter and Half-Liter Plastic Bottles

1. Insert the bottles through the larger part of the hole in the suspension plate.
2. Place the bottles so the smaller angled part of the bottles points in towards the middle of the case. Snap each bottle into place in the smaller part of the hole. Be sure the bottles are held below the threaded section.
3. Secure bottles by placing the o-ring around them.



Spout Position

If the suspension plate was removed from the refrigerator, replace it. Place the spout over the last bottle in the series, since the first action of the sampling cycle is a spout advance.

Installing The Sampler

Install the sampler on a firm, level surface adjacent to the sampling point. If the sampler is installed outdoors, consider enclosing it in a shelter or under some sort of protection. This will improve the performance and life of the unit. The Manning Parts Department can supply an optional full-size NEMA 3R insulated fiberglass enclosure designed for this purpose.

Connecting Power

The VSR sampler was designed with components which operate on 12 VDC power. Recognizing that 115 VAC power has to be available to run the refrigerator, the sampler takes advantage of the constant supply by employing an AC/DC converter to provide power to the system. The converter is located inside the top chassis. It comes equipped with a power cord, but it can be hard wired if desired. A power switch, which controls flow of current to the controller, is located on the electronics enclosure. The refrigerator has its own individual power cord. By using the AC/DC converter the user does not have to be concerned with replacement of batteries, charging of batteries, or any other factors which affect 12 VDC systems. The system has been thoroughly tested using 115 VAC and will provide outstanding service, reliability, and longevity. To power the unit up follow these simple steps:

1. Check to make sure that the unit is ready to be powered up.
2. Locate the power cord coming out of the top chassis.
3. Plug the cord into the appropriate receptacle.

4. Turn the power switch, located on the right side of the electronics enclosure, to "ON". Verify, by looking at the display, that power is being applied to the system. If the display does not light up, confirm that the appropriate connections have been made. If the unit does still not power up, call the Manning Service Department. They will be able to provide assistance in getting the unit operational.

WARNING: Hard-wiring should only be done by a certified electrician.

Sample Intake Line

General Purpose/Non-Toxic Sampling Option

Attach the intake hose to the connector on the short hose on the measuring chamber top..

Intake Hose Placement

Place the intake hose strainer 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. The correct and incorrect hose placements are shown below.

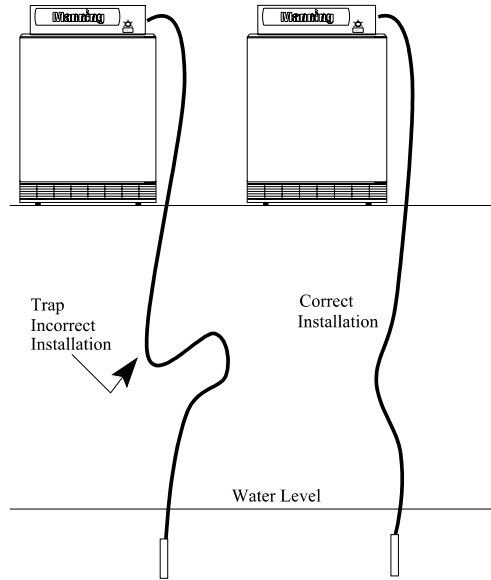


Figure 25 - Intake Hose Placement

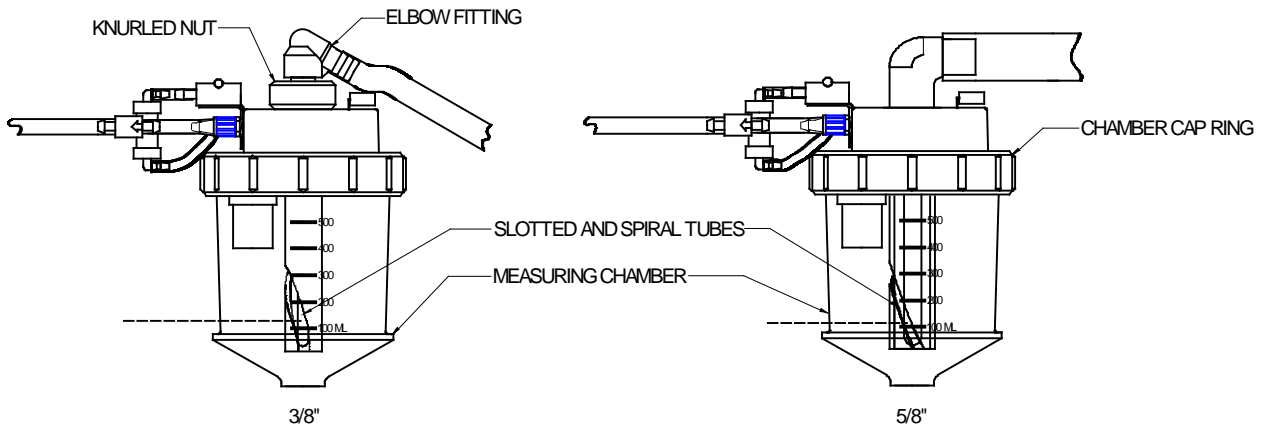
Running a Test Cycle

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. Run a test cycle before programming any operational modes into the sampler.

1. Turn the main power switch to the "ON" position. The display should read "SAMPLER READY".
2. If the multiple bottle option is being used, rotate the spout so that it is over a bottle.
3. Submerge 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.
4. Press the TEST CYCLE key on the keypad to initiate the test cycle. You will be prompted for the number of samples you want to take. Enter the number and press <ENTER>.

Setting the Sample Size

The sample volume is determined by the opening between the spiral and slotted tubes on the chamber top. By rotating the spiral tube, the opening is moved up or down. See the figure below.



To adjust the sample volume on the 3/8" chamber, rotate the knurled nut on the top of the chamber top clockwise while holding the elbow fitting stationary. This rotates the spiral tube. **Only rotate the nut clockwise.**

To adjust the sample volume on the 5/8" chamber, first loosen the chamber cap ring and remove the chamber top. Then, rotate the clear spiral tube to move the opening to the desired level. Replace the chamber top.

Run test cycles with water to check for the desired sample volume, making adjustments as needed. A graduated measuring container may also be used for very accurate sample volumes.

As long as the position of the opening between the spiral and slotted tubes is not changed, the sample volume is consistent regardless of hose length or draw height.

NOTE: The sample can be collected in the containers, or the distribution assembly can be removed and the sample collected in a beaker.

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 each 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; or 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. For the multi-bottle option, the first action is the advance of the spout to the next bottle. (For single bottle samplers, this step is omitted.) Next, the sampler forces pressurized air through the intake hose to purge the line of any contents or obstructions. This is called the “purge.” When the purge is complete, the controller operates the suction side of the compressor and draws fluid into the chamber. The fluid is purged to the specified volume and released into the sample container. If a full chamber is not sensed, the sampler makes another draw attempt. If after two attempts a full chamber is still not sensed, the sampler stops operation until the next sample event.

If the multi-bottle option is being used, the distribution spout remains stationary until the next sample event. This delay prevents cross-contamination of the next sample.

Sample Recovery

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

If the sample containers are to be left in the suspension plate, install the caps over the suspension collars. Then remove the suspension plate (with bottles) from the refrigerator. Lift the distribution assembly off the suspension plate and place it on the wire racks mounted in the refrigerator.

It may be easier to remove the distribution assembly first, and then install the bottle caps.

External Connections

The sampler comes with a 3-foot, 4 wire cable for connecting to external devices such as flow meters. A 10-foot cable is available as an option.

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.

The following chart describes the external connections which are necessary to operate the sampler:

Contact In & Analog In Connections			
Purpose	Connector Designation	Color	Polarity
Contact In	A	Red	No Polarity
Contact In	B	Black	No Polarity
Analog In (+)	D	White	Positive
Analog In (-)	C	Green	Negative

Bottle Full/Stepper Motor

The Model VSR can utilize both a Bottle Full Sensor and Stepper Motor (not at the same time).

Connections for the Bottle Full Sensor and the Stepper Motor are hardwired to the unit.

The sampler may be converted from single to multiple bottle or multiple to single bottle use.

To connect them follow the instructions listed below:

- A) Locate the cable bottle full/stepper cable inside the refrigerator. It will have a black plug on the end. Connect either the bottle full sensor cable or the stepper motor into the connector, depending upon whether single or multiple bottle sampling is being performed.



Bottle Full Sensor Cable

- B) Verify that the sampler configuration is correct.

This should complete the installation of the Bottle Full/Stepper Motor.

Contact Closure

This enables the sampler to accept a contact closure from an external device. The parameter to be measured is set, recorded, and totaled 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 4-pin connector on the top chassis near the power cord. (If you purchased the Analog Option, it will be labeled ("Contact/Analog In").
- B) Wire the red and black leads from the Contact In/Analog cable to the external device
- C) Connect the connector to the 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.

Analog Signal (Optional)

With this option, the sampler can accept an external 4-20mA signal from an external device. The flow volume is internally totaled 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. To connect the external device to the sampler follow the steps listed below:



Contact In/Analog In
Cable

- A) Locate the connector on the top chassis which is labeled "Contact/Analog In" connector.
- B) Wire the white wire (+) and the green wire (-) from the cable to the external device's analog output.
- C) Re-connect the connector to the "Contact/Analog In" plug.

This should complete the installation of the contact closure. Test the connection through the external

device to verify the wiring is correct and the sampler is initiating a sampling cycle when the signal is received. See the *08 Mode in the Programming section for additional information.

This completes the installation of the sampler. The unit should now be operational. Proceed to the programming instructions to program the sampler for operation.

Programming

INTRODUCTION

The sampler is controlled by a microprocessor that can execute a wide variety of time and flow sampling sequences called Modes. 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 *99 Function configures the sampler. Configuration defines multiple variables that do not usually change between different applications. These are such things as the type of sampler (single bottle, multiple bottle, or storm water), the number of bottles, and other factors like draw time, and purge time. Instructions for configuration of the sampler begin on page 2-5.

SAMPLING MODES

The sampler has two basic Modes: Time and Flow. (NOTE: While referred to as Flow Mode, the sampler can actuate based on signals from any external device. What device or why the device is supplying the 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 mode is based on a preset time period that must pass before a sample is taken. Flow mode has two variants. The standard controller (contact closure option) allows sampling based on contact closures from an external device. The analog controller (4-20mA option) allows sampling based on an analog signal totalized by the sampler's controller. All programs (or Modes) available for the Model VSR are based on either Time or Flow. Instructions for programming the different Modes begin on page 2-10.

Multi-Bottle Sampling Modes

All of the programs or Modes can be used with multiple bottle samplers.

Single Bottle Modes

All General Programs (Basic Time and Flow Modes)

- *02 Time Interval Override Mode
- *04 Multiple Time Intervals Mode
- *05 Totalizing Analog Flow Mode
- *06 Totalizing Analog Level Mode

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UTILITY & DISPLAY FUNCTIONS

Key	Function
<RESET>	Functions as a Reset (a soft boot in computer terms) for the sampler and clears the current program mode.
<TEST CYCLE>	Allows the user to check the sampler for mechanical operation by taking a physical sample.
<BOTTLE ADV>	Advances the spout clockwise 1 bottle each time the key is pressed. This function will not work when a program is running.
<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.
<CLOCK>	Sets the time. To set, press RESET twice, press CLOCK, enter the 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 real 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 user is in or out of a programmed mode. If the user is out of a programmed mode, pressing <DISPLAY> will show the configuration settings input in *99. If the user is in a programmed mode (e.g. a TIME, FLOW, or * Mode), pressing <DISPLAY> will show the current time, spout position, and other information specific to the current mode. NOTE: <u>See Appendix B for a Logic Map of the Programming Modes and what displays are active when the Display key is pressed.</u>
*	Used to program Star Modes.
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.

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:

TIME OF DAY The time of day is always displayed in the bottom right hand corner of the display. The format is a 24 hour clock HH:MM:SS. If the display is not counting down the seconds, the controller may have quit functioning. Press <RESET> <RESET> to warm boot the system. If this does not clear the problem, please call Manning at 1-800-863-9337.

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

- 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 mode 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, purge time, measure time, deposit time) and *07 DELAYED SAMPLE EVENT MODE which are shown in MM:SS format. Non time displays are characterized by a 4 digit display which does not possess a flashing cursor. The information relayed here may be the sample number or the bottle number depending on the active program and its state.
- Configuration:** See Appendix B for more information.
- Operational:** See Appendix B for more information.

SAMPLER CONFIGURATION FUNCTIONS

*99

*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 mode (explanations and step-by-step instructions are given below). Once entries have been made in *99, re-entering the configuration mode 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 * Mode. Press the * key to access the * Mode.
ENTER * MODE? — —	Prompts the user to enter either a program or the configuration function. Press 99 and <ENTER> to configure the sampler.
SAMPLER SETTING? —	Sets the sampler to a specific type of operation or bottle configuration: 1 = Single Bottle 2 = Multi-Bottle Other numbers are not valid and will cause the sampler to malfunction. Enter the desired configuration and press <ENTER>
# OF BOTTLES? — —	Sets the number of bottles (1,2,3,4,6,8,12, or 24) in the sampler. If 1 was selected for the SAMPLER SETTING above, this prompt is bypassed. Input the number of bottles and press <ENTER>.
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? — — —	Time window (4-150 secs) 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 liquid sensor, increase the draw time.

MEASURE TIME?

— —

Time window (3-99 secs) during which the sample is purged to the specified volume. Press ENTER to accept the measure time which is displayed or input a new measure time as a 2 digit number and then press ENTER. If the sample size is not purging to the specified volume, the measure time needs to be increased.

DEPOSIT TIME?

— —

Time window (3-99 secs) during which the sample is deposited in the bottle. Press ENTER to accept the time shown or input a new time as a 2 digit number and press ENTER. If all of the fluid is not being deposited into the sample container, the discharge time should be increased.

OF CHAMBER FILLS?

—

The number of times (1-4) the 500ml measuring chamber is filled and deposited into a bottle, per sampling event. (Only one chamber fill is performed during a test cycle). Press ENTER to accept the number of chamber fills shown or input a new number of chamber fills and press the ENTER key.

AUTO RESTART?

—

Sets the auto restart mode: 0 - No auto restart; 1 - auto restart activated. 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 MODE?

—

Sets the test cycle mode. 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.

KEYPAD BEEP MODE?

—

Sets whether the keypad beeps when keys are pressed:

0 - No beep 1 - Will beep.

Press <ENTER> to accept the setting shown, or input a new number and press <ENTER>. This also controls what is displayed during an analog program if the unit has the optional analog controller. These displays are explained in detail in the Analog Programming Section on page 2-8.

BACKLIGHT MODE?

—

Sets whether the display backlights:

- 0 - Backlight is never on. This is good if power conservation 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.
- 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 *99 mode and input the 4 digit numeric password at the PASSWORD PROTECTION prompt. Press <ENTER>. The user can now go into *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 Mode, 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.

*91 Data Logging

The * 91 mode 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 an 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 sampler's memory holds up to 512 entries in battery backed RAM, so in case of power loss the unit will not lose logged 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 logged data on 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. The *91 mode can only be entered from the SAMPLER READY prompt. The user can reach this screen from any location by pressing <RESET> twice.

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 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 four (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 #
— —

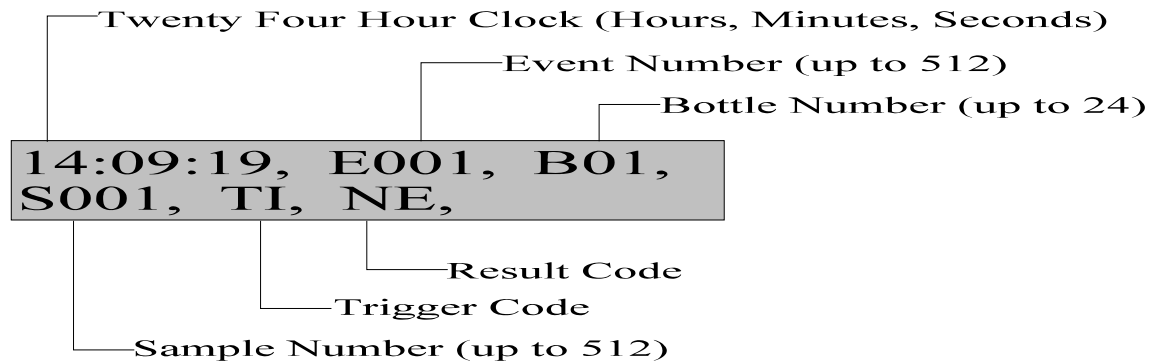
This display asks the user to enter the current month in two digit format. For example 03 = March, 11 = November, etc...

ENTER DAY DD #
— —

The user enters the two 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 four digit format.



VIEW MENU

The view menu allows the user to review logged events and activities. The data logged is not limited to sampling events. Activities such as power failure, warm starts, cold starts, etc. are also logged to provide the operator with a detailed history of the activities of the unit. The data in the VIEW menu is shown in coded format to allow the maximum amount of data 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 data 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 log was cleared. For example E001 would be the first logged event with E512 being the last since the unit logs a maximum of 512 events.

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

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

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 | AL = Analog Level |
| AF = Analog Flow | RD = Rising Delta |
| FD = Falling Delta | TC = Test Cycle (In a program mode) |
| TY = Test Cycle (Not in a program mode) | |

RESULT CODES: The result code indicates whether the unit was successful or unsuccessful in collecting the sample. If the sampler was successful, a result code of NE will be displayed. 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 data about non-sampling events such as power failures, start sequences, reset occurrences, etc. This data displayed is the time, in twenty four hour format, the event # and the activity (in this example START):

16:04:44,E001,START

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

ENTER SELECTION
—

At this prompt input <2> and press <ENTER>

OF EVENTS = _ _ _ _

Shows the operator the number of events logged. 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 event number at which they want to begin the display of logged events. Input the starting event # as a three 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 three 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 two digit number (00 to 99) representing the amount of time, in seconds, you wish the display to show a logged event before advancing to the next event. After inputting the number, press <ENTER>

The sampler automatically advances sequentially through the logged events, first displaying the site data and then displaying each event for the set number of scroll seconds. This will continue until the number of events entered in the COUNT # have been displayed. The sampler will then return to the ENTER SELECTION prompt within *91.

The operator can control the display of events with 3 keys.

RESET KEY: Pressing the reset key will terminate the display of events and return to the data logging menu.

DISPLAY KEY: Pressing the display key will advance the display to the next event. Each press of the display key will advance the display to the next event.

CLEAR KEY: Pressing the clear key will move the display backwards to the previous event. Pressing and holding the clear key will pause the display of events.

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 _ _ , _ , _ _

```

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

1st Line

- 1st field - Time at which the sample was logged.
- 2nd field - Headed by a capital "E", indicates the event number.
- 3rd field - Headed by a capital "B" represents the bottle number.

2nd Line

- 1st field - Headed by a capital "S" indicates the sample number.
- 2nd field - 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 field - The last field 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 logged 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

The download menu is intended to allow the operator to make either a hard copy (by sending the data to a printer) or an electronic copy (by sending the data to a PC or a Data Transfer Unit). The data is in ASCII format and is comma delimited for easier interface with commercially available spreadsheet programs. The Baud Rate is fixed at 9600 baud 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. NOTE: Downloading is only possible on samplers with the serial option installed.

ENTER SELECTION
—

At this prompt input a <4> and press <ENTER>

OF EVENTS = _ _ _ _

Shows the operator the number of events logged. 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 logged 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 logged event before advancing to the next screen. After inputting press <ENTER>. NOTE: entering a scroll time of 00 seconds will allow downloading at the maximum speed.

The sampler will display the logged data as it is being downloaded.

CLEAR MENU

The sampler is capable of holding up to 512 events or activities in memory. Once the memory is full, the unit will not store any additional data until the event log is cleared. Once the log has been cleared the information that had been stored there is permanently erased. If the data 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.

There are two methods of clearing data from memory - through the *91 function or through the *14 function. *91 allows the operator to clear the logged data from the clear menu. This method has allows the operator to back out of the clear operation without actually clearing the data. The sequence of steps is detailed below:

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 the data 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.

*14 CLEAR LOG DATA

* 14 Clear Log Data option allows the operator to clear the logged data without entering the *91 data logging program. This selection does not give the user the opportunity to back-out of the clearing of the log. This is an immediate and unalterable erasure. The *14 clear data unlike the *91 clear data is accessible from the SAMPLER READY prompt

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 the configuration function. Press 14 and <ENTER> to erase the logged data.

CLEARING LOG DATA

The menu shows the log being cleared. The log is now clear. The data that was contained within the log is now erased and is unrecoverable.

SAMPLER READY
12:48

The unit returns to the SAMPLER READY prompt awaiting further action.

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 (*05,*06, *09, *11, and *13), 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 VSR. 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 in 4-20mA, etc.) sent from the external device. The higher limit will correspond to the highest signal level (20mA in 4-20mA, etc.) 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 Analog Option and the KEYPAD BEEP MODE configuration prompt

The prompt that appears before the password is the KEYPAD BEEP MODE prompt. It is a diagnostic prompt that allows the user to turn the keypad beep on or off and set the controller to display certain values relating to the analog controller. When KEYPAD BEEP MODE is set to 0, the LCD will not beep from external inputs and will not display any information about the external input. When KEYPAD BEEP MODE is set to 1, the LCD will beep every time an input is taken from the external device and the LCD will display a sequence of three numbers. The first set of numbers displayed is the number of samples taken since the program was started. The second set of numbers displayed is the digital step (0-255) discussed above. The third set of numbers displayed is the level or flow associated with the digital step displayed immediately before it.

The following are examples of information displayed on the LCD during an analog program when KEYPAD BEEP MODE is set to option 1 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.

***08 Analog Display Routine**

The analog display routine allows the operator to display the analog signal received from an external meter (level, flow pH, etc.). This routine can be used while the sampler is being installed, connected to a flow meter, or to check the calibration of the sampler's analog to digital converter.

The program is started by entering <*08> at the "SAMPLER READY" prompt. The analog value will be displayed in three formats: 1) As a digital value (0 to 255); 2) As a DC voltage (1 to 5 VDC); and 3) in milliamps (4.0 to 20.0 mA). The program will continue to loop until reset by the operator pressing the <RESET> key twice. The analog input signal can be varied while the program is running and the display will change accordingly.

The sampler's analog routine can be calibrated by inputting a known milliamp signal or attaching a variable voltage source across the analog input terminals.

ANALOG VALUES TABLE

	TABLE A1	
mA	DC VOLTS	DIGITAL VALUE
4.0	1.00	000
5.0	1.25	015
6.0	1.50	031
7.0	1.75	047
8.0	2.00	063
9.0	2.25	079
10	2.50	095
11	2.75	111
12	3.00	127
13	3.25	143
14	3.50	159
15	3.75	175
16	4.00	191
17	4.25	207
18	4.50	223
19	4.75	239
20	5.00	255

Table A1 is a conversion table for the analog values. For example, if a voltage of 3.00 volts is placed across the analog input terminals the sampler should display 12 mA, 3.00 VDS and a digital value of 127. The analog input circuit is designed with a precision 250 ohm resistor across the input terminals. When an mA analog signal is input the current flows through the 250 ohm resistor generating a voltage drop proportional to the current flow. At 12 mA the voltage drop is $.012 \times 250 = 3.00$ volts. The three volts is converted into a digital value 127. When a three volt signal is placed across the analog input terminals it generates a current flow according to ohms law of $I = 3/250 = .012$ mA.

Constant current sources are not common. However, batteries of known voltages are readily available; thus, using a voltage source to calibrate the sampler is useful.

A 4-20 mA source can be calibrated by placing a 250 ohm resistor in the loop and measuring the voltage drop across the resistor with a voltmeter. Table A1 can be used to interpolate the corresponding MA signal or Ohms law ($V/R = I$) can be used to calculate the mA signal. If the voltage is 4.25, then the mA signal is $4.25/250 = .017$ amps or 17 mA.

ADD-ON PROGRAMMING FUNCTIONS

Multiple Bottles per Sampling Event

Multiple Bottles per Sampling Event is not a stand alone function but works in conjunction with TIME, FLOW and certain * Modes (*02, *04, *05, *06, *09) to expand the capabilities of the sampler. This option places 1 sample in from 2-24 bottles in rapid succession during 1 sampling event (such as a contact closure or a time interval). To use Multiple Bottle per Sampling Event, the user selects the mode of choice - a TIME, FLOW, or * Mode. After entering the required information, the PUSH START/OPTIONS prompt will appear on the display. At this cue press <MULTI BOTTLE> and enter the number of bottles into which 1 sample should be placed, in rapid succession. For example, Multiple Bottles per Sampling Event would be used if a sample is to be taken every 100,000 gallons, and 1 sample is to be placed in 5 different bottles each time there is a contact closure. The unit would start the sampling sequence after it had received a contact closure. It would draw and place 1 sample in the first bottle, immediately move to the second, draw and place 1 sample in that bottle, immediately move to the third, draw and place 1 sample in that bottle and so on until it had deposited 1 sample in the specified number of bottles (in this example 5).

Display on LCD

Explanation

<p>SAMPLER READY 12:48</p>	<p>This display indicates the sampler is ready to program. Multiple Bottles per Sampling Event is not a stand alone program. It works in conjunction with FLOW, TIME, and certain * Modes. In this example <FLOW> was pushed as the mode of choice.</p>
<p>PUSH START/OPTIONS</p>	<p>At this prompt the user selects Multiple Bottles per Sampling Event, by pressing <MULTI BOTTLE>.</p>
<p>BOTTLES PER SAMPLE? — —</p>	<p>Input the number of bottles into which 1 sample will be placed in rapid succession during a sampling event and press <ENTER>.</p>
<p>PUSH START/OPTIONS</p>	<p>At this point, simply press <START>. <u>NOTE: Multiple Bottles per Sampling Event and Multiple Samples per Bottle cannot be selected simultaneously. They are mutually exclusive options.</u></p>
<p>FLOW MODE — — — —</p>	<p>The unit is now waiting for a contact closure to initiate the sample sequence.</p>

Multiple Samples per Bottle

Multiple Samples per Bottle is not a stand alone function but works in conjunction with other TIME, FLOW and certain * Modes (*02, *04, *05, *06, *09) to expand the capabilities of the sampler. The sampler places from 2 to 99 samples in each bottle. In order to use Multiple Samples per Bottle, the user selects the mode of choice - a TIME, FLOW, or * Mode. After entering the required information, the PUSH START/OPTIONS prompt will appear on the display. At this cue press <MULTI SAMPLE> and enter the number of samples per bottle. For example, if Flow Mode were being used and Multiple Samples Per Bottle is set at 5, each time an event occurred, such as a contact closure or the end of a time interval, the sampler would place a sample in a bottle. When the next event occurs, the sampler would place another sample in the SAME bottle, until 5 samples had been placed in that bottle. It would then advance the spout to the next bottle in sequence. The sampler would then repeat the process above for the current bottle. This would continue until the total number of bottles the unit is configured for (set in *99) have received their allocation of samples.

Display on LCD	Explanation
<p>SAMPLER READY 12:48</p>	This display indicates the sampler is ready to program. Multiple Samples per Bottle is not a stand alone program. It works in conjunction with FLOW, TIME and certain * Modes. In this example <FLOW> was pushed as the mode of choice.
<p>PUSH START/OPTIONS</p>	At this prompt the user selects Multiple Samples per Bottle, by pressing <MULTI SAMPLE>.
<p>SAMPLES PER BOTTLE? — —</p>	Input the number of bottles into which 1 sample will be placed during a sampling event and press <ENTER>.
<p>PUSH START/OPTIONS</p>	At this point, simply press <START>. <u>NOTE: Multiple Bottles per Sampling Event and Multiple Samples per Bottle cannot be selected simultaneously. They are mutually exclusive options.</u>
<p>FLOW MODE — — — —</p>	The unit is now waiting for a contact closure to initiate the sample sequence.

Delay Start - Time

Delay Start - Time works in conjunction with TIME and certain * Modes to expand the capabilities of the sampler. It is not a stand alone program and cannot be used with * Start, FLOW MODES, *01, *05, *06, *09, *11, *12, or *13. Delay Start - Time works by allowing the user to add a period of time to the beginning of a TIME or * Mode 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 - Time in the program negating the user's ability to add an additional Delay Start - Time.** The user selects the mode 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 - Time 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 - Time and 1.5 hours for the Time Interval). The sampler would then take a sample every 1.5 hours until all of the bottles (set in *99) each have a sample placed in them or 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 * Modes. In this example <TIME> was pushed as the mode 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 mode).
PUSH START/OPTIONS	The sampler is now ready to begin operation. Press <START> to begin the Delay Start countdown, or add other options such as Multiple Samples per Bottle or Multiple Bottles per Sampling Event.
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 * Modes.

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 (TIME, FLOW, Program 02, Program 05) must be programmed.

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 Program 15, 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 Program 15 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 where 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 (or <PROG > key, if a PSB4 sampler) to begin programming.
ENTER PROGRAM # — — 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> . To turn off Active Sampling, enter a "0" and press <ENTER>. If Active Sampling is turned off, the display will return to the SAMPLER READY prompt.

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 RESUMING sampling at the beginning of each active period (enter "1"). Restarting sampling causes the sampler reset the bottle and sample count at the beginning of the next active period.

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. Enter the start time and press <ENTER>. Enter a start time of 00:00 if you want sampling to start at the beginning of the day.

Mon. STOP TIME
__:__ 07/30FRI

The sampler then asks for the sop time in HH:MM format. Enter the stop and press <ENTER>. Enter a stop time of 24:00 if you want sampling to continue to the end of the day.

This step and the previous one are repeated for each day that was selected to be an active sampling day.

SAMPLER READY A
04:30:02

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 Program 15, you can then enter a sampling program.

GENERAL PROGRAMS

Time Mode - * Start

* START is a unique programming mode. It is unlike any other mode in that it automatically programs the unit to take a sample every hour. Simply press the * 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 advance the spout, draw 1 sample, and place it in a bottle. The time interval will reset as soon as the sample cycle starts. At the end of the second hour the spout will advance and another sample will be taken and deposited. This will continue until the total number of bottles the unit is configured for (set in *99) each have 1 sample placed in them or 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. For example, if the sampler was configured for 24 bottles, the sampler would place 1 sample in each bottle, over a 24 hour period for a total of 24 samples, and then stop operation.

Display on LCD

Explanation

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

Time Mode - Single Time Interval

This mode is similar to * 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 advance the spout, draw 1 sample, and place it in a 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, the spout will advance and another sample will be taken and deposited. This will continue until the total number of bottles the unit is configured for (set in *99) each have 1 sample placed in them or 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, advance the spout, take the first sample, and reset the timer. After another 1 hour and 30 minutes the spout would advance to bottle 2, the sampler would take a 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.

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Flow Mode

Flow Modes differ from Time Modes 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 Mode 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 advance the spout, draw 1 sample and place it in a 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 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 these two conditions occur, the sampler ends the program.

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 Mode - Pulse Accumulation

FLOW Mode - Pulse Accumulation operates the same as FLOW Mode 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 advance the spout, draw 1 sample and then place it in a bottle. It will then wait for the next accumulation. This will continue 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 these two conditions occur, the sampler ends the program.

Display on LCD	Explanation
<p>SAMPLER READY 10:04</p>	This display indicates the sampler is ready to program and displays the current time. Press <FLOW> to begin programming.
<p>PUSH START/OPTIONS</p>	To set the number of contacts to be accumulated in FLOW Mode - Pulse Accumulation, press <DELAY START> and then the <START> button.
<p>DELAY IN PULSES? — — — —</p>	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 pulses before taking a sample.
<p>PUSH START/OPTIONS</p>	Unless add-on options to the program are desired, press <START>.
<p>FLOW MODE — — — —</p>	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.

MULTI-BOTTLE SAMPLING PROGRAMS

*01 Flow Mode - Independently Timed Spout Advance

The *01 program is used to obtain flow proportional samples over a period of time. Each bottle the sampler is configured for has a time interval (referred to as a time window) during which it is active. Samples can only be placed in THAT bottle during THAT active time window. Once the sampler is programmed, it waits for a contact closure while counting down the time interval that was set. If it receives a contact closure, while counting down the Time Interval, a sample sequence will be initiated. The sampler will advance the spout, draw 1 sample, and place it in the active bottle. For every contact closure received during the active time window, the sampler will place 1 sample in the SAME active bottle. Once the first time window has elapsed (all the time windows have the same time increment), the sampler will begin counting down the second time window while waiting for contact closures for the next active bottle. This continues until all of the bottles (set in *99) have at least 1 sample placed in them. A bottle could potentially have more than 1 sample if more than 1 contact closure is received during the bottle's active time window. If the sampler has not received a contact closure by the end of the active time window the unit will advance the bottle spout and place 1 sample in the bottle that had most recently been active.

NOTE: There is no overflow protection in this mode. Make sure that the sample volume is small enough compared to the flow rate to prevent over-filling.

Display on LCD	Explanation
SAMPLER READY 12:48	This display indicates the sampler is ready to program and displays the current time. Press the * 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 01, and press <ENTER>.
ACTIVE TIME INTERVAL _ _ _ : _ _ _	The sampler then asks for an interval time. This is the amount of time (1 min to 99 hours and 59 min) during which the sampler will place samples in the active bottle. Enter the time in HH:MM format and press <ENTER>.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
FLOW MODE (* 01) _ _ _ _ _	The sampler is now waiting to receive contact closures and is independently counting down the interval time.

*02 Flow Mode - Time Interval Override

*02 operates much like basic FLOW mode 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 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 advance the spout, draw a sample, and then place it in a 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 will advance the spout, 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 the total number of bottles the unit is configured for (set in *99) each have their set number of samples placed in them or a bottle full condition occurs. If either of these two conditions occur, the sampler ends the program. The unit will take 1 sample per override time interval until all bottles have samples or a bottle full condition occurs.

Display on LCD

Explanation

<p>SAMPLER READY 12:48</p>	<p>This display indicates the sampler is ready to program and displays the current time. Press the * key to begin programming.</p>
<p>ENTER * MODE — —</p>	<p>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 02, and press <ENTER>.</p>
<p>TIME OVERRIDE? — : —</p>	<p>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 inputting.</p>
<p>PUSH START/OPTIONS</p>	<p>If no add-on options are desired, press <START> to begin the program.</p>
<p>FLOW MODE (* 02) — — — —</p>	<p>The sampler is now ready to receive contact closures and is independently counting down the Time Override.</p>

*03 Flow Mode - External Event

*03 is used for monitoring intermittent events by combining portions of Flow and Time modes. *03 differs from regular flow modes based on the way the sampler interacts with the contact closures it receives. In normal flow mode the sampler receives a momentary closure from an external device, and this initiates a sampling cycle. In *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 *03 to operate as intended. By the contact remaining closed, the time portion of the mode 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 regular flow mode, 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 the total number of bottles the unit is configured for (set in *99) each have their set number of samples placed in them or a bottle full condition occurs. If the contact opens before either of these two 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 * 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 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 *03.
FLOW MODE (* 03) _ _ _ _	The sampler is now ready to receive contact closures and is independently counting down the Time Override.

*04 Time Mode - Multiple Intervals

The *04 mode 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 1 bottle and then advance the spout. The sampler will repeat the operation each time an interval expires. The sampler will continue this pattern until all the intervals entered have expired, the total number of bottles the unit is configured for (set in *99) each have at least 1 sample placed in them, or a bottle full condition occurs. Data entry can be ended at any time by pressing the * 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 * 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 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 * 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.

*07 Flow Mode - Time Interval Delay

*07 operates much like basic FLOW mode except a time interval delay is added after a contact closure has been received. Just like in FLOW mode, 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 the total number of bottles the unit is configured for (set in *99) each have their set number of samples placed in them or a bottle full condition occurs. If either of these two conditions occur, the sampler ends the program.

Display on LCD

Explanation

<p>SAMPLER READY 12:48</p>	<p>This display indicates the sampler is ready to program and displays the current time. Press the * key to begin programming.</p>
<p>ENTER * MODE — —</p>	<p>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 02, and press <ENTER>.</p>
<p>TIME DELAY? — — : — —</p>	<p>Input the time the sampler is to wait, after receipt of a contact closure, to take a sample. After getting the signal the unit will count down the interval and take a sample. Press <ENTER> after input.</p>
<p>PUSH START/OPTIONS</p>	<p>If no add-on options are desired, press <START> to begin the program.</p>
<p>FLOW MODE (* 07) — — — —</p>	<p>The sampler is now ready to receive contact closures.</p>

ANALOG SAMPLING PROGRAMS

*05 Flow Mode - Totalizing Analog

The *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 the analog controller works, refer to the analog programming section on page 2-8. 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. 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 *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 * 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 anticipated flow rate. Since the unit of measurement is generic it can stand for any volume/unit of time. If the flow rate is 40, it could be entered as: 4000, 0400, or 0040. The decimal point is implied, in each case, so <u>be consistent with all entries.</u> Rate must be in units per minute.
MINIMUM FLOW RATE? — — — —	Enter the 4 most significant digits of the Minimum anticipated flow rate. The same criteria apply to this input as to Maximum Flow Rate.

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 ($4000 \times 10 = 40,000$) 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. Remember the decimal point is implied and must be consistent with previous entries. 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 ($1500 \times 100 = 150,000$).

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.

*06 Analog Level Mode

The *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 the analog controller works, refer to the analog programming section on page 2-8). 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 *99) each have a sample placed in them or a bottle full condition occurs.

To use the *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 * 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.

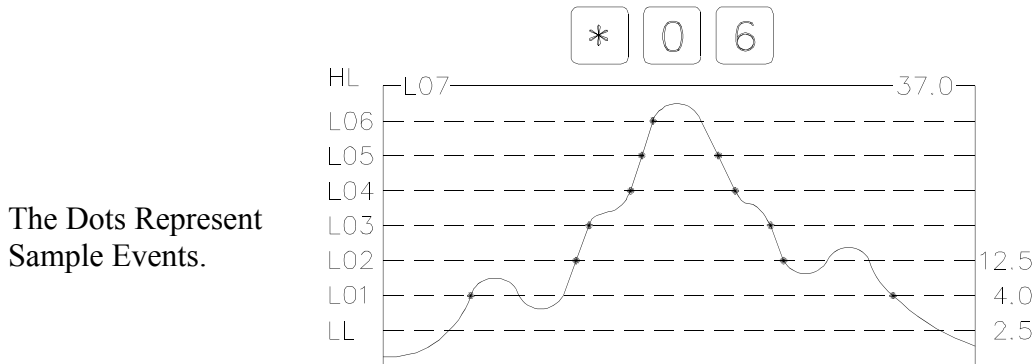


Figure 2-2 The Totalizing Analog Level Mode.

Display on LCD

Explanation

<p>SAMPLER READY 12:48</p>	<p>This display indicates the sampler is ready to program and displays the current time. Press the * key to begin programming.</p>
<p>ENTER * MODE — —</p>	<p>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>.</p>
<p>UPPER LEVEL LIMIT? — — — —</p>	<p>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.</p>
<p>LOWER LEVEL LIMIT? — — — —</p>	<p>Enter the Lower Level Limit as a 4-digit number. Remember to be consistent with the implied decimal from previous entries.</p>
<p>SAMPLING LEVEL 1? — — — —</p>	<p>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.</p>

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 * 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.

*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 the analog controller works, refer to the analog programming section on page 2-8). 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: <u>The user can enter only 1 Rising Delta for the duration of the program.</u>
Falling (negative) Delta	Falling change in water level, resulting in a sample. NOTE: <u>The user can enter only 1 Falling Delta for the duration of the program.</u>
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.

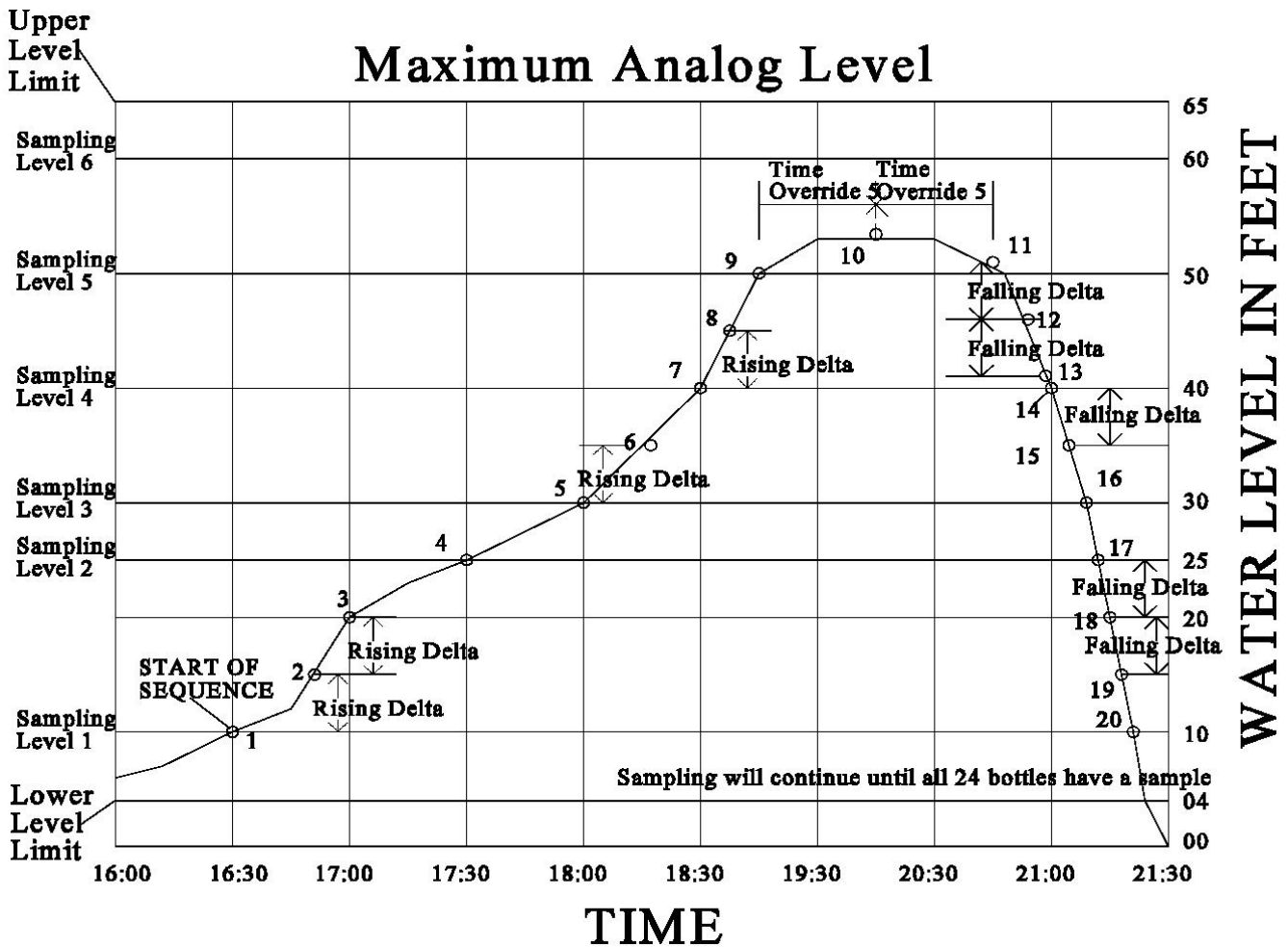


Figure 2-3 The *09 Storm Water Sampling Mode

Display on LCD	Explanation
<p>SAMPLER READY 12:48</p>	<p>This display indicates the sampler is ready to program and displays the current time. Press the * key to begin programming.</p>
<p>ENTER * MODE — —</p>	<p>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>.</p>
<p>UPPER LEVEL LIMIT? — — — —</p>	<p>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.</p>
<p>LOWER LEVEL LIMIT? — — — —</p>	<p>Enter the Lower Level Limit as a 4-digit number. Remember to be consistent with the implied decimal from previous entries.</p>
<p>RISING DELTA? — — — —</p>	<p>Enter a 4-digit number which represents the <u>rising</u> 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.</p>
<p>FALLING DELTA? — — — —</p>	<p>Enter a 4-digit number which represents <u>the falling</u> 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.</p>
<p>SAMPLING LEVEL 1? — — — —</p>	<p>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.</p>
<p>TIME OVERRIDE 1? — — : — —</p>	<p>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.</p>
<p>SAMPLING LEVEL 2? — — — —</p>	<p>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.</p>
<p>TIME OVERRIDE 2? — — — —</p>	<p>Enter a time in HH:MM format. Operates on the same principal as Time Override 1.</p>

SAMPLING LEVEL 3?

Enter a 4-digit number. Operates the same as previous Sampling Levels.

TIME OVERRIDE 3?

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

If no add-on options are desired, press <START> to begin the program.

FLOW MODE (*09)

The sampler will immediately begin reading the analog signal.

MULTI-BOTTLE FLOW COMPOSITE PROGRAMS

*10 Flow Mode - Multiple Bottle Composite

The *10 mode augments basic flow mode by allowing Multiple Bottles per Sample and Multiple Samples per Bottle to be used together. Normally they are mutually exclusive but *10 combines the two, using Flow with Multiple Bottles per Sample as the base. It adds Multiple Samples per Bottle by letting the user place multiple samples (1-99) in the same bottle creating a composite sample. NOTE: The number of samples should be equal to or less than the volume of the sample containers divided by the volume of the sample, to prevent over filling. The unit operates by accepting contact closures 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 *10 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 unit will advance the spout, draw its samples and place them in the correct bottles. It will then wait for the next contact closure. This will continue 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 these two conditions are met, the sampler ends the program.

For example, assume the sampler is configured for 24 bottles and Samples per Bottle is set to 3 (see step by step programming below). The sampler, after receiving a contact closure, will in rapid succession place 1 sample in each bottle it is configured for (set in *99). In this case, since the sampler is configured for 24 bottles, a total of 24 samples would be deposited (one in each bottle). After depositing this set of samples the unit would pause awaiting the next contact closure to place the second set of samples in the bottles (there would be 48 total samples taken after the second contact closure - 2 in each bottle). After the third set, the sampler would end the sequence and wait for a new program (there would be 72 total samples taken - 3 in each bottle).

The override time causes the unit to take samples if the contact closure fails to occur. The override time starts counting down immediately after pressing <START>. If a contact closure is received, the override time resets and immediately begins to count down again. NOTE: This means that the override time must be longer than the time it takes for the sampling sequence to complete. If it is not, the override time will elapse while the sampler is in the sequence causing the sampler to immediately start another sequence after it finishes the previous one.

Display on LCD

Explanation

SAMPLER READY
12:48

This display indicates the sampler is ready to program and displays the current time. Press the * 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 10, and press <ENTER>.

SAMPLES PER BOTTLE?

— —

Enter the number of samples per bottle as a 2-digit number (1-99). Make sure the volume to be placed in the bottles is not greater than the actual volume of the bottles.

TIME OVERRIDE?

— — : — —

Enter in HH:MM format. Remember to allow enough time for the sampler to collect the required samples.

PUSH START/OPTIONS

If no add-on options are desired, press <START> to begin the program.

FLOW MODE (*10)

— — — —

The sampler is now ready to receive contact closures and is independently counting down the interval time.

*11 Flow Mode - Totalizing Analog Multiple Bottle Composite

This mode is a combination of *05 (the ability to process an analog signal), and *10 (the ability to use Multiple Bottles per Sample and Multiple Samples per Bottle together). *11 works by integrating and totalizing an analog signal (4-20mA) from an external device that represents flow rate. For more details on how the analog controller works, refer to the analog programming section on page 2-8. 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. 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, the sample collection process is initiated. The unit will advance the spout and in rapid succession draw and place its samples. The unit will then pause awaiting the next trigger. Every time the totalized volume matches the Sample Trigger Volume, the sampler will draw its samples, deposit them, and wait for another Sample Trigger. The sampler will continue this pattern 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.

For example, assume the sampler is configured for 24 bottles and Samples per Bottle is set to 3 (see step by step programming below). The sampler, after receiving a contact closure, will in rapid succession place 1 sample in each bottle it is configured for (set in *99). In this case, since the sampler is configured for 24 bottles, a total of 24 samples would be deposited (one in each bottle). After depositing this set of samples the unit would pause awaiting the next contact closure to place the second set of samples in the bottles (there would be 48 total samples taken after the second contact closure - 2 in each bottle). After the third set, the sampler would end the sequence and wait for a new program (there would be 72 total samples taken - 3 in each bottle).

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.

The override time causes the unit to take samples if the Flow Trigger fails to occur. The override time starts counting down immediately after pressing <START>. If the Flow Trigger is received, the override time resets and immediately begins to count down again. NOTE: This means that the override time must be longer than the time it takes for the sampling sequence to complete. If it is not, the override time will elapse while the sampler is in the sequence causing the sampler to immediately start another sequence after it finishes the previous one. The time override fills bottles the same way as if a Flow Trigger were received. This will continue until the maximum number of samples (1-99) have been placed in the bottles (the number of samples should be equal to or less than the volume of the sample containers divided by the volume of the sample, to prevent over filling).

Display on LCD	Explanation
SAMPLER READY 12:48	This display indicates the sampler is ready to program and displays the current time. Press the * 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 11, and press <ENTER>.
MAXIMUM FLOW RATE? _ _ _ _	Input the 4 most significant digits of the Maximum anticipated flow rate. Since the unit of measurement is generic it can stand for any volume/unit of time. If the flow rate is 40, it could be entered as: 4000, 0400, or 0040. The decimal point is implied, in each case, so <u>be consistent with all entries</u> . Rate must be in units per minute.
MINIMUM FLOW RATE? _ _ _ _	Enter the 4 most significant digits of the Minimum anticipated flow rate. The same criteria apply to this input as to Maximum Flow Rate.
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 ($4000 \times 10 = 40,000$) to have the unit scale the flow rate as 40,000.
SAMPLE TRIGGER? _ _ _ _	Enter the 4 most significant digits of totalized flow at which a sample should be taken. Remember the decimal point is implied and must be consistent with previous entries. If the user wanted to take a sample every 150,000 units, the entry would be 1500.
TRIGGER MULTIPLIER? _ _ _ _	The Trigger Multiplier scales the Sample Trigger. Using the example above, if 150,000 units is the Trigger point, the Trigger Multiplier would be 100 ($1500 \times 100 = 150,000$).
SAMPLES PER BOTTLE? _ _	Enter the number of samples per bottle as a 2-digit number (1-99). Make sure the volume to be placed in the bottles is not greater than the actual volume of the bottles.
TIME OVERRIDE? _ _ : _ _	Enter in HH:MM format. Remember to allow enough time for the sampler to collect the required samples.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
FLOW MODE (*11) _ _ _ _	The sampler will immediately begin reading the analog signal.

*12 Flow Mode - Multiple Bottle Composite with Bottle Groups

The *12 mode functions almost identically to *10 mode, however, in this mode, up to 24 separate bottle groups can be created which accept composite samples. *12 is useful when it is not possible to collect samples on a regular basis, such as on a weekend or at a remote site. In this mode the user selects the number of bottle groups, how long each group is active (receives samples), the maximum number of samples a group will take, and a time override. NOTE: The number of bottle groups is entered, not the number of bottles in a group. After pushing <START>, the sampler immediately begins counting down the Delay Start. Once the Delay Start has finished counting down the sampler will be ready to receive an event (contact closure or time override). The finish of the Delay Start will also start the time override counting down. If the sampler receives an event, the unit will initiate the sampling sequence. There are several simultaneous actions.

- 1) The spout will advance to the first bottle in the active bottle group and begin the sampling process.
- 2) The active bottle group time will begin counting down. NOTE: Make sure the active time period allows enough time to collect all the samples required. If the active time period elapses before the Samples per Bottle has been satisfied, the unit will finish the sequence in progress and then move to the next bottle group without completing the current bottle group.
- 3) The time override will reset and begin counting down again. The override time causes the unit to take samples if a contact closure fails to occur. The override time starts counting down immediately after pressing <START>. NOTE: The override time must be longer than the time it takes for the sampling sequence to complete. If it is not, the override time will elapse while the unit is in a sampling sequence causing another sequence to begin immediately after finishing the previous one.

The first bottle group will be active and receive all samples for its active time period, up to the maximum number of samples. If the maximum is reached, the sampler will still wait out the rest of the active time before switching to the next bottle group. After the initiation of a sampling sequence, the sampler will advance to the first bottle in the group. The unit will place 1 sample in this bottle, and then advance to the next bottle in the group and deposit a sample. This will continue until all the bottles in the group have 1 sample placed in them (see NOTE on #2 above). The sampler will then wait for another event (contact closure or a time override elapse (see NOTE on #3 above)). When the event occurs the unit will place another sample in each bottle of the active group. This will continue, as events take place, until the specified number of Samples per Bottle is reached and all Bottle Groups have been utilized. See page 2-36 for a full explanation of how bottle groups are divided and what order the spout fills the bottles.

Display on LCD

Explanation

SAMPLER READY
12:48

This display indicates the sampler is ready to program and displays the current time. Press the * 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 12, and press <ENTER>.

SAMPLES PER BOTTLE? — —	Enter number of samples per bottle as a 2-digit number (1-99). Make sure the volume to be placed in the bottles is not greater than the actual volume of the bottles.
TIME OVERRIDE? — — : — —	Enter in HH:MM format. Remember to allow enough time for the sampler to collect the required samples.
ENTER DELAY START — — : — —	This display prompts the user to enter a delay start time (HH:MM format). This is the amount of time the sampler is to wait before starting.
ACTIVE PERIOD? — — : — —	Enter a time (HH:MM format). This is the time window in which bottle groups are active. It applies to all bottle groups. Make sure it is long enough to allow the sampler to collect the number of samples required.
# OF BOTTLE GROUPS? — —	Enter a 2-digit number (must be an integer). This is the number of bottle groups to be created from the number of bottles set in *99. The number of bottles will be divided by the number of bottle groups to determine how many bottles are in a group.
PUSH START/OPTIONS	If no add-on options are desired, press <START> to begin the program.
DELAY START TIME — — : — —	This display shows the time remaining on the Delay Start.
FLOW MODE (*12) — — — —	The sampler is now waiting to receive contact closures and is independently counting down the interval time.

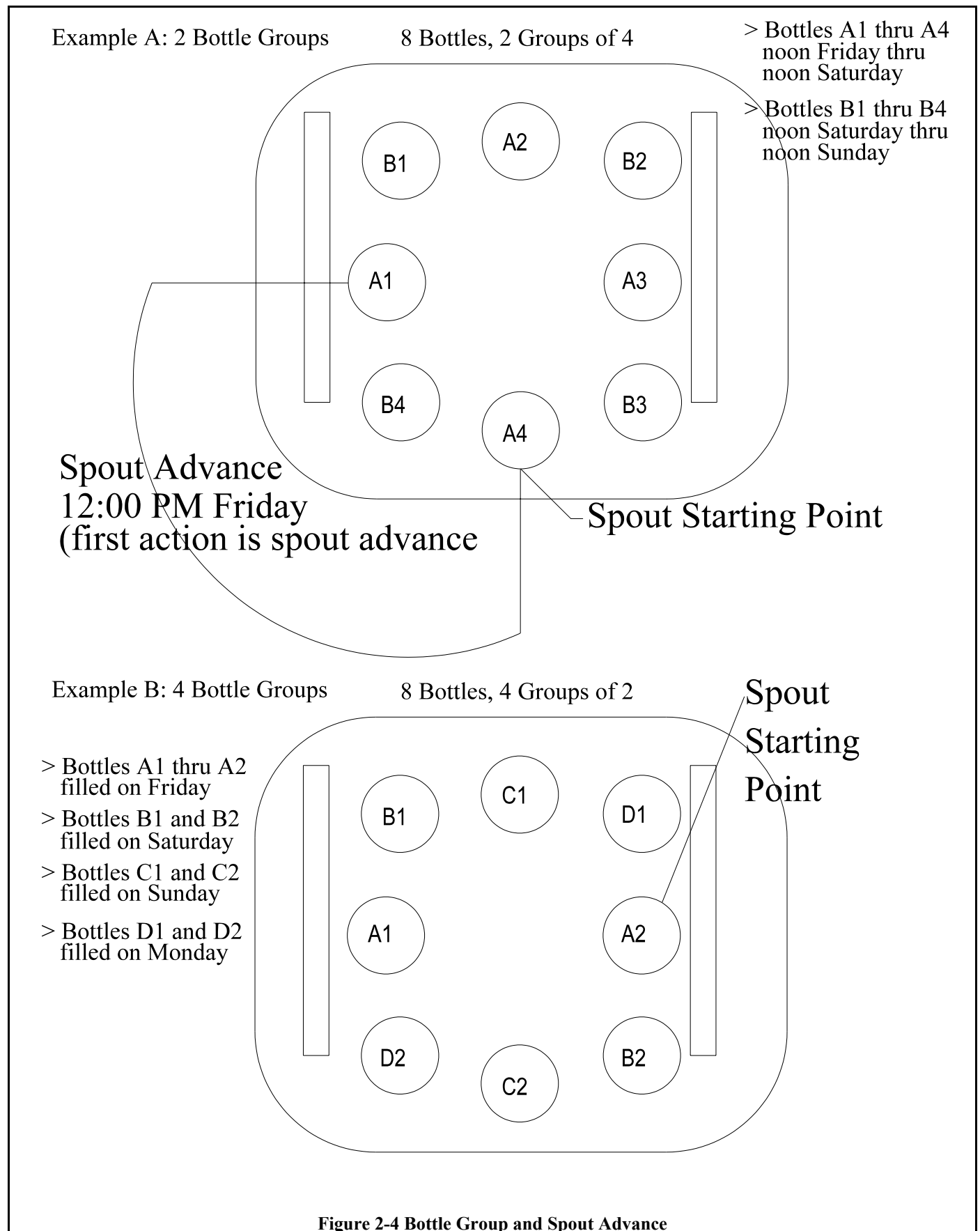


Figure 2-4 Bottle Group and Spout Advance

***13 Flow Mode - Totalizing Analog Multiple Bottle Composite with Bottle Groups**

The *13 mode functions in the same way as the *12 mode, except it integrates and totalizes an analog signal (4-20mA) from an external device that represents flow rate. 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. For more details on how the analog controller works, refer to the analog programming section on page 2-8. *13 is useful when it is not possible to collect samples on a regular basis, such as on a weekend or at a remote site. In this mode the user selects the number of bottle groups, how long each group is active (receives samples), the maximum number of samples a group will take, and a time override. NOTE: The number of **bottle groups** is entered, not the number of bottles in a group. After pushing <START>, the sampler immediately begins counting down the Delay Start. Once the Delay Start has finished counting down, the sampler will begin reading the analog signal and be ready to act on an event (totalized volume or time override). The finish of the Delay Start will also start the time override counting down. If the sampler receives an event, the unit will initiate the sampling sequence. There are several simultaneous actions:

- 1) The spout will advance to the first bottle in the active bottle group and begin the sampling process.
- 2) The active bottle group time will begin counting down. NOTE: Make sure the active time period allows enough time to collect all the samples required. If the active time period elapses before the Samples per Bottle has been satisfied, the unit will finish the sequence in progress and then move to the next bottle group without completing the current bottle group.
- 3) The time override will reset and begin counting down again. The override time causes the unit to take samples if the Flow Trigger fails to occur. The override time starts counting down immediately after pressing <START>. NOTE: The override time must be longer than the time it takes for the sampling sequence to complete. If it is not, the override time will elapse while the unit is in a sampling sequence causing another sequence to begin immediately after finishing the previous one.

The first bottle group will be active and receive all samples for its active time period, up to the maximum number of samples. If the maximum is reached, the sampler will still wait out the rest of the active time before switching to the next bottle group. After the initiation of a sampling sequence, the sampler will advance to the first bottle in the group. The unit will place 1 sample in this bottle, and then advance to the next bottle in the group and deposit a sample. This will continue until all the bottles in the group have 1 sample placed in them (see NOTE on #2 above). The sampler will then wait for another event (totalized volume or time override (see NOTE on #3 above)). When the event occurs the unit will place another sample in each bottle of the active group. This will continue, as events take place, until the specified number of Samples per Bottle is reached and all Bottle Groups have been utilized. See page 2-36 for a full explanation of how bottle groups are divided and what order the spout fills the bottles.

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 * 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 13, and press <ENTER>.
MAXIMUM FLOW RATE? — — — —	Input the 4 most significant digits of the Maximum anticipated flow rate. Since the unit of measurement is generic it can stand for any volume/unit of time. If the flow rate is 40, it could be entered as: 4000, 0400, or 0040. The decimal point is implied, in each case, so <u>be consistent with all entries</u> . Rate must be in units per minute.
MINIMUM FLOW RATE? — — — —	Enter the 4 most significant digits of the Minimum anticipated flow rate. The same criteria apply to this input as to Maximum Flow Rate.
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 ($4000 \times 10 = 40,000$) to have the unit scale the flow rate as 40,000.
SAMPLE TRIGGER? — — — —	Enter the 4 most significant digits of totalized flow at which a sample should be taken. Remember the decimal point is implied and must be consistent with previous entries. If the user wanted to take a sample every 150,000 units, the entry would be 1500.
TRIGGER MULTIPLIER? — — — —	The Trigger Multiplier scales the Sample Trigger. Using the example above, if 150,000 units is the Trigger point, the Trigger Multiplier would be 100 ($1500 \times 100 = 150,000$).
SAMPLES PER BOTTLE? — — — —	Enter the number of samples per bottle as a 2-digit number (1-99). Make sure the volume to be placed in the bottles is not greater than the actual volume of the bottles.
TIME OVERRIDE? — — : — —	Enter in HH:MM format. Remember to allow enough time for the sampler to collect the required samples.
ENTER DELAY START — — : — —	This display prompts the user to enter a delay start time (HH:MM format). This is the amount of time the sampler is to wait before starting.
ACTIVE PERIOD? — — : — —	Enter a time (HH:MM format). This is the time window in which bottle groups are active. It applies to all bottle groups. Make sure it is long enough to allow the sampler to collect the number of samples required.

OF BOTTLE GROUPS?

Enter a 2-digit number (must be an integer). This is the number of bottle groups to be created from the number of bottles set in *99.

PUSH START/OPTIONS

If no add-on options are desired, press <START> to begin the program.

DELAY START TIME

__ : __

This display shows the time remaining on the Delay Start.

FLOW MODE (*13)

Once the Delay Start ends, the sampler will immediately begin reading the analog signal and begin counting down the Time Override.

Maintenance and Troubleshooting

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MAINTENANCE

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

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 should be able to assist in setting a cleaning regime that will help produce the most accurate results possible.

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

All toxic option (non-contaminating) wetted parts are autoclavable. Standard PVC wetted parts are not.

Intake Hose

There are two types of intake hose used with the sampler - PVC and Teflon[®]. PVC intake hose is used for general purpose sampling (Non-Toxic) applications. Teflon[®] hose is used for priority pollutant sampling (Toxic) applications.

1. Remove the intake hose. Remove the strainer if necessary. Do not loosen the compression rings!
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 which could contaminate future samples. 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 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.

Measuring Chamber

Caution: Do not allow water to enter the differential pressure switch. Remove the pressure switch and its tubing before turning the chassis top or chamber top upside down. Unplug the tubing for additional protection.

FAILURE TO KEEP THE PRESSURE SWITCH DRY WILL RESULT IN SWITCH FAILURE.

1. Disconnect the chamber full harness and remove the differential pressure switch and the attached tubing from the chamber top.
2. Remove the pressure and vacuum air lines on the chamber top.
3. Loosen the chamber top cap ring and remove the chamber top. Then loosen the chamber hold down wing nut and remove the measuring chamber.
4. Wash the chamber and top with an appropriate cleaning solution. A test tube brush can be used to scrub the internal surfaces.
5. Check the o-rings, two on the chamber top and one at the bottom of the measuring chamber, for gauges and imperfections, and replace the o-rings if necessary.
6. Clean the chamber base and pinch tubing. Replace the pinch tubing if worn.
7. Rinse all parts thoroughly in clean water. Thoroughly dry all parts. Lubricate the two chamber top o-rings with an o-ring lubricant. Reassemble the chamber.

Spout (multiple bottle units only)

1. Remove the spout from the upper union by gently pulling the spout gear from below. (Rotating back and forth may help.)
2. Wash the spout with the appropriate cleaning solution. Use a test tube brush to clean the internal surfaces of the spout and upper union.
3. Rinse thoroughly with clean water and re-assemble. When replacing the spout, the timing mark on the stepper motor gear must align with the timing mark on the spout gear.

Sample Containers

1. Wash with the appropriate cleaning solution. Use a brush to clean the internal surfaces.
2. Rinse thoroughly in clean water.
3. Glass bottles are Autoclavable. The bottle caps are not.

ENVIRONMENTAL PROTECTION

Once a year (or as necessary) replace the two Zerust s inside the top chassis. If the sampler is in an area of high humidity, the use of additional desiccant may be desirable. Contact Manning technical support for assistance.

CHECKING THE PINCH CYLINDER

The sampler uses an air cylinder to pinch off the silicone discharge tubing during the sample cycle. If the problem with the tubing not being pinched is suspected, follow the steps below:

1. Remove the chamber top and look down the center of the measuring chamber.
2. Run a test cycle. Observe the discharge tubing during the cycle to see if it is fully pinching the tubing.

If the tubing does not fully pinch or does not stay fully pinched until the deposit portion of the sample cycle, then there is either an air leak, bad pinch air cylinder, or poor performance (i.e., insufficient pressure) from the air system. Contact Manning Technical Support for further assistance.

CHECKING THE DIFFERENTIAL PRESSURE SWITCH

Pressure switch failure can have serious consequences so it is important to replace the switch as soon as possible when it begins to fail.

CAUTION: If the pressure switch fails completely, water can flow into the chamber and into the compressor, resulting in more expensive repairs.

To check the pressure switch or fill sensor, follow these instructions.

1. Disconnect the wires leading to the pressure switch.
2. Press the TEST CYCLE key. During the draw cycle, touch the wires together before the chamber fills completely. **Do not let the chamber fill completely.**

If the draw stops and the purge begins, replace the pressure switch.

If the draw does not stop, replace the controller.

3. Call the Manning Service Department (800-863-9337) if assistance is needed.

TROUBLESHOOTING

Troubleshooting instructions are based on a logical sequence of events leading to a malfunction. If trouble occurs, look for the most simple solution first. Is the power supply connected? Are any connections loose or wires broken? Review the problem, review normal operating procedures, and then check one possibility at a time starting with the easiest to verify. If the malfunction continues, call the Manning Environmental, Inc. Service Department at 1-800-863-9337. We can often assist over the phone. We can also advise 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 (see page 3-4)

Problem	Possible Cause	Remedy
System non-responsive	Circuit Breaker tripped	Turn the on/off switch to on.
	Loose Connection	Check connectors on the I/O board. Tighten if necessary.
	Controller Lock-up	Push the hard reset button located on the lower left side of the processor board. See figure 3-2. Note: The configuration information will have to be re-entered in *99.
	Controller Failure	Remove and replace controller. (see parts list)
Works inconsistently	Loose Wiring	Check the wiring, starting with the power connections.

Problem	Possible Cause	Remedy
Water Spurts into the Chamber	Intake Hose Drawing Air	Reposition intake hose.
	Controller Failing	Remove and replace controller. (see parts list)
Chamber Overfills	Twisted Pinch Tube	Check tube, untwist.
	Pressure Switch Failure	Can cause serious damage. See the detailed instructions on how to check the pressure switch.

<p>Weak Vacuum</p>	<p>Intake Hose Pinched Hose Line Clogged Air Leak Pinch Valve Failure Compressor Failure</p>	<p>Check the hose for pinch damage, replace if damaged. Flush with water to clear the clog. Check and tighten the wingnuts at the top of the chamber. Check tubing, fittings, o-rings, and chamber seals. Replace parts if necessary. Check the pinch valve for freedom of movement. If it is hard to move or sticks, refer to the detailed instructions in this section on how to check the pinch valve. Replace the compressor or send to the factory for service.</p>
<p>Compressor hums, no action</p>	<p>Hose Clogged Compressor Failure</p>	<p>Flush hose with water to clear the clog. Replace the compressor or send to the factory for service.</p>
<p>Compressor runs, no purge</p>	<p>Air Leak or Bad Seals Pinch Valve Failure Pinch Tubing Clogged or Twisted</p>	<p>Check all o-rings and seals. Check the pinch valve for freedom of movement. If it is hard to move or sticks, refer to the detailed instructions in this section on how to check the pinch valve. Untwist or flush with water to clear the clog.</p>
<p>Purges Constantly or the draw cuts off before the chamber is full</p>	<p>Draw Time Set Too Short Controller Failure Pressure Switch Failure</p>	<p>Increase the draw time set during *99 configuration. Remove and replace the controller. (see the parts list) Can cause serious equipment damage. See the detailed instructions on how to check the pressure switch.</p>

Problem	Possible Cause	Remedy
<p>Controller does not respond</p>	<p>Password in Effect Controller Failure</p>	<p>Enter the password. Remove and replace the controller. (see parts list)</p>

Keypad inoperative	Membrane Switch Failure	Remove and replace the membrane switch (see parts list)
*99 self-test error	Controller Failure	Remove and replace the controller. (see parts list)
Forgotten Password	N/A	Call Manning Service Department

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 that the equipment be returned 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 needed and an estimate of how much the repair will be. Manning will ask for authorization before proceeding.

Address For Repairs:

Manning Environmental, Inc.
RMA # _____
101 Bar T Drive
Florence, Texas 76527-4445

VSR Parts List- 04/24/12

Intake Hoses, Tubing, Strainers, and Fittings

Part Number	Description	U/I	Qty
MS566925B	Pinch/discharge tubing, bulk, 3/8" (VSR3)	Ft	A/R
MS566919B	Pinch/discharge tubing, bulk, 5/8" (VSR5)	Ft	A/R
MS552104	Female quick-disconnect hose fitting 3/8" Intake (April 2012 and earlier)	Ea	A/R
MS552105	Male quick-disconnect hose fitting 3/8" Intake (April 2012 and earlier)	Ea	A/R
MS552110	3/8" Male hose coupling (May 2012 and later)	Ea	A/R
MS552111	3/8" Male hose coupling (May 2012 and later)	Ea	A/R
MS566917	Bulk clear PVC hose, 3/8" ID	Ft	A/R
MS566931	Bulk PTFE hose, 3/8" ID	Ft	A/R
MS889147	Strainer, PVC, 3/8" intake	Ea	A/R
MS579591	Strainer, stainless steel, 3/8" intake	Ea	A/R
MS566918	Bulk clear PVC hose, 5/8" ID	Ft	A/R
MS552031	Coupling, hose, 5/8" straight	Ea	A/R
MS889148	Strainer, PVC, 5/8" intake	Ea	A/R
MS579584	Strainer, Stainless Steel, 5/8" intake	Ea	A/R
MS552171	Fitting, compression, modified for use with PTFE hose	Ea	A/R

Measuring Chamber

Part Number	Description	U/I	Qty
MS889155	Chamber top assembly, VSR3	Ea	1
.MS542191	O-ring, chamber top	Ea	2
.MS542188	O-ring, spiral tube	Ea	1
.MS542189	O-ring, slotted tube	Ea	1
.MS638540	Pressure switch assembly	Ea	1
.MS552176	Fitting, air, quick disconnect	Ea	1
.MS552078	Fitting, barbed, 1/8" ID	Ea	2
.MS552180	Luer, Threaded, Female	Ea	2
.MS430115	Bracket, pressure switch	Ea	1
.MS566900	Tubing, pressure switch silicone	In	8
.MS565872	Trap, water	Ea	1
.MS552100	Spiral and Slotted tubes, matched set	Ea	1
.MS552078	Fitting, elbow, molded	Ea	1
.MS579592	Chamber top cap ring	Ea	1
.MS579593-001	Chamber top, molded, with probes VSR3	Ea	1
.MS579605	Nut, adjusting	Ea	1
.MS579603-1	Splash shield	Ea	1
.MS885022	Extension, sensor tube, short	Ea	1
..MS542236	O-ring, sensor tube extension	Ea	2
MS885801	Chamber top assembly, VSR5	Ea	1

Part Number	Description	U/I	Qty
.MS542191	O-ring, chamber top	Ea	2
.MS638540	Pressure switch assembly	Ea	1
.MS566900	Tubing, pressure switch silicone	In	8
.MS565872	Trap, water	Ea	1
.MS579592	Chamber top cap ring	Ea	1
.MS579593-002	Chamber top, molded, with probes VSR5	Ea	1
.MS552180	Luer, Threaded, Female	Ea	2
.MS552078	Fitting, barbed, 1/8" ID	Ea	2
.MS430115	Bracket, pressure switch	Ea	1
.MS579603-1	Splash shield	Ea	1
.MS885022	Extension, sensor tube, short	Ea	1
..MS542236	O-ring, sensor tube extension	Ea	2
MS687545	Chamber, measuring, molded	Ea	1
MS579496	Chamber base, VSR3	Ea	1
MS579397	Chamber base, VSR5	Ea	1
MS542187	O-ring, chamber base	Ea	1
MS889023	Extension, sensor tube, long	Ea	1
MS810061	Check Valve Assembly, Chamber Top	Ea	1
.MS565870	Check Valve	Ea	2
.MS552181	Fitting, "Y"	Ea	1
.MS552182	Luer, Male	Ea	2
.MS552183	Lock Ring, Luer, Red	Ea	1
.MS552184	Lock Ring, Luer, Blue	Ea	1
.MS566912	Tubing, Clear, 3/16" ID	In	A/R

Multi-Bottle Distribution Assembly and Parts

Part Number	Description	U/I	Qty
MS889702	Distribution assembly, stationary sampler, 3/8" intake with PVC spout	Ea	1
.MS889081	Spout assembly, PVC, 3/8" intake	Ea	1
.MS889707	Stepper motor assembly w/rubber connector	Ea	1
.MS889729	Stepper motor assembly w/plastic connector	EA	1
.MS552096	Upper union, 3/8"	Ea	1
.MS542186	O-Ring, upper union	Ea	1
.MS542202	O-Ring, upper union	Ea	1
MS889702-002	Distribution assembly, VSR5 sampler, 5/8" intake with PVC spout	Ea	1
.MS889701	Spout assembly, PVC, 5/8" intake	Ea	1
.MS889707	Stepper motor assembly w/rubber connector	Ea	1
.MS889729	Stepper motor assembly w/plastic connector	Ea	1
.MS552093	Upper union, 5/8"	Ea	1
.MS542186	O-Ring, upper union	Ea	1
.MS542202	O-Ring, upper union	Ea	1

MS889689	Suspension plate, 24 bottle	Ea	1
.MS542224	O-ring, bottle retaining	Ea	1
.MS612991	Cable tie, pushbutton	Ea	1

Bottles

Part Number	Description	U/I	Qty
MS687547	2.5 Gallon polyethylene bottle with cap	Ea	A/R
MS687551	4 Gallon polyethylene bottle with cap	Ea	A/R
MS889715	2.5 Gallon glass bottle with cap with Teflon-lined lid	Ea	A/R
MS685535	5 Gallon polyethylene bottle with cap	Ea	A/R
MS889117	Bottle Set, 24 1000mL polyethylene bottles with caps	Ea	1
.MS687533	1000mL polyethylene bottle (no cap)	Ea	A/R
.MS564241	Bottle cap for 1000mL and 500mL polyethylene bottles	Ea	A/R
MS889041	Bottle set, 24 500mL polyethylene bottles with caps	Ea	1
.MS687534	500mL polyethylene bottle (no cap)	Ea	A/R

Mechanical Parts and Miscellaneous Accessories

Part Number	Description	U/I	Qty
MS783027	Zerust vapor capsule	Ea	2
MS545059	Grommet, enclosure, stepped	Ea	1
MAN-VSR	Manual, VSR 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
MS818013	Cable, alarm 3'	Ea	A/R
MS889774	Conversion kit, VSR3 multi-bottle to single bottle	Ea	A/R
MS889770	Conversion kit, VSR3 single bottle to multi-bottle	Ea	A/R
MS889771	Conversion Kit, VSR5 single bottle to multi-bottle	Ea	A/R
MS889775	Conversion Kit, VSR5 multi-bottle to single bottle	Ea	A/R
MS889831	Bottle full sensor, 3/8"	Ea	1
MS889830	Bottle full sensor, 5/8"	Ea	1
MS818029	Cable, bottle full sensor w/rubber connector	Ea	1
MS818031	Cable, bottle full sensor w/plastic connector	Ea	1
MS885005	Refrigerator, VSR, 6.1CF white, 110VAC 60Hz	Ea	1
MS885002	Refrigerator, VSR, 6.1CF stainless steel 110VAC 60Hz	Ea	1
MS885003	Refrigerator, VSR, 6.1CF white, 220VAC 50Hz	Ea	1
MS889027	Refrigerator, VSR, 6.1CF white, 110VAC 60Hz with digital temperature control	Ea	1
MS889031	Refrigerator, VSR, 6.1CF stainless steel, 110VAC 60Hz with digital temperature control	Ea	1
MS889037	Refrigerator, VSR, 4.1CF, 110VAC 60Hz (<i>for single-bottle samplers only</i>)	Ea	1



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13 February 2014

Errata for the VSR Sampler Manual.

This document contains changes and corrections to the Operating and Instruction Manual for the Model VSR Manning Stationary Vacuum Samplers, Revision 0-600.

Contents.

1. Sampler Chamber Top Assembly Changes.
2. Connecting the Sampler to an External Device.
3. Serial Out Option.
4. Sampler Alarm Option.
5. Stationary Sampler Battery Backup Option.
6. New Hose Couplings for VSR3
7. VSR Sampler Theory of Operation.

Sampler Chamber Top Assembly Changes.

The following summarizes the changes that have been made to the vacuum sampler chamber top assemblies:

1. The 5/8" intake chamber top, used on the VSR5 and VST5 samplers, has been redesigned to be similar to the 3/8" chamber top. See Figure 1. The new part number for the 5/8" chamber top is MS885801. The old 5/8" chamber top, part number MS885800 is obsolete and no longer produced. Besides the interior diameter of the intake hose, the main difference between the 5/8" chamber top and the 3/8" version is that it is necessary to remove the chamber top to adjust the sampler volume by turning the spiral tube. See Figure 1.
2. Due to the change in the 5/8" chamber top, the intake hoses used on VSR5 and VST5 samplers have been changed to remove the elbow in the female coupling. This creates a straight connection to the chamber top. New part numbers have been created for the hose assemblies.
3. Both chamber tops now use removable sensor tube extensions to trigger the pressure switch at smaller sample volumes.
4. The chamber tops contain continuity probes that serve as a backup to the pressure switch, in the event it fails to trigger when the chamber is full.
5. The air connection to the chamber top assemblies has been changed by the addition of a check valve assembly with luer fittings.

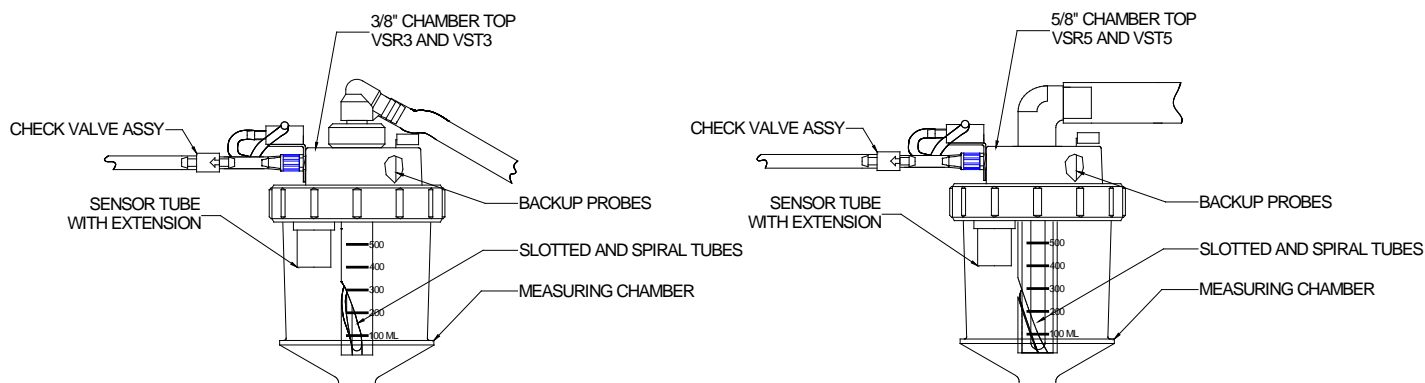


Figure 1.

Sensor Tube Extension.

Manning vacuum samplers use a differential pressure switch to determine if the chamber is full. The pressure switch measures the difference in pressure between the main part of the chamber and the sensor tube, which is part of the chamber top assembly. Installing an extension onto the existing sensor tube causes the pressure switch to trigger with less fluid in the chamber. This aids in keeping fluid away from the pressure switch, which can be damaged if liquid gets inside of it. Because the sensor tube extension can shorten the overall draw time of the sample cycle, it saves battery power on portable units.

The short sensor tube extension allows the chamber to fill to approximately 500mL. The long sensor tube extension allows the chamber to fill to approximately 100mL. The three score marks on the long sensor tube extension can be used to cut the tube to shorter lengths, allowing the chamber to fill more. The score marks are for 200mL, 300mL and 400mL volumes. When trimming the sensor tube, make sure that the cut is straight and clean. If the maximum sample volume is desired, then remove the extension from the chamber top.

To insert a sensor tube extension, first apply a thin coat of silicone grease or o-ring lubricant to the two o-rings on the extension. Then, firmly insert the tube into the chamber top sensor tube. See Figure 2.

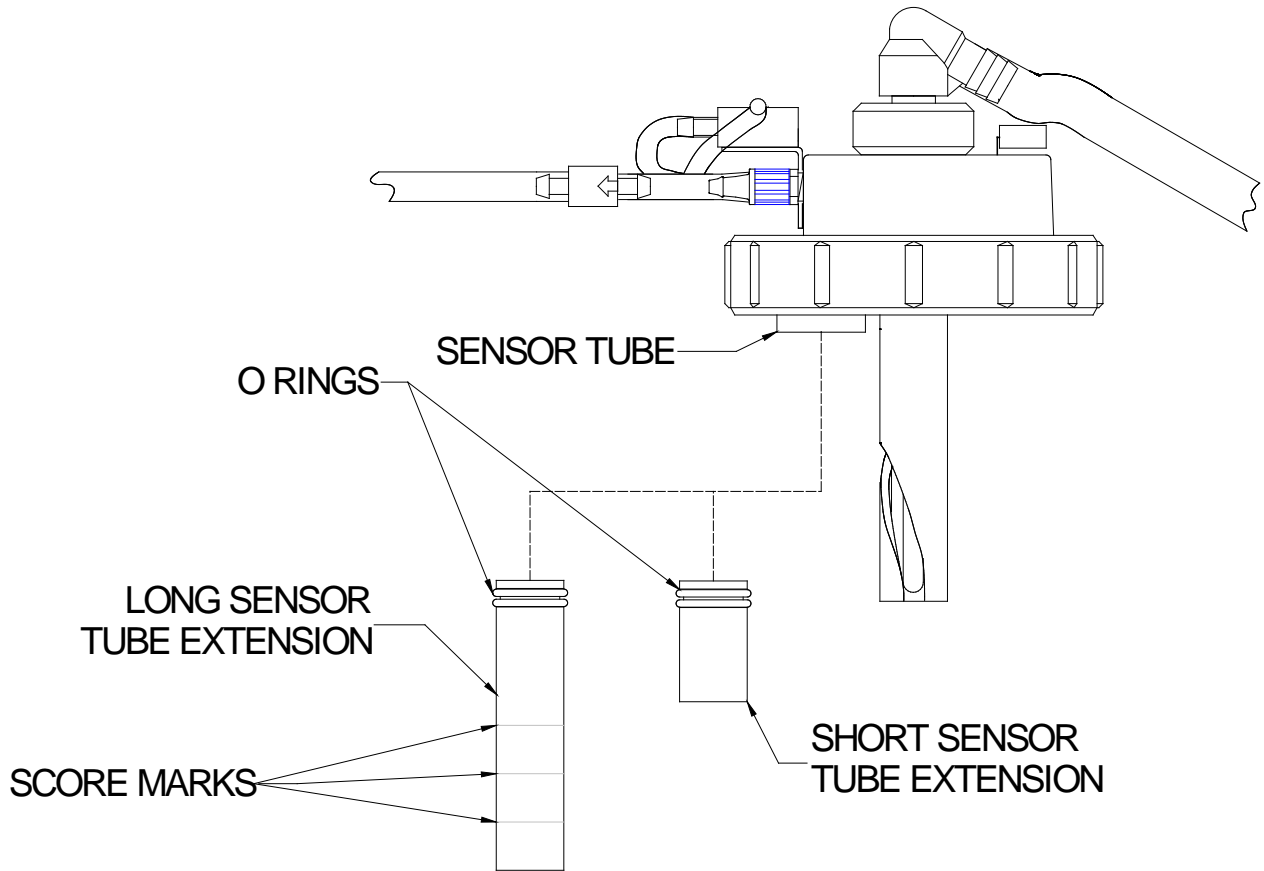


Figure 2.

A retainer is located on the left side of the sampler top chassis to hold a sensor tube extension when it is not in use. If the sensor tube extension(s) are not going to be used, or if the sampler is being exposed to direct sunlight, Manning recommends storing the extensions in a cool dark place to prolong the life of the o-rings.

Chamber Full Backup Probes.

The chamber full backup probes are designed to trigger a chamber full signal in many cases when the differential pressure switch fails. At the end of the purge portion of the sample cycle, the differential pressure switch is checked. Because the chamber has no fluid in it, the switch should be open. If the sampler controller detects that the switch is closed (i.e. shorted), a C/F SWITCH SHORTED message is displayed, the sampler purges the intake line and the sample cycle ends. In this case, the controller cannot tell if the chamber is full, so no sample is taken.

In the event that the pressure switch always stays open (i.e., it cannot detect the difference in pressure in the chamber top assembly when fluid has filled the chamber), the chamber fills until the backup probes are touching the fluid. This sends a signal to the controller that the chamber is full and the controller start the measure portion of the sample cycle. A C/F SWITCH FAILURE message is displayed followed by a USING BACKUP PROBES message.

As the backup probes depend upon the conductivity of the fluid to operate correctly, if the fluid is not very conductive (i.e., very clean water) or the probes become coated, they will not operate. Although the sampler can be operated using just the backup probes, Manning recommends replacing the pressure switch.

The backup probes are connected to the sampler with a plug-in type connector. When removing the chamber top assembly from the sampler for cleaning or other maintenance, unplug the connector from the probes and then disconnect the faston connectors from the pressure switch. Do not pull the connectors out by the wires or damage to the harness may result. See Figure 3.

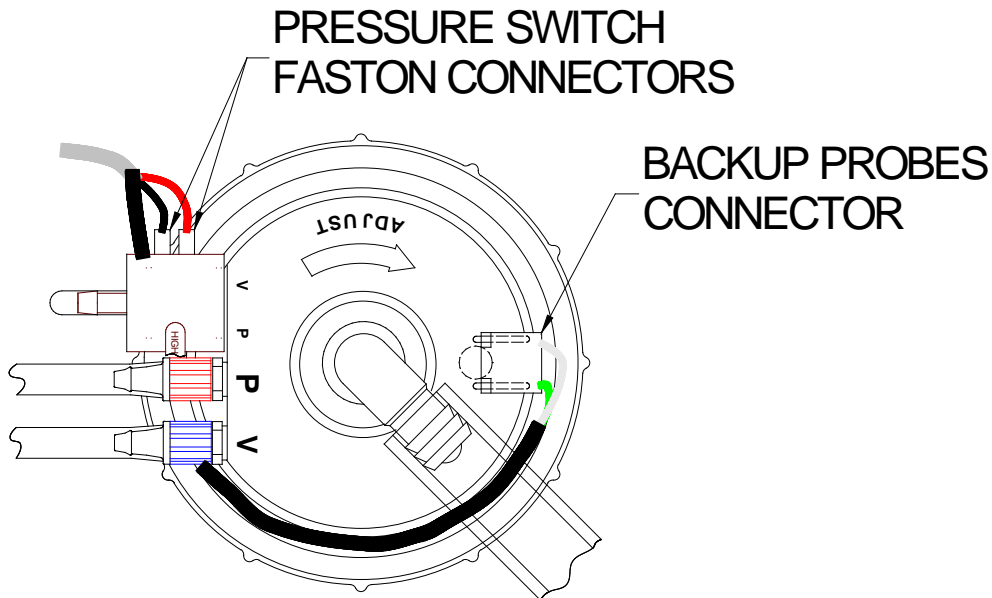


Figure 3.

Check Valve Assembly.

The check valve assembly consists of a “Y” fitting with two check valves and two male luer fittings with lock rings. It splits the air path to the chamber top so that pressure is directed to the sensor tube portion of the chamber top, preventing fluid from getting into the pressure switch assembly, which can cause the switch to fail. Vacuum is directed to the chamber top outside of the sensor tube. Luer fittings are used to attach the air lines to the chamber top, which are color coded- red for pressure and blue for vacuum. See Figure 4.

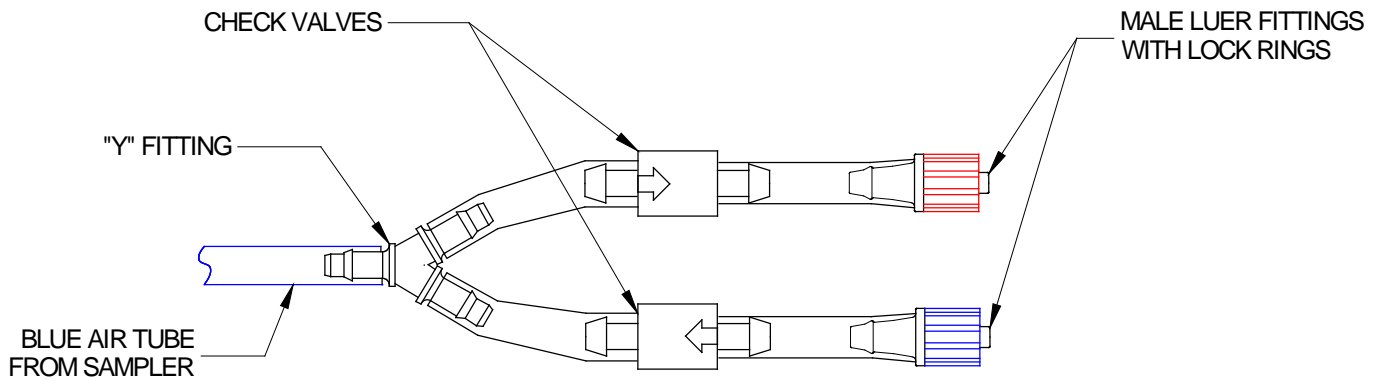


Figure 4.

To connect the air lines, insert the male luer fitting into the female fitting on the chamber top assembly (see Figure 3- red to the pressure port marked with a “P”, and blue to the vacuum port marked with a “V”) and turn the lock ring to the right until it locks. To remove the air lines, unlock the luer lock rings by turning them to the left and pull the fittings out. See Figure 5.

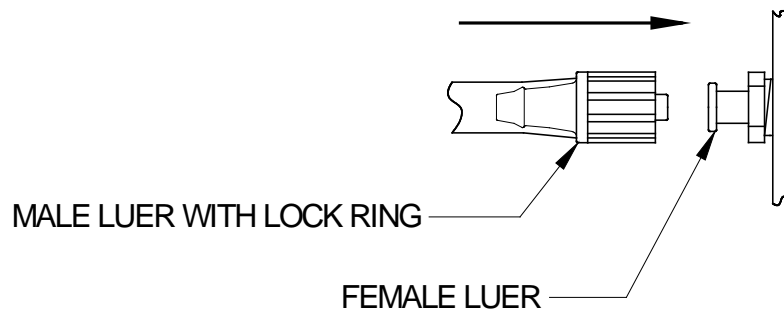


Figure 5.

Water Trap.

A water trap is installed on the vacuum (low) side of the pressure switch to help prevent fluid from entering the switch and damaging it. See Figure 6. If fluid is observed in the water trap, the sampler should be checked to insure that the pressure switch is working correctly. To remove fluid from the water trap, remove it from the chamber top and use compressed air to dry it out.

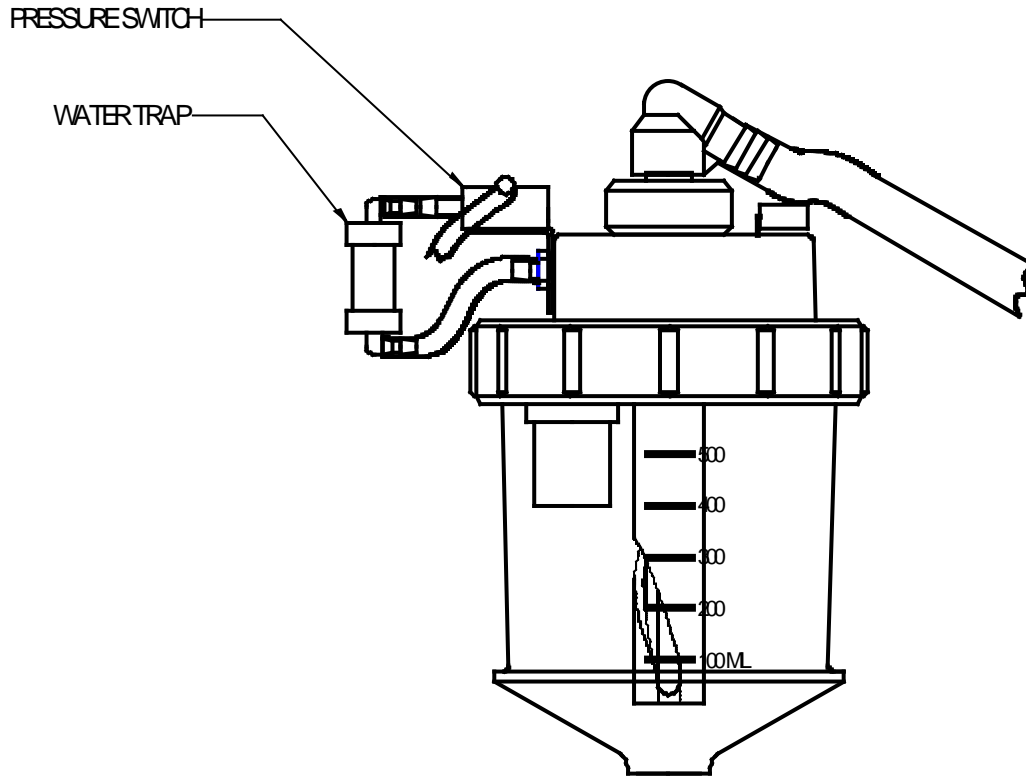


Figure 6.

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.

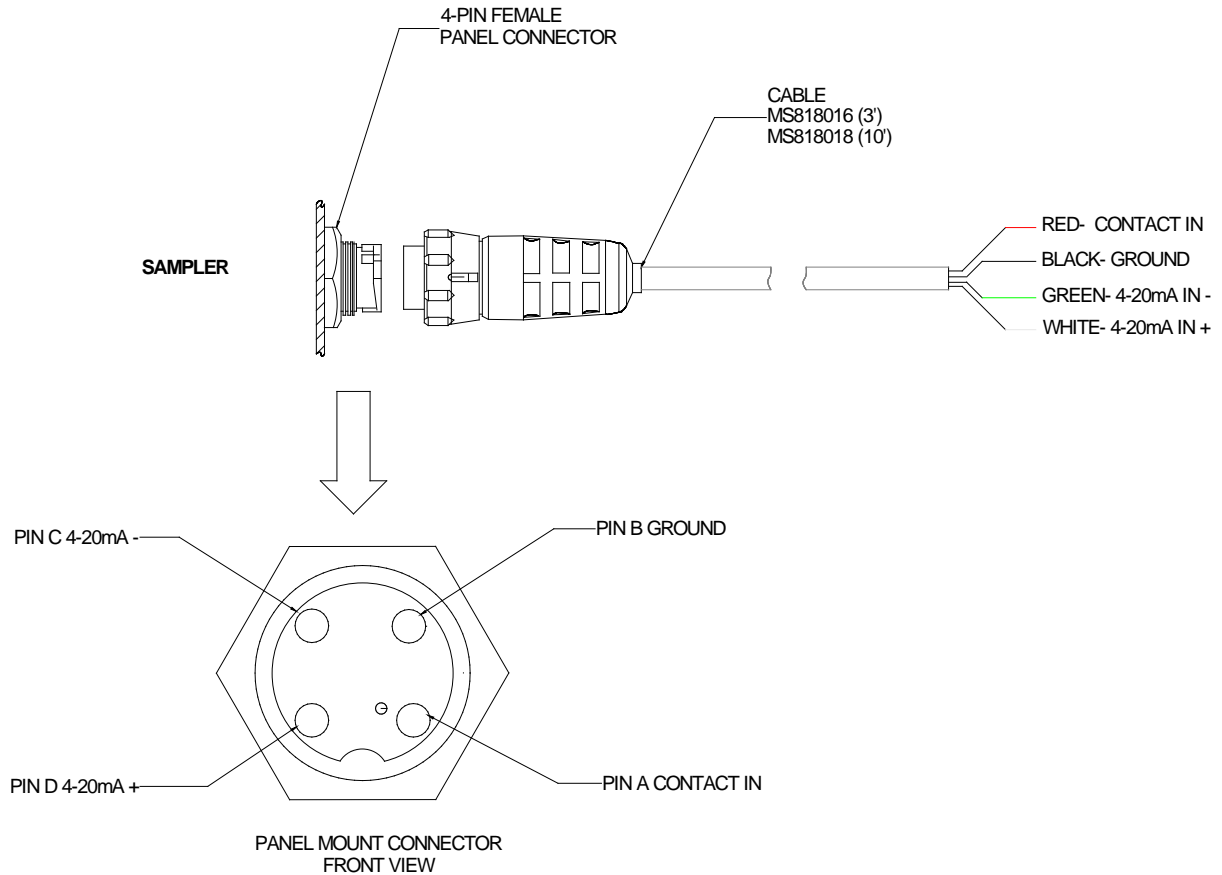


Figure 7.

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 7.

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.

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 8.

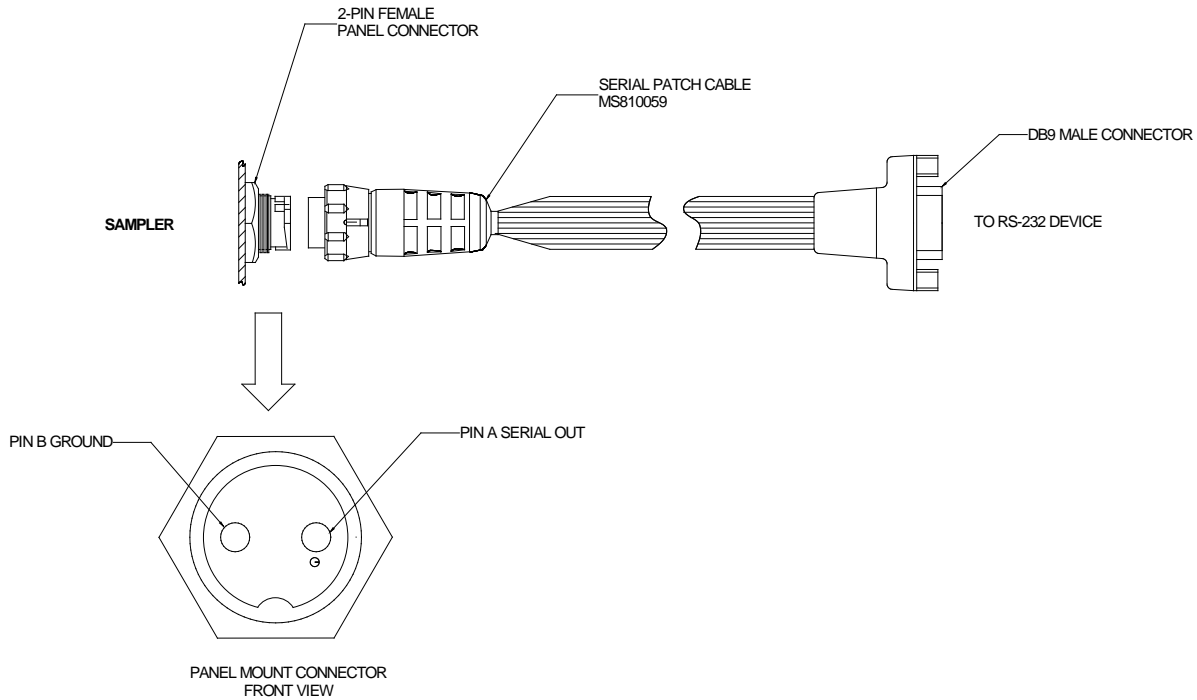


Figure 8.

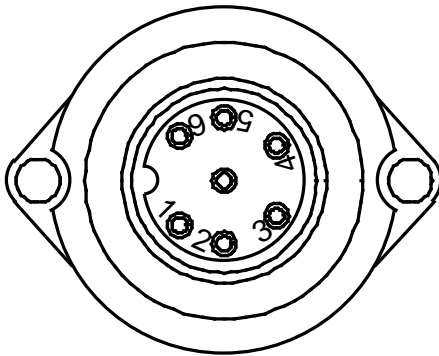
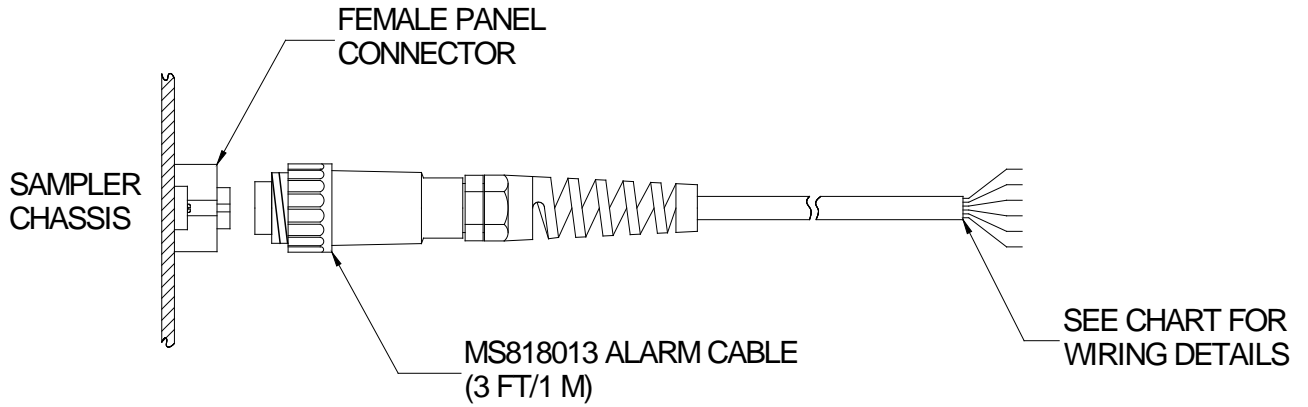
The user-supplied serial cable that connects the computer or other external device must have a female DB9 connector on the end that will connect to the sampler’s patch cable. This cable should be a standard cable, and not a null-modem type.

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.

Sampler Alarm Option.

The alarm option provides three sets of normally open relay contacts that are closed when the sampler detects that certain conditions exist. The relay contacts are rated 5 Amps at 230VAC or 30VDC. A 3-foot (1 Meter) cable connects to the female panel connector on the sampler chassis to allow external alarm connections.

The alarm cable is terminated with six 18-gauge wires in a pigtail. To connect the alarm cable to the sampler, line up the connectors and carefully push the cable connector into the panel connector. Then, secure the cable by tightening the threaded shell. See Figure 9.



Note: Pin 7 (center) is not used

Female Panel Connector Detail

Pin #	Wire Color	Function
1	Black	Sample Cycle
2	Red	
3	White	Missed Sample
4	Green	
5	Orange	Bottle Full/ End of Sequence
6	Blue	

Figure 9.

The alarms function as follows:

1. **Sample Cycle.** This set of relay contacts close during the sample cycle, indicating that a sample is in progress.
2. **Missed Sample.** This set of relay contacts close when the sampler has not successfully taken a sample. The sampler attempts to draw the sample twice. The contacts close at the end of the sample cycle and will remain closed until the sampler is reset, or another sample cycle is started.
3. **Bottle Full/End of Sequence.** This set of relay contacts close when a bottle full condition is detected on single-bottle (composite) samplers, or when the sampler has completed a sampling sequence (deposited the last sample in the last bottle) on multi-bottle (discrete) samplers.

Notes:

On vacuum samplers, the logic that triggers a missed sample alarm is based on the sampler not receiving a chamber full signal from the differential pressure switch (i.e., the measuring chamber did not fill up with fluid to trigger the pressure switch). On samplers equipped with the back-up probes, if the pressure switch fails (never closes), a successful sample may still be taken using the probes. In this situation, the sampler triggers a missed sample alarm even though the sample was taken successfully. Error messages indicating that the pressure switch has failed are displayed on the sampler LCD during the sample cycle and at each reset if the backup probes are used to detect the chamber fill.

Stationary Sampler Battery Backup Option.

The battery backup option for stationary samplers allows the sampler to continue to operate when normal AC power is lost for short periods of time. *Backup power is only supplied to the sampler, not the refrigerator.*

The battery backup consists of a 12VDC 7Ahr battery and a dual-stage charger that are mounted outside of the sampler. Inside of the sampler, a relay is used to switch between the battery backup and normal power. A wiring harness connects the battery to the sampler with a two-pin connector.

With AC power present, the charger maintains a charge on the battery, and the sampler's internal +12VDC power supply powers the sampler through the normally open contacts of the relay (the relay is powered by the sampler's power supply). When AC power is lost the relay is de-energized and switches power to the backup battery. See Figure 10.

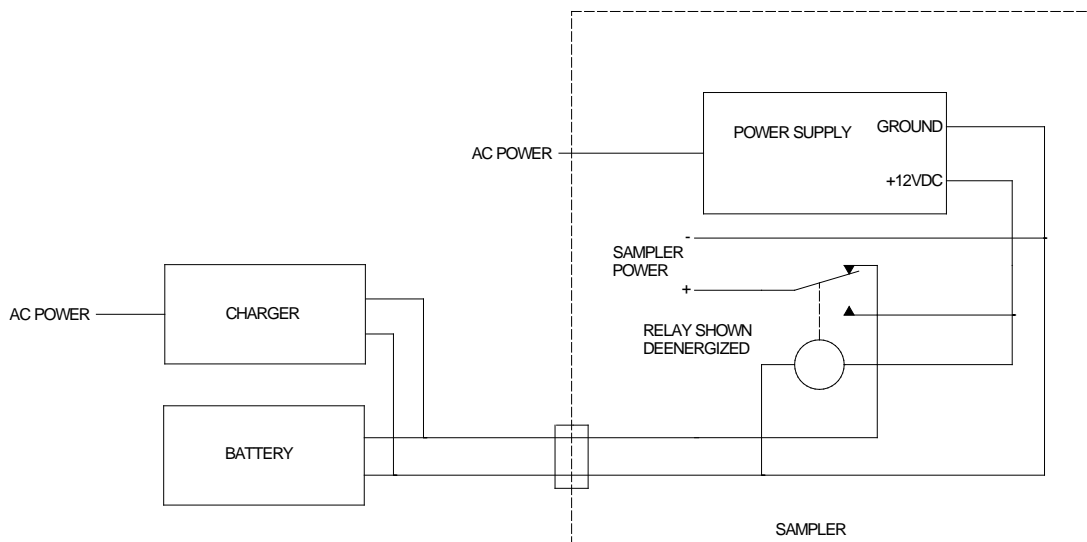


Figure 10.

Prior to operating the sampler, connect the battery to the wiring harness by attaching the insulated faston connectors to the terminals on the battery. The connectors are marked red for positive and black for negative. Connect the charger to AC power with its supplied power cord. The two-pin cable connector on the wiring harness is connected to the BATTERY BACKUP panel connector on the sampler. The battery should be allowed to fully charge before the sampler is put into operation. (For more information on the battery charger, refer to its operating manual.)

When the sampler switches between normal power and battery backup, you may see POWER GLITCH and/or POWER FAIL messages. This is normal due to the lag time of the relay contacts. The sampler must be programmed to auto-restart after a power failure (*99 sampler configuration mode, AUTO RESTART set to 1) for the battery backup to operate correctly.

New Hose Couplings for VSR3.

Manning has replaced the MS552104 female and MS552105 male quick-disconnect hose couplings used on VSR3 3/8" intake samplers in April 2013. See the table below:

Old Part Number	New Part Number
MS552104 female quick-disconnect coupling	MS552111 3/8" female coupling
MS552105 male quick-disconnect coupling	MS552110 3/8" male coupling

The 3/8" couplings are black 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 Figures 11 and 12.



Figure 11. Left- old couplings, Right- new couplings

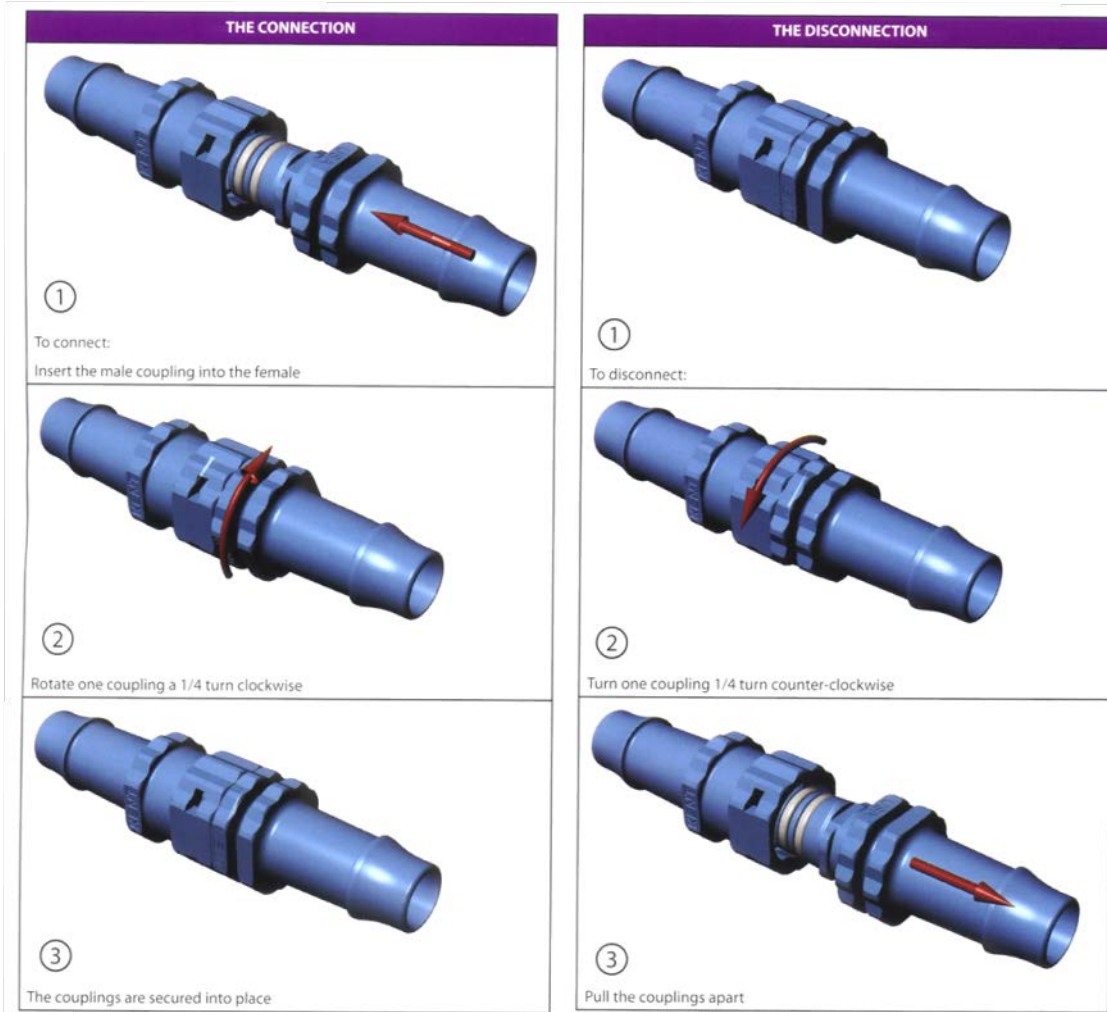
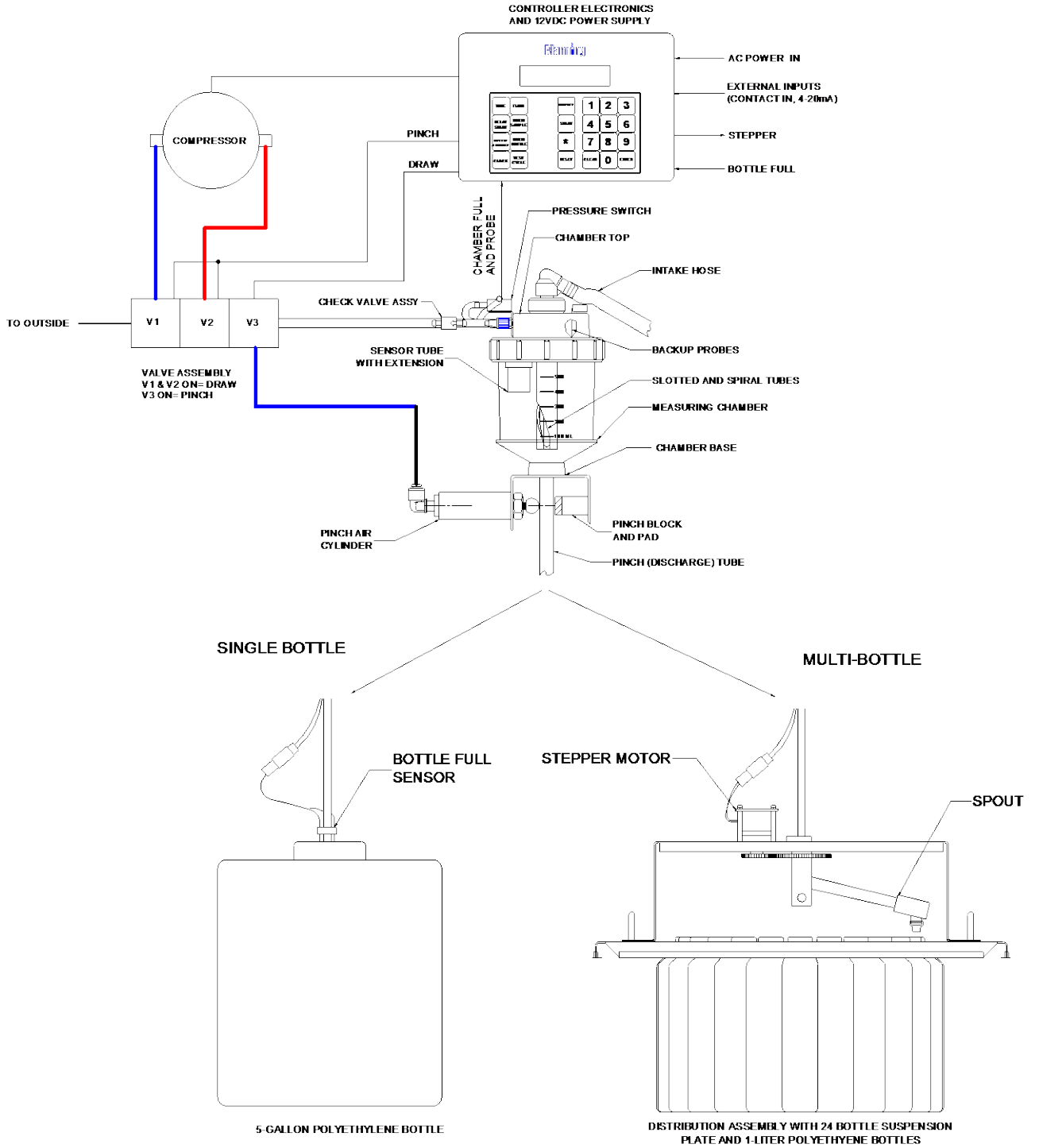


Figure 12. Coupling Operation

The MS552104 and MS552105 quick-disconnect fittings, are still available and will remain so for the foreseeable future. For more information contact Manning Technical Support at (800) 863-9337.

VSR Sampler Theory of Operation.



VSR BLOCK DIAGRAM
Figure 13.

The sampler uses an air compressor with associated valves to produce vacuum in a chamber to draw the fluid in to be sampled. The air system also produces pressure to purge the chamber and intake line. See Figure 13.

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

The compressor and valves are located inside of the sampler top chassis, along with the electronics. The sample measuring chamber and associated hardware are located on top of the chassis. The sampler is powered externally by 110 or 220 VAC, which is supplied to an internal +12VDC power supply that runs the sampler's electronics.

The sampler measuring chamber assembly consists of a chamber top and measuring chamber mounted on top of a chamber base. O-rings on the chamber top and between the measuring chamber and chamber base acts as seals. (Note: In the block diagram, the 3/8"-intake measuring chamber is shown.)

The compressor is connected to a set of three 3-way air valves. Valves V1 and V2 work together to supply either pressure or vacuum to valve V3. V3 directs the pressure or vacuum to either the sampler measure chamber through the check valve assembly or the pinch air cylinder. The check valve assembly consists of a "Y" fitting with two check valves and two male luer fittings with lock rings. It splits the air path to the chamber top so that pressure is directed to the sensor tube portion of the chamber top, while vacuum is directed to the chamber top outside of the sensor tube.

At the beginning of the sample cycle, the compressor and valve V3 are turned on, which direct pressure to the pinch air cylinder. This causes it to seal the bottom of the sampler measuring chamber by squeezing the pinch/discharge tube against the pinch block and pad. Valve V3 is then turned off, which maintains pressure in the pinch air cylinder.

With valve V3 off, pressurized air is now directed to the sampler measuring chamber through the check valve assembly to the chamber top. This purges the intake line. After the purge is complete, valves V1 and V2 are turned on, which causes air to be drawn out of the chamber (vacuum), allowing fluid to fill the chamber.

The sampler controller detects that the measuring chamber is full using a differential pressure switch. The switch is connected between a sensor tube located inside of the chamber top assembly and the chamber top itself. When fluid fills the chamber to the point where a part of the bottom of the sensor tube is under water, a difference in pressure is created in the switch. A set of electrical contacts in the pressure switch closes, signaling that the chamber is full. A sensor tube extension installed in the chamber top determines the fluid level the pressure switch closes at. The standard extension allows the chamber to fill to approximately 500mL. An additional longer extension also provided with the sampler allows the chamber to be filled to smaller levels if desired.

A set of continuity probes located on the chamber top act as a backup to the differential pressure switch in case of failure. If the sampler controller receives a signal from the backup probes that the chamber is full without receiving a signal from the pressure switch, the sample is still taken, and a warning message is displayed that the pressure switch may be defective.

Once the sampler controller has detected that the chamber is full, valves V1 and V2 are turned off. With pressure now being supplied to the chamber, fluid is forced out of the chamber until the opening created by the position of the spiral and slotted tubes on the chamber top is exposed. The spiral tube rotates around the slotted tube, allowing the measured sample volume to be adjusted. While the sample is being measured, the intake line is also being purged.

Once the sample is measured, valves V1, V2 and V3 are all momentarily turned on, which draws air out of the pinch air cylinder, releasing the seal on the pinch/discharge tube. The sample is then deposited into the collection bottle. The compressor is turned off and the sample cycle is complete.

For single bottle samplers, the bottle full sensor located on the discharge tube signals the controller that the bottle is full. This is a continuity probe type of sensor. When the controller senses that the bottle is full, samples are no longer taken.

For multi-bottle samplers, the controller supplies power to the distribution assembly's stepper motor for rotating the spout from bottle to bottle. The spout is advanced (stepped) in a clockwise direction. Each motor step moves the spout 15 degrees, or one bottle location for a 24-bottle system (360 divided by 24 equals 15).

