


**STANDARD OPERATING PROCEDURE**  
**Instructions for Operating ISCO® Samplers when Collecting**  
**Surface Water**

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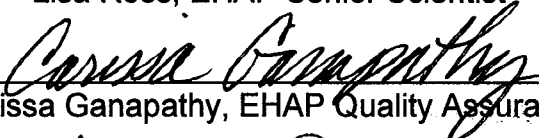
**KEY WORDS-**

sample bottles, calibration, automatic sampling, remote sampling

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Environmental Hazards Assessment Program (EHAP) organization and personnel such as management, senior scientist, quality assurance officer, project leader, etc. are defined and discussed in SOP ADMN002.

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## 1.0 INTRODUCTION

### 1.1 Purpose

To provide standardized instruction for the operation of the ISCO® model 2700, 2700R, and 6700 auto-samplers when collecting surface water.

### 1.2 Scope

This document will provide specific instructions for instrument set-up, calibration, and programming for surface water collection with an auto-sampler in the field. This document is designed for the collection of up to 24 separate (discrete) sequential samples from a remote liquid source. The samples are collected using a purge and fill sequence that is programmed for each sampling site. Programming instructions for model 2700R can be used with 24, 8, or 2 bottles. Instructions for model 2700 and 6700 are specific for 24, 350mL bottles because currently, DPR does not have the supplemental equipment required for other configurations.

## 2.0 MATERIALS

- 2.1 Model 2700 (Figure 1), 2700R (Figure 2) or 6700 (Figure 3) ISCO® sampler
- 2.2  $\frac{3}{8}$ " Teflon® or Teflon®-lined tubing (suction line)
- 2.3 24 350mL glass sample bottles
- 2.4 12V battery (deep cycle RV/marine suggested)
- 2.5 Battery connector cable
- 2.6 Bottle tub and retaining ring
- 2.7 De-ionized water
- 2.8 Disposable gloves
- 2.9 Stainless steel inlet strainer
- 2.10 Small hose clamps
- 2.11 Flat-head screwdriver
- 2.12 Knife or scissors (to cut tubing if needed)
- 2.13 Model 1640 ISCO® Liquid Level Sample Actuator (water sensor; optional)
- 2.14 Large plastic bags

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### 3.0 PROCEDURES

#### 3.1 System set-up for model 2700 and 2700R

**3.1.1** Place sampler on a level surface as close to the sample source as possible. Keep in mind the possibility of flooding the sampler in areas where high rainfall may cause flow increases.

**3.1.2** Attach the suction line. This is the tubing that extends from the sampler pump to the liquid source of the sample. Make the vertical distance between the liquid level and the pump as short as possible (no more than 26 ft. of lift).

Slip one end of Teflon® tubing inside the silicon rubber pump tube as far as it will go (wetting the outside may aid in insertion). Cut suction line as short as possible for application in order to conserve battery and route downhill to sampling point. Attach a strainer to the liquid end (intake) of the suction line and secure with a small hose-clamp. Place intake in the main flow of the sample source. If source is flowing rapidly, secure the strainer to the substrate.

**3.1.3** Attach external power source (12V battery).

Plug the connector end of the battery cable into the “12 VDC” connector on the back of the control box (see [Figure 4](#)). Screw finger tight. Connect the + and - leads on the free end of the cable to the + and - terminals of the battery.

**3.1.4** Attach the Liquid Level Sample Actuator (OPTIONAL).

The project leader will decide whether or not to use this option, and if it is used the project leader will decide how it will be used. It is best to use this device when sampling for run-off in remote areas where the unit is not easily accessed. It is used to detect a rise in water level of the sample source associated with rain run-off.

Plug the connector end of the sensor into the “flow meter” connector on the back of the control box (see [Figure 4](#)). Screw finger tight. Set-up the sensor at the edge of the water source or in a rain gauge at a designated distance above initial water level. This distance should be at least 2 “ to detect an increase in water level caused by run-off. Set sensor switch to latch (continuous sampling regardless of

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water level) or toggle (on and off with water flux; stops sampling if water level drops below sensor) depending on the study preference. When programming the control box, flip the sensor switch once or twice so that the computer recognizes that the sensor is in use. Once the program is started, the machine will pause until the sensor is activated.

### 3.1.5 Install sample bottles

#### Model 2700:

If it is not already in the number one position, manually rotate the distributor arm by pressing the DISTRIBUTOR ADVANCE key multiple times until "-01-" is seen in the display. This will reset the arm to the first bottle position. Unlatch and remove the top portion of the sampler so that the bottom tub is open. Remove the retaining ring (Figure 5). Wearing disposable gloves, place 24 clean glass bottles in the rack. Note the indentations on the inside to aid in rotational alignment (Figure 5). Line up the bottles with the corresponding numbers on the outside of the tub. Replace the retaining ring to secure the bottles firmly in place. Replace the top portion of the sampler, aligning the distributor arm with bottle number one and latch. The procedure for cleaning the glassware is in SOP EQOT002.00.

#### Model 2700R:

If it is not already in the number one position, manually rotate the distributor arm by pressing the DISTRIBUTOR ADVANCE key multiple times until "-01-" is seen in the display. This will reset the arm to the first bottle position. Remove the bottle rack from the refrigerator compartment. Set rack on a large plastic bag for a clean surface. Remove the retaining ring (Figure 6). Wearing disposable gloves, place sample bottles in the rack. If a 2-bottle configuration is being used, you must install the 2-bottle locating base (see manual). Use the bottle guideline for a 24 or 8 bottle configuration (Figure 7). Note the four metal triangles on the inside to aid in rotational alignment (Figure 6). Replace the retaining ring to secure the bottles firmly in place. The procedure for cleaning the glassware is in SOP EQOT002.00.

### 3.1.6 Align the bottle rack in the refrigerator compartment (Model 2700R **ONLY**)

Place the rack back into the refrigerator compartment, using the bottle guideline in the center of the rack (Figure 7), and align bottle one underneath the distributor arm. Look carefully to be sure that the discharge will flow into the bottle. The first time you try this you may want to start with some dirty bottles and manually pump some water (press PUMP JOG FWD) into the bottles. Press the DISTRIBUTOR

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ADVANCE key slowly, stopping to look at each bottle and how the discharge tubing is placed, making slight adjustments to the rack as you advance. Also, watch the tubing to be sure it is not catching on the distributor arm (this can cause the program to halt) and that it advances smoothly. Once all sample bottles are aligned with the distributor, adjust the retaining screws on the shelf to hold the rack in place.

### **3.2 System setup for model 6700**

**3.2.1** Place sampler on a level surface close to the sample source.

**3.2.2** Attach the suction line. This is the tubing that extends from the samplers pump to the liquid source of the sample. Make the vertical distance between the liquid level and the pump as small as possible (no more than 26 ft. of lift).

Slip one end of Teflon<sup>®</sup> tubing inside the silicon rubber pump tube as far as it will go (wetting the outside may aid in insertion). You may want to secure with a suitable clamp. Cut suction line as short as possible for application (to conserve battery) and route downhill to sampling point. Cut the line between 3 and 99 feet in 1 foot increments (for example, 25 ft, not 24 2). Attach a strainer to the liquid end of the suction line and secure with a small hose clamp. Place intake in the main flow of the sample source. If source is flowing rapidly, secure the strainer to the substrate.

**3.2.3** Attach external power source (12V battery)

See section 3.1.3. Note: Plug into the far left connector on the back of the control box ([Figure 8](#)).

**3.2.4** Attach the Liquid Level Sample Actuator (OPTIONAL)

See section 3.1.4. Note: Plug into the far right connector on the back of the control box ([Figure 8](#)).

**3.2.5** Install sample bottles

Unlatch and remove the top portion of the sampler so that the bottom tub is open. Remove the retaining ring. Wearing disposable gloves, place 24 clean glass bottles in the rack. Note the indentations on the inside to aid in rotational alignment. Line up the bottles with the corresponding numbers on

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the outside of the tub. Replace the retaining ring to secure the bottles firmly in place. Replace the top portion of the sampler, aligning the distributor arm with bottle number one and latch. The procedure for cleaning the glassware is in SOP EQOT002.00.

### 3.3 Manual programming and calibration of model 2700 and 2700R

**KEYPAD WARNING:** The keypad switches should be pressed with the fingertips **ONLY**. They can be permanently damaged if anything else is used ([Figure 9](#)).

When using this model, make sure to run the program with a completely charged battery. You may want to use a different battery during the programming process to ensure enough charge to run the program. Depending upon how the module was previously programmed, the display will either rotate between “----“ and the bottle number “-01-“, show “----“ only, or rotate between “----“ and “FULL” when it is turned on. Once a program has been configured, it will remain in the memory unless the internal battery dies. Therefore, if programming for a similar sampling event, many steps will have already been completed and you may surpass the steps by pressing the PROGRAM/STEP PROGRAM key.

**3.3.1** Press the ON key. This puts the sampler into a **standby** state, where one of the above mentioned displays will flash.

**3.3.2** Press the PROGRAM/STEP PROGRAM key. This puts the sampler into the **program** state. The MODE indicator light will come on.

**3.3.3** Select sequential time (SEQ. TIME) by pressing 1 on the numeric keypad then press the ENTER VALUE key. Press the PROGRAM/STEP PROGRAM key. The INTERVAL BETWEEN SAMPLES indicator light will come on. In a sequential time sample, each individual sample is placed in a separate sample bottle, and samples are collected at equal increments of time. Other options include composite samples and nonuniform time interval samples.

**3.3.4** Enter the amount of time (in minutes, between 1-9999) to pass between samples by using the numeric keypad. This time frame is determined by the project leader based on individual sampling sites. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key. The DELAY TO FIRST/NEXT SAMPLE indicator light will come on.

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**3.3.5** Enter the amount of time (in minutes, between 1-9999) to pass before the first sample will be taken. If the program should run immediately or the liquid level actuator is being used, press 1. The actuator will pause the program until the sensor is activated. Press ENTER VALUE. (Note: This delay begins counting down from the moment ENTER VALUE is pressed. If the program is not started before this delay has counted down to zero, the delay to the first sample will automatically reset to the interval between samples. Therefore, it is best to complete the calibration and then return through the program, setting this value as you quickly run through the programming steps.) Press the PROGRAM/STEP PROGRAM key. The NOMINAL SAMPLE VOLUME indicator light will come on.

**3.3.6** Press 0, for the manual calibration mode. This mode allows the user to precisely calibrate the delivered sample volume for a given setup. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key. The indicator light will jump to MULTIPLEX MODE.

**3.3.7** Press 2, for bottles per sample mode (where a sample volume greater than a single bottle is required); Press 3 for samples per bottle mode (where collecting a series of small composite samples is required). Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key. The MULTIPLEX NUMBER indicator light will come on.

**3.3.8** Enter the number of bottles to be filled in each sampling event (usually 2-24 btl/smpl) or the number of samples to be composited into a single bottle (up to 10). This number is determined by the project leader and should be in the study protocol. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key. The CALIBRATE SAMPLE VOLUME indicator light will come on.

When calibrating the sample, you will want to use a dirty set of bottles. A sampling cycle contains a series of purges ("P") and fills ("F"). The sampling segment will be rotated on the display with the number of volume counts associated with that segment (for example "P1—" will rotate with "1000"). A sampling cycle may contain up to five complete purge-fill-purge segments. The end of the cycle is marked by entering a volume count of zero for either a purge or fill segment as desired. If at any time the calibration value is unsatisfactory, press CLEAR ENTRY and repeat the step. If a volume count is known from a previous calibration, the numeric value may be used as a starting point for calibration.

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**3.3.9** The display will be rotating between "P0—" and "####" (a previously programmed number of volume counts). P0 is the prepurge segment and is calibrated by **holding down** the PUMP JOG REV key. This purge is only performed once, at the initial onset of the program. The purpose of the prepurge is to clear debris from the inlet and should only take a few seconds. However, streams with high flow may require a longer prepurge. When the desired prepurge is obtained, bubbles of air may be seen in the water source, **release** the PUMP JOG REV key. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key. Note: Zero is a valid entry since the prepurge is not absolutely necessary. It may be left off in situations where battery life is critical.

**3.3.10** The display will be rotating between "F1—" and "####". F1 is the first fill segment and may be used to rinse the suction line, or to fill the bottle. To calibrate, **hold down** the PUMP JOG FWD key. Continue until you have reached the desired volume count, and **release** the PUMP JOG FWD key. If this segment is a suction line rinse, release when water is close to the pump, but not inside. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key.

**3.3.11** The display will be rotating between "P1—" and "####". P1 is the postpurge segment. This segment is typically long enough to remove all liquid from the suction line (view air bubbles from inlet). To calibrate, **hold down** the PUMP JOG REV until the desired volume count is reached, and **release** the PUMP JOG REV key. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key.

**3.3.12** The display will be rotating between "F2—" and "####". F2 is the second fill segment and is only necessary if F1 only rinsed the suction line. To calibrate, **hold down** the PUMP JOG FWD key. Continue until you have filled a sample bottle, and **release** the PUMP JOG FWD key. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key.

**3.3.13** The module will let you continue calibration up to a total of five complete fill/postpurge cycles (F5, P5). It is not necessary to perform this many segments. One or two will be sufficient and is up to the project leader. The last step should be a minor postpurge to back the liquid off a bit so that it does not continue to drip into the bottle. To calibrate, **hold down** the PUMP JOG REV until the desired volume count is reached (approx. 50 volume counts), and **release** the PUMP JOG REV key. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key.



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**3.3.14** Once you have calibrated the sufficient segments, you must enter a zero for the next fill cycle (typically F3). Press 0 on the keypad. Press ENTER VALUE. Press the PROGRAM/STEP PROGRAM key.

**3.3.15** Programming is complete. To run the program, press START PROGRAM/RESET DISTRIBUTOR. The distributor arm will move to position one and the program will start or pause, depending on the program. If the Liquid Level Actuator is in use, the system will pause until the sensor is activated.

### 3.4 Extended programming of model 6700

**KEYPAD WARNING:** The keypad switches should be pressed with the fingertips **ONLY**. They can be permanently damaged if anything else is used ([Figure 10](#)).

Before beginning to program the module, make sure that the clock and calendar are set correctly. To do this, turn the unit on and select OTHER FUNCTIONS. Select MAINTENANCE. Select SET CLOCK. Enter the time (24-hour clock) and date (day-month-year format). Press STOP to return to the main menu. Once a program has been configured, it will remain in the memory unless the internal battery dies. Therefore, if programming for a similar sampling event, many steps will have already been completed and you may surpass the steps by pressing Enter.

**3.4.1** Turn the sampler on by pressing the On/Off key. Immediately press Enter, or wait 8 seconds, for the opening screen to switch to the initial options screen.

**3.4.2** The option PROGRAM will be blinking. Press Enter.

**3.4.3** The Program Name screen appears, and the option NO will be blinking. If necessary, change the program name. If not, press Enter.

To change the program name, press the up-left arrow key once, and the option YES will blink. Press Enter. Change Program Name will be blinking, press Enter. This screen displays the program name text between two quotation marks on Line 1. Lines 2,3, and 4 contain options to spell out the name. There are 10 spaces available for the program name. The cursor is the blinking rectangle, which is on the first character of text in Line 1. The matching character in lines 2 or 3 also blinks. Use the arrow keys to scroll through the menu. Once the cursor is at the appropriate choice, press Enter. The cursor then moves to the right one position (on Line 1), blinking the matching character on Line 2 or 3, and is ready for the next selection, replacing previous text as

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you go. Repeat until the name is complete. Finish the entry by selecting DONE. Then press Enter.

**3.4.4** The Site Description screen appears, and the option NO will be blinking. If necessary, change the description by repeating step 3.4.3. If not, press Enter.

**3.4.5** Select units for length of the suction line. Choose the ft. option and press Enter.

**3.4.6** Select a number for rain storage data interval. The selection made here is irrelevant when not collecting rain data. Press Enter. This selection determines the interval (in minutes) that rain data will be stored in the Summary Report when a rain gauge is attached.

**3.4.7** Select the number of bottles. Use the arrow keys until 24 blinks (if using 24 bottles) and press Enter.

**3.4.8** Type in the bottle volume using numbers on keypad. Type 370, to ensure full bottles and press Enter.

**3.4.9** Type in the length of the suction line (not including the strainer) in feet (as selected in step 3.4.5) and press Enter.

**3.4.10** Auto Suction Head will be blinking. Press Enter. Suction head is the vertical distance between the surface of the liquid source and the sampler's pump.

**3.4.11** Select the number of rinse cycles. Type in 0 or 1 to conserve the battery. Press Enter. This is the number of times the suction line is rinsed before drawing a sample.

**3.4.12** Select the number of times the machine should retry sampling if it fails to deliver the entire sample volume. Twice is a good choice, but this is flexible. Press Enter.

**3.4.13** Select One-Part Program to fill all bottles with one set of pacing, distribution, and enable settings. Press Enter. Two-part Programming is also available when it is desirable to divide the sampling program into parts 'A' and 'B', with different sets of pacing, distribution, and enable settings.

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**3.4.14** Select Uniform Time Paced to sample at regular time intervals. Press Enter. Nonuniform time pacing, random interval pacing, flow pacing, and event pacing are other available options.

**3.4.15** Select the time between sampling events. This is stored in hours first, then minutes, pressing Enter after each is chosen. This time frame is determined by the project leader based on individual sampling sites.

**3.4.16** Type in the number of bottles per sampling event. Press Enter. This number is determined by the project leader and should be in the study protocol.

**3.4.17** This next screen says “Change sets every \_ samples”. You will type in 1 then press Enter. This tells the machine that each bottle is a single sample (not composite) and will be filled completely (to volume entered below).

**3.4.18** Type in the sample volume. Press Enter. This should be 370 mL, so that each bottle will be filled completely.

**3.4.19** Select None, for what the sampler should enable on (rain vs. none). Press Enter. Rain is selected only if a rain gauge is attached. When using the actuator, none is the appropriate choice.

**3.4.20** Select Yes, so once the sampler is enabled it will stay enabled. Press Enter. The sampler can also be programmed to sample according to readings received from a connected rain gauge. If the actuator is in use, the latch/toggle switch will determine how the sampler is enabled (see 3.1.4).

**3.4.21** Select Yes, so that the sampler will begin sampling as soon as it is enabled. Press Enter. If the actuator is in use, the latch/toggle switch will determine how the sampler is enabled (see 3.1.4).

**3.4.22** The pause/resume screen appears. Pauses create an intermittent sampling schedule. If there will be no pauses you should see HH:MM's instead of numbers (if numbers are visible, select clear and press Enter), simply select Done and press Enter. If pauses are required, one or two pairs of pause and resume times may be entered. Use keypad to enter hour and minutes (on 24 hour clock) for pause and resume times. Select Done and press Enter

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**3.4.23** Select No Delay To Start. Press Enter. If an actuator is in use, it will cause a delay until the sensor is activated.

**3.4.24** Select Run Program Once. Press Enter. Auto Re-run is an option that will repeat the program indefinitely until the programmer stops it. Some 6700 sampler's may ask "Run Program Continuously?" at this step. Select No to run program once. Selecting Yes will repeat the program indefinitely until the programmer stops it.

**3.4.25** Programming is complete. Select Yes to begin sampling immediately. Press Enter. If the Liquid Level Actuator is attached, the machine will pause (screen says "program disabled" with time and date) until the sensor is activated. Select No if you will start the program sometime later. Selecting No and pressing Enter returns you to the initial programming screen. The program will be stored in memory until the machine is reprogrammed or the internal battery dies.

## 4.0 COOLING THE SAMPLES

It may be necessary to keep the collected samples cooler than the ambient conditions at the sampling site. Typically, ice is added to the empty space in the center section of the bottle tub. It is best not to contain the ice so that the melted water can run in between the sample bottles, creating an ice bath. For Model 2700R, the ice must remain in bags so it does not fall through the slots in the bottle rack. Use enough ice to fill the empty space, so that it lasts as long as possible. Temperatures may be monitored by adding a Hobo® Temperature Data Logger. See SOP EQOT001.01.

## 5.0 ROUTINE MAINTENANCE

### 5.1 Cleaning guidelines

Before the onset of any new study that will use these samplers, the unit should be thoroughly cleaned. All of the internal pump tubing should be replaced and brand new suction lines should be used to eliminate the possibility of cross contamination from previous sampling events.

**5.1.1** Wash the samplers inside and out using warm, soapy water. The machines may also be sprayed with a hose, as long as the water is kept away from the control box and power source connectors.

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**5.1.2** Clean the strainer with a brush and soapy water. Rinse thoroughly.

**5.1.3** Clean the pump tube and discharge tube by attaching a suction line and placing the end in soapy water. Manually pump the cleaning solution through the delivery system. Rinse three times with clean tap water. Rinse three times with deionized water. If these items are contaminated or worn, discard and replace.

**5.1.4** Clean the suction line. Rinse thoroughly with warm, soapy water. Use a brush, if possible, to remove particulate matter. Rinse three times with tap water. Rinse once with Methanol. Rinse three times to ensure Methanol residues are removed. Let dry. Cap ends with aluminum foil and place in a large plastic bag. If the line is contaminated or worn, discard and replace.

### **5.2 Checking the pump tube**

The pump tube is a single piece of special silicone rubber tubing that routes the sample from the suction line outlet to the sample bottle. The pump tube should be inspected periodically for cracks and wear. To check the tube, disconnect the power supply. Remove the four screws from the pump housing on the front of the control box (model 2700 and 2700R) or loosen the black knob and unlatch the pump band on top of the control box (model 6700). If upon visual inspection the tube appears damaged or fatigued, consult the appropriate manual for replacement.

### **5.3 Checking the humidity**

The control box contains 3 bags of desiccant that are there to absorb the moisture inside the control box. The humidity indicator is located on the top of the control panel on the right hand side. This device indicates the amount of moisture that is present inside the control box. The paper indicator is all blue in a dry state. As moisture begins to accumulate, the numbered areas (in %) on the indicator will turn light pink or white. If the 30% area turns light pink or white, the control box should be opened and the desiccant should be recharged or replaced. To replace or recharge the desiccant, consult the appropriate manual.

## **6.0 REMEDIAL ACTION IN CASE OF MALFUNCTION**

If a situation occurs where the auto-sampler fails to take the required sample, one of the following actions may be taken. It is important that the project leader be informed

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immediately and the decision is left up to him/her. These actions are over-simplified, and should be handled using the project leaders best judgment.

**6.1** If the auto-sampler can still operate, start the sampling program manually and take the sample the way originally intended. Some examples are: the program was entered incorrectly, sensor did not respond, or low battery charge. This action will be most effective if only a small amount of time has passed after the intended start time. Because of the length of time required to run a program, a long delay will decrease the likelihood of detection.

**6.2** Take a grab sample using the best (clean) equipment available. Some examples are: use a 1L amber bottle in the grab pole from the edge of the source, enter the water and use the wading rod and 3L Teflon bottle (this will also require splitting), or enter the water and submerge a 1L amber bottle until full and cap while submerged. If the grab sample is taken by entering the water, make sure that the sample is taken upstream from where you are standing. Samples may be taken at intervals, or once depending on the project leaders preference. This action is more effective in situations where several hours have passed, but there is still the possibility of detection.



Figure 1: ISCO® model 2700

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Figure 2: ISCO® model 2700R

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Figure 3: ISCO® model 6700

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Figure 4: Connectors for battery and liquid level actuator on models 2700 and 2700R

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Figure 5: Tub with retaining ring for models 2700 and 6700

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Figure 6: Bottle rack and retaining ring, inside refrigerator compartment, for model 2700R

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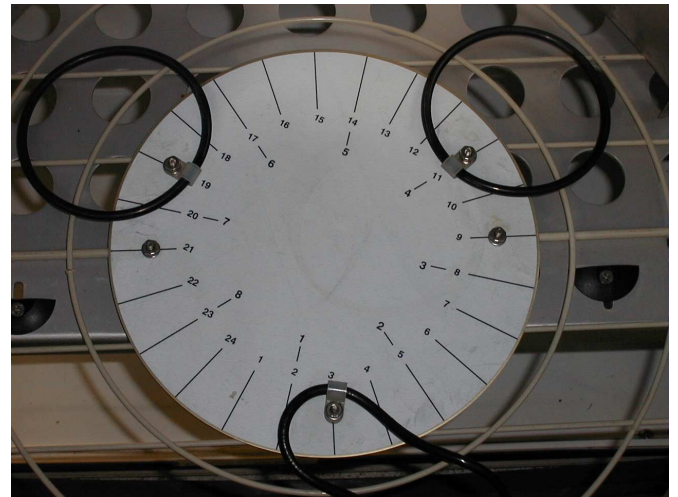


Figure 7: Bottle alignment guide for model 2700R

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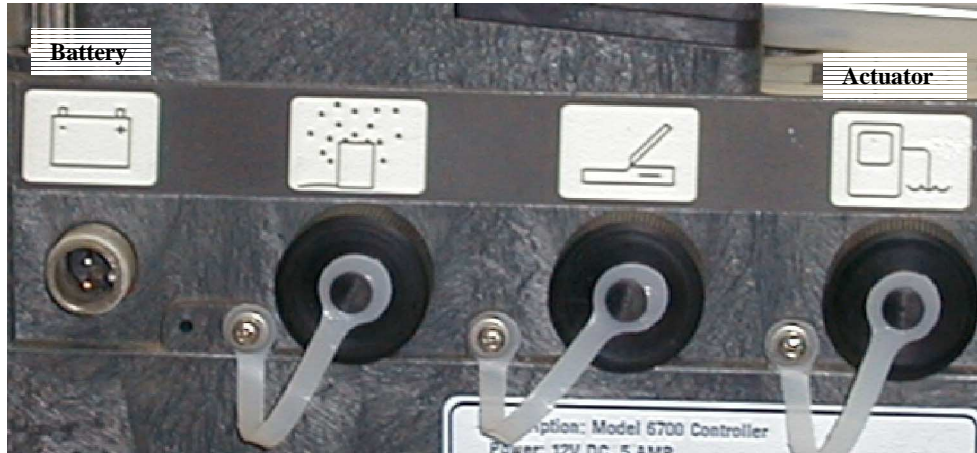


Figure 8: Connectors for battery and liquid level actuator on model 6700

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Figure 9: Keypad for model 2700 and 2700R

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Figure 10: Keypad for model 6700

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