GLS
Sampler

This pocket guide is not intended to replace the instruction manual provided on CD. Read the *Glacier Manual on CD* thoroughly before operating the sampler.

GLS
Sampler

Table of Contents

3. Operation

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Section 1 Installation

1.1 Introduction

This pocket guide contains:

- Installation instructions,
  see Section 1.2

- Programming instructions,
  see Section 2

- Operating instructions,
  see Section 3

1.2 Sampler Preparation Checklist

The following checklist can be used as a guide to prepare the GLS for each use.

☐ 1. Inspect the pump tube. *See Section* 1.3.

☐ 2. Check the discharge tube. *See Section* 1.4.

☐ 3. Install the bottle. *See Section* 1.5.

☐ 4. Icing the bottle (optional). *See Section* 1.6.

☐ 5. Connect a power source. *See Section* 1.7.

☐ 6. Connect a suction line and strainer. *See Section* 1.8.

☐ 7. Connect external devices (essential for flow-paced sampling or sampler inhibiting). *See Section* 1.9.

☐ 8. Place the GLS in position. *See Section* 1.10.

☐ 9. Calibrate sample volumes (optional). *See Section* 2.7.

☐ 10. Lock the GLS (optional). *See Section* 1.11.

1.3 Inspecting the Pump Tube

Inspect the pump tube before running a program. If the pump tube fails, the GLS will not be able to collect samples.

⚠ **WARNING**

Moving parts can cause injuries. Remove power before inspecting pump tube.

To inspect the pump tube:

1. Disconnect the power from the 12V Input Power connector.

2. Remove the pump housing cover by loosening the four thumbscrews.

3. Visually inspect the pump tube for cracks where it is compressed by the rollers. If the tube is cracked, it must be replaced. See section 3.7.

4. Visually inspect the inside of the pump housing. The housing and rollers should be free from debris.

5. Replace the pump housing cover and tighten the thumbscrews.

☑ *Note*

The GLS will display a pump tube warning as part of the View Log screens when it exceeds 500,000 pump counts.

☑ **Note**

The GLS automatically resets the pump tube count to 500,000 after it displays the warning message.

☑ **Note**

Isco pump tubes are made from medical-grade Silastic™ tubing. This tubing will not contribute any organic material to the samples.

1.4 Discharge Tube

The discharge tube is located inside the center section. It is a $\frac{3}{8}$-inch (9 mm) I.D., $8\frac{1}{4}$-inch (210 mm) long piece of medical-grade Silastic™ tubing.

The discharge tube should be well fitted over the bulkhead fitting and routed through the tube guide. The tube must be free of twists or kinks. The tube should extend about $1\frac{1}{2}$ inches (38 mm) past the end of the tube guide (even with the bottom of the center section). This length of tubing is necessary for the GLS to detect an overfilled bottle.

1.5 Installing a Bottle

The base section of the GLS is designed to hold five different types of bottles:

- 2.5 gallon (10 liter) Polyethylene
- 2.5 gallon (10 liter) Glass
- 1 gallon (3.8 liter) Polyethylene (with bottle deck)
- 1 gallon (3.8 liter) Glass (with bottle deck)
- 2 gallon (7.6 liter) ProPak Liner

To install the bottle:

2.5 and 2 gallon (10 and 7.6 liter) - place the bottle in the GLS base section.

1 gallon (3.8 liter) - place the bottle deck into the GLS base section. Set the bottle on top of the bottle deck.

1.6 Sample Cooling

You can cool the samples by placing crushed ice around the outside of the bottle. When using a 2 or 2.5 gallon (7.6 or 10 liter) bottle, the base section can hold 10 pounds (4.5 kg) of ice. When a bottle deck and 1 gallon (3.8 liter) bottle is installed, the base section can hold 14 pounds (6.3 kg) of ice. Frozen gel packs are sometimes a convenient alternative to ice. For maximum cooling, fill the base (with the bottle and deck in place) with water and freeze the base section and its contents.

1.7 Installing a Power Source

The GLS must be powered by a 12-Volt DC power source. Isco recommends using one of the following Model 900 series power sources:

- Batteries -
    - Model 934 Nickel Cadmium Battery, 4.0Ah
    - Model 946 Lead-Acid Battery, 6.5Ah
- Power Packs -
    - Model 913 High Capacity Power Pack, 120 Volts AC
    - Model 923 High Capacity Power Pack, 240 Volts AC
    - Model 914 Battery Backed Power Pack, 120 Volts AC
    - Model 924 Battery Backed Power Pack, 240 Volts AC

1.7.1 To install an Isco Model 900 power source:

1. Place the power source into the center section recess.

2. Secure the power source by pulling the elastic bands over it and attach the clip to the two posts. Note that there are two sets of holes - use the set that places the clip against the power source.

3. Attach the two-pin connector to the Input Power connector on the back of the controller.

4. *Power Packs Only* - Route the AC line cord though the center section's Tubing/Cable port.

☑ *Note*

If you use a battery to power the GLS, always install a fully charged one before running a program.

☑ *Note*

Refer to Isco's Power Products Guide, P/N 60-9003-092, for a complete description of each power source.

1.8 Suction Line and Strainer

The suction line carries the liquid from the sampling point to the GLS pump tubing. The GLS is designed to use:

- $\frac{1}{4}$-inch (6 mm) I.D. vinyl tubing

- $\frac{3}{8}$-inch (9 mm) I.D. vinyl tubing

- $\frac{3}{8}$-inch (9 mm) I.D. Teflon® tubing with a protective polyethylene jacket

The strainer reduces the possibility of debris plugging the suction line. Types available are:

- CPVC body ($\frac{3}{8}$-inch I.D. only)

- Stainless Steel ($\frac{1}{4}$- and $\frac{3}{8}$-inch I.D.)

Your application will dictate the best combination of suction line and strainer.

To prepare the suction line and strainer:

1. Cut the suction line to the shortest feasible length.

2. Attach a strainer to the suction line (Section 1.8.1).

3. Connect the suction line to the pump tube (Section 1.8.2).

☑ *Note*

The vinyl suction line does contain a very low ppm (parts per million) level of phenols. If this affects your samples, use the Teflon suction line.

1.8.1 Cutting the Suction Line

The suction line should be cut to the shortest feasible length. This reduces the possibility of cross-contamination between sample volumes and extends the battery life. The suction line can be easily cut with a knife.

When cutting the suction line, keep in mind the length must be cut to the nearest whole foot or decimeter. The length is measured from end to end, without the strainer or tubing coupler.

If you have altered the length, press the Calibrate button, and enter the new suction line dimensions.

1.8.2 Attaching the Strainer

Items required:
Strainer   Suction line

To attach the strainer to the suction line:

1. Heat the end of the suction line to make it more pliable.

2. Screw the threaded end of the strainer into the suction line.

1.8.3 Connecting the Suction Line

Vinyl Suction Line

To connect the $\frac{1}{4}$-inch (6 mm) or $\frac{3}{8}$-inch (9 mm) vinyl suction line to the pump tube:

Items required:
Suction line with strainer attached
Tubing coupler

1. Insert the end of the tubing coupler with the black clamp into the upper pump tube.

2. Position the black clamp around the pump tube and squeeze the sides of the clamp together.

3. Push the vinyl suction line onto the end of the tubing coupler with the white clamp.

4. Position the white clamp around the suction line and squeeze the ends together.

Teflon Suction Line

To connect the Teflon suction line to the pump tube:

Items required:
Suction line with strainer attached

$\frac{3}{4}$-inch (19 mm) diameter hose clamp
Tool to tighten clamp

1. Place a hose clamp on the upper pump tube.

2. Insert about 1 inch (25 mm) of the Teflon suction line into the upper pump tube.

3. Position the clamp over the joined area and tighten it.

1.9 Connecting External Devices

The GLS can be used with external devices that control the sampler pacing, sampler inhibiting, or both. The sampler pacing input can control the rate of sample collection so that it is proportional to the flow rate of a channel. This input must be used when the Flow Paced program option is selected (see *Sample Pacing*, section 2.4.1). The sampler inhibit input can delay the GLS operation until a monitored parameter meets user-defined conditions.

These devices connect to the 6-pin Flow Meter Connector located on the back of the GLS controller. Compatible Isco devices include:

- Pacing and Inhibiting devices:
  - · 4100 Series Flow Loggers
  - · 4200 Series Flow Meters
  - · 2100 Series Flow Meters
- Pacing devices (non-Isco device interfaces):
  - · 4-20 mA Input Interface
  - · Pulse Duration Input Interface
- Inhibiting devices:
  - · Liquid Level Actuator

☑ *Note*

Flow pacing input signal (pin C) requirements - a 5 to 15 volt DC pulse or isolated contact closure of at least 25 milliseconds in duration.

☑ *Note*

Sampler inhibit signal (pin F) requirements - a low (grounded) level of at least 5 seconds inhibits the operation. A high (or open) level of at least 5 seconds in duration restores the operation.

1.10 Positioning the GLS

There are a few considerations when selecting a site for the GLS. The foremost concern should be personal safety.

⚠ **WARNING**

The installation and use of this product may subject you to hazardous working conditions that can cause you serious or fatal injuries. Take any necessary precautions before entering the worksite. Install and operate this product in accordance with all applicable safety and health regulations, and local ordinances.

The following points should also be considered:

- *Level surface* - The GLS should be placed on a level surface to prevent tipping or spills.

- *Support* - The surface or mounting method must be able to support the GLS at full capacity. A GLS with battery, full sample bottle, and ice may weigh as much as 63 pounds (28.6 kg).

- *Environmental* - The GLS is designed for use in harsh environments. However, you should avoid installing the GLS in

locations where its components are subject to chemical attack. Also, prolonged exposure to direct sunlight will eventually damage the ABS exterior.

- *Avoid submersion* - Although its controller will resist damage (rated NEMA 4x, 6), the GLS cannot prevent the liquid from entering the base and center sections. Liquid entering the base section while the GLS is submerged will most likely invalidate the collected samples.

- *Accessibility* - The GLS must be installed in a location where it can be recovered easily without tipping or difficult maneuvering.

- *Security* - The location may need to provide some degree of security to prevent tampering or vandalism.

The GLS can be installed in a manhole using the optional suspension harness (P/N 60-2954-033). Contact your sales representative or Isco for more information.

1.10.1 Positioning the Strainer and Suction Line

After the GLS is in place, the strainer and suction line should be properly positioned.

The strainer should be placed in the stream so that representative samples are collected. The intake should be in the main flow, not in an

eddy or at the edge of flow. Its depth in the stream can also be important. An intake placed at the bottom of the stream may result in excess heavy solids, while placement at the top may result in the opposite.

The suction line should always be cut to the shortest possible length. Route the suction line so that it runs continuously downhill. Loops of coiled suction line or low areas where the liquid can pool will hold residual amounts of liquid that will cross-contaminate sample volumes.

The suction line will tend to float when sampling from deep flow streams. Refer to Table 1-1. If the depths listed in the chart are exceeded, anchor the line securely so that the suction line and strainer do not become dislodged.

Table 1-1 Safe limits for unanchored suction lines [a]			
Strainer	**Vinyl** 1/4-inch (6 mm)	**Vinyl** 3/8-inch (9 mm)	**Teflon** 3/8-inch (9 mm)
Stainless Steel	—	22 feet (6.7 m)	15 feet (4.5 m)
CPVC	—	4 feet (1.2 m)	—

a. Anchor the line and strainer when depth is exceeded.

1.11 Locking the GLS

Access to the inside of the GLS can be secured by placing a padlock on the carrying handle. Because the carrying handle must be repositioned before gaining access, locking the handle in an upright position secures the top cover, center section and controller, and the base section.

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Section 2 Programming

2.1 The Keypad

$\left[\bigcup\right]$	**Standby Button** – From the Off state, the Standby button turns the GLS on and places it in the Standby state. In any other state, the Standby button will place the sampler in the Off state.
8	**Number Entry Buttons** – The number-entry buttons allow you to enter numerical values when prompted by an interactive screen.
✥	**Arrow Button** – The Arrow button changes the current selection in an interactive screen. Pressing the Arrow button causes a different option to blink.
⏎	**Enter Button** – In an interactive state, the Enter button accepts the selected (blinking) option. In non-interactive states, pressing the Enter button will scroll through any additional displays.

	Stop Button – The Stop button interrupts the current task and the display reverts to the previous screen or state. If you press the Stop key while a number-entry screen is displayed, the GLS restores the previous value. Pressing the Stop key while running a program places the GLS in the Paused state.
	Calibrate Button – Pressing the Calibrate button while in the Standby state takes you to the Calibrate Sample Volume sequence of the programming.
	Grab Sample Button – The Grab Sample Button allows you to collect a grab sample outside of the programmed number of samples.
	Program Button – The Program button is used for the GLS One-button Programming (see *One-button Programming*, section 2.3).
	Go Button – Pressing the Go button places the GLS in the Run state using the current program.

2.2 Programming the GLS

There are two ways to program the GLS:

- One-button Programming
- Standard Programming

One-button Programming quickly loads program settings from a stored program and runs the sampling routine.

Standard Programming allows you to step through the current GLS program settings, making any necessary modifications.

2.3 One-button Programming

The One-button Programming feature of the GLS allows you to load the Stored program settings and run the program in one quick and simple step.

To use the One-button Programming, press -

This sequence of buttons must be pressed within 10 seconds.

2.3.1 Stored Program

At all times the GLS holds two programs, the Stored program and the Current program. The Stored and Current program settings may or may not be the same. When you press the Go button, the GLS runs the Current program settings.

The One-button Programming restores the Current program settings to that of the Stored program.

The GLS is shipped from the factory with the following stored program settings:

- Time Paced
- 15 Minute Pacing Interval
- 9400 ml Bottle Volume - for 2.5 gallon (10 liter) bottles
- Take 96 Samples - covers a 24-hour time period
- 80 ml Sample Volume
- No Delay to First Sample
- $\frac{3}{8}$-inch by 25-foot suction line

2.4 Standard Programming

Standard Programming allows you to step through the current GLS program settings and make any necessary modifications.

To access the Standard Programming, select Program from the Standby screen and press Enter.

The seven-step Standard Programming goes through the following settings:

- Pacing - Choose from time or flow paced sampling. Flow paced sampling requires an external flow metering instrument.
- Interval - Set the pacing interval in minutes or flow pulses.
- Bottle Volume - Enter the capacity of the bottle installed in the GLS base section.

- Number of Samples - Set the number of samples to collect or place the GLS in the Continuous Sampling mode.

- Sample Volume - Enter the desired volume to collect at each sample event.

- Program Start Time- Without a delay the GLS will always take the first sample when you press the Go button. This programming step allows you to delay the first sample.

- Suction Line - Enter the type of suction line in use. This step also includes the Sample Volume Calibration procedure.

2.4.1 Sample Pacing
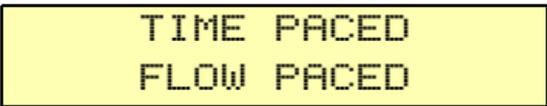
```
TIME PACED
FLOW PACED
```

The GLS displays two pacing options - Time Paced and Flow Paced. Select Time to collect samples at uniform time intervals. Select Flow to collect samples based on flow volumes. An input signal from an external instrument is required when you select Flow Paced.

The current selection will be blinking. To program the pacing method:

1. Press the Arrow button to select an option.

2. Press the Enter button to accept the blinking option. The GLS loads the option into the current program settings and advances to the next step.

2.4.2 Pacing Interval

Time Paced

> 15 MINUTES
> BETWEEN SAMPLES

Flow Paced

> 10 FLOW PULSES
> BETWEEN SAMPLES

After selecting the pacing method, the program now needs a pacing interval. A pacing interval is a value that the sampler will "count down" from after each sample event. Time paced programs will count down an interval in minutes using its internal clock. Flow paced programs will count down the number of flow pulses it receives from an external device.

The Pacing Interval display will show "minutes" or "flow pulses" according to the previously selected pacing method.

You can accept the interval by pressing the Enter button, or change the setting. To change the setting:

1. Enter the new value using the number buttons. The GLS will accept intervals from 1 to 9,999.

   Tip - If you enter an incorrect value with the number-entry buttons, press the Stop button. The GLS restores the original value and waits for a new value.

2. Press the Enter button to accept the new value. The GLS loads the value into the

current program settings and advances to the next step.

2.4.3 Bottle Volume

```
     BOTTLE VOLUME
9400ml (3500-20000)
```

In this programming step, enter the capacity of the bottle installed in the base section of the sampler. As shown on the display, acceptable values range from 3500 to 9990 milliliters.

The GLS typically uses standard bottles provided by Isco. When using Isco's standard bottles refer to the chart below for recommended values. You will note that the value is less than the total capacity. This reduces the possibility of missed samples due to a Bottle Full error, or spills when recovering the sampler.

| Table 2-1 Recommended bottle volumes	
Bottle Description	**Enter this value (in ml)**
2.5 gallon (10 liter) glass	9400
2.5 gallon (10 liter) polyethylene	9400
1 gallon (3.8 liter) glass	3500
1 gallon (3.8 liter) polyethylene	3500
2 gallon (7.6 liter) ProPak liner	7000

You may use a non-standard bottle in the GLS. When entering the non-standard bottle volume, it is advisable to enter a value less than the total volume. Again, this will reduce the possibility of missed samples and spills.

To enter the Bottle Volume:

1. Press the appropriate number buttons on the keypad. The GLS requires all four numbers.

2. Press the Enter button to accept the new value. The GLS loads the value into the current program settings and advances to the next step.

Overfilling the bottle or missing samples can affect your sampling results. In some applications, missed or spilled samples may render the bottle contents to be less than a representative composite sample.

2.4.4 Number of Samples
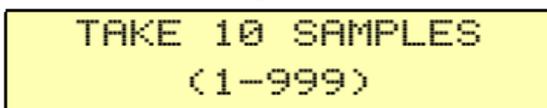
```
TAKE 10 SAMPLES
    (1-999)
```

To enter the number of samples to collect:

1. Press the appropriate number buttons on the keypad.

2. Press the Enter button to accept the new value. The GLS loads the value into the current program settings and advances to the next step.

Continuous Sampling Mode

The GLS can be placed in a Continuous Sampling mode. In this mode, the GLS collects samples without regard for the total number of samples. Samples are collected until the Liquid Detector senses a full bottle condition. (Sample volumes should be greater than 50 ml for the liquid detector to reliably sense this condition.) The GLS then halts the sampling routine. To enable the Continuous Sampling mode:

1. At the "TAKE XX SAMPLES" display, press the Zero button.

2. Press the Enter button. The GLS is placed in the Continuous Sampling mode and advances to the next programming step.

2.4.5 Sample Volume

```
    SAMPLE VOLUME
 80 ml (10-930)
```

Enter the volume to collect at each sampling event. This value must be within the range shown on the GLS display.
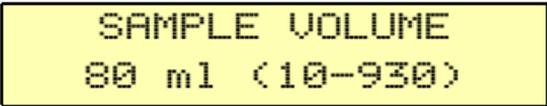
To enter the sample volume:

1. Press the appropriate number buttons on the keypad.

2. Press the Enter button to accept the new value. The GLS loads the value into the current program settings and advances to the next step.

☑ *Note*

Sample volumes greater than 50 ml are recommended.
This volume is necessary for the bottle full detection to
work properly.

2.4.6 Program Start Time

```
NO DELAY TO START
  SET START TIME
```

The sampling program can be delayed to start
at a user-specified time and day. To define the
start time:

1. Use the Arrow button to select "NO DELAY
   TO START" or "SET START TIME," then
   press the Enter button.

   Select "NO DELAY TO START" to take the
   first sample immediately after the Go but-
   ton is pressed. If you select this option, pro-
   gramming advances to *Suction Line* (section
   2.4.7).

   Select the "SET START TIME" to delay the
   first sample until a programmed time and
   date. If you select this option the GLS
   advances to the "FIRST SAMPLE AT" dis-
   play.

```
FIRST SAMPLE AT:
 08:00 3/27/12
```

2. Enter the start hour with the number entry
   buttons. The hours must be entered in a
   24-hour (military time) format. For
   example, 5:00 p.m. is 17:00 on a 24-hour

clock. Press the Enter button to accept the hour setting and advance the cursor to the minutes.

Tip – If you enter an incorrect value, press the Stop button. The GLS will restore the original setting and wait for a new value.

3. Enter the minutes with the number entry buttons. Press the Enter button to accept the minutes setting and advance the cursor to the day setting.

4. Enter the start date with the number entry buttons. Press the Enter button to accept the date and advance the cursor to the month setting.

5. Enter the number of the month (for example, August = 08) with the number entry buttons. Press the Enter button and the GLS abbreviates the name of the month and advances the cursor to the year setting.

6. Enter the last two digits of the year (for example, 2003 = 03). Press the Enter button to accept the year.

☑ *Note*

If the programmed start time elapses before running the program, the GLS will take the first sample immediately after the Go button is pressed.

If you selected "TIME PACED" in step #1, (section 2.4.1), the GLS advances to the *Suction Line* setting. If you selected "FLOW PACED,"

the GLS advances to the "MAXIMUM RUN TIME" display.
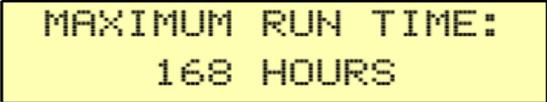
```
MAXIMUM RUN TIME:
    168 HOURS
```

Some sampling protocols require a known composite sampling interval, that is, the run time of a sampling program. For time-paced sampling programs, the run time is the number of samples multiplied by the pacing interval. But for flow-paced sampling, the run time may vary widely because of the dependency on flow rates.

- If your sampling protocol requires a known run time, enter the number of hours for the MAXIMUM RUN TIME. If the GLS has not yet completed the sampling program, it will end the sampling program when it reaches the the MAXIMUM RUN TIME.

- If your sampling protocol does not have this requirement, enter "0" (zero). The GLS will run until it completes the total number of samples.

2.4.7 Suction Line

The display alternates between:

```
    SUCTION LINE
    9mm BY 7.6 m
```

and

```
PRESS GO TO RUN OR
CALIBRATE TO CHANGE
```

This Suction Line display reports the suction line diameter and length. This information must be correct so that the GLS can deliver sample volumes as programmed. Verify that the diameter and length match the suction line in use.

If the suction line settings are correct, calibration is not necessary. To skip the calibration, press the Go button to run the program, or press the Enter button to accept the values and return to the Standby state.

If the settings do not match the suction line in use, you must enter new values. Press the Calibrate button and proceed with the Calibration steps (see section 2.7).

While the two displays alternate, the GLS is counting down a five-minute time interval. If you do not press a button during this count down, the GLS times out and automatically runs the current program.

If your sampling protocol requires the utmost volume accuracy, step through the calibration

procedure and check the delivered sample volume. Calibration may improve the GLS's volume accuracy.

2.5 Storing a Program

GLS is shipped with default program settings as its stored program. You can overwrite the stored program settings with your own program by using the Program Store function.

To store a program:

1. Modify the current program using the standard programming.
2. Press **7 8 6 7 3 ←** while in the Standby state. The GLS displays "PROGRAM STORED" for four seconds.

The current program settings are now saved in the GLS memory as the Stored Program. In the field, recall and run the program with the One-button programming procedure.

☑ *Note*

The stored program settings are held in the sampler's memory until the software is updated or the GLS is re-initialized. Either of these actions will restore the factory default program settings.

2.6 Setting the Time and Date

Should it become necessary to set the time or date, do the following:

1. From the standby state, press the Arrow button until the time and date is blinking.

2. Press the Enter button to access time and date entry display. The cursor is waiting for you to enter the current time.

3. Enter the hours with the number entry buttons. The hours must be entered in a 24-hour (military time) format. For example, 5:00 p.m. is 17:00 on a 24-hour clock. Press the Enter button to accept the hour setting and advance the cursor to the minutes.

4. Enter the minutes with the number entry buttons. Press the Enter button to accept the minutes setting and advance the cursor to the day setting.

5. Enter today's date with the number entry buttons. Press the Enter button to accept the date and advance the cursor to the month setting.

6. Enter the number of the month (for example, August = 08) with the number entry buttons. Press the Enter button and the GLS abbreviates the month and advances the cursor to the year setting.

7. Enter the last two digits of the year (for example, 1999 = 99). Press the Enter button to accept the year and return to standby.

2.7 Calibration

The GLS can deliver sample volumes repeatable to ±10 ml. The GLS relies on you to enter correct suction line diameter and length values. The GLS uses these values to:

- Generate internal pump tables to "measure" the liquid volume

- Calculate the suction head.

By calculating the suction head, the delivered volumes are not affected by varying liquid levels. The GLS automatically calculates the suction head using input from the Liquid Detector.

☑ *Note*

Incorrect suction line values or disabling the liquid detector may adversely affect the volume accuracy.

☑ *Note*

Calibrating the sampler can enhance sample volume accuracy.

To calibrate sample volumes, press the Calibrate button and follow the steps:

```
SUCTION LINE SIZE:
1/4 inch    3/8 inch
```

1. Enter the suction line size.

```
SUCTION LINE LENGTH:
    25 ft  (3-99)
```

2. Enter the suction line length.

```
  SUCTION HEAD
 10 ft  (0-25 ft)
```

3. If the liquid detector is disabled, the GLS will ask for a manual or "fixed" suction head since it will not be able to calculate the head.

```
CHECK SAMPLE VOLUME?
      YES  NO
```

4. Check the sample volume. This process deposits the programmed sample volume into a container so you can measure the delivered volume. You can then enter the actual volume delivered to refine the GLS pump tables. To continue, select YES.

```
  CALIBRATE VOLUME
PRESS ↵ WHEN READY!
```

5. The GLS waits while you prepare to collect a sample. To prepare, pull the lower pump tube from the bulkhead fitting. Hold the end of the tube over an empty graduated cylinder, such as Isco's 1,000 ml plastic graduated cylinder, P/N 299-0020-00. Press the Enter button when you are ready.

```
TAKING 200 ml
CALIBRATE SAMPLE
```

6. The GLS goes through a complete sample collection cycle and deposits the sample into the graduated cylinder.

```
VOLUME DELIVERED
      200 ml
```

7. When it has finished collecting the sample, the GLS displays the expected volume. Measure the volume in the graduated cylinder. If the actual and displayed amounts differ, enter the actual amount using the number-entry buttons. Press Enter to accept the value.

```
___ml! ARE YOU
SURE? YES   NO
```

8. If the actual amount that you enter is significantly different from the expected volume, the GLS will ask you confirm your entry. Re-measure the liquid in the cylinder and compare it with the displayed value. If they match, select YES and the GLS updates its internal pump tables and returns to the Standby state. If they do not match, select NO and repeat step 5.

☑ *Note*

Repeat the calibration steps to check volume accuracy.

Section 3 Operation

3.1 Starting a Program

You can start the GLS operation by pressing the Go button. Pressing this button runs the current program.

The GLS operation can also be started with the one-button programming sequence.

This action will load the stored program settings as the current settings and run the program.

Generally when you start a program, the GLS will attempt to take its first sample at the start time - unless the sampler must wait for a program start time or if the sampler is inhibited.

3.1.1 Program Start Times

The Program Start Time can be used to start the sample collection at a later time after you press Go.

If a Program Start Time has been programmed, the GLS waits until the this time and date before drawing its first sample. While waiting the GLS display alternates between the screens below.

```
FIRST SAMPLE AT:
 08:00 27-MAR-12
```

```
 CURRENT TIME:
07:49:32 27-MAR-12
```

3.1.2 Sampler Inhibit

Before the GLS takes its first sample, it checks the inhibit line of the Flow Meter connector. If the GLS detects a logic low (grounded) level, it will suspend the program until the external device returns the line to a logic high (or open) level.

While the GLS is inhibited it will display the screen below.

```
    SAMPLER
   INHIBITED
```

The inhibit line allows an external device, while monitoring parameters of interest, to control the sampler operation. Compatible Isco devices

can be configured to inhibit a sampler until a parameter meets user-defined conditions. For example, a 4200 Flow Meter with a Model 201 pH/Temperature Module can be programmed to suspend sample collection until the stream temperature exceeds 100º F.

When the external device releases the inhibit, the GLS will:

• immediately take the first sample

• reset the time or flow pacing interval and begin counting down

• latch the inhibit signal

Latching the inhibit signal means that the GLS will ignore any later inhibit signals from an external device. Once the GLS collects its first sample, its operation will continue until the program is done.

☑ *Note*

The GLS will not "store" samples while it is inhibited. The GLS takes no action at all when it counts down a complete time or flow-pacing interval.

☑ *Note*

Sampler Inhibit signal (pin F) requirements - a low (grounded) level of at least 5 seconds inhibits the operation. A high (or open) level of at least 5 seconds in duration restores the operation.

3.2 Run State Displays

The GLS updates its display while it is running a program so that you can monitor the status. The Run State displays are listed below.

3.2.1 Collecting a sample

As the GLS goes through a sample collection cycle it displays…

```
    TAKING SAMPLE
      xxx of yyy
```

or

```
    TAKING SAMPLE
         xxx
```

…where "xxx" is the current sample number and "yyy" is the programmed number of samples.

3.2.2 Waiting to sample

While the GLS counts down the pacing interval it displays…

```
  SAMPLE xxx of yyy
      IN  mmm:ss
```
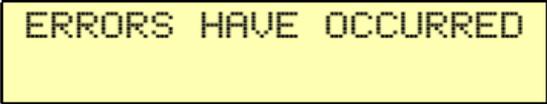
or

```
  SAMPLE xxx of yyy
  IN zzz FLOW PULSE
```

…where "xxx" is the next sample number and "yyy" is the programmed number of samples. If the GLS is in the Continuous Sampling mode, it only displays the next sample number.

3.2.3 Errors

If the GLS encounters an error while running a program, the following display alternates with the pacing interval countdown display:
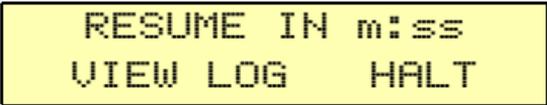
```
ERRORS HAVE OCCURRED
```

You can pause a running program to determine the type of error.

3.2.4 Pausing or Stopping a Program

Press the Stop button to pause a running program. The GLS will display the paused options screen.

```
    RESUME IN m:ss
 VIEW LOG    HALT
```

The screen displays three options - Resume, View Log, and Halt.

- *Resume* - select this option to return to the running program. When the GLS enters the paused state, it starts a five-minute idle time-out. If you do not press a button within five minutes, the GLS will automatically resume the running program.

- *View Log* - select this option to scroll through the log.
- *Halt* - select this option to stop the program. Once you stop a program, it cannot be resumed. To run a program the GLS must be restarted.

Use the Arrow button to select an option. When the desired option is blinking, press the Enter button.

The GLS continues to count down the pacing interval while it is paused. Keep in mind that if the count reaches zero the GLS will not take a sample. It records this as a "MISSED SAMPLE - PROGRAM PAUSED" in the log.

3.3 Program Completion

A running program will end in one of three ways:

- *Program Completed* - The GLS has taken all of the programmed samples.
- *Program Halted* - Stopped by the user.
- *Bottle Full* - The GLS detected a full bottle and stopped the program.

3.4 Post-sampling Activities

Typical post-sampling activities include recovering the sampler, preparing the full bottle to return to the laboratory, and viewing the log. Each activity is discussed in the following sections.

3.4.1 Recovering the Sampler

When the GLS completes the program, it often must be retrieved and placed in a location that allows you easily gain access to its contents. If you must move the sampler keep the following in mind:

- A GLS with battery, full sample bottle, and ice may weigh as much as 63 pounds (28.6 kg).

- The GLS must be kept level to avoid spilling the bottle's contents.

3.4.2 Preparing the Full Sample Bottle

To prepare a full bottle to return to the lab you must first gain access to the sampler's base. To open the sampler:

1. Place the sampler on a level surface.

2. Rotate the carrying handle from its secured (vertical) position to its open (horizontal) position. Unlock the handle if necessary.

3. Release the two latches that fasten the center section to the base section.

4. Lift the center section from the base and set the center section aside.

5. Now that you have gained access to the bottle, place a cap on it. Then, lift the bottle out of the base. At this point, it is a good idea to label the bottle with the time, date, and site, along with other pertinent information.

3.4.3 Viewing the Log

The log is a recorded history of the last or currently running program. The GLS records key program events, such as start and stop times, and exceptional events, such as power failures or missed samples.

The log can be viewed by selecting the "VIEW LOG" option at the Standby or Paused state displays.

As you begin to view the Log, the GLS reports the following:

- The number of samples it has collected
- Missed samples. The GLS skips this display if there are none to report. If there are, the GLS will report the number of samples missed and the cause. Possible causes are:
    - No liquid detected
    - No more liquid
    - Power fail
    - User stopped pump
    - Paused
    - Pump jammed
    - Program halted
    - Bottle full
- Program start time
- Current status. One of the following will be reported:
   - Program completed

- · Program halted
- · Bottle full
- · Program paused (with number of samples remaining)

- • Power lost. If power was lost while the GLS was running the program, it reports the times it was lost and restored. This will be reported whether a sample was missed or not.

- • Last sample volume calibration date

- • Last programmed date

- • Clock set at (time and date)

- • Sampler ID and software revision number

- • Pump tube warning if the pump counts exceed 500,000. When the GLS displays this message, replace the pump tube to prevent failures. The GLS automatically resets the pump count to zero after displaying this message.

☑ *Note*

Pressing the Go button clears the log. The only information that the GLS retains from program to program is the Last Calibration Date, Last Programmed Date, Clock Set, and the Sampler ID and Software Revision. The GLS also keeps the current pump count value which is used to determine when to display the pump tube warning. Re-initializing the GLS or updating the software will also clear the log.

3.5 Errors

The GLS can detect program errors or conditions that have caused it to miss a sample. If the GLS encounters an error condition and is still running a program, it alternates the message below with the current display.
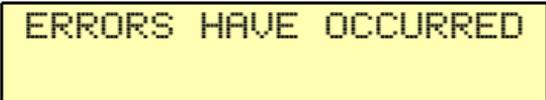
> ERRORS HAVE OCCURRED

The GLS also makes an entry in the Log, which can be viewed later to determine the cause. Possible log entries are:

- *No liquid detected* - The GLS did not detect any liquid.
- *No more liquid* - The GLS did detect liquid during the fill cycle, but it stopped detecting liquid before a complete sample volume was collected.
- *Power fail* - Power was lost and caused the GLS to miss a sample.
- *User stopped pump* - The user pressed the Stop button while the GLS was collecting a sample.
- *Paused* - The GLS was in the paused state when a sample was to have been initiated.
- *Pump jammed* - The GLS pump jammed during a sample collection cycle.
- *Program halted* - Remaining samples were not collected because the program was halted.

• *Bottle full* - Remaining samples were not collected because the GLS detected a full bottle.

3.6 Grab Samples

Grab samples let you take a single sample on demand, collecting the sample in an external container. You can collect a grab sample while the GLS is running a program, paused, or in standby.

To collect a grab sample:

1. Press the Grab Sample button.

2. The GLS asks how much liquid to collect. Using the number-entry buttons, enter the desired volume (in ml). Press the Enter button to continue.

3. The GLS waits for you to prepare to collect a grab sample. Pull the lower pump tube from the bulkhead fitting. Hold the end of the tube over a container. Press the Enter button when you are ready.

4. The GLS goes through a complete sample collection cycle and deposits the requested amount of liquid in the container.

5. Return the pump tube to the bulkhead fitting.

☑ *Note*

If a grab sample is taken while a program is running, it is not counted as part of the number of samples.

☑ *Note*

If you interrupt a running program to collect a grab sample and miss a programmed sample event, it is logged as "PROGRAM PAUSED" error.

3.7 Replacing the Pump Tube

The pump tube is subject to wear during pump operation. It should be replaced when the GLS displays the pump tube warning at 500,000 pump counts, or when inspection of the tube reveals any cracks along its side.

⚠ **WARNING**

Moving parts can cause injuries. Remove power before replacing the pump tube.

To replace the pump tube:

1. Disconnect the power from the 12V Input Power connector.

2. Loosen the two thumbscrews and remove the liquid detector cover.

3. Loosen the four thumbscrews and remove the pump housing cover.

4. Pull the pump tube out of the pump housing. Rotating the pump rollers will help free the tube.

5. Pull the pump tube from the bulkhead fitting and disconnect the suction line.

6. Clean the inside of the pump housing if necessary.

7. Isco replacement pump tubes are marked with two black bands. These bands are used to correctly locate the tubing in the liquid detector and the pump. Position the pump inlet, or short end, in the upper groove of the liquid detector. The band should be placed at the outer edge of the liquid detector.

8. Slip the pump tube under the pump rollers. Rotating the rollers as you do this will help to slide the tube into the pump housing.

9. Position the pump outlet, or long end, in the lower groove of the liquid detector. Again, the band should be placed at the outer edge of the liquid detector.

10. Replace the liquid detector and pump housing covers. The thumbscrews should be fully hand-tightened.

11. Connect the pump outlet end to the bulkhead fitting.

12. Reconnect the suction line.

☑ *Note*

Replacement pump tubes, P/N 60-2954-030, are available from Isco.

☑ *Note*

If you are cutting replacement tubes from bulk Silastic tubing, cut the length to 27.75 inches (705 mm). Since the bulk tubing will not have bands to mark the correct position, ensure that 18.25 inches (490 mm) of tubing is

inside the liquid detector and pump, and that the tube is not kinked where it fits over the bulkhead fitting.

☑ *Note*

The factory set value of 500,000 pump counts will deliver approximately 500 samples of 200 ml each, using a $^3/8$-inch by 10-foot suction line at a 5-foot suction head.

☑ *Note*

The peristaltic pump and tube will perform the best when you:

- Use Isco replacement pump tubes or bulk tubing.
- Install the tube properly, aligning the inside edges of the bands with the outside edges of the liquid detector.
- Follow the natural curve of the pump tube when fitting the tube inside the pump housing.
- Use the shortest possible length of suction line.