# QCEC

*"Dependability Defined"*

# *Century 3000 CVE-16*
## *Wall-Mount Indoor Wastewater Sampler*

## Operations and Maintenance Manual
## v2A June 13, 2016

Part Number: 69-2303-411

## TELEDYNE ISCO
### Everywhere**you**look™

TO:  Purchaser of QCEC Brand Products

FROM:  Teledyne ISCO

We hope that you find this recent product purchase meets your needs.  We wanted to update you that the QCEC product you purchased is now manufactured by Teledyne ISCO and is backed by Teledyne ISCO's commitment to quality products and exceptional customer service.

Teledyne Isco, a world leader in automatic water sampling and open channel flow monitoring products, acquired in late April 2017 the QCEC line of water & wastewater automatic samplers and flowmeters. With the addition of this sampling vacuum pump technology, we are able to offer a broader sampler product offering to meet customers' needs.

Teledyne Isco has been in business for over 50 years manufacturing a wide range of products for professionals working in water pollution monitoring and abatement, engineers and managers involved with wastewater process control, and scientists involved in field and laboratory work. We take pride in the fact that the products we produce are used by our customers to improve the quality of life on Earth.

We offer all our customers responsive, competent, and excellent service and support. Our customers are the most important part of our business, and we work tirelessly to ensure your complete satisfaction.  Provided below are key contact information so that you can reach us at your convenience.


Water & Wastewater Product Support:
Telephone                            (402) 853-5350
Toll Free (USA)                     (866) 298-6174
Email                                    IscoEPS@teledyne.com

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Website                                 www.teledyneisco.com

# Teledyne Isco Two Year Limited Factory Service Warranty*

This warranty exclusively covers Teledyne Isco instruments, providing a two-year limited warranty covering parts and labor.

Any instrument that fails during the warranty period due to faulty parts or workmanship will be repaired at the factory at no charge to the customer. Teledyne Isco's exclusive liability is limited to repair or replacement of defective instruments. Teledyne Isco is not liable for consequential damages.

Teledyne Isco will pay surface transportation charges both ways within the 48 contiguous United States if the instrument proves to be defective within 30 days of shipment. Throughout the remainder of the warranty period, the customer will pay to return the instrument to Teledyne Isco, and Teledyne Isco will pay surface transportation to return the repaired instrument to the customer. Teledyne Isco will not pay air freight or customer's packing and crating charges. This warranty does not cover loss, damage, or defects resulting from transportation between the customer's facility and the repair facility.

The warranty for any instrument is the one in effect on date of shipment. The warranty period begins on the shipping date, unless Teledyne Isco agrees in writing to a different date.

Excluded from this warranty are normal wear; expendable items such as desiccant, pH sensors, charts, ribbon, lamps, tubing, and glassware; fittings and wetted parts of valves; check valves, pistons, piston seals, wash seals, cylinders, pulse damper, diaphragms, inlet lines and filter elements, and damage due to corrosion, misuse, accident, or lack of proper maintenance. This warranty does not cover products not sold under the Teledyne Isco trademark or for which any other warranty is specifically stated.

No item may be returned for warranty service without a return material authorization number issued by Teledyne Isco.

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The warrantor is Teledyne Isco, 4700 Superior, Lincoln, NE 68504, U.S.A.

**\* This warranty applies to the USA and countries where Teledyne Isco does not have an authorized dealer. Customers in countries outside the USA, where Teledyne Isco has an authorized dealer, should contact their Teledyne Isco dealer for warranty service.**

Before returning any instrument for repair, please call, fax, or e-mail the Teledyne Isco Service Department for instructions. Many problems can often be diagnosed and corrected over the phone, or by e-mail, without returning the instrument to the factory.

Instruments needing factory repair should be packed carefully, and shipped to the attention of the service department. Small, non-fragile items can be sent by insured parcel post. **PLEASE BE SURE TO ENCLOSE A NOTE EXPLAINING THE PROBLEM.**

| | |
|---|---|
| **Shipping Address:** | Teledyne Isco - Attention Repair Service<br>4700 Superior Street<br>Lincoln, NE 68504 USA |
| **Mailing Address:** | Teledyne Isco<br>PO Box 82531<br>Lincoln, NE 68501 USA |
| **Phone:** | Repair service:  (800) 775-2965 (lab instruments)<br>(866) 298-6174 (samplers & flow meters)<br>Sales & General Information: (800) 228-4373 (USA & Canada) |
| **Fax:** | (402) 465-3001 |
| **Email:** | IscoService@teledyne.com |

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# Configuration Quick Start

The following sample procedure would configure a CVE-16 sampler's program 1 to collect samples at 20 minute intervals:

1.  Power up the sampler to display its Program 1 READY screen, then press F3 three times to access that program's sampling Cycle settings:

    ```
    PGM SELECT
    Use ↕ to select
    > Program#1
    EXIT    TOP    SEL
    ```
    [F3] [F3]

    ```
    PGM CONFIG
    Use ↕ to select
    > Cycle
    HOME   BACK   SEL
    ```
    [F3]

2.  Press F3 again to display the PREPURGE setting. Then type the number of seconds the sample chamber should be pressurized to clear the intake prior to each sample (e.g., 20):

    [F3]
    ```
    PREPURGE
    (0-99 sec.)
    > 15_
    HOME   BACK   SEL
    ```

    (2) (0)
    ```
    PREPURGE
    (0-99 sec.)
    > 20_
    UNDO   BACK   SEL
    ```
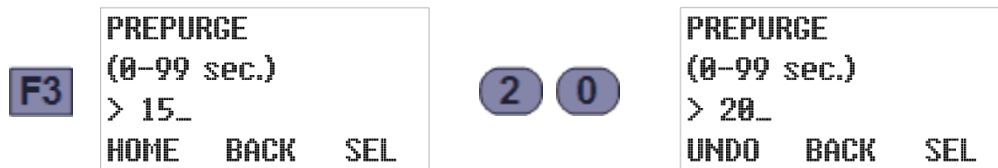
3.  Press F3 to accept that Prepurge duration and view the SAMPLE SECONDS. Then type the number of seconds the sample chamber should be depressurized to fill it with wastewater (e.g., 45):

    [F3]
    ```
    SMPL SECONDS
    (1-200) sec.
    >25_
    HOME   BACK   SEL
    ```

    (4) (5)
    ```
    SMPL SECONDS
    (1-200) sec.
    >45_
    UNDO   BACK   SEL
    ```
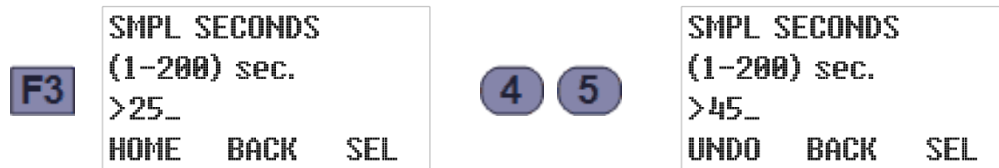
4.  Press F3 to accept that setting and view the POSTPURGE time. Then type the number of seconds the chamber should be pressurized to clear the intake after each sample (e.g., 18):

    [F3]
    ```
    POSTPURGE
    (10-99 sec.)
    > 10_
    HOME   BACK   SEL
    ```

    (1) (8)
    ```
    POSTPURGE
    (10-99 sec.)
    > 18_
    UNDO   BACK   SEL
    ```
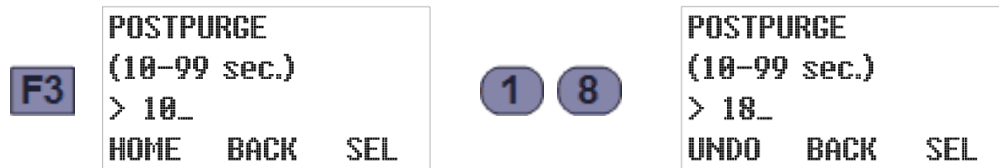
5.  Press F3 to accept that setting and view the number of times the intake line should be rinsed prior to each sample. Then type the desired NUMBER of RINSES (e.g., 2):

    [F3]
    ```
    NUM. RINSES
    (0-4)
    > 0_
    UNDO   BACK   SEL
    ```

    (2)
    ```
    NUM. RINSES
    (0-4)
    > 2_
    UNDO   BACK   SEL
    ```

6.  Press F3 to accept that setting. If it is not zero, the rinse cycle PRESSURE TIME will then be displayed. Then type the number of seconds each rinse should pressurize the sample chamber (e.g., 8):

    [F3]
    ```
    PRESSURE TIME
    (0-99 sec.)
    > 2_
    HOME   BACK   SEL
    ```

    (8)
    ```
    PRESSURE TIME
    (0-99 sec.)
    > 8_
    UNDO   BACK   SEL
    ```

7. Press F3 to accept that setting and view the rinse cycle VACUUM TIME. Then type the number of seconds each rinse should suction in wastewater (e.g., 6):

`F3`
```
VACUUM TIME
(0-99 sec.)
> 2_
HOME    BACK    SEL
```
`6`
```
VACUUM TIME
(0-99 sec.)
> 6_
UNDO    BACK    SEL
```

8. Press F3 to accept that setting and view the RECYCLE setting. Then type 0 to disable or 1 to enable the incomplete sample retry feature:

`F3`
```
RECYCLE
Toggle ↕
> OFF
BACK    TGL    SEL
```
`1`
```
RECYCLE
Toggle ↕
> ON
BACK    TGL    SEL
```

9. Press F3 to accept that setting and view the CONSECUTIVE SAMPLING setting. To draw just one sample per interval, type 1 (if necessary) to disable that feature:

`F3`
```
CONSECUTIVE SMP
(1-24)
> 1_
HOME    BACK    SEL
```
`1`
```
CONSECUTIVE SMP
(1-24)
> 1_
UNDO    BACK    SEL
```

10. Press F3 to accept that setting and return to the PROGRAM CONFIG menu:

`F3`
```
PGM CONFIG
Use ↕ to select
> Smpl. Interval
HOME    BACK    SEL
```

11. Press F3 to view the selected SAMPLING INTERVAL type. To change it, use the Up or Down key to scroll to the desired interval type (e.g., timed intervals):

`F3`
```
SMPL. INTERVAL
Use ↕ to select
> Flow
HOME    BACK    SEL
```
⬆ or ⬇
```
SMPL. INTERVAL
Use ↕ to select
> Time
HOME    BACK    SEL
```

12. Press F3 to accept that setting and view its current TIME OPTION. To change it, use the Up or Down key to scroll to the desired option (e.g., fixed time intervals):

`F3`
```
TIME OPTION
Use ↕ to select
> Time Variable
HOME    BACK    SEL
```
⬇ or ⬆
```
TIME OPTION
Use ↕ to select
> Time Fixed
HOME    BACK    SEL
```

13. Press F3 to accept that option and view its current SAMPLE MINUTES setting. Then type the desired new interval duration (e.g., 20 minutes):

`F3`
```
SMPL MIN
(1-9999)
> 30_
HOME    BACK    SEL
```
`2` `0`
```
SMPL MIN
(1-9999)
> 20_
UNDO    BACK    SEL
```

## Composite Sample Storage Quick Start

The following additional steps would configure a composite sampler to collect those samples for 16 hours, deposit all 48 of them into a 2.5-gallon container, and then stop:

14. Press F3 twice to accept that interval, return to the PROGRAM CONFIG menu, and display the installed SAMPLE STORAGE TYPE (always composite for wall-mount samplers):

```
         PGM CONFIG                          SAMPLE TYPE
         Use ↕ to select                     Use ↕ to select
 [F3]    >Bottle Opts.            [F3]       >Composite
         HOME   BACK   SEL                   HOME   BACK   SEL
```

15. Press F3 to accept that setting and view the COMPOSITE SIZE setting. Then use the Up or Down key to scroll to the installed sample container size (e.g., 2.5 gallons):

```
         COMP SIZE                           COMP SIZE
         Use ↕ to select                     Use ↕ to select
 [F3]    >5 gal.          [↓] or [↑]         >2.5 gal.
         HOME   BACK   SEL                   HOME   BACK   SEL
```
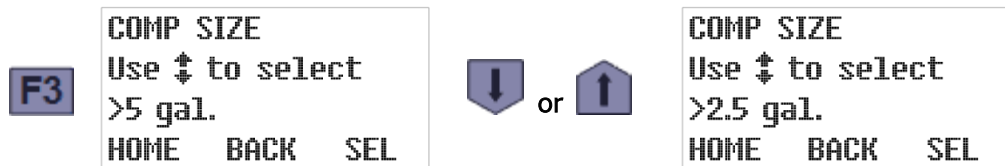
16. Press F3 to accept that setting and view the number of samples the container is currently set to receive. Then type the number of samples you want the program to collect (e.g., 48):

```
         SMPLS/BOTTLE                        SMPLS/BOTTLE
         (1-85)                              (1-85)
 [F3]    >85_            [4] [8]             >48_
         HOME   BACK   SEL                   UNDO   BACK   SEL
```
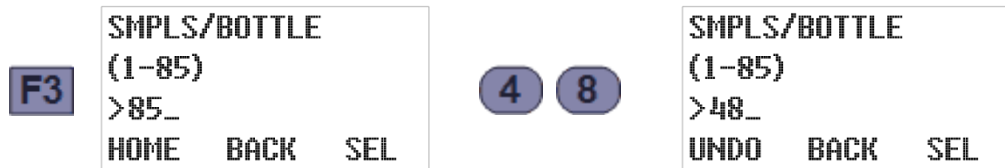
17. Press F3 to accept that setting and return to the PROGRAM CONFIG menu. Assuming you don't want to enable any PROGRAM RUN OPTIONS (which are all disabled by default), press F1 twice to display the PROGRAM READY screen:

```
         PGM CONFIG                          Pgm1 : READY
         Use ↕ to select                     Time (min.): 20
 [F3]    >Pgm. Run Opts.   [F1] [F1]         > 0 : 0%
         HOME   BACK   SEL                    RUN  TIMED  MENU
```

18. Twenty minutes before the first sample is to be drawn, press F1 to start the sampling program. Barring unforeseen problems, that program would then run for 16 hours and stop:

```
         Pgm1 : RUNNING            after              Pgm1 : DONE
         Time (min.): 20         16 hours             >Pgm Complete
 [F1]    > 0 : 0%        ▶      (48 samples)          >Normal
          STOP  MAN  PAUSE                            RESET
```
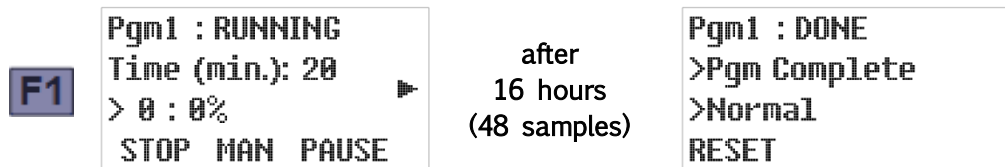
19. You should then replace the sample container with an empty one and press F1 to reset the program. Then repeat Step 19 twenty minutes before you want to start the next day's sampling.

# Operation Quick Start

When powered up, the controller first displays one of its Ready screens (see page 54). All you need to do is start the indicated sampling program by pressing the RUN [F1] key:

sampler
powers up

```
Pgm1 : READY       [====]
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```

[F1]

```
Pgm1 : RUNNING     [====]
Time (min.): 60
> 0 : 2%              ▶
 STOP  MAN  PAUSE
```

The indicated time or flow interval counter will then accumulate until it reaches 100 percent of its target value, at which time the sampling cycle will be initiated (see page 60):

interval
reaches
100%

```
SAMPLING           [====]
rinse press…          ▶
sec: 14
STOP
```

or

```
SAMPLING           [====]
prepurge…             ▶
sec: 12
STOP
```

After the sample has been discharged to its storage container, the previously-displayed Running screen will reappear. The program will continue running until the specified number of samples has been collected, then stop and display its DONE screen. Alternately, you can manually stop it at any time by pressing the STOP [F1] key:

after last
sample is
collected

```
Pgm1 : DONE        [====]
>Pgm Complete
>Normal
RESET
```

OR [F1]

```
Pgm1 : STOPPED     [====]
>Pgm Stopped
>From Keypad
RESET
```

In either case, the program's sample counters must then be reset (by pressing the RESET [F1] key) before another round of sampling can be initiated. Before doing so, remove the samples and install an empty container or bottle carousel.

*The unit's operation can be further simplified* by setting the Bottle Limit option (see page 47) to "Program Continue"). The program would then continue sampling indefinitely, without requiring anyone to ever press the RESET [F1] key.

As the program would then have no way of knowing how many samples it has discharged since the container was last emptied, the sample count screen (see page 59) merely indicates "NL" (no limit). However, a composite sampler equipped with a bottle-full float switch would suspend its interval counters (and display a downward-pointing float icon) if that switch ever opened, then restart them from zero as soon the container was replaced (thus reclosing the switch):

```
Pgm1 : RUNNING     [====]
Smpl#:NL
12:34:56 07/08/15 ▶⤓
 STOP  MAN  PAUSE
```

if composite
container
filled up

```
Pgm1 : RUNNING     [====]
Time (min.): 60
> 0 : 0%           ▶⤓
 STOP  MAN  PAUSE
```

# Chapter 1: Introduction

CVE-16 Wall Mount Samplers collect constant volume wastewater samples at programmed time or flow intervals and deposit them into external composite sample containers. Their vacuum pumps provide long-term consistent sampling with vertical lifts of up to 23 feet (28 feet with the quick-lift pump option), with no need to frequently replace the internal tubes that render peristaltic pumps inconsistent, unreliable and costly to maintain.

🚫 *The CVE-16 vacuum system cannot be used to sample pressurized wastewater streams, or open streams whose surfaces are higher than the sampler. Attempting to do so will ruin the sampler by filling it with water.*

If you have any questions or suggestions, feel free to call QCEC at 1-515-266-2268 and ask for wastewater sampling technical support.

**Pump, Solenoid Valve, Liquid Sensor Controller,
Transformer and Fuse Holder are behind the partition**
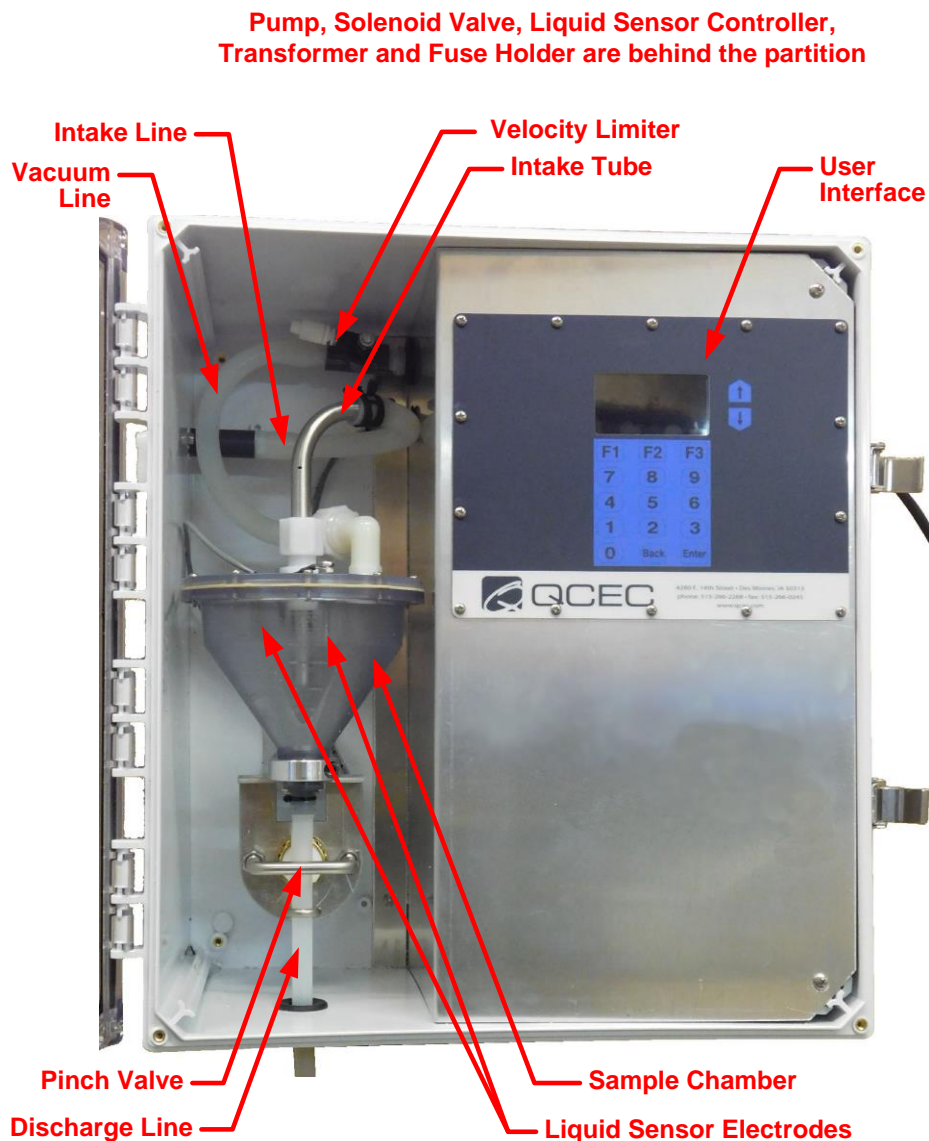


*Figure 1-1:  CVE-16 Wall-Mounted Sampler Component Locations*

# 1.1: Physical Description

Each CVE-16 Wall Mount Sampler includes sample collection and sampling control systems mounted in a durable plastic housing with a clear access door. The interior of that housing is divided by an aluminum partition that protects the electrical components and provides a mounting surface for the user interface panel.

Unlike our other sampler models, these units do not include sample storage compartments and containers. Each must instead be provided with a suitable customer-provided composite sample container, which might or might not need to be housed in a refrigerated compartment.

## 1.1.1: Sample Collection System

The sample collection system has the following major components (see Figure 1-1):

- A clear plastic **sample chamber** with an adjustable wastewater inlet tube (whose projection into the chamber determines the sample size) and a discharge-tube **pinch valve**.
- A **liquid sensor** the controller uses to determine when the chamber is full.
- A 120 VAC piston **air compressor/vacuum pump** connected to that chamber by a four-way **solenoid valve**, which alternately evacuates and pressurizes the sample chamber in order to draw wastewater in and force it back out.
- A pump discharge **pressure regulator** and an intake **velocity-limiting valve**.
- A 3/8 inch clear **stream sampling tube** that extends to an unpressurized wastewater stream whose surface is at a lower elevation than the sampler.

Each sample is collected by:

1. Blowing air through the chamber to clear the sample intake line.
2. Sucking water into the chamber until it rises above the top of the intake tube.
3. Blowing any water that is above the intake tube back out through the intake line.
4. Opening the discharge valve to drain the remaining consistant-volume sample into the sample container.

The velocity-limiting valve is mounted to the partition, while the liquid sensor's controller, pump, solenoid and pressure regulator are located behind it. For 240VAC units, that protected area also houses a 240-to-120 VAC transformer.

## 1.1.2: Sampling Control System

The CVE-16 sampling control system includes two circuit boards that are referred to as the **logic** and **power** boards. They collectively provide the following features:

- a 32-bit microcontroller that can run any of six **sampling programs**
- a **backup battery** that powers the microcontroller's **real-time clock** but not its field elements (thus precluding continued sampling) when external power is unavailable
- the onboard **user interface**
- a variety of discrete and analog **inputs and outputs** (see next page)
- an **SDI-12 communication interface** for the CVE-16 liquid sensor control box

- the following communication ports (not yet implemented or unused by this model):
  - a USB-A thumb drive port (for archival data transfer)
  - USB-B and RS232 Modbus ports

The logic board (which includes the user interface components) is mounted on the protective partition, with the power board immediately behind it. That protected area also houses a step-down transformer and fuse for the control system.

### 1.1.2.1:  User Interface Panel

The logic board's LCD readout and password-protected keypad are used to:

- adjust the clock and the LCD brightness/contrast, and administer the access passwords and archival data (see Chapter 3: User Interface Panel);
- configure the sampling programs (see Chapter 4: Sampling Program Configuration); and
- monitor and control the unit's operation (see Chapter 5: Sampler Operation).

### 1.1.2.2:  Inputs and Outputs

Each controller's logic board supports a variety of field input and output signals, some of which are wired directly to logic board connectors while others are routed through additional circuitry and connectors on the power board:

- All of the controller's required and optional inputs and outputs are described in detail in Appendix A (see page 74)
- Those circuits, and the circular plastic connectors (CPCs) to which the corresponding field devices must or can be wired, are shown on the Electrical Diagram appended to the back of this manual.
- Instructions for connecting your field devices to the controller's external CPCs are provided in Chapter 2 (see page 17).

### 1.1.3:  Sample Storage System

Wall-Mount Samplers are meant for composite-sampling applications, which discharge all samples into a single customer-supplied, external, presumably refrigerated storage container. The controller's discrete/sequential sampling features, which are only designed to work with QCEC's bottle turntable and carousels, are factory disabled.

## 1.2: Sampling Programs

The control system provides six user-configurable sampling programs, one of which is selected and can be run at any given time. Each of those programs can be configured to:

- draw configurable, fixed-size (up to 400 milliliter) samples, or sets of consecutive samples, at specified time or flow intervals;

  Flow intervals can be based on either an analog or a discrete-pulse flow meter signal, or a PLC or other remote device could use the pulsing flow input to trigger individual samples.

- rinse the sampling line up to four times prior to drawing each sample.

- repeat any sampling cycle up to four times (five total) if needed to collect the specified volume of wastewater.

- delay its execution a specified number of minutes after it is started, or until the optional float input is asserted.

- automatically stop after a configurable amount of time or number of samples, or if the discharged volumes exceed 90 percent of the sample container's capacity.

  AND/OR

  suspend and resume sampling as an optional external float switch opens and closes.

  Alternately, a PLC or other remote device could use the external float-switch input to remotely suspend and resume the collection of samples.

- start sampling, pause or halt and later resume, take manual samples and finally stop at scheduled times on specified days of the week, then automatically restart itself if desired.

- energize a run-status relay to indicate a sample is being collected, or an alarm relay to indicate the program has stopped or encountered a fault condition.

Appendix A: Controller Capabilities discusses the configurable features of the sampling program, while Chapter 4: Sampling Program Configuration tells how to view and change the parameters that configure those features.

# Chapter 2: Installation

Each CVE-16 Wall Mount Sampler is meant to be used in a fixed location, with any optional external I/O devices connected, the far end of its sampling line fixed in the wastewater stream it is used to sample, its discharge tube routed to a suitable sample container, and its power cord plugged into an AC power receptacle.

When you are ready to install your sampler:

5. Move it to its intended final location, remove it from its shipping carton and remove any internal packing materials.

6. Mount it on a vertical surface such that its horizontal surfaces are approximately level.

7. Position the wastewater intake strainer and connect it to the sampler's intake fitting using 3/8 inch clear, flexible tubing.

8. Route the discharge tube into your sample container.

9. Connect any external I/O devices (flow and/or float input, run and/or alarm output).

10. Plug the provided power cord into a grounded AC power receptacle.

11. Verify or correct the control system clock settings (see page 24).

12. Configure the sampling program(s) to your needs (see page 28).

13. When lifting small samples, you may need to adjust the velocity valve (see next page).

## 2.1:  Sampling Line Connection

The wastewater inlet connection is a 1/2 inch FNPT fitting recessed into the left side of the sampler housing. You can connect any appropriate plumbing materials, but the most common choice is 3/8 by 5/8 inch (I.D. by O.D.) clear PVC tubing connected using a right-angle barbed or compression fitting. Either fitting and needed length of tubing can be purchased from QCEC.

If you are using tubing and a compression fitting obtained from QCEC:

1. Loosen (but do not remove) the compression nut.

2. Wet the end of the tubing and force it into the fitting as far as it will go.

3. Tighten the nut.

✍   *If you fully disassemble the fitting, there is a good chance the compression ring might fall out and be lost. Without it, you will be unable to obtain an airtight connection.*

The far end of each tube is usually connected to an in-stream strainer, such as the stainless steel or PVC strainer available from QCEC.  As shown to the right, both of them feature barbed fittings that the intake lines can be slipped over and clamped to.

🚫   *The CVE-16 vacuum system cannot be used to sample pressurized wastewater streams, or open streams whose surfaces are higher than the sampler. Attempting to do so will ruin the sampler by filling it with water.*

## 2.2:  Positioning Considerations

Your CVE-16 Wall Mount Sampler can be installed in nearly any location, provided the waste-water stream from which the samples will be drawn is no more than 23 feet below the top of the sampler's housing (28 if equipped with the optional quick-lift pump).

The unit is equipped with a grounded 9-foot 14/3 AWG power cord that exits the upper right side of the housing. If an AC receptacle is not located within reach of that cord, a sufficiently-long, customer-provided appliance-quality 15-amp extension cord will be needed.

## 2.3:  Sample Size Adjustment

The CVE-16 sampling system collects uniform samples by suctioning wastewater into a sample chamber until it rises above the bottom of the intake tube, then blowing the excess back out. The size of those samples can thus be changed by adjusting how far that tube extends below the top of the sample chamber.

That tube extends down into the chamber through a compression fitting mounted in its lid. To adjust its extension into the chamber, repeat the following steps until the desired sample size is obtained:



4. Loosen the compression fitting nut.
5. Slide the tube farther down into or up out of the chamber.
6. Retighten the compression fitting nut.
7. Draw a manual sample and measure its volume.

✍  *The sample size must be known to avoid setting the sampling programs to discharge more wastewater to the sample containers than they can hold.*

### 2.3.1:  Velocity Valve Adjustment

In order to raise small samples limited distances, you might need to open the velocity-limiting valve. For example, if you need to lift 100 milliliter samples less than three feet, you should start by opening that valve two turns from its factory setting.

As shown on Figure 1-1, that valve is mounted to just to the right of the sample chamber:

• To open that valve, thus reducing the vacuum force applied to the sample chamber and the resulting water flow rate, turn the chrome knob counterclockwise.
• To close it, thus increasing the vacuum and flow rate, turn that knob clockwise.

## 2.4:  Field I/O Connections

CVE-16 Wall Mount Samplers can be equipped with either or both of the following circular plastic connectors (CPC) for field I/O device cables:

- a four-pin flow inputs connector (analog and/or pulsing-discrete signals)
- a seven-pin field I/O connector (alarm and run output and float input signals)

Custom cables must be fabricated (from the provided matching screw-terminal cable connectors) for any field devices you chose to connect.
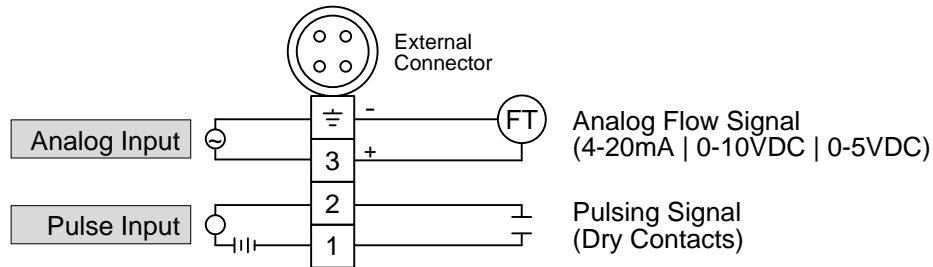


*Figure 2-1:  Flow Input Connections*

### 2.4.1:  Flow Inputs

The four-pin flow input connector provides field wiring terminals for pulse and analog flow input signals, either of which can be connected and used to trigger sample collection at configured stream flow intervals (see page 80):

- If that feature is configured for a pulsing input, connect a dry-contact signal source to input connector pins 1 and 2. The interval pulse count will be incremented each time that controller-powered circuit is externally closed.

✍   *To adapt this input to an externally-powered discrete signal, connect it to the normally-open contacts of an interposing relay and use that signal to energize the relay coil.*

- If that feature is configured for a 4-to-20 mA, 0-to-5 V or 0-to-10 V analog flow signal, connect the transmitter's positive (+) and negative (–) terminals to input connector pins 3 and 4 (ground), respectively.

QCEC offers both an open-channel ultrasonic flowmeter (the QC-OC-1) and a closed-channel Doppler flowmeter (the QC-DT-1), both of which provide both analog and pulsing discrete flow outputs that satisfy the requirements of our wastewater sampler flow inputs.
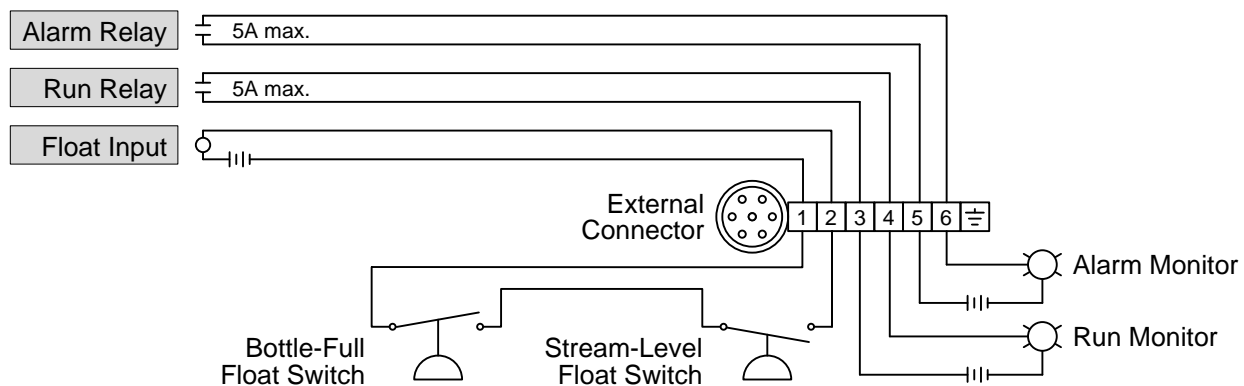
_Figure 2-2:   Relay Output and Float Input Connections_

### 2.4.2:  Relay Outputs

As shown above, four of the optional field I/O connector's seven pins connect to 5 Amp relay contacts on the controller's power board:

- the run-status relay connects pins 3 and 4 when the unit is sampling (see page 78)
- the alarm relay (if enabled, see page 45) connects pins 5 and 6 when sampling is stopped or certain non-fatal fault conditions are detected (see page 74).

They can thus be used to turn appropriate _externally-powered_ indicator lamps or annunciators on and off, or to signal those conditions to a SCADA or other host control system.

### 2.4.3:  Float Input

The optional field I/O connector also provides a pair of terminals wired to the controller's self-powered Float Input (see page 76). No samples will be drawn unless that circuit is closed or the Float Option (see page 45) is disabled:

- If your unit was purchased with a composite sample container, it will include a bottle-full float switch that will open as the fluid level rises above about 90 percent of the container's volume (if not, you can obtain a suitable container and float-switch from a third party). If such a switch is wired across pins 1 and 2 of the field I/O connector, it will interrupt the collection of samples before the sample container overflows.

- Alternately, those I/O connector pins can be wired to a stream-level float switch (or other dry-contact device) that closes the circuit only when the stream flow is sufficient to sample. The sampler can then be configured to delay or interrupting the collection of samples if there is not enough flow to sample.

✍ _Due to the variety of suitable stream-level sensors that are available, QCEC neither sells nor recommends them—you must select and obtain one from a third-party supplier._

- To employ both a bottle-full and a low-flow float switch, wire them in series across pins 1 and 2 of the I/O connector (as shown above). Samples will then be drawn only when both switches are closed.

- If you do not want to install either type of float switch, you must either disable the Float Option or install a jumper across I/O connector pins 1 and 2.

# Chapter 3: User Interface Panel

The sampler's operation can be configured, monitored and controlled using its user interface panel, which consists of an LCD readout and password-protected keypad mounted behind the clear access door.
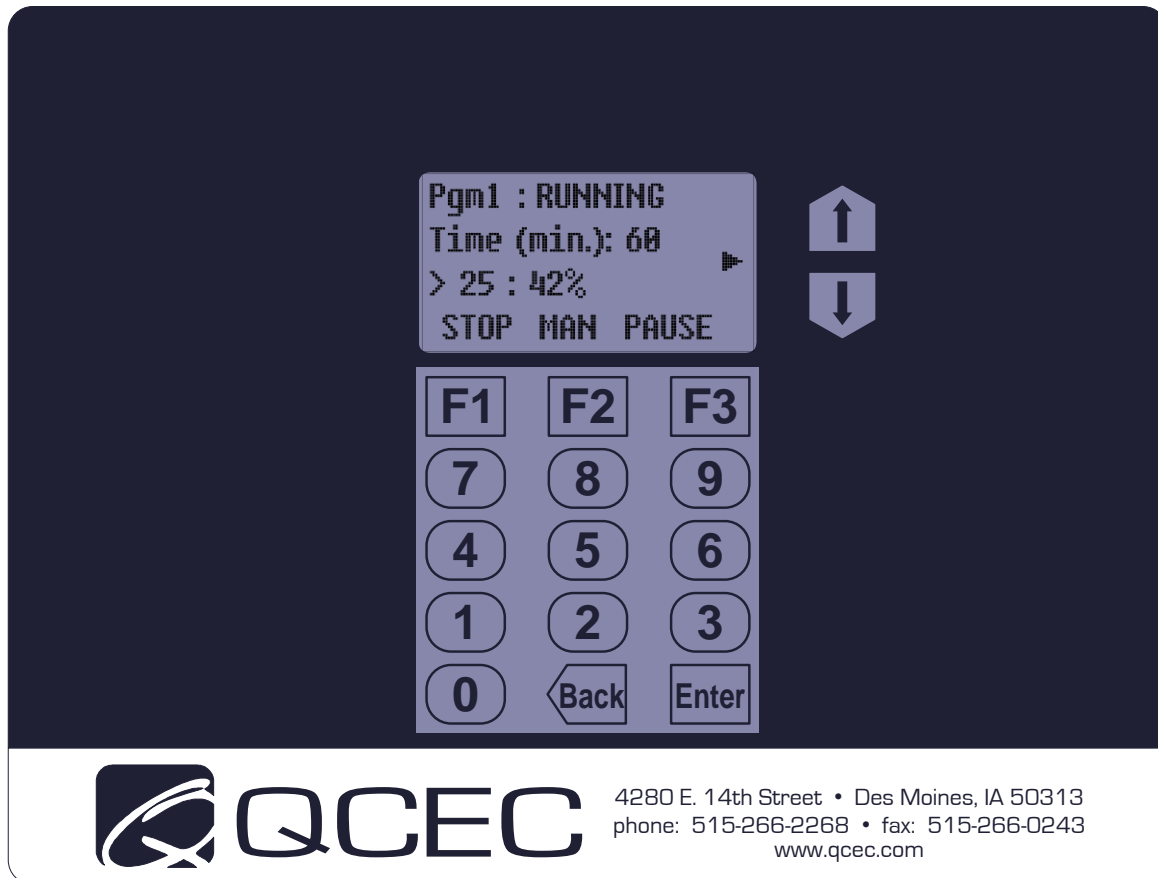


*Figure 3-1:  User Interface Panel*

Its LCD readout displays the identity of the selected sampling program, which the operator can start and stop or pause and resume (see Chapter 5: Sampler Operation). It displays four lines of alphanumeric text, plus a column of status icons that might appear along its right edge:

- The top line identifies and displays that program's operating state. The second and third lines display sets of status information, which you can cycle through by pressing the UP and Down keys to the right of the LCD.

- The bottom line indicates the functions (if any) of the top three keys (F1, F2 and F3).

- Various status icons (see Table 5-1 on page 53) are displayed along the right edge of the readout (as you face it).

- *The display panel backlight will automatically turn off if no keyboard activity has been detected in the last two minutes. Pressing any key will then turn it back on.*

## 3.1: Menu System

The control system is set up and administered via a hierarchical menu (see page 72) accessed by pressing the F3 key when the prompt above it reads "MENU". If the administration password (see page 22) has its default value (0), the first Main Menu option will then be displayed:

```
Pgm1 : READY
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```
F3
```
MAIN MENU
Use ↕ to select
> Program Menu
 HOME   BACK   SEL
```

If that password has a non-zero value, the Password entry screen will appear instead. Like many other menu screens, it assigns the HOME, BACK and SEL[ect] functions to the F1, F2 and F3 keys:

- Pressing HOME [F1] generally displays the parent menu for the current screen. If you are editing settings, any changes you have made to the current parameter will not be saved.

- Pressing BACK [F2] or the Back (bottom row, center) key generally restores the previously-displayed screen or, if you are editing numerical parameter values, backspaces over the most-recently typed digit.

- Pressing SEL [F3] or the Enter (bottom row, right) key generally displays the next parameter or screen in a sequence. If you are editing settings, any changes you have made to the current parameter will be saved.

In this case, pressing HOME [F1] would restore the operating state display (as would BACK [F2] or the Back key before you start typing the password):

```
PASSWORD
(0-9999999)
> _
 HOME   BACK   SEL
```
F1
```
Pgm1 : READY
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```

To access the Main Menu, use the numeric keys to type the correct password, then press SEL [F3] or the Enter key. If the password was 56, for example:

5  6
```
PASSWORD
(0-9999999)
> 56_
 UNDO   BACK   SEL
```
F3
or
Enter
```
MAIN MENU
Use ↕ to select
> Program Menu
 HOME   BACK   SEL
```

Typing the first digit changes the F1 prompt to UNDO—pressing that key would then clear any digits you had typed so far and restore the initial Password screen. In contrast, pressing BACK [F2] or the Back key will clear only the last typed digit.

Whenever any Main Menu screen is displayed, you can scroll through its four options by pressing the Up or Down key, display the first option of the indicated subordinate menu by pressing SEL [F3] or the Enter key, or exit the menu system by pressing HOME [F1]:

```
MAIN MENU
Use ↕ to select
> Program Menu
 HOME   BACK   SEL
```

**F3** or **Enter**

```
PGM CONFIG
Use ↕ to select
> Cycle
 HOME   BACK   SEL
```

[↓]

```
MAIN MENU
Use ↕ to select
> Admin. Menu
 HOME   BACK   SEL
```

**F3** or **Enter**

```
ADMIN MENU
Use ↕ to select
> Set Password
 HOME   BACK   SEL
```

[↓]

```
MAIN MENU
Use ↕ to select
> Load Cell Menu
 HOME   BACK   SEL
```

**F3** or **Enter**

```
GET PASSWORD
(0-9999999)
> _
 HOME   BACK   SEL
```

[↓]

```
MAIN MENU
Use ↕ to select
> Factory Menu
 HOME   BACK   SEL
```

**F3** or **Enter**

```
GET PASSWORD
(0-9999999)
> _
 HOME   BACK   SEL
```

**F1**

```
Pgm1 : READY
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```

For convenience, each of those subordinate menus is set up so saving a setting (or initiating an action) automatically displays the next one. Also, pressing the Enter key (or SEL [F3], if available) when a setting's current value is first displayed leaves it unchanged. So you can advance through the entire menu, viewing but not changing any settings, by simply pressing the Enter key enough times.

✍ *Access to the Load Cell and Factory Menus, which are used to adapt each controller to its sampler prior to shipment, are restricted by additional secret passwords.*

## 3.2: Administration Menu

Administration Menu screens can be used to:

- change or clear the administration password (see page 22),
- set the real-time clock and enable/disable daylight savings time (see page 24),
- adjust the LCD brightness (page 25),
- download and erase the archived data (see page 26),
- change the unit's ID number (page 27), and/or
- select English or Metric volumetric units (page 27).

To access those features:

1. Access the **Main Menu** by pressing the MENU [F3] key and (if so prompted) entering the optional password (see Menu System above).

2. Press the DOWN key to scroll to the **Administration Menu** option, then press the SEL [F3] or Enter key to display that menu's first option:

```
MAIN MENU
Use ↕ to select
> Program Menu
 HOME   BACK   SEL
```

```
MAIN MENU
Use ↕ to select
> Admin. Menu
 HOME   BACK   SEL
```

[F3] or [Enter]

```
ADMIN MENU
Use ↕ to select
> Set Password
 HOME   BACK   SEL
```
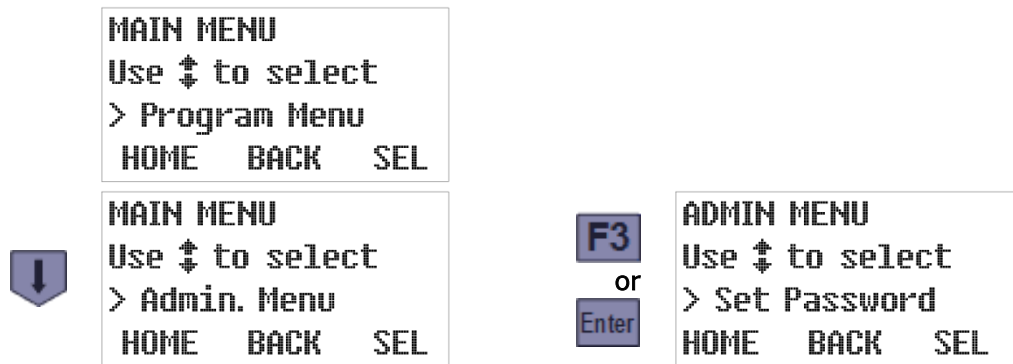
### 3.2.1: Administration Password

The **administration password** can be used to prevent unauthorized individuals from accessing the Administration and Program menus (see page 20):

- If it is set to zero (its factory default value), pressing the MENU [F3] key will immediately display the first Main Menu option.
- If it is assigned a value from 1 to 9,999,999 (leading zeroes are not allowed), pressing MENU [F3] will display the Password entry screen.

✍ *The Load Cell and Factory Menus, which are meant to be used only by QCEC personnel, are protected by additional passwords that must be entered even if the administration password is cleared (set to zero).*

✍ *If you forget the value of your administration password, contact QCEC for instructions on how to regain access to your sampler's menu system.*

To change the administration password's value:

1. Select the Administration menu (see page 22) to display its first option (Set Password). The second line of the readout will then show the range of allowable values while the third displays the current password:

```
ADMIN MENU
Use ↕ to select
> Set Password
HOME   BACK   SEL
```

F3
or
Enter

```
SET PASSWORD
(0-9999999)
> 8675309_
HOME   BACK   SEL
```
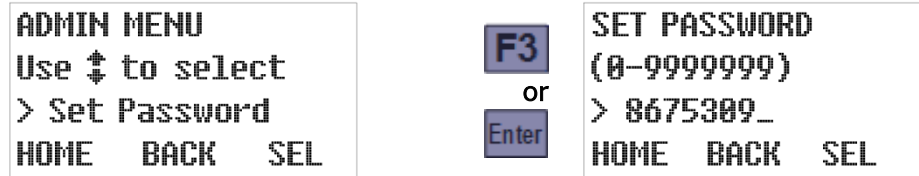
2. Type the new password by pressing the corresponding numeric keys (the old password will be erased and the F1 prompt will change from HOME to UNDO). Then press the SEL [F3] or Enter key to save the displayed password and advance to the next Administration Menu option. To change it to 56, for example, just press 5, then 6, and finally SEL [F3] or Enter. The new value will then be saved and the next Admin Menu option will be displayed:

(5) (6)

```
SET PASSWORD
(0-9999999)
> 56_
UNDO   BACK   SEL
```

F3
or
Enter

```
ADMIN MENU
Use ↕ to select
> Clr Password
 HOME   BACK   SEL
```

While entering a new password:

- Pressing UNDO [F1] would restore the old password value.
- Pressing BACK [F2] or the Back key would delete the right-most typed digit. Backspacing over the first digit will restore the old password.

Setting the password to zero (0) removes any previously set Administration and Program Menu protection. An easier way to do that, however, is to execute the second Admin Menu option:

1. Select the Administration Menu (see page 22 and press the DOWN key to display its Clear Password option.

2. Press the SEL [F3] or Enter key to immediately set the password to zero. A STATUS UPDATE screen will appear briefly, followed by the next Administration Menu option:

```
ADMIN MENU
Use ↕ to select
> Clr Password
 HOME   BACK   SEL
```

F3
or
Enter

```
STATUS UPDATE
User Password
CLEARED
 ESC
```

2 second
delay, then

```
ADMIN MENU
Use ↕ to select
> Set DST
 HOME   BACK   SEL
```
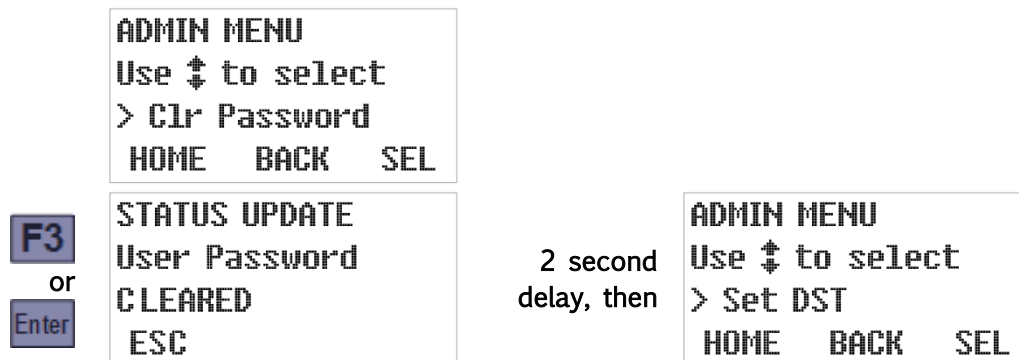
### 3.2.2: Clock Settings

The control board includes a real-time clock chip with a backup battery, so it runs even when the control board is powered down. This enables it to timestamp all archived data and to collect samples at scheduled times. In addition, the current time and date are displayed on the third line of the second operating status screen (see page 58).

The third Administration Menu option allows you to quickly adjust the clock by one hour when daylight savings time (DST) begins or ends, while the fourth allows you to directly reset the clock to the current date and time. Because you should make sure the DST option is correct before setting the time, those options should be executed in the order presented:

1. Select the Administration Menu (see page 22), use the Down key to scroll to its third (Set DST) option, and then press the SEL [F3] or Enter key. The third line of the readout will then show the current daylight savings time setting:

<div style="text-align:center">

press<br>
until you see ⬇️

```
ADMIN MENU
Use ↕ to select
> Set DST
 HOME   BACK   SEL
```

[F3]<br>or<br>[Enter]

```
DST
Toggle ↕
Winter
 HOME   BACK   SEL
```

</div>
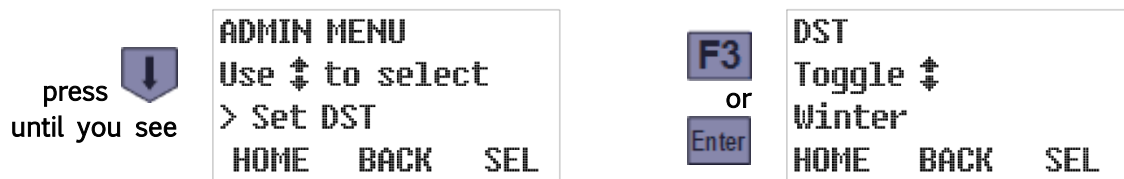
2. If necessary, press either the Up or the Down key to toggle that setting. When the desired setting is displayed, press the SEL [F3] or Enter key to save it and display the Set Clock option:

<div style="text-align:center">

⬇️

```
DST
Toggle ↕
Summer
 HOME   BACK   SEL
```

[F3]<br>or<br>[Enter]

```
ADMIN MENU
Use ↕ to select
> Set Clock
 HOME   BACK   SEL
```

</div>
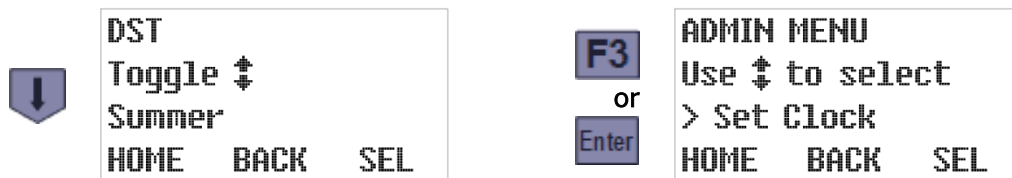
3. To adjust the date and time settings, press the SEL [F3] or Enter key. Otherwise, scroll to another Administration Menu option or press the HOME [F1] key to restore the Main Menu. The current date setting is displayed first. If it is correct, or after you have corrected it, press the Enter key to save the displayed date and access the current time setting:

<div style="text-align:center">

[F3]<br>or<br>[Enter]

```
CURRENT DATE
mm/dd/yy ↕⊞
01/23/14
ESC    ◀      ▶
```

[Enter]

```
CURRENT TIME
hh:mm:ss ↕⊞
12:34:56
ESC    ◀      ▶
```

</div>

The same techniques are used to change both settings. The third line displays the current value, with an underline cursor indicating the digit currently subject to editing:

- Press the Previous [F2] or Next [F3] key to move that cursor one digit left or right.

- Press any appropriate numeric key to set the current digit and advance the cursor, OR press the Up or Down key to increment or decrement the current digit.

- Press the ESC [F1] key to undo any change to the displayed setting and return to the Administration Menu/Set Clock screen.

4. Pressing the Enter key while the time setting is displayed saves that time and displays the next Administration Menu option:

```
CURRENT TIME
hh:mm:ss ↕⊞
12:00:00
ESC      ◀      ▶
```

[Enter]

```
ADMIN MENU
Use ↕ to select
> Adjust LCD
 HOME   BACK   SEL
```
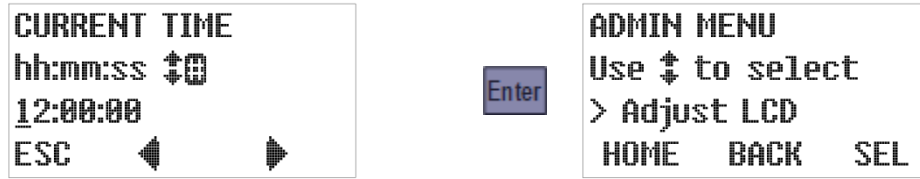
### 3.2.3: LCD Brightness

To adjust the brightness of the LCD backlight, which determines the contrast of the user interface panel:

1. Select the Administration Menu (see page 22), use the Up or Down key to scroll to its fifth (Adjust LCD) option, and then press the SEL [F3] or Enter key to display the current setting:

```
ADMIN MENU
Use ↕ to select
> Adjust LCD
 HOME   BACK   SEL
```

[F3]
or
[Enter]

```
LCD CONTRAST
Use ↕ to select
>15
HOME   BACK   SEL
```
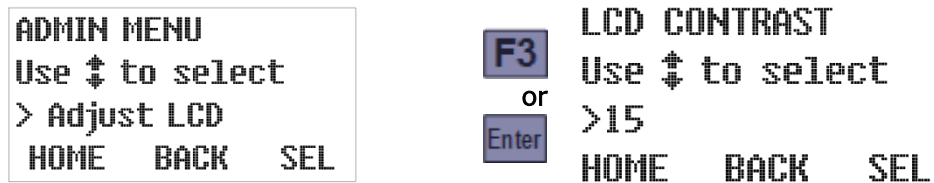
2. Pressing the Up or Down key will increment or decrement that setting while making the screen slightly brighter or darker. The darkest possible setting is 0, the brightest is 30:

[↓] to
minimum

```
LCD CONTRAST
Use ↕ to select
>0
HOME   BACK   SEL
```

[↑] to
maximum

```
LCD CONTRAST
Use ↕ to select
>30
HOME   BACK   SEL
```

3. Pressing the SEL [F3] or Enter key saves the displayed setting and displays the next Administration Menu option.

[F3]
or
[Enter]

```
ADMIN MENU
Use ↕ to select
> Download Archive
HOME   BACK   SEL
```

## 3.2.4: Archival Data Administration

Samplers manufactured since mid-March of 2016 archive timestamped sample collection records that their operators can review via the user interface panel (see pages 65 and 84).

To erase those log files from the microprocessor's memory, select the Administration Menu (see page 22), use the Up or Down key to scroll to its seventh (Clear Archive) option, and press the SEL [F3] or Enter key:

repeat

until

```
ADMIN MENU
Use ↕ to select
> Clr Archive
HOME   BACK   SEL
```

F3

or

Enter

```
PLEASE WAIT
Clearing…
ARCHIVE
ESC
```

when finished

```
SET UNIT ID
(1-255)
> 1_
HOME   BACK   SEL
```
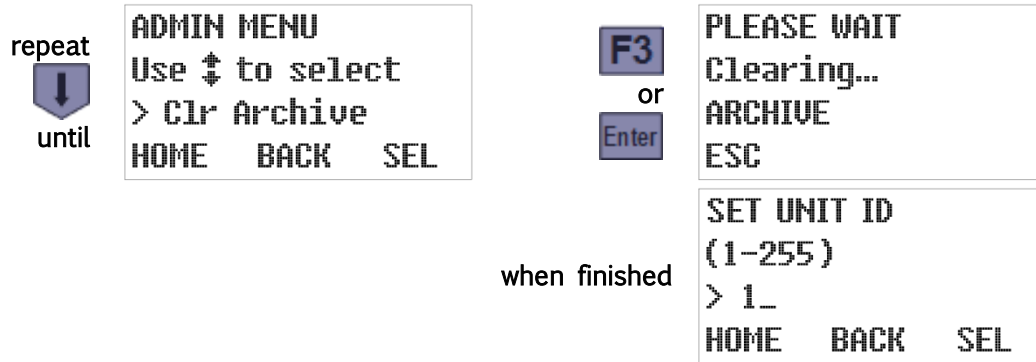
In future versions of the controller software, the Administration Menu's as-yet-unimplemented Download Archive option will allow users to copy that data to USB-connected memory devices or connected computers.

### 3.2.5: Set ID Number

Each sampler can be assigned a unique ID number that will be included in its archival data files and used to identify it via its serial communication channels. To set it:

1. Select the Administration Menu (see page 22), use the Up key to scroll to its Set ID option, and then press the SEL [F3] or Enter key to display the current ID:

<table>
<tr>
<td>press<br>until you see ⬆</td>
<td>ADMIN MENU<br>Use ↕ to select<br>&gt; Set ID<br> HOME   BACK   SEL</td>
<td>F3<br>or<br>Enter</td>
<td>SET UNIT ID<br>(1–255)<br>&gt; 1_<br> HOME   BACK   SEL</td>
</tr>
</table>
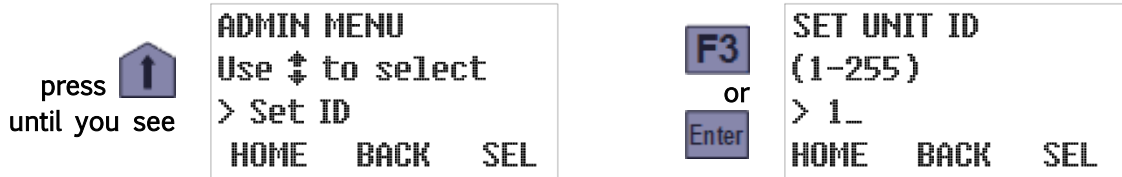
2. Type the new ID by pressing the corresponding numeric keys, then press the SEL [F3] or Enter key to save it and advance to the next Administration Menu option:

<table>
<tr>
<td>5  6</td>
<td>SET UNIT ID<br>(1–255)<br>&gt; 32_<br>UNDO   BACK   SEL</td>
<td>F3<br>or<br>Enter</td>
<td>ADMIN MENU<br>Use ↕ to select<br>&gt; Set Units<br> HOME   BACK   SEL</td>
</tr>
</table>

### 3.2.6: Set Volumetric Units

Each sampler can be configured on-the-fly to display flow volumes and composite bottle sizes in either English or metric units (e.g., gallons or liters). To do so:

1. Select the Administration Menu (see page 22), use the Up key to scroll to its Set Units option, and then press the SEL [F3] or Enter key to display the currently selected option:

<table>
<tr>
<td>⬆</td>
<td>ADMIN MENU<br>Use ↕ to select<br>&gt; Set Units<br> HOME   BACK   SEL</td>
<td>F3<br>or<br>Enter</td>
<td>UNITS<br>Toggle ↕<br>English<br>HOME   BACK   SEL</td>
</tr>
</table>

2. Press the Up or Down key to toggle to this option's alternate value. Then press the SEL [F3] or Enter key to save the displayed setting and advance to the next Administration Menu option:

<table>
<tr>
<td>⬆ or ⬇</td>
<td>UNITS<br>Toggle ↕<br>Metric<br>HOME   BACK   SEL</td>
<td>F3<br>or<br>Enter</td>
<td>ADMIN MENU<br>Use ↕ to select<br>&gt; Set Password<br>HOME   BACK   SEL</td>
</tr>
</table>

# Chapter 4: Sampling Program Configuration

The user interface panel's **Program Menu** is used to configure the Sampling Programs (see Appendix A:) and specify which one is selected to be configured and/or started. Although you can directly view and change individual parameters in each program's set, the menu is designed so that all parameters for each program can be set in one continuous process:

- Each program's parameters are divided into several configuration groups.
- Selecting a specific program displays the first parameter in its first group.
- Pressing the SEL [F3] or Enter key (whether or not you have changed the displayed value) displays the next parameter in the same group.
- Options that are rendered inapplicable by those you have already set are not displayed.
- Setting the last parameter in any group returns you to the Program Configuration menu with the next parameter group selected.

In other words, simply access the Program Menu, select the program you want to configure, and then keep pressing the SEL [F3] or Enter key as you verify or change each setting.

## 4.1: Program Selection

Access the **Main Menu** by pressing the MENU [F3] key and (if so prompted) entering the optional password (see Menu System on page 20). The **Program Menu** should be the first Main Menu option—if not, use the Up or Down key to scroll to that option. Then press the SEL [F3] or Enter key to display the Program Select screen:

```
MAIN MENU
Use ↕ to select
> Program Menu
 HOME   BACK   SEL
```

[F3] or [Enter]

```
PGM SELECT
Use ↕ to select
> Program#1
EXIT   TOP   SEL
```
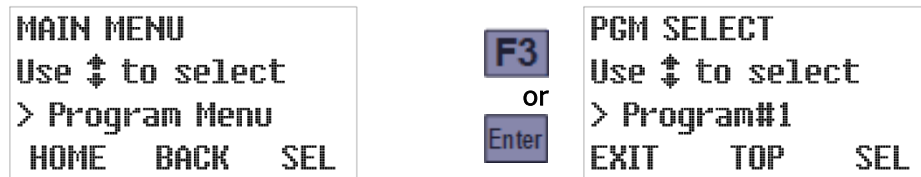
Use the Up or Down key to scroll to the program you want, then press the SEL [F3] or Enter key to select it and display the Program Configuration menu.

```
PGM SELECT
Use ↕ to select
> Program#2
EXIT   TOP   SEL
```

[↓]

[F3] or [Enter]

```
PGM CONFIG
Use ↕ to select
> Cycle
HOME   BACK   SEL
```
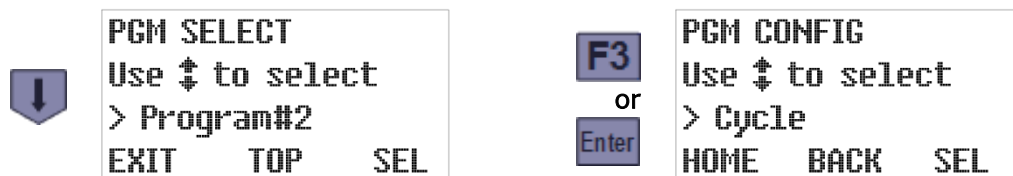
If that program has already been configured and you are just selecting it to be run, press HOME [F1] twice (or BACK [F2] or the Back key three times) to return to the Ready screen:

```
MAIN MENU
Use ↕ to select
> Program Menu
 HOME   BACK   SEL
```

[F1]

[F1]

```
Pgm2 : READY
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```
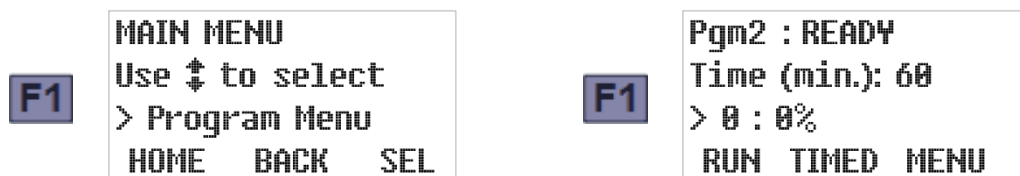
Otherwise, you can configure the selected program by setting the parameters in each of its five configuration groups (see next section).

## 4.2: Program Configuration Groups

The configuration parameters for each program are divided into five groups:

- Sampling Cycle Settings (see page 30)
- Sampling Intervals (see page 34)
- Bottle Options (see page 42)
- Run Options (see page 43)
- Program Events (see page 48)

To access a particular group, select the program you want to configure (see above) to display its Program Configuration menu. Use the Up or Down key to scroll to the parameter group of interest, then press the SEL [F3] or Enter key to display that group's first setting:

```
PGM CONFIG
Use ↕ to select
>Cycle
HOME   BACK   SEL
```
[F3] or [Enter]
```
PREPURGE
(0-99 sec.)
> 15_
HOME   BACK   SEL
```

[↓]
```
PGM CONFIG
Use ↕ to select
>Smpl. Interval
HOME   BACK   SEL
```
[F3] or [Enter]
```
SMPL. INTERVAL
Use ↕ to select
>Time
HOME   BACK   SEL
```

[↓]
```
PGM CONFIG
Use ↕ to select
>Bottle Opts.
HOME   BACK   SEL
```
[F3] or [Enter]
```
SAMPLE TYPE
Use ↕ to select
>Composite
HOME   BACK   SEL
```

[↓]
```
PGM CONFIG
Use ↕ to select
>Pgm. Run Opts.
HOME   BACK   SEL
```
[F3] or [Enter]
```
AUTO RERUN
Toggle ↕
>Enable
HOME   BACK   SEL
```

[↓]
```
PGM CONFIG
Use ↕ to select
>Pgm. Events
HOME   BACK   SEL
```
[F3] or [Enter]
```
PGM EVENT #1
Use ↕ to select
>End List
HOME   BACK   SEL
```

You can return to the Program Configuration menu from any parameter screen by pressing the HOME [F1] key, and then to the Program Selection screen by pressing the BACK [F2] key:

[F1]
```
PGM CONFIG
Use ↕ to select
>Cycle
HOME   BACK   SEL
```

[F2]
```
PGM SELECT
Use ↕ to select
> Program#1
EXIT    TOP    SEL
```

## 4.3: Sampling Cycle Settings

This group includes the parameters that configure the sampling cycle (see page 60):

- pre-sampling purge duration (see page 30)
- sampling time (see page 31)
- post-sampling purge duration (see page 31)
- line conditioning rinses (see page 32)
- incomplete sample recycling (see page 33)
- consecutive sampling (see page 33)

To access those parameters, select the program you want to configure (see page 28) and press the SEL [F3] or Enter key to display its first parameter group (Cycle). Then press the SEL [F3] or Enter key again to display that group's first setting:

```
PGM SELECT
Use ↕ to select
> Program#2
EXIT    TOP    SEL
```

[F3] or [Enter]

```
PGM CONFIG
Use ↕ to select
> Cycle
HOME   BACK    SEL
```

[F3] or [Enter]

```
PREPURGE
(0-99 sec.)
> 15_
HOME   BACK    SEL
```
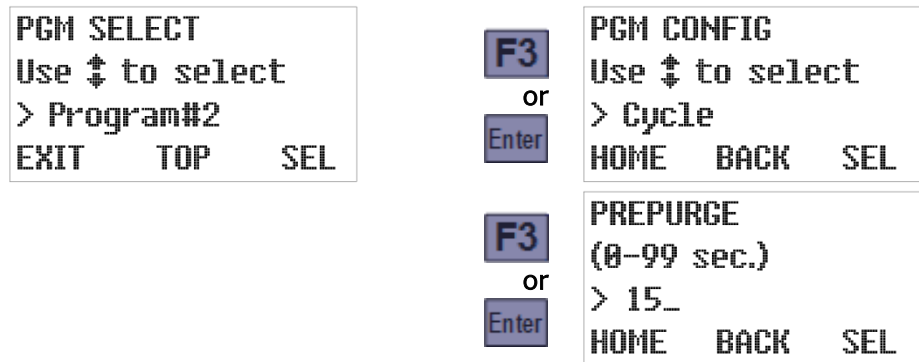
### 4.3.1: Pre-Sampling Purge Duration

This parameter specifies the number of seconds the chamber will be pressurized to clear the sampling tube prior to drawing a sample. To determine and optionally change its value:

1. Select the Cycle parameter group to display this parameter's current value (see above).

2. If desired, type a new prepurge duration by pressing the corresponding numeric keys. When you type the first digit, the old value is erased and the F1 prompt changes from HOME to UNDO. You can then press the UNDO [F1] key to start over, or the BACK [F2] or Back key to delete the most-recently typed digit.

3. Press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Sampling Cycle group parameter.

To change the prepurge duration to 20 seconds, for example:

[2] [0]

```
PREPURGE
(0-99 sec.)
> 20_
UNDO   BACK    SEL
```

[F3] or [Enter]

```
SMPL SECONDS
(1-200) sec.
>25_
HOME   BACK    SEL
```

### 4.3.2: Sampling Time

This parameter specifies the maximum number of seconds the chamber will be depressurized to draw in each wastewater sample (if the liquid sensor is not triggered first). To determine and optionally change its value:

5. Accept or change the Prepurge duration, which will display this parameter's current value.

6. If desired, type a new sampling time by pressing the corresponding numeric keys. When you type the first digit, the old value is erased and the F1 prompt changes from HOME to UNDO. You can then press the UNDO [F1] key to start over, or the BACK [F2] or Back key to delete the most-recently typed digit.

7. Press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Sampling Cycle group parameter.

To change the sample size to 45 seconds, for example:

```
┌─────────────────────┐          ┌─────────────────────┐
│ SMPL SECONDS        │  ┌────┐  │ POSTPURGE           │
│ (1-200) sec.        │  │ F3 │  │ (10-99 sec.)        │
│ >45_                │  └────┘  │ > 10_               │
│                     │   or     │                     │
│ UNDO   BACK   SEL   │ ┌─────┐  │ HOME   BACK   SEL   │
└─────────────────────┘ │Enter│  └─────────────────────┘
  (4) (5)               └─────┘
```

✍  *The sampling time should exceed the number of seconds needed to raise the water level in the chamber up to the liquid-sensing electrodes.*

### 4.3.3: Post-Sampling Purge Duration

This parameter specifies the number of seconds the chamber will be pressurized after each sample in order to force excess water from the chamber and clear the intake tube prior to discharging the samples. To determine and optionally change its value:

1. Accept or change the Sample Size, which will display this parameter's current value.

2. If desired, type a new postpurge duration by pressing the corresponding numeric keys. When you type the first digit, the old value will be erased and the F1 prompt will change from HOME to UNDO. You can then press the UNDO [F1] key to start over, or the BACK [F2] or Back key to delete the most-recently typed digit.

3. Press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Sampling Cycle group parameter.

To change the postpurge time to 18 seconds, for example:

```
┌─────────────────────┐          ┌─────────────────────┐
│ POSTPURGE           │  ┌────┐  │ NUM. RINSES         │
│ (10-99 sec.)        │  │ F3 │  │ (0-4)               │
│ > 18_               │  └────┘  │ > 0_                │
│                     │   or     │                     │
│ UNDO   BACK   SEL   │ ┌─────┐  │ HOME   BACK   SEL   │
└─────────────────────┘ │Enter│  └─────────────────────┘
  (1) (8)               └─────┘
```

✍  *The subsequent discharge phase will continue to pressurize the chamber for another 12 seconds. To avoid spraying the sample out under high pressure, the postpurge must clear all water from the intake line.*

## 4.3.4:  Line Conditioning Rinses

This feature can be configured to rinse out the intake line up to four times prior to drawing each sample. To enable it, specify a non-zero number of rinses and then set its pressure and vacuum phase durations:

1. View/change the Postpurge Duration and then press the SEL [F3] or Enter key to display the currently-specified number of rinses (see above).

2. Type the desired value by pressing the corresponding numeric key. Then press the SEL [F3] or Enter key to save the displayed number of rinses:

   - Setting it to 0 disables this feature, in which case the screens for setting its pressure and vacuum phase durations will not be displayed:

   

   - Setting it to any other value would display the current pressure phase duration:

   

3. Type the new pressure time by pressing the corresponding numeric keys. Then press the SEL [F3] or Enter key to save the displayed pressure time and display the current vacuum phase duration:
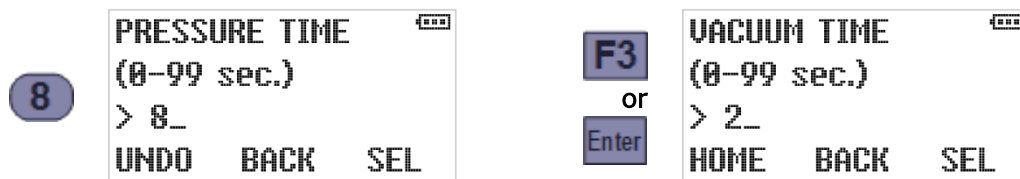
   

4. Type the new vacuum time by pressing the corresponding numeric keys. Then press the SEL [F3] or Enter key to save the displayed vacuum time and advance to the next Sampling Cycle group parameter:
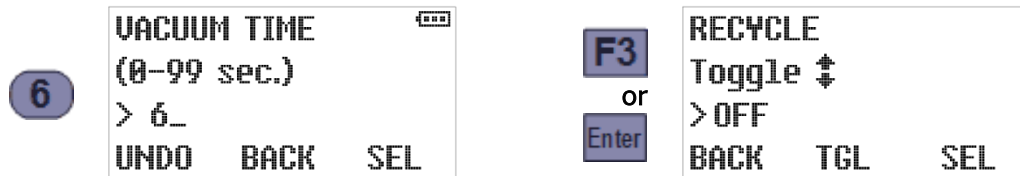
   

✍ *The vacuum phase(s) should be brief enough to avoid drawing water into the sample chamber.*

### 4.3.5:  Incomplete Sample Recycling

If this feature is enabled, the controller will "recycle" the rinse, prepurge and vacuum stages of the sampling cycle as many as four times if the first cycle fails to fill the sample chamber. To enable or disable it:

1. View/change the rinse settings and then press the SEL [F3] or Enter key to display the current status of this feature.

2. You can enable this feature by pressing the 1 key, disable it by pressing the 0 key, or toggle its status by pressing the TGL [F2], Up or Down key.

3. Press the SEL [F3] or Enter key to save the displayed status and advance to the next Sampling Cycle group parameter.



### 4.3.6:  Consecutive Sampling

This parameter specifies the number of samples to be drawn at the end of each time or flow interval. If you set it to more than one, the full sampling cycle (including recycling if needed) will be repeated the specified number of times for each interval.

You might want to specify more than one and configure appropriate bottle options (see page 42) for either of two reasons:

- Drawing several samples one after the other and discharging them to the same container effectively allows you to collect samples larger than the 900 ml maximum size.

- Drawing consecutive samples and discharging them to different containers allows you to save and process duplicate samples for verification purposes.

To view/change the number of samples to be drawn per interval:

1. View/change the recycling settings and then press the SEL [F3] or Enter key to display the current value of this parameter.

2. Type the new value by pressing the corresponding numeric keys. Then press the SEL [F3] or Enter key to save the displayed value and return to the Program Configuration menu scrolled to the next parameter group.

To configure a sample to draw two samples per interval, for example:

## 4.4: Sampling Intervals

This group includes one main parameter that specifies the type of sampling interval(s) the controller will use, and several parameter groups that configure those interval(s).

To directly access the sampling interval type, select the program you want to configure (see page 28), then press the Down key to scroll to the Sample Intervals group:

```
            PGM CONFIG                      PGM CONFIG
[F3]        Use ↕ to select       [↓]       Use ↕ to select
 or         >Cycle                          >Smpl. Interval
[Enter]     HOME   BACK   SEL               HOME   BACK   SEL
```
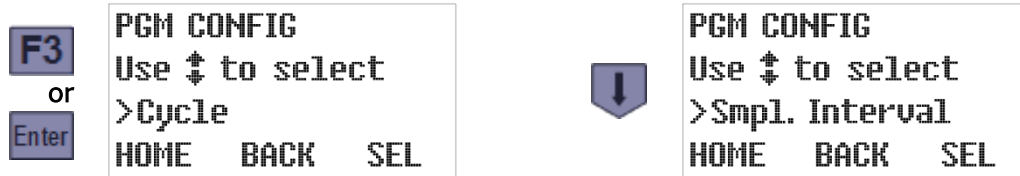
Press the SEL [F3] or Enter key to display the currently-configured interval type, then use the Down or Up key to scroll to the desired new setting. With that value displayed, press the SEL [F3] or Enter key to display the first parameter for that interval type:

```
            SMPL. INTERVAL                  TIME OPTION
[F3]        Use ↕ to select       [F3]      Use ↕ to select
 or         >Time                  or        >Time Variable
[Enter]     HOME   BACK   SEL      [Enter]   HOME   BACK   SEL


            SMPL. INTERVAL                  FLOW TYPE
[↓]         Use ↕ to select       [F3]      Use ↕ to select
            >Flow                  or        >Pulses
            HOME   BACK   SEL      [Enter]   HOME   BACK   SEL


            SMPL. INTERVAL                  TIME OPTION
[↓]         Use ↕ to select       [F3]      Use ↕ to select
            >Time+Flow             or        >Time Variable
            HOME   BACK   SEL      [Enter]   HOME   BACK   SEL
```
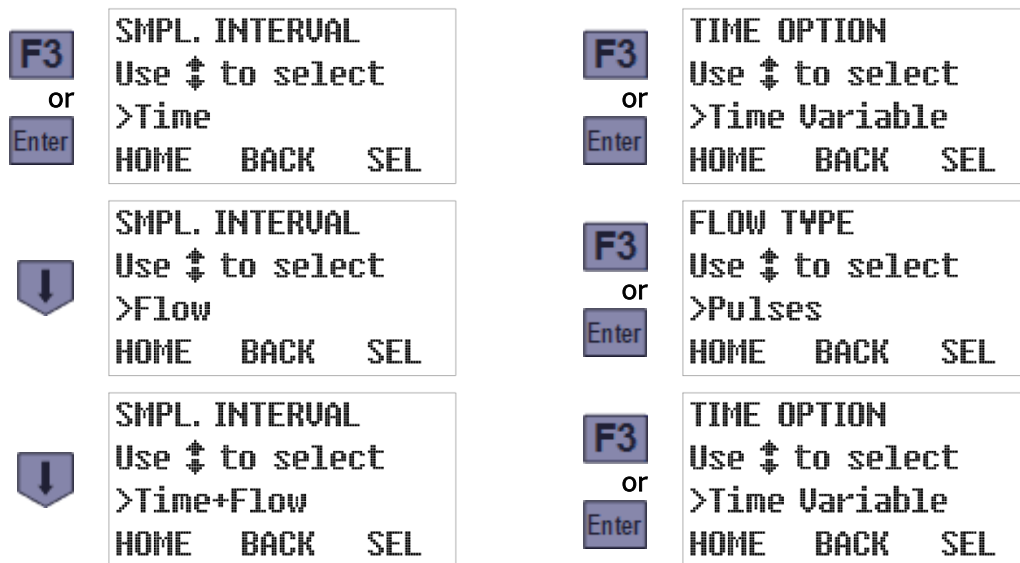
### 4.4.1:  Timed Interval Sampling

Selecting the Time sampling interval option configures the controller to wait a specified number of minutes after initiating one sample before initiating the next:

- If the samples are to be drawn at regular intervals, select the Time Fixed option and then set the fixed length of those intervals. For example, you might configure a program to draw samples every 60 minutes until it is stopped.

- Otherwise, select the Time Variable option and then specify no more than 24 time intervals. One sample will be drawn at the end of each specified interval, after which the last interval will be repeated until the program is stopped. For example, you might configure a program to draw its first sample an hour after starting and then switch to 30 minute intervals.

To select the desired option:

1. Scroll the Sample Interval parameter's value to Time (see above), then press the SEL [F3] or Enter key to save that value and display the currently-selected Time Option:
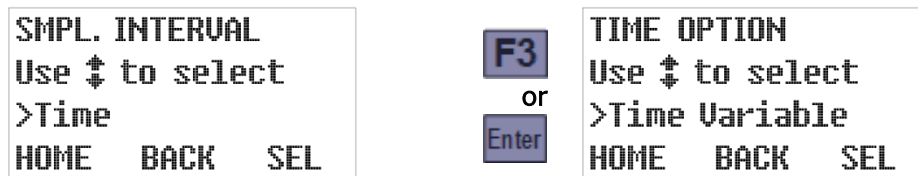
```
SMPL. INTERVAL          TIME OPTION
Use ↕ to select    F3   Use ↕ to select
>Time              or   >Time Variable
HOME   BACK   SEL  Enter HOME   BACK   SEL
```

2. Use the Up or Down key to toggle between that parameter's two possible values, then press the SEL [F3] or Enter key to save the displayed value and display its first setting:

```
TIME OPTION            SMPL MIN
Use ↕ to select    F3  (1-9999)
>Time Fixed        or  > 30_
HOME   BACK   SEL  Enter HOME   BACK   SEL

TIME OPTION            SMPL MIN #1
Use ↕ to select    F3  (1-9999)
>Time Variable     or  > 30_
HOME   BACK   SEL  Enter HOME   BACK   SEL
```
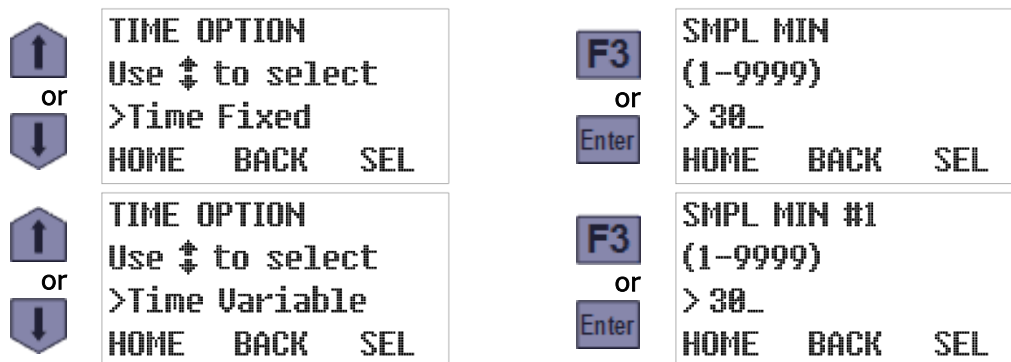
### 4.4.1.1:  Fixed Length Time Intervals

As shown above, selecting the Time Fixed option displays its first (and only) parameter—the length of time it waits between initiating any sample and the next. To change it, type the new duration (20 minutes, for example) by pressing the corresponding numeric keys. Then press the SEL [F3] or Enter key to save the displayed Sample Minutes (changed or not) and display the Program Configuration menu's Bottle Options screen:

```
SMPL MIN               PGM CONFIG
(1-9999)           F3  Use ↕ to select
> 20_              or  > Bottle Opts.
UNDO   BACK   SEL  Enter HOME   BACK   SEL
```

### 4.4.1.2: Variable Length Time Intervals

As shown previously, selecting the Time Variable option displays the first of 24 Sample Minutes parameters—the length of time it will wait before drawing its first sample. To change its value, type the new duration (20 minutes, for example) by pressing the corresponding numeric keys. Press the SEL [F3] or Enter key to save that value (changed or not) and display the next:

```
SMPL MIN #1        F3     SMPL MIN #2
(1-9999)           or     (0-9999)0-end
> 20_             Enter    > 60_
UNDO   BACK   SEL         HOME   BACK   SEL
```

The digit keys can then be used to change the number of minutes the program would wait between initiating its first and second samples. Pressing the SEL [F3] or Enter key would again save the displayed value and display the next. And so on until pressing the SEL [F3] or Enter key while Sample Minutes #24 is displayed restores the Program Configuration menu scrolled to its next group (Bottle Options).

```
SMPL MIN #24       F3     PGM CONFIG
(1-9999)0-end      or     Use ↕ to select
> 60_             Enter    > Bottle Opts.
UNDO   BACK   SEL         HOME   BACK   SEL
```

However, you do not need to set all 24 intervals—setting any one of them to 0 configures the program to use the value of the preceding parameter for all subsequent intervals. For example, setting Sample Minutes #5 to 120 and Sample Minutes Minutes #6 to 0 would have the same effect as setting Sample Minutes #6 through #24 all to 120 (the value of Sample Minutes #5):

```
SMPL MIN #5        F3     SMPL MIN #6
(0-9999)0-end      or     (0-9999)0-end
> 120_            Enter    > 150_
UNDO   BACK   SEL         HOME   BACK   SEL

SMPL MIN #6        F3     PGM CONFIG
(0-9999)0-end      or     Use ↕ to select
> 0_              Enter    > Bottle Opts.
UNDO   BACK   SEL         HOME   BACK   SEL
```
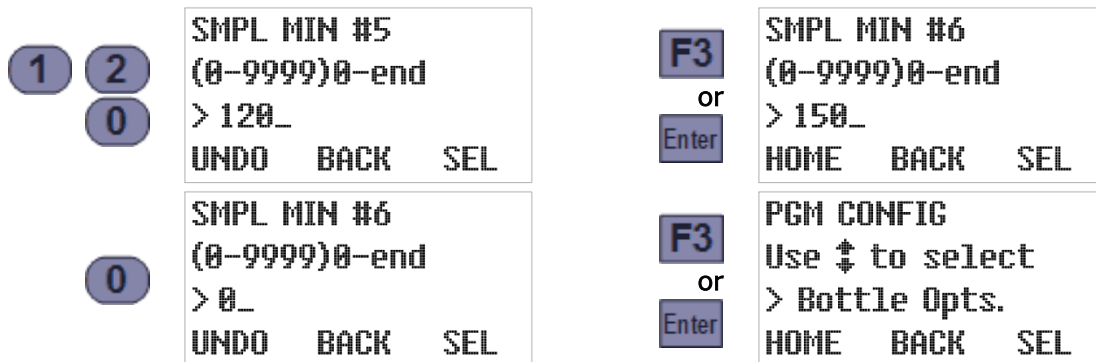
## 4.4.2: Flow Interval Sampling

Selecting the Flow sampling interval option configures the controller to initiate sampling as its accumulated flow measurement increases by specified volumes. You must then:

- Select the flow input type (4-20 mA, 0-5 Vdc, 0-10 Vdc, or discrete pulse).

- Specify the flow rate corresponding to the maximum signal (analog input only).

- Specify the incremental flow between the initiation of one sample and the next:

  - If the samples are to be drawn at regular intervals (for example, after each 5000 gallon flow increment), select the Flow Fixed option and set the fixed length of those intervals.
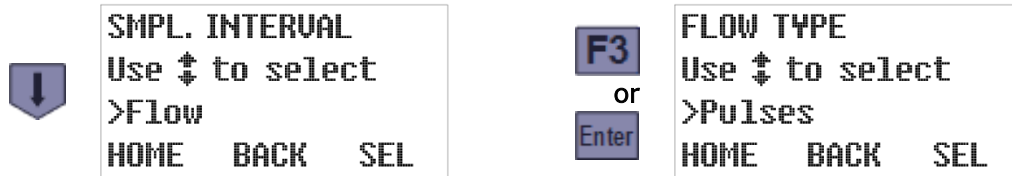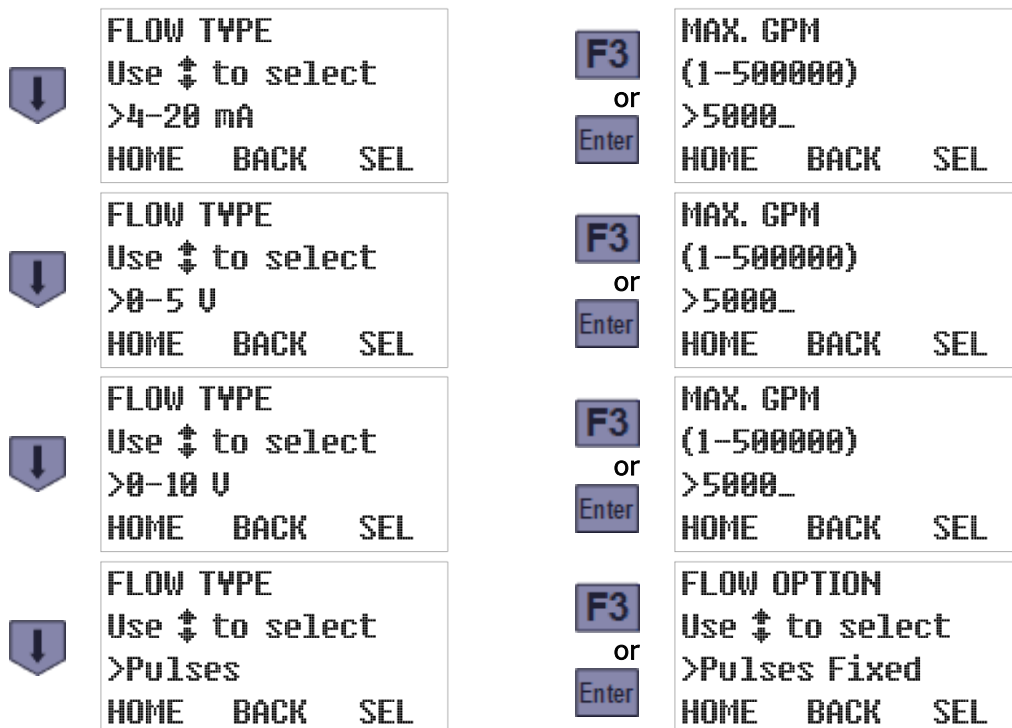
  - Otherwise, select the Flow Variable option and specify no more than 24 flow intervals. One sample will be drawn at the end of each specified interval, after which the last interval will be repeated until the program is stopped. For example, you might configure a program to draw its first sample when the total flow reaches 5000 gallons, and then switch to 2500 gallon intervals (i.e., after 7500, 10000 and so on total gallons).

**Flow volumes are specified in either gallons or liters**, depending on the current Administration Menu Units Setting (see page 27).

**To specify the input type**, scroll the Sample Interval parameter's value to Flow, then press the SEL [F3] or Enter key to save that value and display the currently-selected Flow Type:

```
          SMPL. INTERVAL                        FLOW TYPE
   ↓      Use ↕ to select      F3     or        Use ↕ to select
          >Flow                  Enter          >Pulses
          HOME   BACK   SEL                      HOME   BACK   SEL
```

Use the Up or Down key to scroll to the desired type, then press the SEL [F3] or Enter key to save it and display its first setting:

```
          FLOW TYPE                             MAX. GPM
   ↓      Use ↕ to select      F3     or        (1-500000)
          >4-20 mA               Enter          >5000_
          HOME   BACK   SEL                      HOME   BACK   SEL

          FLOW TYPE                             MAX. GPM
   ↓      Use ↕ to select      F3     or        (1-500000)
          >0-5 V                Enter          >5000_
          HOME   BACK   SEL                      HOME   BACK   SEL

          FLOW TYPE                             MAX. GPM
   ↓      Use ↕ to select      F3     or        (1-500000)
          >0-10 V               Enter          >5000_
          HOME   BACK   SEL                      HOME   BACK   SEL

          FLOW TYPE                             FLOW OPTION
   ↓      Use ↕ to select      F3     or        Use ↕ to select
          >Pulses               Enter          >Pulses Fixed
          HOME   BACK   SEL                      HOME   BACK   SEL
```

### 4.4.2.1: Analog Flow Input

If you select one of the analog inputs types (4-20 mA, 0-5 Vdc, or 0-10 Vdc), samples will be initiated an integer number of gallons apart. Thus, you must specify the flow rate (in gallons per minute) corresponding to the transmitter's maximum signal, after which you can specify the sampling intervals in gallons:

1. Select the flow input type (as described above) to display the current maximum flow rate setting (the rate at which the transmitter would transmit its maximum signal). This example shows the 0-10 Vdc option, but the resulting screen would be the same for the 0-5 Vdc or 4-20 mA options as well:

```
FLOW TYPE
Use ↕ to select
>0-10 V
HOME    BACK    SEL
```
F3 or Enter
```
MAX. GPM
(1-500000)
>5000_
HOME    BACK    SEL
```
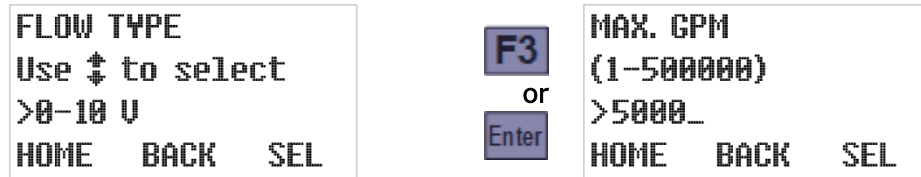
2. To change that setting, type a new maximum flow rate by pressing the corresponding numeric keys. When you type the first digit, the old value will be erased and the F1 prompt will change from HOME to UNDO. You can then press the UNDO [F1] key to start over, or the BACK [F2] or Back key to delete the most-recently typed digit.

3. Press the SEL [F3] or Enter key to save the displayed value (changed or not) and display the current flow option (fixed or variable sampling intervals). As an example:

1 5 0 0
```
MAX. GPM
(1-500000)
>1500_
UNDO    BACK    SEL
```
F3 or Enter
```
GALLONS OPTION
Use ↕ to select
>Gallons Variable
HOME    BACK    SEL
```

The above example assumes you are using a flow transmitter whose signal varies from 0 Vdc at no flow up to 10 Vdc at 1500 gallons per minute. A 1.0 Vdc signal would then indicate the flow was 150 gpm, so the controller would then calculate the instantaneous flow by multiplying 150 by the input signal in volts.

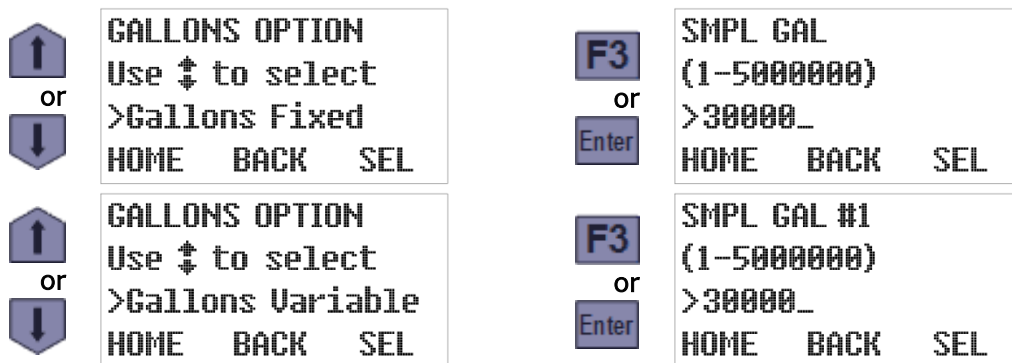4. Use the Up or Down key to toggle between the Flow Option's two possible values, then press the SEL [F3] or Enter key to save the displayed value and display its first setting:

↑ or ↓
```
GALLONS OPTION
Use ↕ to select
>Gallons Fixed
HOME    BACK    SEL
```
F3 or Enter
```
SMPL GAL
(1-5000000)
>30000_
HOME    BACK    SEL
```

↑ or ↓
```
GALLONS OPTION
Use ↕ to select
>Gallons Variable
HOME    BACK    SEL
```
F3 or Enter
```
SMPL GAL #1
(1-5000000)
>30000_
HOME    BACK    SEL
```

### 4.4.2.1.1:  Fixed Volume Flow Intervals

As shown previously, selecting the Flow Fixed option displays its only parameter—the specified change in flow between samples. To change that interval, type a new value by pressing the corresponding numeric keys. Then press the SEL [F3] or Enter key to save the displayed Sample Gallons (changed or not) and display the Program Configuration menu's next screen:

```
2 4      SMPL GAL              F3       PGM CONFIG
0 0      (1-5000000)                    Use ↕ to select
                                or
         >2400_                         > Bottle Opts.
                              Enter
         UNDO   BACK   SEL             HOME   BACK   SEL
```
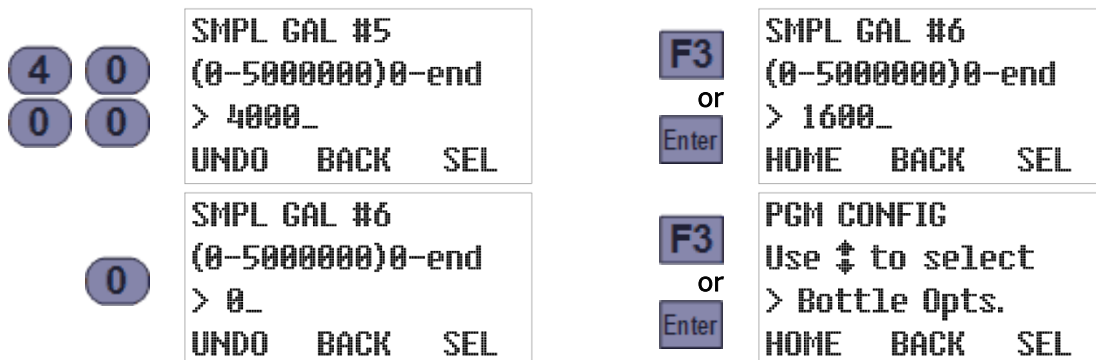
### 4.4.2.1.2:  Variable Volume Flow Intervals

As shown previously, selecting the Flow Variable option displays the first of 24 Sample Gallons parameters—the incremental flow at which the controller will draw its first sample. To change it, type the new flow increment (2400 gallons, for example) by pressing the corresponding numeric keys. Press the SEL [F3] or Enter key to save that value (changed or not) and display the next:

```
2 4      SMPL GAL #1           F3       SMPL GAL #2
0 0      (1-5000000)                    (0-5000000)0-end
                                or
         > 2400_                        > 4000_
                              Enter
         UNDO   BACK   SEL             HOME   BACK   SEL
```

The digit keys can then be used to change the number of gallons the program would measure between initiating its first and second samples. Pressing the SEL [F3] or Enter key would again save the displayed value and display the next. And so on until pressing the SEL [F3] or Enter key while Sample Gallons #24 is displayed restores the Program Configuration menu scrolled to its next group (Bottle Options):

```
3 2      SMPL GAL #24          F3       PGM CONFIG
0 0      (0-5000000)0-end               Use ↕ to select
                                or
         > 3200_                        > Bottle Opts.
                              Enter
         UNDO   BACK   SEL             HOME   BACK   SEL
```

However, you do not need to set all 24 intervals—setting any one of them to 0 configures the program to use the value of the preceding parameter for all subsequent intervals. For example, setting Sample Gallons #5 to 4000 and Sample Gallons #6 to 0 would have the same effect as setting Sample Gallons #6 through #24 all to 4000 (the value of Sample Gallons #5):

```
4 0      SMPL GAL #5           F3       SMPL GAL #6
0 0      (0-5000000)0-end               (0-5000000)0-end
                                or
         > 4000_                        > 1600_
                              Enter
         UNDO   BACK   SEL             HOME   BACK   SEL
```

```
         SMPL GAL #6           F3       PGM CONFIG
         (0-5000000)0-end               Use ↕ to select
                                or
  0      > 0_                           > Bottle Opts.
                              Enter
         UNDO   BACK   SEL             HOME   BACK   SEL
```

### 4.4.2.2:  Pulsing Flow Input

The pulse flow type is for meters that transmit discrete pulses at specific flow intervals. For example, a meter that sends one pulse for every 100 gallons of flow will transmit its first pulse when the total flow it has measured reaches 100 gallons, a second at 200 gallons, and so on.

When this flow type is selected, you must configure the controller to draw samples at intervals that are an integer number of pulses apart (which correspond to the flow increments at which you really want it to draw samples):

1. Select the pulse flow type (see page 37) to display the current value of the flow option (fixed or variable intervals):

```
FLOW TYPE
Use ↕ to select
>Pulses
HOME    BACK    SEL
```

[F3] or [Enter]

```
FLOW OPTION
Use ↕ to select
>Pulses Variable
HOME    BACK    SEL
```

2. Use the Up or Down key to toggle between that parameter's two possible values, then press the SEL [F3] or Enter key to save the displayed value and display its first setting:

[↑] or [↓]

```
FLOW OPTION
Use ↕ to select
>Pulses Fixed
HOME    BACK    SEL
```

[F3] or [Enter]

```
SMPL PULSES
(1-9999)
>320_
HOME    BACK    SEL
```

[↑] or [↓]

```
FLOW OPTION
Use ↕ to select
>Pulses Variable
HOME    BACK    SEL
```

[F3] or [Enter]

```
SMPL PULSES #1
(1-9999)
>320_
HOME    BACK    SEL
```

### 4.4.2.2.1:  Fixed Pulses Flow Intervals

As shown above, selecting the Pulses Fixed option displays its only parameter—the specified number of input pulses between samples. To change that setting, type the new interval pulse count (240, for example) by pressing the corresponding numeric keys. Then press the SEL [F3] or Enter key to save the displayed Sample Pulses (changed or not) and display the Program Configuration menu's next screen:

[2] [4] [0]

```
SMPL PULSES
(1-9999)
>320_
HOME    BACK    SEL
```

[F3] or [Enter]

```
PGM CONFIG
Use ↕ to select
> Bottle Opts.
HOME    BACK    SEL
```
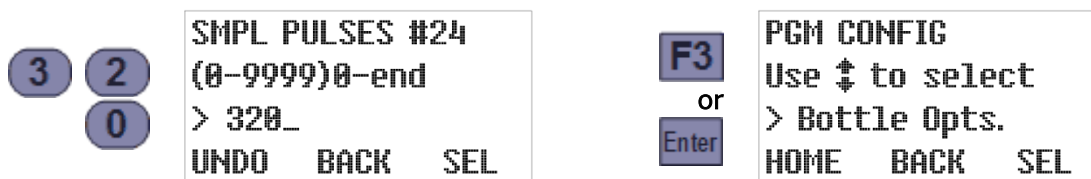
You can repurpose the flow-pulse input to initiate a sample each time a connected PLC or other external device closes its circuit (see page 75). In that case, you would of course set this parameter to 1.

### 4.4.2.2.2:  Variable Pulses Flow Intervals
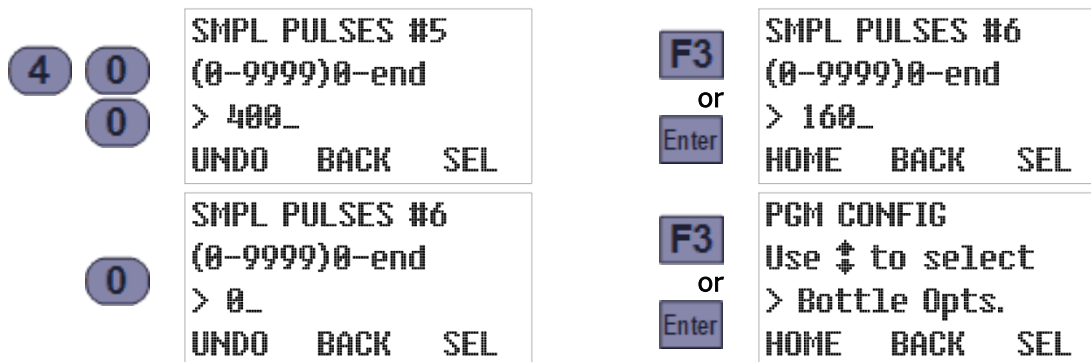
Selecting the Pulses Variable option displays the first of 24 Sample Pulses parameters—the number of pulses at which the controller will draw its first sample. To change it, type the new first sample pulse count (240, for example) by pressing the corresponding numeric keys. Press the SEL [F3] or Enter key to save that value (changed or not) and display the next:

```
  2   4      SMPL PULSES #1         F3     SMPL PULSES #2
             (1-9999)                      (0-9999)0-end
      0       >320_                 or      > 480_
             HOME   BACK   SEL     Enter   HOME   BACK   SEL
```

The digit keys can then be used to change the number of pulses the program would wait between initiating its first and second samples. Pressing the SEL [F3] or Enter key would again save the displayed value and display the next. And so on until pressing the SEL [F3] or Enter key while Sample Pulses #24 is displayed restores the Program Configuration menu scrolled to its next group (Bottle Options):

```
  3   2      SMPL PULSES #24        F3     PGM CONFIG
             (0-9999)0-end                 Use ↕ to select
      0       > 320_                or      > Bottle Opts.
             UNDO   BACK   SEL     Enter   HOME   BACK   SEL
```

However, you do not need to set all 24 intervals—setting any one of them to 0 configures the program to use the value of the preceding parameter for all subsequent intervals. For example, setting Sample Pulses #5 to 400 and Sample Pulses #6 to 0 would have the same effect as setting Sample Pulses #6 through #24 all to 400 (the value of Sample Pulses #5):

```
  4   0      SMPL PULSES #5         F3     SMPL PULSES #6
             (0-9999)0-end                 (0-9999)0-end
      0       > 400_                or      > 160_
             UNDO   BACK   SEL     Enter   HOME   BACK   SEL

             SMPL PULSES #6         F3     PGM CONFIG
             (0-9999)0-end                 Use ↕ to select
      0       > 0_                  or      > Bottle Opts.
             UNDO   BACK   SEL     Enter   HOME   BACK   SEL
```

### 4.4.3:  Time+Flow Interval Sampling

Selecting the Time+Flow sampling interval option configures the controller to draw samples at either time or flow intervals, which ever proves to be the soonest for each sample. In other words, it accumulates both the time and the flow since the last sample was initiated, and initiates the next (and resets both counters) as soon as either reaches its configured target.

When this option is selected, you will be prompted to:

1. select the Time Option and set its associated parameters (see page 35), and then

2. select the Flow Type and Option and set their associated parameters (see page 37).
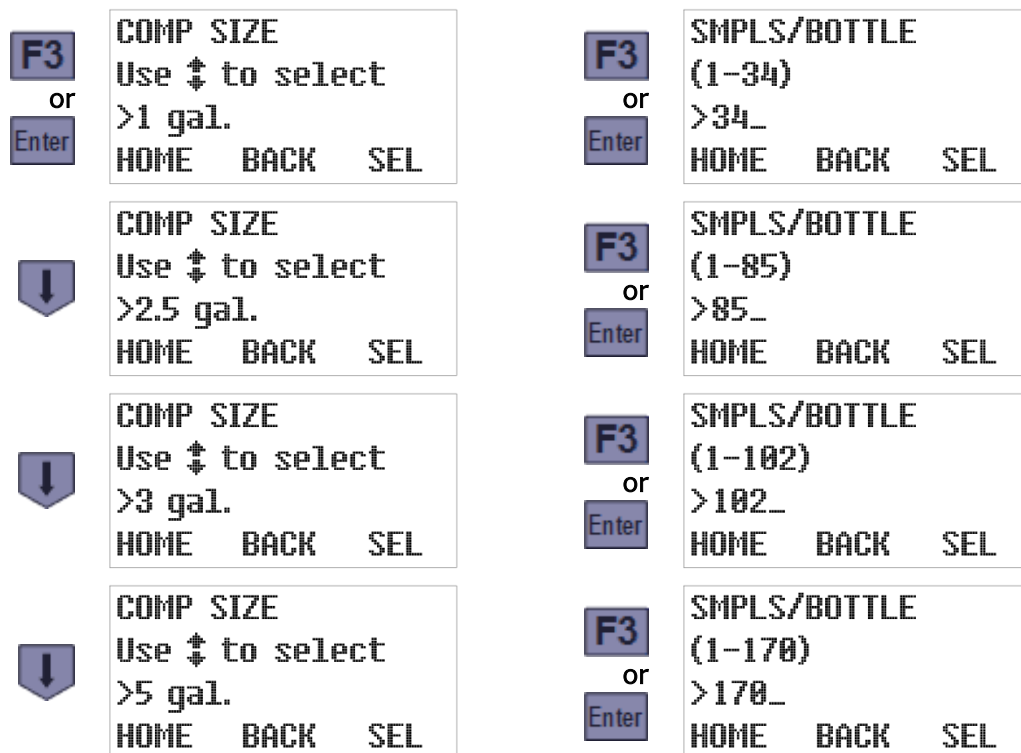
## 4.5: Bottle Options

This group includes one main parameter that specifies which type of sample containers your sampler has (see page 13), and a set of parameters for each possible type. To directly access that main parameter, select the program you want to configure (see page 28), then press the Down key twice to scroll to the Bottle Options group:

```
PGM CONFIG
Use ↕ to select
> Cycle
HOME   BACK   SEL
```
F3 or Enter

```
PGM CONFIG
Use ↕ to select
> Bottle Opts.
HOME   BACK   SEL
```

Press the SEL [F3] or Enter key to display the currently-selected storage type. For Wall-Mount Samplers, this will always be Composite and cannot be changed. Pressing the SEL [F3] or Enter key will then display the currently-configured container size:

F3 or Enter
```
SAMPLE TYPE
Use ↕ to select
>Composite
HOME   BACK   SEL
```

F3 or Enter
```
COMP SIZE
Use ↕ to select
>1 gal.
HOME   BACK   SEL
```

**That size will be shown in either liters or gallons**, depending on the current Administration Menu Units Setting (see page 27). Use the Up or Down key to scroll to the container size you are using, then press the SEL [F3] or Enter key to save that setting and display the number of samples that container is currently set to receive (note that the maximum is calculated by dividing 90 percent of the container volume by the previously-set sample size):

F3 or Enter
```
COMP SIZE
Use ↕ to select
>1 gal.
HOME   BACK   SEL
```

F3 or Enter
```
SMPLS/BOTTLE
(1-34)
>34_
HOME   BACK   SEL
```

↓
```
COMP SIZE
Use ↕ to select
>2.5 gal.
HOME   BACK   SEL
```

F3 or Enter
```
SMPLS/BOTTLE
(1-85)
>85_
HOME   BACK   SEL
```

↓
```
COMP SIZE
Use ↕ to select
>3 gal.
HOME   BACK   SEL
```

F3 or Enter
```
SMPLS/BOTTLE
(1-102)
>102_
HOME   BACK   SEL
```

↓
```
COMP SIZE
Use ↕ to select
>5 gal.
HOME   BACK   SEL
```

F3 or Enter
```
SMPLS/BOTTLE
(1-170)
>170_
HOME   BACK   SEL
```

The digit keys can then be used to change the number of samples the program will discharge to the container before automatically stopping itself. Pressing the SEL [F3] or Enter key will save the displayed value and display the Program Configuration menu with its next group selected:
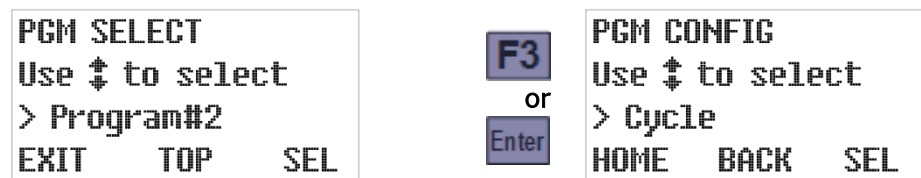
```
        SMPLS/BOTTLE           F3      PGM CONFIG
 7  5   (1-85)          or     Use ↕ to select
        >75_                           > Pgm. Run Opts.
        UNDO  BACK  SEL    Enter       HOME  BACK  SEL
```

✍ *This setting might be automatically reduced if you subsequently select a smaller container or increase the configured sample size.*

## 4.6: Program Run Options

This group includes the parameters that configure the following features:

- automatic rerun (see page 44)
- delayed starting (see page 44)
- float enable (see page 45)
- fault enable (see page 45)
- timed stop (see page 46)
- bottle limit override (see page 47)

To directly access those parameters, select the program you want to configure (see page 28):

```
        PGM SELECT             F3      PGM CONFIG
        Use ↕ to select   or   Use ↕ to select
        > Program#2                    > Cycle
        EXIT  TOP  SEL     Enter       HOME  BACK  SEL
```

Press the Up key twice to scroll to the Program Configuration menu's Run Options group, then press the SEL [F3] or Enter key again to display that group's first setting:

```
        PGM CONFIG             F3      AUTO RERUN
 ↑  ↑   Use ↕ to select    or  Toggle ↕
        > Pgm. Run Opts.               >Disable
        HOME  BACK  SEL    Enter       HOME  BACK  SEL
```

### 4.6.1:  Automatic Rerun

By default, the sampling program must be manually reset each time it stops, which indicates to the controller that the sample containers have been emptied. If you configure a Start Event (see page 48) to repeatedly start and stop the sampler, enabling the Automatic Rerun parameter as well would enable the program to restart without being reset.

✍   *You should not enable this parameter unless you are scheduling automatic start events.*

To view and optionally change this setting:

1. Select the Run Options group to display this parameter's current value (see above).

2. If desired, press the Up or Down key to toggle it on or off, then press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Run Options group parameter.

```
                 AUTO RERUN                      DELAY START
   ↑             Toggle ↕                        (0-9999 min.)
      or                          or
   ↓             >Enable                         > 0_
                 HOME   BACK   SEL               HOME   BACK   SEL
```
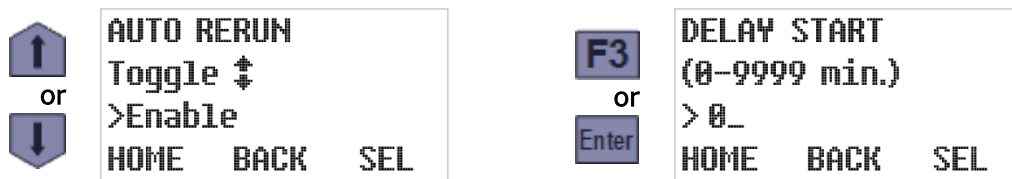
### 4.6.2:  Delayed Start

By default, starting a sampling program will immediately initiate its interval timers. If it is set up to draw samples at one hour intervals, for example, the first will be taken one hour after the program is started. You can configure it to wait longer than that by setting a non-zero start delay. Other methods of delaying the first sample are to use the Float Enable parameter (see below), schedule regular automatic Start Events (see page 48), or manually set up one-time Timed Starts (see page 55).

To view and optionally change this setting:

1. Accept or change the Auto Rerun setting, which will display this parameter's current value.

2. If desired, type a new delay duration by pressing the corresponding numeric keys. When you type the first digit, the old value is erased and the F1 prompt changes from HOME to UNDO. You can then press the UNDO [F1] key to start over, or the BACK [F2] or Back key to delete the most-recently typed digit.

3. Press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Run Option group parameter.

To change the start delay to 360 minutes, for example:

```
                 DELAY START                     FAULT OPTION
   3   6         (0-9999 min.)                    Toggle ↕
      0                          or
                 > 360_                          >Disable
                 UNDO   BACK   SEL               HOME   BACK   SEL
```

### 4.6.3: Fault Option

This parameter specifies whether the alarm relay (see page 74) should energize when the sampling program is waiting to be reset (whether it completed normally, was manually stopped, or detected a fatal fault) or is continuing to run despite have detected a non-fatal fault.

To view and optionally change this setting:

1. Accept or change the Float Option setting, which will display this parameter's current value.

2. If desired, press the Up or Down key to toggle it on or off, then press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Run Options group parameter:

```
        ┌─────────────────────┐              ┌─────────────────────┐
  ⬆     │ FAULT OPTION        │     F3       │ FLOAT OPTION        │
  or    │ Toggle ↕            │     or       │ Toggle ↕            │
  ⬇     │ >Enable             │    Enter     │ >Disable            │
        │ HOME   BACK   SEL   │              │ HOME   BACK   SEL   │
        └─────────────────────┘              └─────────────────────┘
```

### 4.6.4: Float Option

This parameter configures the program to suspend sampling until its float input circuit is closed and subsequently either continue or pause sampling if it reopens (see page 76).

To view and optionally change its value:

1. Accept or change the Delay Start setting, which will display this parameter's current value.

2. If desired, press the Up or Down key to toggle it on or off, then press the SEL [F3] or Enter key to save the displayed value (changed or not) and advance to the next Run Options group parameter.

```
        ┌─────────────────────┐              ┌─────────────────────┐
  ⬆     │ FLOAT OPTION        │     F3       │ TIMED STOP          │
  or    │ Toggle ↕            │     or       │ Use ↕ to select     │
  ⬇     │ >Enable             │    Enter     │ > None              │
        │ HOME   BACK   SEL   │              │ HOME   BACK   SEL   │
        └─────────────────────┘              └─────────────────────┘
```

### 4.6.5: Timed Stop

This parameter configures the program to automatically stop a specified number of hours or minutes after it initiates its interval timers. To view and optionally change its value:

1. Accept or change the Fault Option setting, which will display this parameter's current value.

2. If desired, press the Up or Down key to scroll to the desired value, then press the SEL [F3] or Enter key to save that value (changed or not). Selecting any option other than Custom will save that value and display the next Run Option parameter's current value:

```
TIMED STOP
Use ↕ to select
> None
HOME    BACK    SEL
```

```
TIMED STOP
Use ↕ to select
> 24 Hour
HOME    BACK    SEL
```

```
F3
or
Enter
```

```
PGM CONFIG
Use ↕ to select
> Pgm. Events
HOME    BACK    SEL
```

```
TIMED STOP
Use ↕ to select
> 12 Hour
HOME    BACK    SEL
```

```
TIMED STOP
Use ↕ to select
> 8 Hour
HOME    BACK    SEL
```

```
TIMED STOP
Use ↕ to select
> Custom
HOME    BACK    SEL
```

```
F3
or
Enter
```

```
STOP TIME
(0-9999 min.)
> 0_
HOME    BACK    SEL
```

Selecting the Custom option displays a screen for setting the number of minutes the program will run before automatically stopping. The digit keys can then be used to change that setting, and pressing the SEL [F3] or Enter key will save the displayed value and display the next Run Option parameter's current value:

```
9  6
0
```

```
STOP TIME
(0-9999 min.)
> 960_
UNDO    BACK    SEL
```

```
F3
or
Enter
```

```
BOTTLE LIMIT
Toggle ↕
>Pgm Stop
HOME    BACK    SEL
```

### 4.6.6: Bottle Limit Override

Each program's Bottle Options (see page 42) configure it to stop after discharging a specific number of samples into its composite sample container, provided this parameter has its default "Program Stop" value. If you would prefer that the unit continue drawing samples indefinitely, without keeping track of how full the sample container is, you should instead set this parameter to "Program Continue":

1. Accept or change the Stop Time setting, which will display this parameter's current value.

2. If desired, press the Up or Down key to toggle between its two possible values, then press the SEL [F3] or Enter key to save the displayed value (changed or not) and return to the Program Configuration menu.

```
BOTTLE LIMIT
Toggle ↕
>Pgm Continue
HOME   BACK   SEL
```

or

```
PGM CONFIG
Use ↕ to select
> Pgm. Events
HOME   BACK   SEL
```
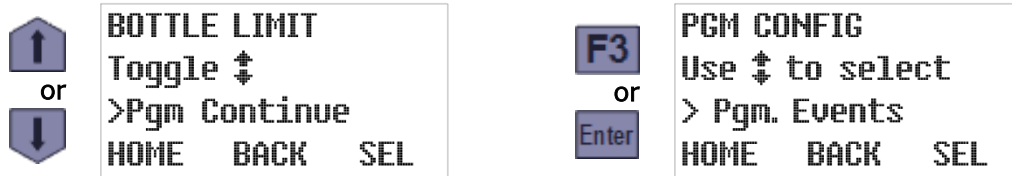
# 4.7: Program Events

Each program's scheduled events (see page 83) are defined by a list that can be accessed via the **Program Events** group. Each event on that list has three associated values:

- the type of event (start, stop, pause, halt, resume or manually sample),
- the days of the week on which the event will be executed, and
- the time of day on those days at which the event will be initiated.

Events are consecutively numbered as they are defined, so the event numbers shown when you review the list do not indicate the order in which those events will be executed. You cannot directly access a particular event's settings, add a new event without reviewing those already on the list, or delete an event without deleting all higher numbered events as well. But you can disable an existing event (by setting it to execute on no days of the week), or replace it by changing any or all of its three settings (type, days and/or time).

## 4.7.1: Reviewing Scheduled Events

When you access the Program Events group, it will initially display the event type for the first event on the list (which will be **End List** if there are none). Repeatedly pressing the Enter key will then display the remaining settings for that event, followed by the settings for the second event, and so on until you reach the first undefined event (whose type will be End List).

To review the event schedule:

1. Select the program you want to schedule events for (see page 28):
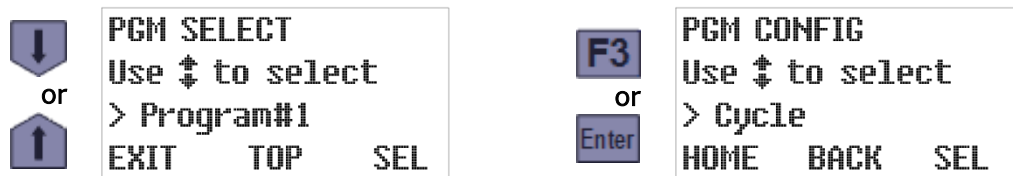


2. Press the Up key to scroll to the Program Events group, then press SEL [F3] or the Enter key to display the type of the first scheduled event (**Start Time** in the example below):



3. Press the Enter key to view that event's days setting, and again to view its time setting:



   The second line of the WEEKDAYS screen displays seven letters representing the days of the week, while the third displays bullets indicating the days (if any) on which the event will occur—Monday through Friday in the example to the left above.

Similarly, the second line of the EVENT TIME screen displays the program's 24-hour time (a.k.a. military) time format while its third line indicates the time on those days at which this event will be initated—2:00 PM (1400 hours) in the example to the right above.

4. Continue pressing the Enter key repeatedly to review each event in turn. You can also re-examine previously-viewed screens by repeatedly pressing the Back key.

5. After you have reviewed the last listed event, the readout will indicate you have reached an event assigned the End List type. You can then press the Event key again to return to the Program Configuration menu, or add a new event to the end of the list (see below).

```
PGM EVENT #8          PGM CONFIG
Use ↕ to select       Use ↕ to select
>End List             > Pgm. Events
HOME   BACK   SEL      HOME   BACK   SEL
```
[Enter]

## 4.7.2: Adding and Editing Events

Entirely new events can only be added to the end of the list, by changing the placeholder **End List** event that is displayed after you review the last existing event (see above). However, you might be able to effectively add a new one by editing a disabled event (see page 52). *In either case, there is no procedural difference between adding and editing an event*:

1. Navigate to the Program Events group and access its End List event as described above:

```
PGM CONFIG            PGM EVENT #1
Use ↕ to select       Use ↕ to select
> Pgm. Events         >End List
HOME   BACK   SEL      HOME   BACK   SEL
```
[F3] or [Enter]

✍ *This example assumes no events have yet been set up. If any have, you must review them (see above) in order to access the End List event. While doing so, you can verify that the event has not been set up previously and make sure it would not be better to create it by rescheduling or otherwise editing an existing event.*

2. Use the Up or Down key to scroll to the desired event type (Start Time, for example), then press SEL [F3] or the Enter key to save that selection and display the Weekdays screen:
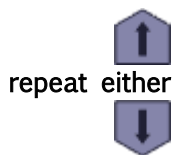
```
PGM EVENT #1          WEEKDAYS #1
Use ↕ to select       SMTWTFS ↕▨
>Start Time           _●
HOME   BACK   SEL      ESC    ◀    ▶
```
repeat either [↑] [↓]    [F3] or [Enter]

3. The third line includes an underline cursor that can be moved to a different day by pressing the Previous [F2] or Next [F3] key:
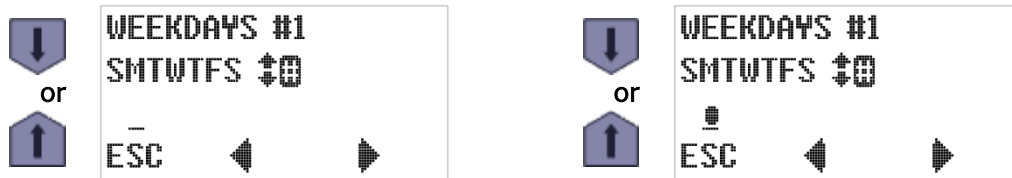
```
[F3] [F3]             WEEKDAYS #1           [F2]   WEEKDAYS #1
                      SMTWTFS ↕▨                   SMTWTFS ↕▨
                        ●_                          ●
                      ESC    ◀    ▶                ESC    ◀    ▶
```
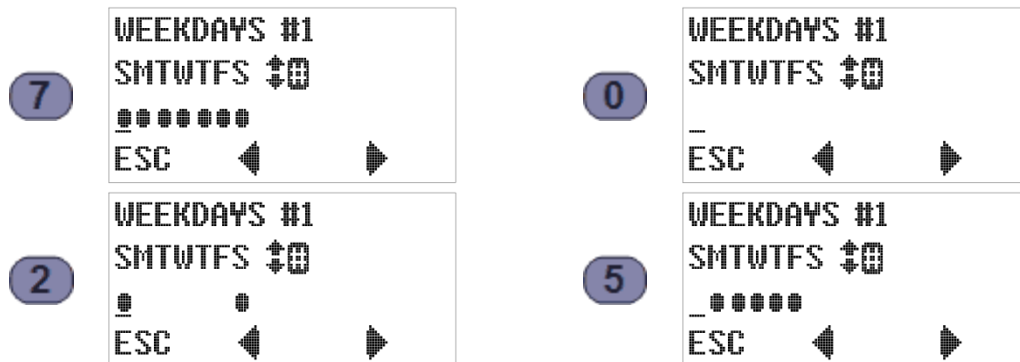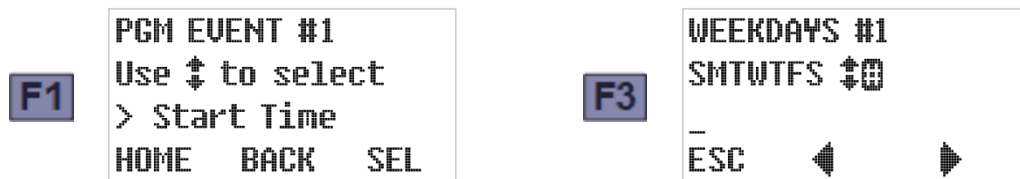
4. Pressing the Up or Down key will toggle execution on the cursor-selected weekday on or off, as indicated by the arrows prompt at the end of the second line:

```
         WEEKDAYS #1              WEEKDAYS #1
  [↓]    SMTWTFS ‡▥       [↓]     SMTWTFS ‡▥
   or                      or
   [↑]   _                 [↑]     ▪
         ESC   ◀    ▶             ESC   ◀    ▶
```

5. You can schedule an event to occur on a specific set of days by pressing the 7 (all days), 0 (no days), 2 (Saturday and Sunday only), or 5 (Monday through Friday) key—as hinted by the hash tag/number sign prompt at the end of the second line:

```
        WEEKDAYS #1              WEEKDAYS #1
  (7)   SMTWTFS ‡▥       (0)     SMTWTFS ‡▥
        ▪▪▪▪▪▪▪                  _
        ESC   ◀    ▶             ESC   ◀    ▶

        WEEKDAYS #1              WEEKDAYS #1
  (2)   SMTWTFS ‡▥       (5)     SMTWTFS ‡▥
        ▪      ▪                 _▪▪▪▪▪
        ESC   ◀    ▶             ESC   ◀    ▶
```

6. Pressing the ESC [F1] key cancels any change(s) you have tentatively made to this setting (but not any changes made to the current event's other settings) and restores the parent Program Event screen. For example:

```
         PGM EVENT #1             WEEKDAYS #1
  [F1]   Use ‡ to select   [F3]   SMTWTFS ‡▥
         > Start Time
         HOME  BACK  SEL          _
                                  ESC   ◀    ▶
```

7. Pressing the Enter key saves the weekdays setting and displays the Event Time screen:

```
         WEEKDAYS #1                EVENT TIME #1
         SMTWTFS ‡▥      [Enter]    hh:mm:ss ‡▥
         _▪▪▪▪▪                     12:00:00
         ESC   ◀    ▶               ESC   ◀    ▶
```

Again, an underline cursor indicates the digit currently subject to editing:

• Press the Previous [F2] or Next [F3] key to move that cursor one digit left or right.

• Press any appropriate numeric key to set the current digit and advance the cursor, OR press the Up or Down key to increment or decrement the current digit (either action is recognized only if a valid time results).

• Press the ESC [F1] key to undo any change to the displayed time and return to the Weekdays screen.

8. Pressing the Enter key saves the indicated time setting and displays the first screen for the next Program.

### 4.7.3: Deleting Events

Events can be deleted only from the end of the list—by reviewing the settings for each event you want to keep and then changing the type of the first one you want to delete to **End List**.

✍ *An event could effectively be removed from the middle of the list by disabling it, as described in the next topic.*

For example, if there were eight listed events and you wanted to delete all but the first two:

1. Access the Program Events group as described above:

```
PGM CONFIG
Use ↕ to select
> Pgm. Events
HOME   BACK   SEL
```

[F3] or [Enter]

```
PGM EVENT #1
Use ↕ to select
> Start Time
HOME   BACK   SEL
```

2. Press the Enter key repeatedly until the first Event #3 screen appears, then use the Up or Down key to scroll to the End List event type:

[Enter] repeat until

```
PGM EVENT #3
Use ↕ to select
>Stop Time
HOME   BACK   SEL
```

repeat either ↑↓

```
PGM EVENT #3
Use ↕ to select
>End List
HOME   BACK   SEL
```

3. Finally, press SEL [F3] or the Enter key to delete this and any higher-numbered events:

[F3] or [Enter]

```
PGM CONFIG
Use ↕ to select
> Pgm. Events
HOME   BACK   SEL
```

### 4.7.4: Disabling Events

You can disable an event without deleting it (so you could later re-enable it), or effectively delete an event from the middle of the list, by configuring it to occur on no days of the week. For example, if there are four or more defined events but you no longer want the third one to execute:

1. Access the Program Events group as previously described:

```
PGM CONFIG          │ F3  │   PGM EVENT #1
Use ↕ to select     │ or  │   Use ↕ to select
> Pgm. Events       │Enter│   > Start Time
HOME    BACK    SEL │     │   HOME    BACK    SEL
```

2. Press the Enter key repeatedly until the first Event #3 screen appears. The displayed event type will be irrelevent once the event has been disabled, so you need only press SEL [F3] or the Enter key to display its WEEKDAYS screen:

```
               Enter    PGM EVENT #3        │ F3  │   WEEKDAYS #3
                        Use ↕ to select     │ or  │   SMTWTFS ↕▢
          repeat until  >Stop Time          │Enter│   ●●●●●●●
                        HOME    BACK    SEL │     │   ESC    ◀       ▶
```

3. Press the 0 (zero) key to deselect all days of the week, then press the Enter key to save that change and display the event's execution time:

```
        (0)     WEEKDAYS #3         │Enter│   EVENT TIME #3
                SMTWTFS ↕▢          │     │   hh:mm:ss ↕▢
                _                   │     │   12:00:00
                ESC    ◀       ▶    │     │   ESC    ◀       ▶
```

4. The time setting will also be irrelevent given that execution has been disabled for every weekday. So you need only press the Enter key to display the next event's type screen, from which you can exit the Program Events group by pressing HOME [F1]:

```
        Enter   PGM EVENT #4        │ F1  │   PGM CONFIG
                Use ↕ to select     │     │   Use ↕ to select
                >Pause Program      │     │   > Pgm. Events
                HOME    BACK    SEL │     │   HOME    BACK    SEL
```

# Chapter 5: Sampler Operation

Although a CVE-16 Wall Mount Sampler requires little or no operator intervention (see page 10), its user interface panel can be used to:

- select a different sampling program (see page 28)
- start the indicated program (see page 55)
- monitor the program while it is running (see page 58)
- manually collect unscheduled samples (see page 62)
- pause and resume sample collection (see page 62)
- stop and reset the sampling program (see page 64)
- review archived sample collection data (see page 65)

That interface (see below) is mounted in the upper housing's top panel and consists of a keypad and a four-line LCD readout:

- The readout's top line identifies the selected program and displays its operating state.
- Its second and third lines display sets of status information you can cycle through by pressing the Up or Down keys to the right of the readout.
- Its bottom line indicates the functions of the F1, F2 and F3 keys.

In addition, any of the icons listed in Table 5-1 might be displayed along its right edge.

*Table 5-1:  User Interface Panel and Icons*
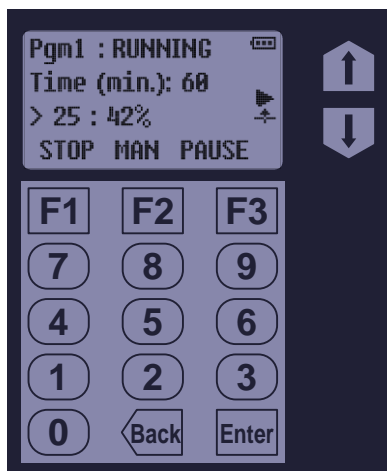
| Icon | Description |
| --- | --- |
| | program is running (see page 58) |
| | program is paused (see page 62) |
| | program will automatically start at a specific time (see pages 57 and 56) |
| | program will automatically stop at a specified time (see page 64) |
| | sampling cycle is being repeated (see page 61) |
| | non-fatal faults (see page 55) |
| | arrow up: float switch is closed / arrow down: float switch is open (see pages 56 and 63) |
| | power supply voltage level |

## 5.1: Ready State

The LCD's top line identifies the selected program and its operating state, which is "READY" while it is waiting to be started. The second and third lines display sets of additional information you can scroll through using the Up and Down keys:

If set for Time+Flow intervals, the elapsed Time and Gallons or Time and Pulses will be shown. If not, only one of them will.

```
Pgm1 : READY        ▭
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```
Program 1 is set to sample at timed intervals. The first one will be drawn 60 minutes after the program is started.

```
Pgm1 : READY        ▭
Gallons : 2500
> 0 : 0%
 RUN  TIMED  MENU
```
Program 1 is set to sample at flow meter volume intervals. The first one will be drawn 2500 gallons after the program is started.

```
Pgm1 : READY        ▭
Pulses : 600
> 0 : 0%
 RUN  TIMED  MENU
```
Program 1 is set to sample at flow meter pulse intervals. The first one will be drawn 600 pulses after the program is started.

```
Pgm1 : READY        ▭
Smpl:#1
12:34:56 07/08/15
 RUN  TIMED  MENU
```
The next sample drawn will be the first. The current time is 12:34:56. The current date is July 8, 2015.

```
Pgm1 : READY        ▭
Comp: 5 gal.
Smpl#: 0 of 168
 RUN  TIMED  MENU
```
Program 1 is set to discharge 168 samples into a 5 gallon container.

When the program is waiting to be started:

- Pressing the RUN [F1] button starts it immediately.
- Pressing the TIMED [F2] button allows you to set the date and time at which it will start.
- Pressing the MENU [F3] key will activate themenu system, from which you could select a different program (see page 28).

The Alarm Relay (if enabled) is energized if the program is waiting to be reset after completing normally or being manually stopped, or if the float input circuit is enabled and open.

## 5.2: Sampler Conditions

The approximate control system power supply voltage is always indicated by a battery icon in the upper right corner of the user interface readout.

In addition, a fault icon will be displayed if any of the following conditions exists:

- sampling has been suspended because the float input circuit is open; or
- the most recent sample cycle failed to collect the programmed size sample.

Those conditions will also energize the Alarm Relay (if enabled), which is also energized when the program is waiting to be reset after completing normally or being manually stopped.
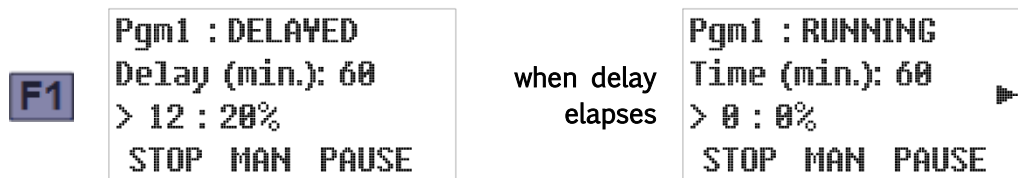
## 5.3: Starting the Selected Program

When the control system is in its Ready state:

- Pressing the RUN [F1] key starts the selected sampling program immediately. However, it might not begin sampling until a time delay elapses, a bottle-full or stream-level float switch is closed, or a scheduled time arrives.
- Pressing the TIMED [F2] key allows you to set a timer that starts that program at a specified time and date (see Timed-Delay Starting below). Any configured time or float-input delay would further delay the first sampling interval.
- Pressing the MENU [F3] key will activate the menu system (see 20). You could then select a different program using the Program Menu (see page 28), although you might first need to enter the administration password (see page 20).

### 5.3.1: Timed-Delay Starting

The interval counter(s) will not start until the start delay (if non-zero) has elapsed. In the meantime, the operating state will display as DELAYED and the first information screen will indicate the progress of that delay:

```
        Pgm1 : DELAYED
 ┌──┐    Delay (min.): 60       when delay    Pgm1 : RUNNING
 │F1│    > 12 : 20%                            Time (min.): 60    ▶
 └──┘     STOP  MAN  PAUSE      elapses        > 0 : 0%
                                               STOP  MAN  PAUSE
```

## 5.3.2: Float-Delayed Starting

If the float input is enabled (see page 45), the sampling program will not start its interval counter(s) until the float-switch circuit is closed (see page 76). Those counter(s) will remain at zero as long as the float icon points down and start accumulating when it points up (think of this icon as a thumbs-up or thumbs-down indicator):

before
switch closes

```
Pgm1 : FLT START
Time (min.): 60
> 0 : 0%              ▶
 STOP  MAN  PAUSE
```

when switch
closes

```
Pgm1 : RUNNING
Time (min.): 60
> 0 : 2%              ▶
 STOP  MAN  PAUSE
```
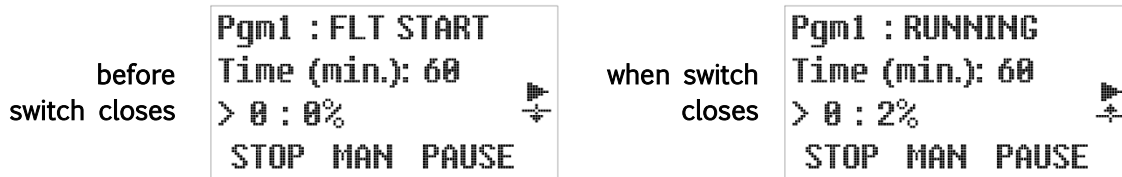
Depending on which of the Factory Menu float input options is enabled, the sampler will subsequently either continue or suspend sampling (see page 63) if the float-switch circuit subsequently reopens.

## 5.3.3: Timed Starting

The selected program can also be started by pressing the TIMED [F2] key, which displays the first of two screens from which you specify the date and time at which you want it to start:

```
Pgm1 : READY
Time (min.): 60
> 0 : 0%
 RUN  TIMED  MENU
```

[F2]

```
START TIME
mm/dd/yy ↕▣
01/23/15
ESC   ◀        ▶
```

That screen initially displays today's date. Leave it unchanged or:

- Press the Previous [F2] or Next [F3] key to move the underline cursor (which initially selects the first digit of the month for editing) one digit left or right.

- Press the appropriate numeric key to set the selected digit and automatically move the cursor to the right, OR
  Press the Up or Down key to increment or decrement that digit, then press the Previous [F2] or Next [F3] key to manually move the cursor.

- Press the ESC [F1] key to cancel the Timed Start and return to the Ready state screen.

Once the desired start date has been set, press the Enter key to save it and display the screen for specifying the time of day at which the program should start. That screen initially shows the current time, which can be changed using the same methods as the date. Use F2 and F3 to select a digit you want to change, then press the Up or Down arrow or a numeric key to change that digit as desired. Finally, press Enter to initiate the TIMED operating state discussed in the following section:
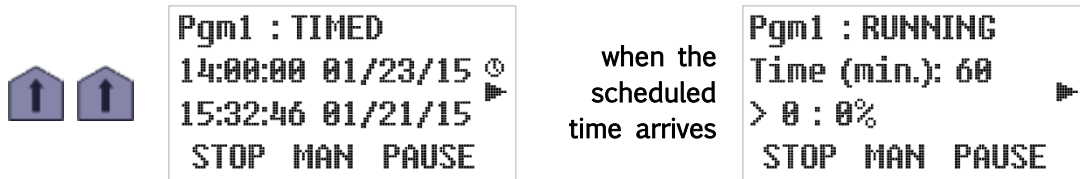
[Enter]

```
START TIME
hh:mm:ss ↕▣
14:00:00
ESC   ◀        ▶
```

[Enter]

```
Pgm1 : TIMED
Time (min.): 60      ⏱
> 0 : 0%             ▶
 STOP  MAN  PAUSE
```

### 5.3.3.1:  Timed State

The Timed operating state is entered when the selected program is:

* set to start at a specified time and day (see previous section), or
* configured to start (or restart) at scheduled times on specified days of every week and then manually started by pressing the RUN [F1] key (see next section).

The run-time screens will then display a clock icon and you can scroll to an additional screen that shows the time and date at which the interval counters will start. The following example of that screen indicates sampling will begin in approximately two days:

```
Pgm1 : TIMED                          Pgm1 : RUNNING
14:00:00 01/23/15 ⏱      when the     Time (min.): 60
15:32:46 01/21/15 ▶      scheduled    > 0 : 0%              ▶
 STOP  MAN  PAUSE        time arrives  STOP  MAN  PAUSE
```

When that time arrives, the program proceeds as if you had just pressed the RUN [F1] key:

### 5.3.4:  Scheduled Starting

Each program can be configured to start (or restart) at scheduled times on specified days of every week. Manually starting such a program will initiate its Timed operating state (see above). When the scheduled time arrives, the program will proceed as if you had just pressed the RUN [F1] key.

When that program completes or is stopped, it will have to be reset before the next start event can restart it unless it is also configured for automatic restarting. If it is, it will instead reset itself and then enter its Auto Rerun state, which is identical to the Timed state described above except the displayed state would be AUTO RERUN instead of TIMED:

```
Pgm1 : AUTO RERUN                     Pgm1 : AUTO RERUN
Time (min.): 60      ⏱                07:00:00 01/25/15 ⏱
> 0 : 0%             ▶                18:07:23 01/24/15 ▶
 STOP  MAN  PAUSE                      STOP  MAN  PAUSE
```

When this screen first appears, the sample containers should be replaced with empties.

## 5.4: Running State

Once the selected program has initiated its sampling-interval counters, the readout's top line displays its operating state as "RUNNING". The second and third lines display scrolling sets of additional information similar to those available in the Ready state:

If set for Time+Flow intervals, the elapsed Time and Gallons or Time and Pulses will be shown. If not, only one of them will.

```
Pgm1 : RUNNING
Time (min.): 60
> 25 : 42%
 STOP  MAN  PAUSE
```

Program 1 is sampling at timed intervals. The next one will be drawn after a 60 minute interval that started 25 minutes ago (42 percent elapsed).

```
Pgm1 : RUNNING
Gallons : 2500
> 1048 : 42%
 STOP  MAN  PAUSE
```

Program 1 is sampling at measured flow intervals. The next one will be drawn after a 2500 gallon interval that started 1048 gallons ago (42 percent elapsed).

```
Pgm1 : RUNNING
Pulses : 600
> 253 : 42%
 STOP  MAN  PAUSE
```

Program 1 is sampling at flow meter pulse intervals. The next one will be drawn after a 600 pulse interval that started 253 pulses ago (42 percent elapsed).

```
Pgm1 : RUNNING
Smpl:#8 : 100 ml
12:34:56 07/08/15
 STOP  MAN  PAUSE
```

Program 1 is drawing 100 ml. samples. The next one will be the eighth (#8). The current time is 12:34:56. The current date is July 8, 2015.

sample container screens (see page 59)

start timer (see page 55) or stop timer (see page 64) screen
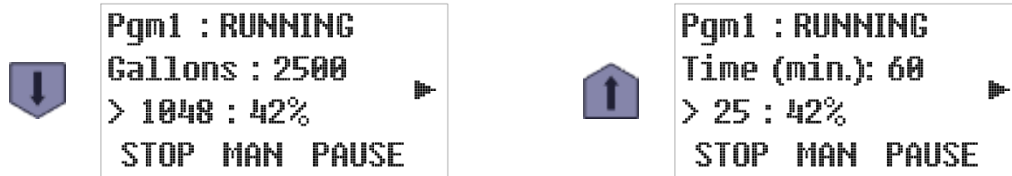
When the indicated program is running, the top row keys are assigned the following functions:

- Pressing F1 will immediately stop the program (see page 64).
- Pressing F2 will immediately trigger the collection of a manual sample (see page 62).
- Pressing F3 will pause the sampling (see page 62).
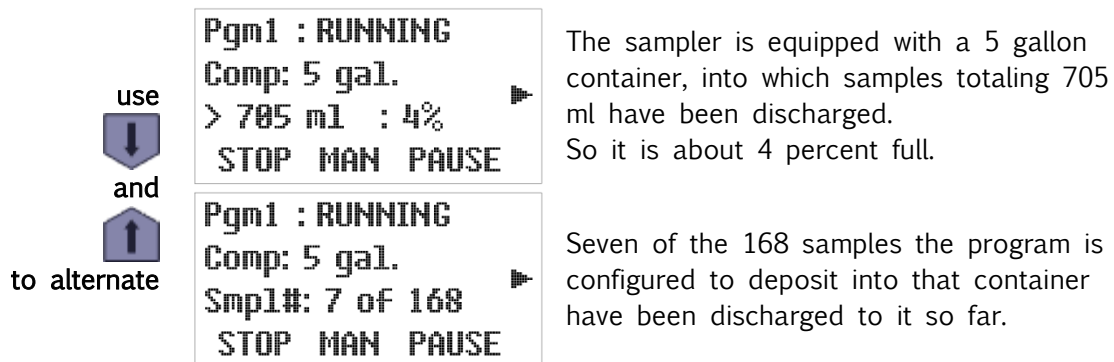
## 5.4.1: Sampling Intervals

As shown on the previous page, the second and third lines of the primary run-state readout will depend on whether the selected program is configured to draw samples at the end of elapsed time (minutes) or stream flow (gallons or pulses) intervals.

If the program has been configured to sample at the ends of flow intervals with a time limit, both screens will be displayed—you can then use the Up and Down keys to scroll between them. When either interval counter reaches 100 percent, both counters will be reset as an automatic sampling cycle is initiated.

```
Pgm1 : RUNNING                    Pgm1 : RUNNING
Gallons : 2500                    Time (min.): 60
> 1048 : 42%          ▶          > 25 : 42%          ▶
 STOP  MAN  PAUSE                  STOP  MAN  PAUSE
```

## 5.4.2: Sample Container Screens

Unless the No Limit option (see page 64) has been enabled, the controller will keep track of the total volume of wastewater discharged to each sample container and stop if it exceeds 90 percent of the container's capacity. The following run-state screens indicate which containers are installed and how full they are:

use

```
Pgm1 : RUNNING
Comp: 5 gal.
> 705 ml  : 4%        ▶
 STOP  MAN  PAUSE
```

The sampler is equipped with a 5 gallon container, into which samples totaling 705 ml have been discharged.
So it is about 4 percent full.

and

to alternate

```
Pgm1 : RUNNING
Comp: 5 gal.
Smpl#: 7 of 168       ▶
 STOP  MAN  PAUSE
```

Seven of the 168 samples the program is configured to deposit into that container have been discharged to it so far.

The container size is shown in either liters or gallons, depending on the Administration Menu Set Units setting (see page 27).

### 5.4.3: Sampling Cycle

Figure A-2 on page 78 illustrates the full CVE-16 sampling cycle, which can be configured to include up to four optional line rinse and an optional line pre-purge. When the running program triggers that cycle (or a manual sample is initiated), the optional Run-Status output is set, the displayed state will change to "SAMPLING" and the second and third lines of the readout will report the progress of the sampling cycle (which requires no operator participation):

```
SAMPLING
loadcell init…
sec: 2
STOP
```
initialization counts down to zero, then
```
SAMPLING
loadcell zero…
sec: 20
STOP
```

The zeroing step determines the sampling chamber's tare weight. It should take less than the allotted 20 seconds, after which the cycle will advance to its rinse or prepurge phase.

If the sample chamber's tare weight cannot be determined, the remainder of the current sampling cycle will be skipped and the following screen will be briefly displayed:

```
SMPL. ERROR
Loadcell
Not Zeroed…
STOP
```
after a few seconds
```
Pgm1 : RUNNING
Time (min.): 60
> 3 : 5%
 STOP  MAN  PAUSE
```

Once the load cell has been zeroed, any accumulated water will be blown from the sampling line and strainer by either the first line rinse or the pre-purge:

* If line rinsing is disabled, the program will simply purge the sampling line before suctioning in the intended sample.

* Otherwise, each enabled rinse first blows the line clear and then partially fills it with wastewater. The sample is drawn after the line is purged to complete the final rinse.

as soon as the tare weight is determined
```
SAMPLING
rinse press…
sec: 14
STOP
```
these two screens are displayed only if one or more optional rinse cycles have been set up

followed by
```
SAMPLING
rinse vac…
sec: 10
STOP
```

when the final rinse (if any) is completed
```
SAMPLING
prepurge…
sec: 12
STOP
```
prepurge counts down, then sample is drawn
```
SAMPLING
size: 100 ml.
sec: 99
STOP
```

The sample is continuously weighed as it is drawn in. When the target weight is reached, the line is again purged and the sample is reweighed:

as soon as the target weight is reached
```
SAMPLING
postpurge…
sec: 25
STOP
```

post-purge counts down
```
SAMPLING
read weight…
sec: 4
STOP
```

After the final weight is recorded, pressure is briefly applied to clear the sampling line. Then the discharge valve is opened to drain the sample to the storage container. The optional Run State output is then cleared and the run state readouts (see page 58) are restored:

the chamber is slightly pressurized
```
SAMPLING
read done
please wait…
STOP
```

then the discharge valve opens
```
SAMPLING
discharge…
sec: 12
STOP
```

after the discharge step counts down to zero, the running state readouts are restored (the interval counter was restarted when the sample was initiated)
```
Pgm1 : RUNNING
Time (min.): 60
> 3 : 5%
 STOP  MAN  PAUSE
```

### 5.4.3.1: Incomplete Sample Recycling

If a minimum of 60 percent of the intended sample weight is not collected within the allotted 99 seconds, a failed sample error will be indicated:

- If "recycling" is disabled, the error screen is displayed for only a few seconds, after which the line is purged and the incomplete sample is weighed.

- If it is enabled, a recycling icon is displayed while the prepurge and sampling steps are repeated. When the intended weight is reached, or the fourth recycle fails, the line is purged and the sample is weighed.

if the target weight is not reached
```
SAMPLING
Failed sample
please wait…
STOP
```

If recycling is enabled
```
SAMPLING
Failed sample
please wait…
STOP
```

when sample is completed or aborted
```
SAMPLING
postpurge…
sec: 25
STOP
```

post-purge counts down
```
SAMPLING
read weight…
sec: 4
STOP
```

### 5.4.3.2: Manual Sampling

Pressing the MAN [F2] key while the selected program is running will trigger the immediate collection of an unscheduled sample using the configured sampling cycle discussed above:

```
Pgm1 : RUNNING              SAMPLING
Time (min.): 60             loadcell init…
> 25 : 42%          ▶       sec: 2
 STOP  MAN  PAUSE           STOP
```

That sample will be counted toward the number of samples the program is configured to put into the sample container. If that fills it, the sampling program will be stopped.

If an automatic sample would otherwise have been triggered during the manual cycle, the following screen will be briefly displayed:

```
SMPL. INTERVAL
Sample Blocked
>Wait
ESC
```

Blocked samples ARE NOT DRAWN when the manual sample is completed.
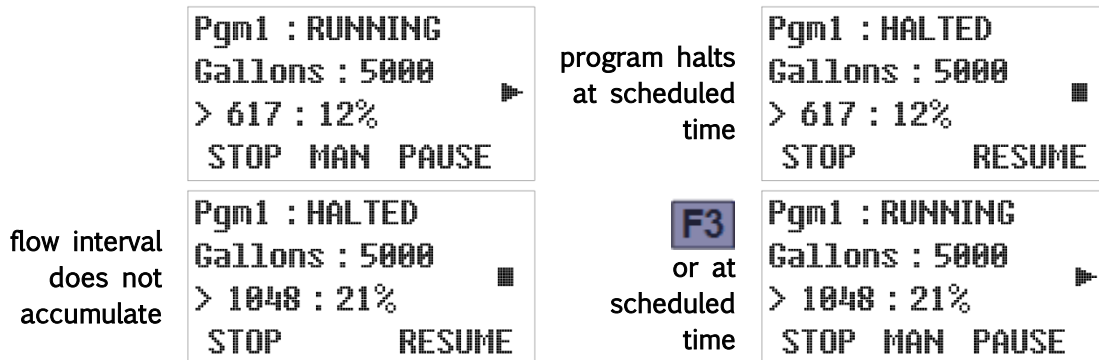
## 5.5: Paused and Halted States

If you press the PAUSE [F3] key while a program is running, it will immediately enter its PAUSED state. Programs can also be configured to automatically pause and resume at scheduled times.

While the program is paused, the run icon is replaced by a paused icon. The sampling interval will continue to accumulate, but no samples will be taken until the RUNNING state is restored by pressing the RESUME [F3] key:

```
Pgm1 : RUNNING              Pgm1 : PAUSED
Time (min.): 60             Time (min.): 60
> 25 : 42%          ▶       > 26 : 43%        ‖
 STOP  MAN  PAUSE           STOP       RESUME
```

```
Pgm1 : PAUSED               Pgm1 : RUNNING
Time (min.): 60             Time (min.): 60
> 47 : 78%          ‖       > 48 : 80%        ▶
 STOP       RESUME          STOP  MAN  PAUSE
```

interval continues to accumulate

Programs can also be configured to halt and resume at scheduled times. The resulting Halted state is similar to the Paused state, except that any configured flow intervals will not continue to accumulate.

While the program is halted, the running icon is replaced by a halted icon (as shown below). The Running state is often automatically restored at a scheduled time, but in any case can be manually restored by pressing the RESUME [F3] key:

```
Pgm1 : RUNNING
Gallons : 5000
> 617 : 12%          ▶
 STOP  MAN  PAUSE
```

program halts
at scheduled
time

```
Pgm1 : HALTED
Gallons : 5000
> 617 : 12%          ■
 STOP        RESUME
```

flow interval
does not
accumulate

```
Pgm1 : HALTED
Gallons : 5000
> 1048 : 21%         ■
 STOP        RESUME
```

`F3`
or at
scheduled
time

```
Pgm1 : RUNNING
Gallons : 5000
> 1048 : 21%         ▶
 STOP  MAN  PAUSE
```
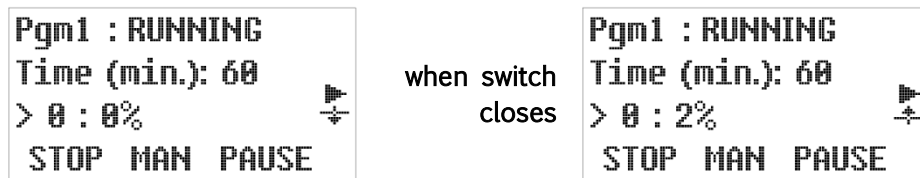
You can stop the program or take manual samples while automatic sampling is paused or halted. If the configured sampling interval reaches 100 percent one or more times, the following screen will briefly appear:

```
SMPL. INTERVAL
Sample Blocked
>Wait
ESC
```

✍ *Blocked samples are not drawn when the paused or halted program is resumed.*

### 5.5.1: Float Suspended Sampling

If the Float Option (see page 45) is enabled and factory-configured (see page 76) to suspend sampling when that input is cleared, the interval counters are held at zero whenever the float switch is open:

```
Pgm1 : RUNNING
Time (min.): 60
> 0 : 0%             ↧
 STOP  MAN  PAUSE
```

when switch
closes

```
Pgm1 : RUNNING
Time (min.): 60
> 0 : 2%             ↥
 STOP  MAN  PAUSE
```

Note that the float icon points down when the float-switch circuit is open (sampling suspended) and up when that circuit is closed (sampling resumed). This can be remembered by thinking of this icon as a thumbs-up or thumbs-down indicator:

- ↧ indicates the stream depth is insufficient to sample
- ↥ indicates the stream depth is sufficient to sample

# 5.6: Stopping the Program

The running program might have been set up to take a specific number of samples and then stop, in which case it would then display the following DONE operating state screen:

```
Pgm1 : RUNNING
Comp: 5 gal.
Smpl#: 167 of 168
 STOP  MAN  PAUSE
```
when final
sample has
been drawn
```
Pgm1 : DONE
>Pgm Complete
>Normal
RESET
```

Alternately, it might have been set to only run for a specified length of time or to stop at a specific, scheduled time. If so, it displays a timed stop icon above the running icon (as shown below) and you can scroll to an added RUNNING screen whose second line shows the time and date at which the program will will shut down and display the DONE operating state screen:

```
Pgm1 : RUNNING
18:00:00 07/09/15
12:34:56 07/08/15
 STOP  MAN  PAUSE
```
when
scheduled
time arrives
```
Pgm1 : DONE
>Pgm Complete
>Normal
RESET
```

In either case, the program can be prematurely stopped by pressing the STOP [F1] key, after which it would then display its STOPPED screen:

```
Pgm1 : STOPPED
>Pgm Stopped
>From Keypad
RESET
```

The RESET prompt indicates you cannot restart the program until you press the F1 key to zero its interval and container volume counters and advance it to its READY state.

## 5.6.1: Continuous Operation

If the Bottle Limit option (see page 47) is set to "Program Continue", the program will ignore its samples per bottle setting and continue sampling indefinitely, without requiring anyone to ever press the RESET [F1] key.

As the sampling program has no way of knowing how many samples it has discharged since the container was last emptied, the sample count screen (see page 59) merely indicates "NL" (no limit). However, a composite sampler would still suspend sampling if its bottle-full float switch ever opened, restarting its interval counter(s) when the container was replaced:

```
Pgm1 : RUNNING
Smpl#:NL
12:34:56 07/08/15
 STOP  MAN  PAUSE
```
if composite
container
filled up
```
Pgm1 : RUNNING
Time (min.): 60
> 0 : 0%
 STOP  MAN  PAUSE
```

## 5.7: Reviewing Archived Data

As discussed on page 84, samplers manufactured since mid-March of 2016 store timestamped records of each sample they draw, separated into individual log files for each sampling run (i.e., one log file for each time any sampling program has been run.

That archived data can be reviewed from the user interface panel by pressing the 5 key when the selected program is running (or waiting to be started), but not while the Administration or Program menu is active. The first line of the resulting display will indicate you are viewing log file 1, in which data for the current (or pending) sampling run is being (or will be) recorded:

```
  ⑤      ARC:Log:1            ▭
         07:00:00 05/10/16
         13:45:07 05/10/16 ▶
         BACK  MORE  DETAIL
```

or

```
         ARC:Log:1            ▭
         Not Started
         13:45:07 05/10/16
         BACK  MORE
```
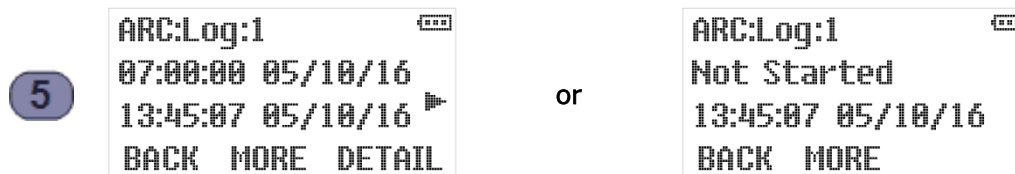
The second line of that display indicates the date and time at which the selected program was started, while the third line displays the date and time at which you started viewing its log file. For example, the screen shown to the left above indicates the currently running program was started at 7:00 AM on May 10, 2016, and the data archive was opened at about 1:45 PM that same day. If the program had not yet been started, the screen shown to the right above would be displayed.

✍ *The icons along the right edge of the screen will continue to indicate the current status of the selected program (see Table 5-1 on page 53).*

✍ *The DETAIL prompt for the F3 key appears only for log files that contain one or more sample and/or exception records.*

Pressing the Down arrow would then access the first log file screen for the second-most recent sampling run (log 2) and display the times and dates at which that sampling run was started and stopped. For example, the display shown to the left below indicates the prior sampling run was initiated at 7 AM on May 9, and concluded about 12 hours later:

```
  ⬇      ARC:Log:2            ▭
         07:00:00 05/09/16
         19:02:30 05/09/16
         BACK  MORE  DETAIL
```

```
  ⬆      ARC:Log:1            ▭
         07:00:00 05/10/16
         13:45:07 05/10/16 ▶
         BACK  MORE  DETAIL
```

You can use the Up and Down keys to scroll through the available log files. Pressing the Up key while viewing the newest will access the oldest, pressing the Down key while viewing the oldest will access the newest. The sample screen shown to the left below indicates 42 log files are currently available, the oldest of which was recorded on March 14, 2016:

```
  ⬆      ARC:Log:42           ▭
         07:00:00 03/14/16
         19:02:30 03/14/16 ▶
         BACK  MORE  DETAIL
```

```
  ⬇      ARC:Log:1            ▭
         07:00:00 05/10/16
         13:45:07 05/10/16 ▶
         BACK  MORE  DETAIL
```

✍ *Use the Administration Menu's Clear Archive option (see page 26) to erase the log files.*

Press the MORE [F2] key repeatedly to view the following additional information about each log:

```
ARC:Log:1           ▭
07:00:00 05/10/16
12 smpls rc        ▶
BACK  MORE  DETAIL
```

number of samples collected (rc appears only if some samples required recycling)— this example indicates the sampling run that commenced at 7:00 AM on May 10 collected 12 samples]

```
ARC:Log:1           ▭
Composite
1 5 gal.           ▶
BACK  MORE  DETAIL
```

type, number and size of the containers to which those samples were discharged

```
ARC:Log:1           ▭
07:00:00 05/10/16
2 excepts          ▶
BACK  MORE  DETAIL
```

number of exceptions that occurred during that sampling run (the DETAIL prompt for the F3 key appears only if it is not zero)

```
ARC:Log:1           ▭
07:00:00 05/10/16
2 recycs.          ▶
BACK  MORE  DETAIL
```

number of times the incomplete sample recycling feature was triggered during that sampling run (the DETAIL prompt for the F3 key appears only if it is not zero)

Pressing the DETAIL [F3] key while viewing any of a log file's first three screens will display the number of samples it deposited into its first (or only) sample container. For example:

```
ARC:Bot:1           ▭
3 smpls
ml NA rc           ▶
BACK  MORE  DETAIL
```

or

```
ARC:Bot:1           ▭
12 smpls
ml NA rc           ▶
BACK       DETAIL
```

where the **rc** notation will be present on the third line only if the incomplete sample recycling feature was triggered for at least one of the samples deposited into that bottle. The left screen above is displayed by sequential samplers, in which case repeatedly pressing the MORE [F2] key would reveal how many samples were deposited into each of the other sample containers. The right screen, which does not display the MORE prompt, is displayed by composite samplers.

Pressing the DETAIL [F3] key while any sample container's screen is active would display the timestamp and programmed vacuum time for the first sample discharged to that container. You could then display the same information for each of the other samples in to that container by repeatedly pressing the Up and/or Down keys:

```
ARC:B1:S1           ▭
08:00:00 05/10/16
15 sec             ▶
BACK
```

```
ARC:B1:S2           ▭
09:00:00 05/10/16
15 sec rc          ▶
BACK
```

The example screens shown above indicate the first two samples were drawn at 8:00 and 9:00 AM, respectively. The "rc" notation on the sample 2 screen indicates the sample chamber did not fully fill on the first attempt, thus triggering the incomplete sample recycling feature.

**If a log file's fourth screen indicates one or more exceptions were encountered**, pressing its DETAIL [F3] key will display the timestamp and type of the first such exception detected during that program run. For example:

```
ARC:Log:1          ▭      ARC:Exc:1          ▭
07:00:00 05/10/16         09:24:38 05/10/16
2 excepts        ▶        power down       ▶
 BACK  MORE  DETAIL        BACK
```

where the screen shown to the left indicates that the program run that commenced at 7:00 AM on May 10 encountered two exceptions. The screen on the right indicates the first of them was an electrical power loss at about 9:25 AM on that same date.

**If a log file's fifth screen indicates one or more samples required more than one vacuum phase to collect the intended volume**, pressing its DETAIL [F3] key will display the record for the first such sample. You could then display the records for the other recycled samples by repeatedly pressing the Up and/or Down keys. For example:

```
ARC:Log:1          ▭      ARC:Rcy:1          ▭
07:00:00 05/10/16         16:00:00 05/10/16
2 recycs.        ▶        15 sec           ▶
 BACK  MORE  DETAIL        BACK
```

where the screen shown to the left indicates two of our example program run's sample cycles needed more than one vacuum phase to fill the sample chamber. The screen on the right indicates the first such sample cycle was initiated at about 4:00 PM.

# Chapter 6: Sampler Maintenance

CVE-16 Wall Mount Samplers are designed to be nearly maintenance free, but routine cleaning is advisable and some parts might eventually wear out. Due to their compact size, failed units can easily be returned to the factory for repair. Alternately, replacement parts can be ordered using the numbers listed in Appendix B:

## 6.1: Cleaning the Sampler

You should periodically flush the sample chamber and intake line by drawing several samples from a bucket of warm, soapy water, followed by several more drawn from a bucket of warm rinse water (you might want to set up a special program configuration for this purpose). Replace the tubing and/or chamber if that process fails to remove all significant fouling.

## 6.2: Compression/Vacuum Pump

CVE-16 Wall Mount Samplers are equipped with continuous-duty, permanently-lubricated, piston air compressor/vacuum pumps that provide long-term consistent sampling with vertical lifts of up to either 23 or 28 feet. *These pumps need no routine maintenance*. In particular, and unlike the costly to maintain, inconsistent, and unreliable peristaltic pumps used in competing samplers, they do not have internal tubes that frequently wear out and need to be replaced.

The pump and its 4-way solenoid valve are mounted behind the housing's protective partition. If your pump's performance declines unacceptably, replacement pumps and service/rebuild kits (including instructions) can be obtained from QCEC.
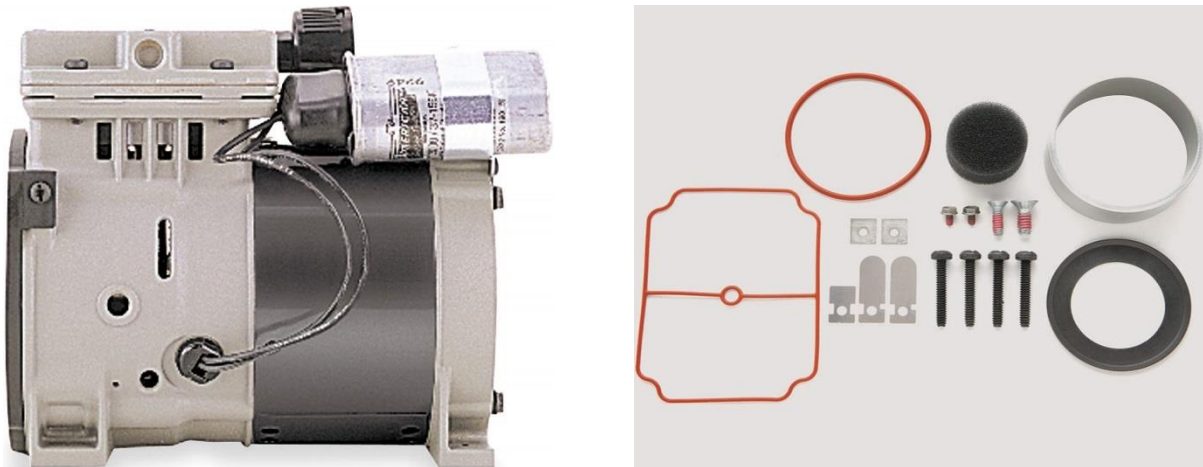


*Figure 6-1: QLS Compressor/Vacuum Pump and Service Kit*

## 6.3: Fuse

The sampler's electrical components are protected by a fast-acting, 10A/250 V cartridge fuse whose holder is mounted behind and can be accessed by removing the controller:

- That fuse can be checked and/or replaced by pulling the front cover of that holder forward and down, which automatically ejects the right end of the fuse.
- The control system can be powered down by tipping the top of the holder up to the left.

## 6.4: Troubleshooting Tips

Use the following suggestions to troubleshoot the listed problems.

### 1: User interface panel is dark:

a) Press any key to turn backlight on (it turns off after two minutes of inactivity).

b) If the screen is still dark but you can make out that it is displaying information, use the Administration Menu to adjust the backlight (see page 25).

c) If the screen is uniformly black, make sure the sampler is powered up (you should be able to hear the fan circulating air through the sample compartment).

d) Check the control system fuse (see page 68)

e) Reboot the controller by briefly tripping that fuse or unplugging the sampler.

f) If the controller is powered but its interface panel is black, the logic board is probably defective—call QCEC for technical assistance.

### 2: One or more buttons never work:

a) The logic board is malfunctioning—call QCEC for technical assistance.

### 3: Readout never changes and cannot be scrolled:

a) Reboot the controller by briefly unplugging the sampler.

b) Controller hardware or software is faulty—call QCEC for technical assistance.

### 4: Readout indicates program will automatically start at midnight, 12/31/99

a) Stop the selected program and disable its Automatic Rerun parameter.

### 5: Samples are too small:

a) The sample chamber should fill to the bottom of the liquid-sensor electrodes. If not:

    i)    Increase the Sample Time setting (see page 31).

    ii)    Check the intake strainer and tubing for obstructions and make sure the intake strainer is fully submerged.

    iii)    Make sure the intake line is properly connected to the sampler's intake port. If a compression fitting is used, the ferrule must be properly positioned and the nut properly tightened.

    iv)    Make sure the pinch valve is energizing and seals the discharge tube when it does.

    v)    Make sure the vacuum pump and solenoid are depressurizing the sample chamber.

    vi)    Check for vacuum line leaks.

    vii)    Adjust the velocity control valve for more vacuum.

b) If water does rise above the bottom of the intake tube, raise that tube (see page 16).

## 6: Samples are too large:

a) Postpurge should lower the water level in the sample chamber to the bottom of its intake tube. If it doesn't:

    i)      Increase the Postpurge setting (see page 31).

    ii)      Make sure the vacuum pump and solenoid are pressurizing the sample chamber.

    iii)      Check the intake strainer and tubing for obstructions.

b) Lower the sample chamber intake tube (see page 16).

## 7: Purging does not clear the intake line:

a) Make sure the pinch valve is energizing and seals the discharge tube when it does.

b) Check the intake strainer and tube for obstructions.

c) Make sure the vacuum pump and solenoid are pressurizing the sample chamber.

## 8: Sampling continues despite full or over-flowing container:

a) Composite samplers can be equipped with a full-bottle float switch. If yours is, a full bottle should cause it to display a downward-pointing float icon and hold its interval timers at zero. If not:

    i)      Verify that the Float Option is enabled (see page 45).

    ii)      Verify that the float is properly installed.

    iii)      Check the float switch and its wiring.

b) If you have not installed a full-bottle switch, draw and measure a manual sample and verify that the installed container will hold the configured number of such samples.

c) Verify that the No Limit feature is disabled. If you deliberately enabled it, be sure to empty the container before it overflows.

# Appendix A: Controller Capabilities

This appendix describes the capabilities of the version 2.0 sample control system firmware, in order to help you decide how best to adapt it to the needs of your sampling application.

## A.1: Overview

The control system consists primarily of six sampling programs and a supervisory routine that executes when the sampler is first powered up and whenever the selected program is stopped.

### A.1.1: Supervisory Routine (Ready State)

When the sampler is powered up, the supervisory routine briefly displays the installed firmware version number and revision letter (e.g., Version 2.0 Revision C). It then indicates the controller is Ready to run. While it is operating in that state, the user interface panel can be used to:

- start the selected program immediately,
- start that program, but delay its execution to a specified future date and time-of-day, or
- display its administration and configuration menus, in order to:
  - set the sampler's configuration password and ID number, adjust its real-time clock and display panel, and manage its archival data;
  - select and configure the control program; and
  - set up certain hardware and menu system features (QCEC personnel only).

Once the selected program has been started, the menu system functions are unavailable until it stops (or is stopped)—at which time the controller returns to its supervisory/Ready state.

✍ The controller administration and program configuration functions are not available while the sampling program is running.

## A.1.2: Menu System Outline

The following outline lists all possible Menu System entries. Those that are actually displayed by any given sampler will depend on its hardware features, purchased options, and values assigned to related Factory and Program Menu parameters.

Main Menu
    Program Menu
        Program Select parameter (1|2|3|4|5|6)
        Program Configuration menu (for selected program)
            sampling Cycle group
                Prepurge (seconds)
                Sampling Time (seconds)
                Postpurge (seconds)
                Number of Rinses  (0 to 4)
                    if > 0:
                        Pressure Time (seconds)
                        Vacuum Time (seconds)
                Recycle (Enable/Disable)
                Consecutive Samples (1 to 24)
            Sample Intervals group
                Sample Interval (Time|Flow|Time+Flow)
                    if Time or Time+Flow:
                        Time Option (Time Fixed|Time Variable)
                            if Time Fixed:
                                Sample Minutes
                            if Time Variable:
                                Sample Minutes list
                    if Flow or Time+Flow:
                        Flow Type (4-20mA|0-5V|0-10V|Pulses)
                            if 4-20mA|0-5V|0-10V:
                                Maximum Gallons [Liters] Per Minute
                                Gallons {Liters] Option (GallonsFixed|GallonsVariable)
                                                        [LitersFixed|LitersVariable]
                                    if Gallons [Liters] Fixed:
                                        Sample Gallons [Liters]
                                    if Gallons {Liters] Variable:
                                        Sample Gallons {Liters] list
                            if Pulses:
                                Flow Option (PulsesFixed|PulsesVariable)
                                    if Pulses Fixed:
                                        Sample Pulses
                                    if Pulses Variable:
                                        Sample Pulses list

Bottle Options group
    Sample Type (Composite)
        Composite Size (options enabled at factory)
        Samples per Bottle
Program Run Options group
    Automatic Rerun
    Delay Start (minutes)
    Float Option (enable/disable)
    Fault Option (enable/disable)
    Timed Stop (None|24Hour|12Hour|8Hour|Custom)
        if Custom:
            Stop Time (minutes)
Program Events list
    for each:
        Program Event (Start|Stop|Sample|Pause|Halt|Resume)
        Weekdays
        Time (of day)
Administration Menu
    Set Password
    Clear Password
    Set Daylight Savings Time (enable|disable)
    Set Clock (date & time-of-day)
    Adjust LCD
    Download Archive
    Clear Archive
    Set ID
    Set Units (English|Metric)
Factory Menu (for QCEC personnel only)
Loadcell Menu (for QCEC personnel only)

## A.2: Inputs and Outputs

As shown on the Electrical Diagram appended to this manual, the sampling controller has the following required and optional inputs and outputs:

- run-status and alarm output relays (see below)
- one analog and one discrete-pulse flow input (see page 75)
- a float-switch input (see page 76)
- a sample-chamber liquid sensor (see page 77)
- pump-motor, solenoid-valve and pinch-valve outputs (see page 77)

This section tells how the CVE-16 sampling software uses its optional field inputs and outputs.

✍ *The CVE-16 Wall Mount Sampler utilizes neither the temperature input nor the turntable inputs and outputs.*

### A.2.1: Run-Status Output

The controller energizes the power board's run-status relay (thus connecting pins 3 and 4 of the optional field I/O connector) as each sampling cycle is initiated, and de-energizes it as that cycle discharges the sample it collected.

### A.2.2: Alarm Output

If the power board's alarm relay is enabled (see page 45), the controller energizes it (thus connecting pins 5 and 6 of the optional field I/O connector) when:

- sampling has been suspended because the float input circuit is open, as discussed below (this will also be indicated by displaying a fault icon along the right edge of the screen);
- the most recent sample cycle failed to determine the sampling chamber's tare weight, or failed to collect at least 60 percent of the specified sample volume; or
- the sampling program is waiting to be reset after completing or being manually stopped.

### A.2.3: Flow Input

The controller provides one analog and one discrete input that are meant for connecting flow meter signals. All Wall-Mount Samplers are equipped with four-pin circular plastic connectors (CPC) that provide terminals for both of those inputs.

Connecting either type of signal allows you to configure flow interval counters (see page 80) that will initiate samples as the total flow in the sampled stream passes specified volumes. Alternately, the pulse input can be used to remotely trigger the collection of individual samples (see below):

To do that, you must set parameter(s) that specify the connected signal type (4-20 mA, 0-5 VDC, 0-10 VDC, or discrete pulse):

- If an analog flow-rate signal is connected, you must also specify the flow rate (in gallons) corresponding to its maximum value (20 mA, 5 VDC or 10 VDC) and the desired flow intervals in gallons. The controller then integrates that signal to determine the accumulated flow, and draws samples at the specified intervals.

- The discrete signal type is intended to be used with a flow meter that integrates its own flow rate measurement and pulses an output relay on and off at specific accumulated flow intervals. If you connect such an input signal, you need only specify the number of pulses corresponding to the flow intervals at which samples are to be drawn.

  Assuming you really want your samples to be drawn at flow volume intervals, you can calculate those counts by dividing the desired flow intervals (in volumetric units) by the incremental flow (in the same units) that triggers each meter relay pulse.

  For example, assume the meter pulses its output relay once for every 1000 gallons of stream flow, and you want to sample that stream at 25,000 gallon intervals. You should then set the interval duration to 25 pulses per sample (25000 gallons per sample divided by 1000 gallons per pulse).

### A.2.3.1: Remote Sample Initiation

Alternately, you can repurpose the pulse input to initiate a sample each time its circuit is closed by a connected PLC or other external device, effectively allowing such a device to remotely trigger the collection of individual samples.:

1. Select either the Flow or Time+Flow sampling interval option.

2. Set the Flow Type parameter to Pulses.

3. Set the Flow Option parameter to Pulses Fixed.

4. Set the Sample Pulses parameter to 1.

### A.2.4:  Float Input

The controller provides one internally-powered discrete input that can be connected to a bottle-full and/or an external stream-level float switch. The controller can then be configured (see below) to draw samples only while or after that input circuit has closed. Thus:

- If a bottle-full float switch is connected, it should open as the fluid level rises above about 90 percent of the container's volume. The sampler could then be configured to stop drawing samples when the bottle filled up.

- If a stream-level float switch is connected, it should close as the stream level rises above an appropriate minimum level. The sampler could then be configured to draw samples only when the stream depth was sufficient to cover the intake strainer (or above some other appropriate threshold).

✍ *More generally, you could configure this input for either run- or start-permissive operation and connect it to any appropriate PLC or other field device relay.*

Most CVE-16 samplers are equipped with a bottle-full CPC that has two float-switch pins. In addition, each can optionally be equipped with a field I/O connector whose two stream-level float-switch pins are connected in series with the float pins provided by the bottle-full CPC. If both connectors are present, you can:

- connect only a bottle-full float switch. You will then need to install a jumper across the float-switch pins of the field I/O connector so the bottle-full switch will close the input circuit unless the bottle is full.

- connect only a stream-level float switch. You will then need to install a jumper across the float-switch pins of the internal connector so the stream-level switch can close the input circuit when the stream flow is high enough to sample.

- connect both a bottle-full and a stream-level float switch. The input circuit will then open if either switch does (i.e., if the sample bottle fills up or the stream flow falls too low).

### A.2.4.1:  Factory Menu Float Setting

If the Float Option (see page 45) is enabled and its input circuit is open when the control program is started, the unit will not start drawing samples until the float switch circuit is closed. If that circuit opens after sampling has begun, the program's response will depend on its Factory Menu FLT setting (which is set to your specifications before the unit is shipped):

- If the FLT START/STOP setting is selected, the program will reset its sampling interval counters and not restart them until the float circuit closes again (i.e., those counters will restart from zero when the water level rises high enough to reclose the float switch).

- If the FLT START setting is selected, the program will continue sampling without interruption even if that circuit reopens.

If the FLT OFF setting is selected, the float input is disabled and the Program Menu's FLOAT INPUT parameter is hidden.
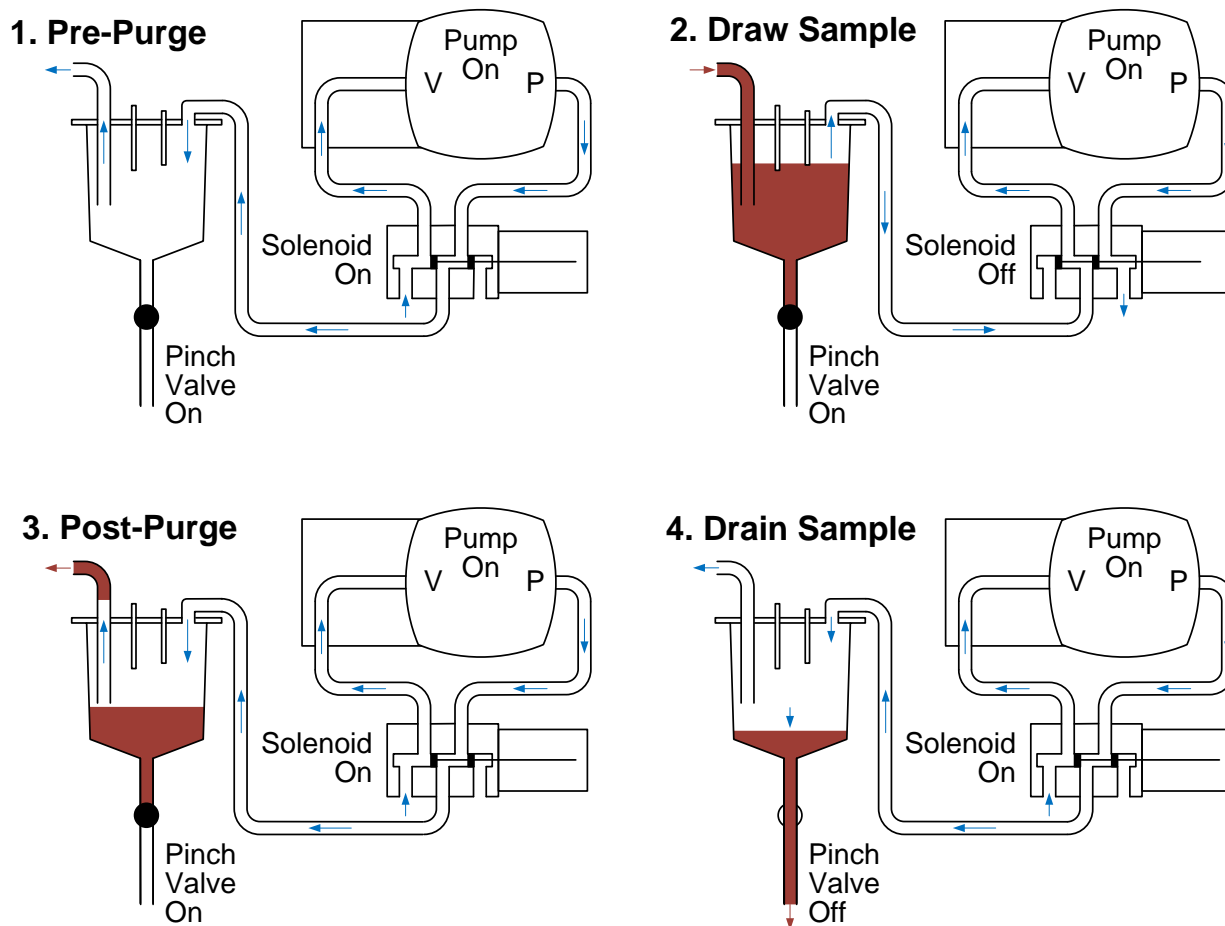
**1. Pre-Purge**

Pump
On
V          P

Solenoid
On

Pinch
Valve
On

**2. Draw Sample**

Pump
On
V          P

Solenoid
Off

Pinch
Valve
On

**3. Post-Purge**

Pump
On
V          P

Solenoid
On

Pinch
Valve
On

**4. Drain Sample**

Pump
On
V          P

Solenoid
On

Pinch
Valve
Off

*Figure A-1: CVE-16 Sample Chamber Pressure Sequencing*

### A.2.5: Liquid Sensor

Each sample cycle vacuums wastewater into the sample chamber until it rises high enough to conduct an electric current between two electrodes that project down from the chamber lid (see panel 2 in the above illustration). The liquid sensor that charges those electrodes and detects the resulting current attaches to the controller's SDI-12 communication port.

### A.2.6: Sampling Outputs

Three electrically-actuated devices control the flow of air and wastewater into and out of the sample chamber (as illustrated above). As shown on the appended Electrical Diagram, each of those devices is controlled by a relay on the controller's power board:

- The Pump relay turns the compressor/vacuum pump motor on at the beginning of each sampling cycle, and off after the collected sample has been discharged.

- The Solenoid relay energizes and de-energizes the four-way solenoid valve that alternately connects the sample chamber to that pump's the vacuum or pressure port.

- The Pinch relay energizes the pinch valve solenoid to seal off the chamber's discharge tube during all but the final (discharge) phase of the sampling cycle. That valve connects to it via a 2-pin CPC in the roof of the sample compartment.

# A.3: Sampling Program

The sampling programs all use the same underlying instructions, but can be configured (via the Program Menu) to provide very different features sets. Each can be set up to:

- draw samples (or sets of consecutive samples), at specified time or flow intervals;
- rinse the sampling line up to four times prior to drawing each sample;
- repeat any sampling cycle up to four times (five total) if needed to collect the desired volume of wastewater;
- delay its execution a specified number of minutes after it is started, or until the optional float input is asserted (or pause and resume repeatedly as that input is set and cleared);
- automatically stop after a configurable amount of time or number of samples; and
- start sampling, pause or halt and later resume, take manual samples and finally stop at scheduled times on specified days of the week, then automatically restart itself if desired.
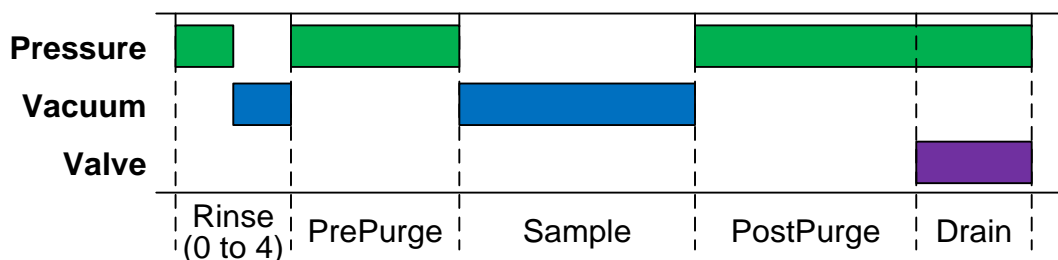


*Figure A-2:  CVE Sampling Cycle*

## A.3.1:  CVE-16 Sampling Cycle

The figure above illustrates the full CVE sampling cycle, which can be configured to include up to four optional rinse cycles (one is shown) and an optional prepurge step (also shown). Figure A-1 on page 77 illustrates the corresponding air flows:

1. The sampling tube and strainer are optionally rinsed up to four times and then "prepurged" to clear out accumulated water and debris:

   - The prepurge pressurizes the sample chamber for a specified number of seconds, which will presumably clear the intake line. It is rarely disabled.
   - It can be preceded by up to four rinses, each of which first pressurizes the chamber to blow out the line and then sucks a limited amount of water into it. The prepurge phase would then blow out the water drawn in by the last rinse.

✍ *If you enable one or more rinse phases, use the manual sampling feature to make sure your settings do not draw water into the sampling chamber.*

2. The chamber is depressurized to draw wastewater into the chamber until it is high enough to conduct an electric current between the liquid-sensor electrodes, which project down from the chamber lid.

✍ *Your Sampling Time setting should be just long enough to raise the wastewater up to the liquid-sensor electrodes, as an added precaution against drawing water into the pump.*

If the liquid sensor is not tripped within the configured time (Sample Seconds):

- If the Fault Option is enabled, an alarm will be indicated.
- If the Sample Recycling feature is enabled, the rinse, prepurge and vacuum steps will be repeated (see below).

3. The chamber is "postpurged" for a specified number of seconds to expel the excess water and clear the entire sample intake tube.

4. The sample is drained by opening the discharge valve for 12 seconds while continuing to pressurize the chamber.

✍ *Make sure your PostPurge setting is long enough to completely clear the inlet tube before the discharge valve opens, so the chamber pressure will not be so high as to spray the sample into the storage container.*

5. If duplicate sampling has been set up, this procedure immediately repeats the specified number of times.

### A.3.1.1: Sample Recycling

Enabling Recycling configures each sampling cycle to repeat its rinse, prepurge, sample, postpurge and weigh phases up to four times before discharging the accumulated sample if:

- the collected sample does not reach its target weight within the allotted 100 seconds, and
- the final weight is less than 60 percent of the specified sample size.

If the sample was underweight because debris was sucked into and restricted the intake tube, the repeated pre- and post-purging might clear the obstruction and allow the sample to reach its intended weight/volume. If it was underweight because the sampler was sucking air due to an insufficient sampled stream flow, that flow might increase during the recycling process.

In any event, if the final, discharged sample is underweight, a non-fatal fault is indicated and the program keeps running. The fault is cleared the next time a full sample is collected.
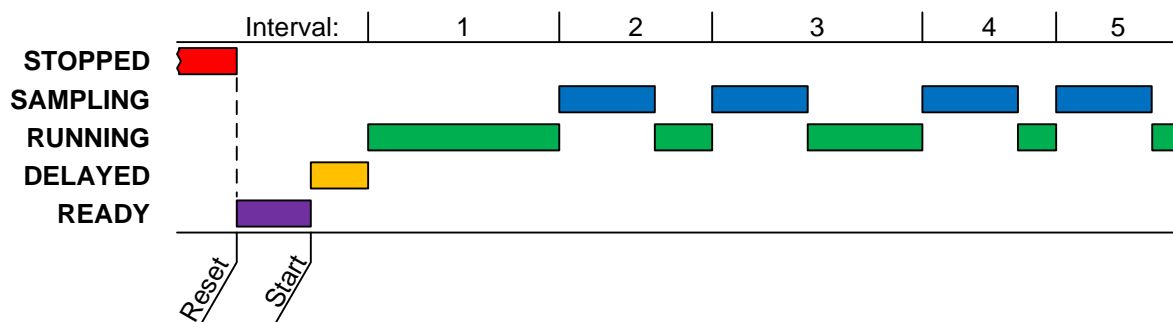
*Figure A-3:  Basic Sample Timing Diagram*

### A.3.2:  Sampling Intervals

Each program is configured to draw samples in an optionally repeating sequence of up to 24 fixed or variable, time and/or flow-based Sampling Intervals. As shown above, the first interval starts after any configured delay (see page 82). At the end of that interval, the program simultaneously triggers its first automatic sample and restarts its interval counter(s). And so on.

The durations of time-sampling intervals are specified in minutes. If any flow-sampling options is selected, a suitable flowmeter must be connected (see page 75) and the interval durations are specified in gallons or flow input pulses (each corresponding to a fixed increment in the total flow measured by the meter):

- When **Time** sampling is chosen, the interval lengths (in minutes) can be fixed or vary in a specified sequence.

- When **Flow** sampling is chosen the interval lengths (in gallons or pulses) can be fixed or vary in a specified sequence,.

- When **Time+Flow** intervals are chosen, both a maximum time and a maximum accumulated flow interval are specified for each sample. Fixed or variable lengths can be independently set for each. For example, you could specify a sequence of variable flow intervals with a fixed maximum time between samples. When the first of each sample's intervals elapses, its sampling cycle is initiated and both interval counters are restarted.

### A.3.2.1:  Variable Intervals

Selecting Time Variable (or Flow Variable) interval timing allows you to specify a sequence of up to 24 interval durations.

- Each sample is drawn when the corresponding interval elapses, until the program's stopping criterion is met (see page 82).

- If the specified number of intervals is fewer than the number of samples the program is configured to draw, the last of those intervals will be used for all subsequent samples.

For example, if the program is configured to stop after 750 minutes (12.5 hours), and you configure six alternating 2 and 1 hour intervals (i.e., 2, 1, 2, 1, 2 and 1), the sixth interval would be used for the sixth and all subsequent samples. Thus, samples would be drawn after 2, 3, 5, 6, 8, 9, 10, 11 and 12 hours.

### A.3.3: Bottle Options

Each program must be "told" how big its sample container is and how many samples to put into it. This is done by setting the associated Bottle Options parameters:

- The Composite Size setting specifies the size of the sample container.
- The Samples per Bottle setting specifies how many samples will be discharged to that container before the program automatically stops.

The specified Samples per Bottle should obviously be less than the number needed to fill the installed container. To derive an appropriate upper limit for that setting:

1. Adjust the sample chamber's intake tube to obtain the desired sample size (see page 16).

2. Divide the measured volume of such a sample into your container size, multiply by 0.9, and round down to the next lowest integer.

✍ *The maximum number of samples you can specify for each bottle is limited to 90 percent of the selected bottle size divided by an arbitrary 20 ml minimum sample size. Assuming your sample size is larger than that, the actual maximum number of samples per bottle will be proportionately lower.*

✍ *Any time you adjust the sample size, you should collect a manual sample and measure its volume. Then make sure the specified Samples per Bottle will fit into the installed bottle(s).*

✍ *At least one extra container is usually kept on hand to allow sampling to continue while the filled bottles are readied for reuse.*

In addition, a Wall-Mount Sampler can be configured to collect multiple samples at essentially the same time by assigning the Cycle group's Consecutive Samples parameter a value greater than one. This would allow you to collect samples larger than the CVE-16 maximum sample size. If the intake tube is adjusted to yield 400 milliliter samples and Consecutive Samples is set to 3, for example, a total of 1200 mL (three samples) will be collected each time the interval counter elapses.

### A.3.4:  Delayed Starting

The selected sampling program can be started by pressing either the START [F1] or TIMED [F2] key while the controller is in its Ready state (i.e., when the supervisory routine is running):

- Pressing START [F1] starts the program immediately.

- Pressing TIMED [F2] prompts you to specify the date and time at which the program will appear to start. Until then, it will operate in a Timed state in which the sampling interval counters do not run but you can initiate manual samples. An additional run-time screen will display the date and time at which the program will "start", along with the current time and date. When that time comes, the program will proceed as if you had just pressed the RUN [F1] key.

    If one or more Program Start events (see page 83) have been configured, the program will also enter its Timed state when the START [F1] key is pressed. It would then proceed as if you had just pressed the RUN [F1] key when the first scheduled start time arrived.

In either case, the sampling interval counters might be further delayed:

- If the program has been set to wait for a Float input (see page 76), it will not start its interval counter(s) until that input is asserted. Until then, the program will display its operating state as TIMED.

- If a non-zero value (up to 9999 minutes) has been assigned to the Delay Start run Option (see page 44), the first sampling interval will be further delayed by that many minutes (see Figure A-3 on page 80). Until then, the program will display its operating state as DELAYED.

### A.3.5:  Timed Stopping

Once a sampling program has started, it will continue running until it has drawn the number of samples specified by its Bottle Options unless:

- it is stopped by pressing the STOP [F3] key,

- its Timed Stop Run Option (see page 46) has been set to stop it a specified number of hours or minutes after the program was started, or

- Stop Program events have been configured it to stop at configured times on specified days of the week (see next section).

If either a Timed Stop or a Stop Program event has been configured, an additional run-time screen will show the scheduled stop time and all such screens will display a timer icon.

## A.3.6: Scheduled Events

Each program can be set to automatically start its interval counters, pause or halt and then resume, initiate manual samples, or stop itself at scheduled times on specified days of the week. As discussed on page 48, those Program Events are defined by a variable-length list of parameters, each of which has three associated values:

- the type of event (see table on next page),
- the days of the week on which the event will be executed, and
- the time of day on those days at which the event will be initiated.

Events do not have to be defined in the order they will execute, and can only be added or deleted from the end of the list.

*Table A-1: Available Program Event Types*

| | |
|---|---|
| Start Program | The parent program will start automatically if it is ready when the scheduled time is reached on the next scheduled day. |
| Stop Program | The parent program will stop automatically if it is running when the scheduled time is reached on the next scheduled day. Unless the Auto Rerun option is enabled (see page 44), the program will have to be manually reset before it can be restarted. |
| Manual Sample | A manual sample will be drawn if the program is running when the scheduled time is reached on the next scheduled day. If a time or flow interval elapses while the manual sample is being drawn, an automatic sample will be drawn as soon as the manual sample cycle has been completed. |
| Pause Program | Sampling will be suspended if the program is running when the scheduled time is reached on the next scheduled day, but the time and flow interval counters will continue to run.<br>Sampling can be resumed by a Resume Program event, or from the user interface panel. If one or more intervals elapse while the program is paused, only the first such sample will be drawn when the program is resumed. |
| Halt Program | The interval time and flow counters will be paused if the program is running when the scheduled time is reached on the next scheduled day. Those counters can be resumed (with the accumulated values they had at the time they were halted) by a Resume Program event, or from the user interface panel. |
| Resume Program | Interval sampling will resume if the program is paused or halted when the scheduled time is reached on the next scheduled day. |
| End List | Previous event is the last one on the list. Changing an event's type to End List deletes it and all high-numbered events. |

## A.3.7: Data Archiving

Every sampler manufactured since mid-March of 2016 archives a timestamped record of:

- each time one of its six sampling programs was started and stopped;
- each sample it has collected, including which bottle it was deposited into and whether or not recycling was required to obtain the desired volume; and
- all operational exceptions, including:
  - power loss and restoration,
  - bottle-full sampling suspensions,
  - sequential turntable indexing errors, and
  - sample compartment temperature deviations.

These sample and exception records are separated into multiple log files. Each time a sampling program completes or is stopped, its log file is closed and a new one is opened. Exceptions that occur between sampling runs are thus logged into the following run's file. The controller will keep up to 50 such files, after which the oldest file will be deleted each time a new one is created. The newest file is accessed as log 1, the one recorded prior to log 1 is accessed as log 2, and so on.

Currently, those log files can only be:

- reviewed onscreen when the menu system is not in use (see page 65); and
- deleted using the Administration Menu's Clear Archive option (see page 26).

Future versions of the controller software will also provide ways to copy the log files to USB memory devices, or download them to connected computers or SCADA systems.

# Appendix B: Replacement Parts

*Table B-1:  Electrical System Parts*

| Part | Number | Additional Information |
|---|---|---|
| Power Cord, Standard, 9-foot | WW142 | North American 120VAC plug |
| Power Cord, EEC, 9-foot | WW447 | European 220VAC plug |
| AC Fuse | WW326 | fast-acting, 10A/250V cartridge fuse |
| Transformer, Controller Power | WW300 | step-down from 120 or 240VAC |

*Table B-2:  Sampling Control System Parts*

| Part | Number | Additional Information |
|---|---|---|
| Controller, Complete | WW322 | specify sampler model |
| Controller Backup Battery | WW390 | CR2032 |
| Controller Face Plate | WW354 | |
| Controller Face Plate Gasket | WW355 | |
| Controller Logic Board | WW401 | specify controller model |
| Controller Power Board | WW320 | |
| Field I/O Connector<br>Protective Cover<br>Mating Cable Connector | WW002<br>WW005<br>WW001 | 7-pin CPC panel connector<br><br>screw terminations |
| Flow Inputs Connector<br>Protective Cover<br>Mating Cable Connector | WW024<br>WW005<br>WW025 | 4-pin CPC panel connector<br><br>screw terminations |
| Float Switch, Bottle-Full | WW130 | |
| Liquid Sensor Controller<br>Long Electrode<br>Short Electrode | WW456<br>WW454<br>WW455 | |

*Table B-3:  Vacuum/Pressurization System Parts*

| Part | Number | Additional Information |
|---|---|---|
| Pressure Regulator, 20 psi | WW092 | |
| Solenoid Valve, 4-Way | WW030 | |
| Vacuum Pump, CVE, 115V<br>Service Kit | WW103<br>WW391 | diaphragm pump, 23 foot lift |
| Vacuum Pump, QLS, 115VAC<br>230 VAC<br>Service Kit | WW102<br>WW439<br>WW298 | piston pump, 28 foot lift |
| Vacuum Pump Mounting Pads | WW131 | 4 required |
| Velocity-Limiter, Bleed Valve<br>Velocity-Limiter, Check Valve | WW033<br>WW019 | a.k.a. Pisco Valve |

*Table B-4:  Intake Line Parts*

| Part | Number | Additional Information |
|---|---|---|
| Intake Fitting, Compression | WW112 | |
| Intake Strainer, PVC & Stainless | WW189 | |
| Intake Strainer, Stainless Steel | WW181 | |
| Intake Tubing, 3/8-inch I.D. | WW043 | sold by the foot—specify length |

*Table B-5:  Sample Chamber Parts*

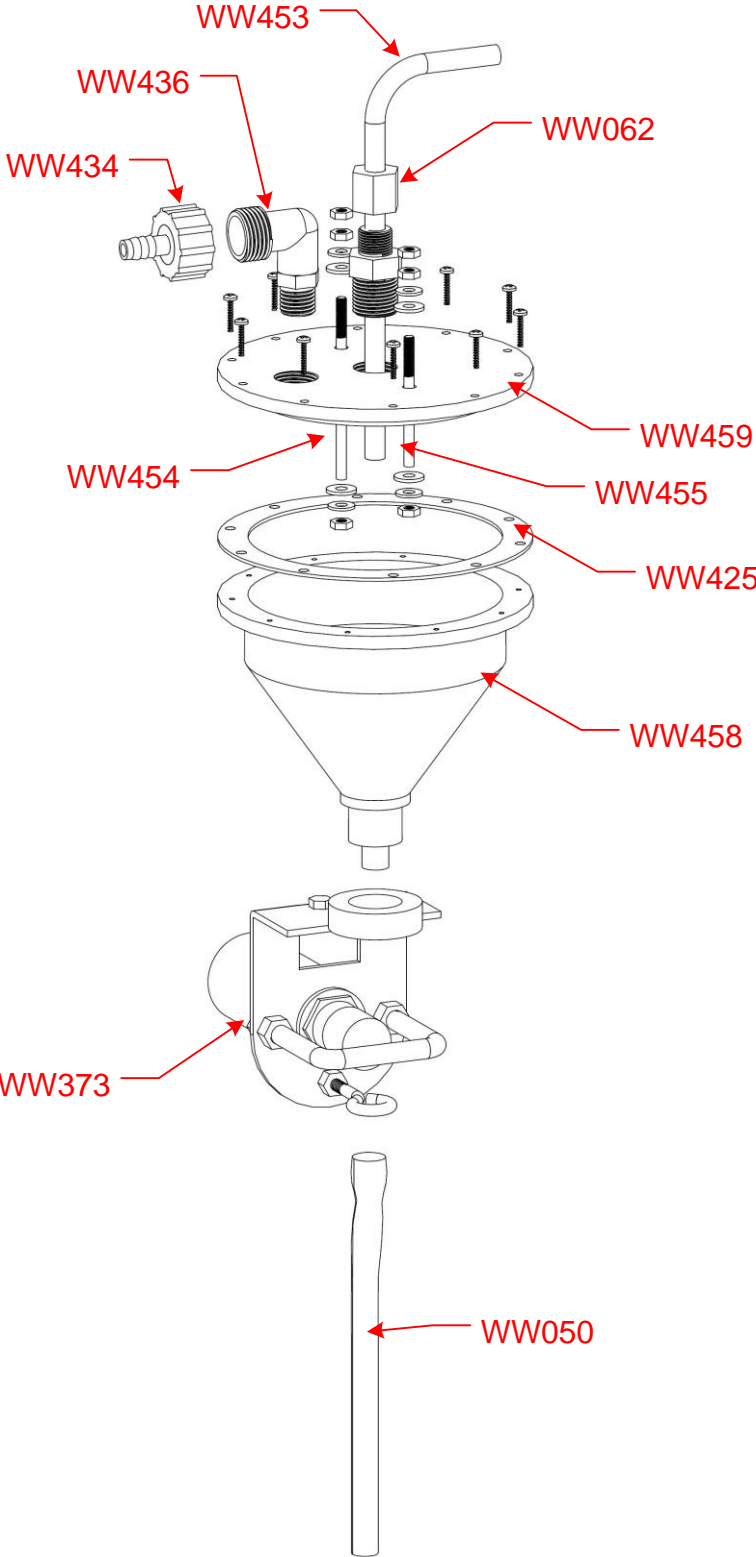| Part | Number | Additional Information |
|---|---|---|
| Chamber Body<br>Chamber Lid<br>Chamber Gasket | WW458<br>WW459<br>WW425 | includes discharge fitting<br>specify CVE-16 lid |
| Discharge Hose | WW050 | cut to length after installing |
| Intake Fitting<br>Intake Tube | WW062<br>WW453 | |
| Long Electrode<br>Short Electrode | WW454<br>WW455 | for liquid sensor |
| Pinch Valve Assembly<br>Solenoid<br>Solenoid Cover | WW373<br>WW193<br>WW370 | |
| Vacuum Fitting, Nipple<br>Vacuum Fitting, Elbow | WW434<br>WW436 | |

*Figure B-1: CVE-16 Sample Chamber Parts*

Logic Board
(viewed from top,
connectors below)

Red

Flash Drive — USB-A

Yellow

Blue

Table Sensor | T° | Flow - +

Liquid Sensor

SDI-12 — R / B / W

USB-B

RJ-14

External Connector

R — 3 +  Analog Flow Signal
B — — (4-20mA | 0-10VDC | 0-5VDC)
R — 2  Pulsing Signal
B — 1  (Dry Contacts)

Connector Optional
Field Devices
Not Included

Pinch Valve

B / R

2 1

Power Board

Red

Yellow

Blue

Alarm

Run

Table

Pinch

Sol.

Pulse — R / B

Float — O / O

AC | DC | Pump

Solenoid — B / Y

External Connector

O O R R Bl Bl

1 2 5 6 3 4

Stream-Level
Float Switch

≤250V, ≤5A  Run Monitor

≤250V, ≤5A  Alarm Monitor

10A

B / G / W

XFMR

W — W
B — W

L / G / N
G

B — B

Vacuum Pump

G
W

Quality Control Equipment Company | Not To Scale | Rev: 1B
CVE-16-WM Electrical Diagram | JDB 06/13/16