

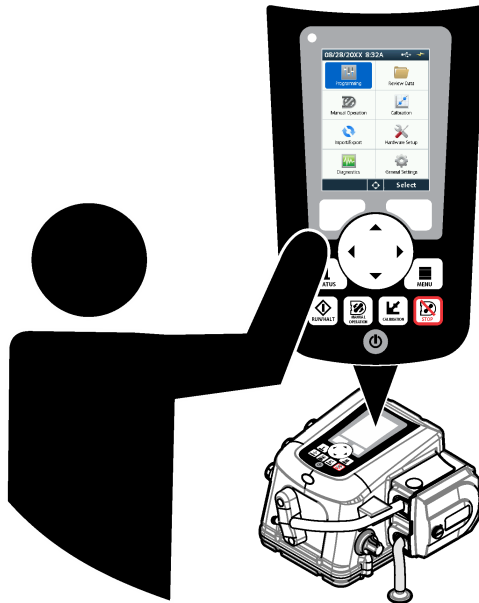


DOC346.53.80493

# AS950 Controller

11/2021, Edition 10

Operations





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## Section 1 Product overview

### NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

The AS950 controller is the controller for the AS950 AWRS, refrigerated and portable samplers. Refer to [Figure 1](#) on page 3. The AS950 controller can also be used as the controller for the SD900 samplers and 900MAX samplers (AWRS, refrigerated and portable).

Refer to the sampler installation and maintenance documentation for the AS950 controller specifications, installation, startup and maintenance information and the AS950 controller replacement parts and accessories.

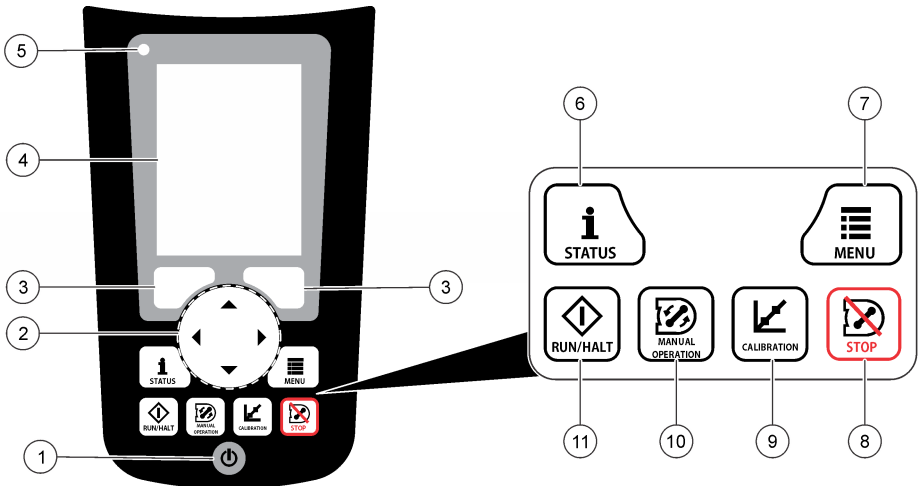
## Section 2 User interface and navigation

### 2.1 Keypad and display description

[Figure 1](#) shows the controller keypad. Refer to [Table 1](#) for the functions of the keys on the keypad. Refer to [Table 2](#) for the indicator light description.

Push the power key to set the controller to on or off. To save power, the display switches off after 5 minutes of no keypad use. Push a key to set the display back to on.

**Figure 1 Controller keypad and display**



1 Power key	5 Indicator light	9 CALIBRATION key
2 Arrow keys	6 STATUS key	10 MANUAL OPERATION key
3 Soft keys	7 MENU key	11 RUN/HALT key
4 Display	8 STOP key	

**Table 1 Key functions**

Key	Function
Soft keys	Selects the function shown on the display.
Arrow keys	Scrolls through the menus and the options. Enters values. Push and hold the arrow keys to scroll through values quickly.
MENU	Shows the main menu. Refer to <a href="#">Main menu overview</a> on page 4.
STOP	Stops the pump.
CALIBRATION	Shows the Calibration menu. Refer to the Calibration option in <a href="#">Table 3</a> on page 4.
Power	Sets the power to on or off.
MANUAL OPERATION	Shows the Manual Operation menu. Refer to the Manual Operation option in <a href="#">Table 3</a> on page 4.
RUN/HALT	Starts, temporarily stops or stops the sampling program.
STATUS	Shows the status of the current sampling program and the power supply. Shows the sample status, data log status, alarm status and hardware status. Refer to <a href="#">Show the program status</a> on page 27.





**Table 2 Indicator light description**

Color	Status	Description
Red	Error	The controller is on. One or more of the measurements the sampler is configured to use (e.g., pH and flow) is not available. Refer to <a href="#">Troubleshooting</a> on page 32.
Green	No Error	The controller is on. There are no errors.





## 2.2 Main menu overview

[Table 3](#) shows the main menu options.

**Table 3 Main menu options**

Option	Description
 Programming	Configures data logging, the alarms and the sampling program.
 Review Data	Shows the sampling history (e.g., samples collected and missed samples). Shows the measurement data (the data log).
 Manual Operation	Collects a grab sample, moves the distributor arm to a selected bottle position or operates the pump in the forward or reverse direction.
 Calibration	Calibrates the sample volume, the attached sensors and the analog input (for flow pacing) at the AUX port, if applicable.

**Table 3 Main menu options (continued)**

Option	Description
 Export/Import	Saves measurement data, sample history and program settings to a memory stick. Copies the program settings from a memory stick to the sampler.
 Hardware Setup	Configures the sampler, sampler ports and attached sensors. Configures and calibrates the liquid detector.
 Diagnostics	Shows the Status screen, event log, alarm log and memory use. Shows the status and configuration of the AUX I/O port. Shows the cabinet temperature (AWRS sampler only). Completes a diagnostic test of the attached sensors, distributor arm, keypad and display. Shows the total run time, forward run time and reverse run time of the pump motor.
 General settings	Shows the instrument information (e.g., serial number). Configures the display settings (e.g., language, date and measurement units). Configures the security settings. Configures the tubing life reminder setting. Erases the sampling history and/or the selected logs.

## Section 3 Operation

### 3.1 Configuration

#### 3.1.1 Configure the general settings

1. Push **MENU**.
2. Select General Settings.
3. Select an option.

Push the **UP** and **DOWN** arrows to change the value. Push the **LEFT** and **RIGHT** arrows to move the cursor.

Option	Description
<b>Date and Time</b>	Sets the time and date. Selects the format for the date and time. Options: dd/mm/yyyy 12h, dd/mm/yyyy 24h, mm/dd/yyyy 12h, mm/dd/yyyy 24h, yyyy/mm/dd 12h, yyyy/mm/dd 24h.
<b>Display</b>	Adjusts the brightness of the display (default: 50%).
<b>Security</b>	Enables security for password protection. When enabled, the user settings that can change the data in the logs or the sampling program cannot be changed until the password is entered. When the display switches off or the controller power is set to off, the password must be entered again.
<b>Language</b>	Sets the display language.

Option	Description
<b>Unit Preferences</b>	<b>Unit System</b> —Sets the system of measurement that shows on the display. Options: US Customary or Metric. <b>Select Units</b> —Sets the individual measurement units that show on the display (e.g., level, velocity, flow, temperature, surface velocity, distance, minimum distance, maximum distance, surge level, rain, cabinet temperature, level raw <sup>1</sup> and surge velocity).
<b>Tubing Life</b>	Sets a reminder when the pump tubing is to be changed. Enter the number of pump cycles used for the reminder (10 to 99,999). An event is recorded to the event log when the total pump cycles are more than the pump cycles selected. Also, an error icon shows near to the tubing life setting on the Diagnostics>Pump screen.  After the pump tubing is changed, select Diagnostics>Pump>Reset Counters to reset the pump cycle count to 0.
<b>Clear Data</b>	Erases the sample history and/or the log(s) selected. Options: Sample History, Data Log, Event Log, Alarm Log and Diagnostics Log.
<b>Restore Factory Defaults</b>	Sets all the controller settings back to the factory defaults. Erases the logs and sample history. The display shows the startup screen for approximately 2 minutes while the defaults are restored back to the factory defaults.

### 3.1.2 Configure the hardware settings

1. Push **MENU**.
2. Select Hardware Setup.
3. Select an option.

Option	Description
<b>Sampler</b>	<b>Site ID</b> —Enters the name for the sampling location (16 characters). <b>Rinses</b> —Sets the number of intake tube rinses before a sample is collected (0 to 3). <b>Sample Retries</b> —Sets the number of sampling tries after a sampling failure occurs (0 to 3).
<b>Configure Sensors</b>	Configures the attached sensors. Refer to <a href="#">Configure the sensors</a> on page 7.
<b>AUX and I/O Port</b>	<b>Type</b> —Configures the AUX I/O port. Refer to <a href="#">Configure the AUX I/O port</a> on page 11.
<b>Liquid Detect</b>	Enables or disables the liquid detector. Calibrates the liquid detector <sup>2</sup> . Refer to <a href="#">Calibrate the liquid detector</a> on page 33. <b>Enabled</b> (default)—Select enabled to use the liquid detector to sense liquid in the tube, which is an important part of volume accuracy and repeatability. Make sure to select enabled in applications where liquid level changes occur. <b>Disabled</b> —Select disabled when the sample is collected from a pressurized line or when the sampler is below the sample source, which can result in trapped water.

<sup>1</sup> Level raw is the value of the level measurement before the algorithm that adjusts for the Bernoulli effect is applied.

<sup>2</sup> Calibrate the liquid detector only with the guidance of technical support.



Option	Description
<b>Rain and RS485 Port</b>	Configures the Rain port for connection to the Hach tipping bucket rain gauge or RS485 communications. Options: Rain or RS485. When RS485 is selected, sets the Modbus address (1 to 255), the baud rate (9600, 19200, 38400, 57600 or 115200) and the parity (None, Even or Odd).
<b>Thermal (AWRS sampler)</b>	Sets the temperature inside the AWRS refrigerated cabinet. Options: 2.00 to 10.00 °C (default: 4.00 °C). Calibrates the temperature inside the AWRS refrigerated cabinet.

### 3.1.2.1 Configure the sensors

1. Push **MENU**.
2. Select Hardware Setup>Configure Sensors>[Select Sensor].
3. Select an option.

**Note:** *Not all of the options that follow apply to all sensors.*

Refer to [Table 4](#) for descriptions of all the pH sensor settings. Refer to [Table 5](#) for descriptions of all the US900x sensor settings. Refer to [Table 6](#) for descriptions of all the AV9000 sensor settings.

Option	Description
<b>Setup Wizard</b>	Configures all the sensor settings. Calibrates the sensor. Obey the screen prompts to complete the procedures. Refer to <a href="#">Calibrate the sensors</a> on page 26.
<b>Calibration</b>	Calibrates the sensor. Refer to <a href="#">Calibrate the sensors</a> on page 26.
<b>Basic Settings</b>	Configures the basic sensor settings.
<b>Flow Settings</b>	Configures the sensor settings that are used to calculate the flow.
<b>Application Settings (US900x)</b>	Configures the sensor settings that are used to control the sensor operation.
<b>Advanced Settings</b>	Configures the optional, advanced sensor settings.
<b>Restore Defaults</b>	Sets the sensor settings and the sensor calibration back to the factory defaults.

**Table 4 Configuration options—pH sensor**

Option	Description
<b>Basic Settings</b>	
AC Frequency	Selects the power line frequency to get the best noise rejection. Options: 50 or 60 Hz (default).
Always On	Sets the sensor to operate continuously or to only operate during the data logging interval for the sensor. Options: Enabled (default) or Disabled. Select Disable to increase the battery life.

**Table 5 Configuration options—US900X ultrasonic sensor**

Option	Description
<b>Basic Settings</b>	
Sensor Type	Selects the sensor type. Options: Downlooking or In-Pipe.

**Table 5 Configuration options—US900X ultrasonic sensor (continued)**

Option	Description
Sediment	Enters the level of sediment in the bottom of the channel. Options: 0.00 to 0.30 m (0.00 to 12.00 in.).
Level Offset (optional)	Enters the difference between the measured level and the actual level. Options: -0.61 to 0.61 m (-24.00 to 24.00 in.). Use Level Offset to correct an offset error without having to do a calibration.
Adjust Level	Completes a distance measurement to use for level adjust.
<b>Flow Settings</b>	
Device	Selects the primary device. Enters the device specifications. Refer to <a href="#">Table 7</a> .
<b>Application Settings</b>	
Filter Size	Selects the number of readings the sampler does and averages for one data point. Options: 1 to 50 (default: 16).
Reject High	Selects the number of the highest values that are discarded. Options: 0 to 49 (default: 4). For example, if the filter size is 16 and the reject high and reject low values are 4, the sensor collects 16 measurements and discards the highest 4 and the lowest 4 measurements. The other 8 values are used to calculate the average data point of level.
Reject Low	Select the number of the lowest values that are discarded. Options: 1 to 49 (default: 4).
Number of Holds	Selects the number of times the last recorded data point is saved to the log if a failed reading occurs due to echo loss. Options: 0 to 15 (default: 4). For example, if the number of holds is 5, the last data point replaces the next five consecutive failed readings or until a successful reading occurs.
Median Filter	Selects the number of data points used in the median filter. The sampler takes median of 3, 5, 7, 9 or 11 data points to decrease noise or outliers (default: None). Only the median values are logged. Raw data values are not logged.
<b>Advanced Settings</b>	
Sample Rate	Selects the number of measurements done per second. Options: 1 to 10 (default: 4 seconds).
Min Dist	Selects the minimum distance from the sensor to the water. Options: 0.13 to 3.96 m (5.25 to 150.75 in.). Distances less than the minimum distance of the sensor are ignored.
Max Dist	Selects the maximum distance from the sensor to the water. Options: 0.13 to 3.96 m (10.50 to 156.00 in.). Distances more than the maximum distance of the sensor are ignored.
Profile	Do not change this setting without guidance from technical support. This setting is used to increase the performance of the sampler when the sampler is used in very difficult conditions. Options: Free Air Low, Free Air Mid (default), Free Air High, Stilling Tube Low, Stilling Tube Mid or Stilling Tube High.
Transmit Power	Do not change this setting without guidance from technical support. This setting is used to increase the performance of the sampler when the sampler is used in very difficult conditions. Options: 2 to 30 (default: 10).

**Table 6 Configuration options—AV9000S sensor**

Option	Description
<b>Basic Settings</b>	
Sensor Direction	Selects the installation direction of the sensor. Select Reversed if the sensor is installed in the reverse direction. Options: Normal (default) or Reversed.
Sensor Offset	Sets the offset used to adjust the measured level value to the correct value.
Sediment	Enters the level of sediment in the bottom of the channel. Options: 0.00 to 0.30 m (0.00 to 12.00 in.).
Level Offset (optional)	Enters the difference between the measured level and the actual level. Options: -0.61 to 0.61 m (-24.00 to 24.00 in.). Use to correct an offset error without having to do a calibration.
<b>Flow Settings</b>	
Device	Selects the primary device. Enters the device specifications. Refer to <a href="#">Table 7</a> .
<b>Advanced Settings</b>	
AV9000S Level	<b>Filter Settings</b> —Selects the type of filter and the filter size (factory default is none). Takes the average and/or median of 3, 5, 7, 9 or 11 data points to reduce noise or outliers. Only the average and/or median values are logged—raw data values are not logged. A significant delay can occur before sudden changes in flow are logged, therefore this option is not recommended for stormwater applications. Options: None, Average, Median or Average and Median.
AV9000S Velocity	<b>Neg. Vel to Zero</b> —Enable to replace all negative velocity measurements with 0. <b>Site Multiplier</b> —The value that adjusts the sensor velocity reading to be the same as the velocity reading from a different instrument. If not sure, use the default value of 1.0. <b>Low Level Cutout</b> —Forces the velocity to a substitute value when the level measurement is below a user-specified value. The value of the substitute velocity is typically 0. The factory default is enabled at 0.8 inches. <b>Filter Settings</b> —Selects the type of filter and the filter size (factory default is none). Takes the average and/or median of 3, 5, 7, 9 or 11 data points to reduce noise or outliers. Only the average and/or median values are logged—raw data values are not logged. A significant delay can occur before sudden changes in flow are logged, therefore this option is not recommended for stormwater applications. Options: None, Average, Median or Average and Median.

**Table 7 Primary device options**

Option	Description
Area Velocity	Select the method of calculating the area, then go to <a href="#">Table 8</a> . Options: Circular, Rectangular, Trapezoidal or U-Shaped.
Flume	Select an option, then go to <a href="#">Table 9</a> . Options: British Rectangle, Cuthroat, H-Type, Leopold-Lagco, Montana, Palmer-Bowlus, Parshall, RBC, San Dimas or Trapezoidal.
Manning	Enter the pipe shape. Options: Circular, Rectangular, Trapezoidal or U-Shaped. Enter the pipe diameter or the width(s) and height, percent slope and manning roughness coefficient. Refer to <a href="#">Manning roughness coefficients</a> on page 33. <b>Percent slope</b> —1 unit per hundred units = 0.01 slope. For example, 1 m of decline for every 100 m = 0.01 slope

**Table 7 Primary device options (continued)**

Option	Description
Nozzle	Enter the nozzle shape. <b>California Pipe</b> —Enter the nozzle diameter (0.01 to 0.91 m). <b>Kennison</b> —Enter the nozzle diameter (6, 8, 10, 12, 16, 20, 24, 30 or 36 in.) and half-section or no half-section.
Weir	Select an option, then go to <a href="#">Table 10</a> . Options: Cipolletti, Compound Notch, Contracted Rectangular, Non-Contracted Rectangle or Thel-Mar. V-Notch.

**Table 8 Area velocity options**

Option	Description
Circular	Enter the pipe diameter. For the US900x, in addition enter the source of the velocity measurement. For example, when an ultrasonic sensor is connected to Sensor 1 port and a submerged area velocity sensor is connected to Sensor 2 port, select Sensor 2 port.
Rectangular	Enter the width and the height of the channel. For the US900x, in addition enter the source of the velocity measurement.
Trapezoidal	Enter the width of the top and bottom of the channel and the height of the channel. For the US900x, in addition enter the source of the velocity measurement.
U-shaped	Enter the channel width. Options: 10 to 2540 cm (4 to 999.99 in.). For the US900x, in addition enter the channel height and the source of the velocity measurement.

**Table 9 Flume options**

Option	Description
British Rectangle	Enter the flume throat length, width and flume throat width.
Cutthroat	Enter the flume width and length.
H-Large	Enter the flume size. Options: 3.0 or 4.0 ft.
H-Medium	Enter the flume size. Options: 0.50, 0.75, 1.00, 1.50, 2.00, 2.50, 3.00 or 4.50 ft.
H-Small	Enter the flume size. Options: 0.4, 0.6, 0.8 or 1.0 ft.
Leopold-Lagco	Enter the flume size. Options: 4, 6, 8, 10, 12, 15, 18, 20, 21, 24, 27, 30, 36, 42, 48, 54 or 60 inches.
Montana	Enter the flume throat width. Options: 1, 2, 3, 6, 9, 12, 18, 24, 30, 36, 48, 60, 72, 84, 96, 108, 120, 144, 180, 240, 300, 360, 480 or 600 inches.
Palmer-Bowlus	Enter the flume throat size. Options: 4, 6, 8, 10, 12, 15, 18, 21, 24, 27, 30, 36, 42, 48, 60 or 72 inches.
Parshall	Enter the flume size. Options: 1, 2, 3, 6, 9, 12, 18, 24, 30, 36, 48, 60, 72, 84, 96, 108, 120, 144, 180, 240, 300, 360, 480 or 600 inches.
RBC	Enter the flume size. Options: 50, 75, 100, 150 or 200 mm.
San Dimas	Enter the flume width.
Trapezoidal	Enter the flume size. Options: 12" 45°, 2" 45°, 8" 60°, Large 60°, Small 60° or XLarge 60°.

**Table 10 Weir options**

Option	Description
Cipolletti	Enter the crest length.
Compound V-Notch	Enter the angle of notch in degrees (22.5 to 120°), notch height, crest width and contracted or non-contracted.
Contracted Rectangular	Enter the crest length.
Non-Contracted Rectangular	Enter the crest length.
Thel-Mar	Enter the size. Options: 6, 8, 10, 12 or 15 inches.
V-Notch	Enter the angle of notch in degrees (22.5 to 120°).

### 3.1.2.2 Configure the AUX I/O port

Configure the AUX I/O port if the AUX I/O port is connected to a Hach flow meter or third-party device.

**Note:** If the optional IO9000 module is connected to the AUX I/O port, refer to the IO9000 module documentation to configure the AUX I/O port.

1. Push **MENU**.
2. Select Hardware Setup>AUX and I/O Port.
3. Make sure that Type is set to AUX.
4. Select an option.

Option	Description
<b>Mode</b>	Selects the AUX I/O port mode of operation. <b>Sample Event</b> —Sends sample information to a Hach flow meter when a sample is collected: time stamp for the sample, success or fail and the bottle number. When there are two sampling programs, the sample information is sent when a sample is collected by either sampling program. <b>Program Complete</b> —Sends a signal when the sampling program is complete. Refer to the auxiliary connector information in the AS950 sampler documentation. When there are two sampling programs, a signal is sent when both sampling programs are complete.
<b>Flow Reading</b>	Selects the type of flow input signal that is supplied by the flow meter to the AUX I/O port. Options: AUX-Pulse or AUX-mA (4–20 mA).

5. When Flow Reading is set to AUX-Pulse, configure the sampler pacing setting of the external flow meter. The sampler pacing setting identifies the flow volume that agrees with one pulse (one count) from the flow meter. Refer to the flow meter documentation.
6. When Flow Reading is set to AUX-mA, select an option.

**Note:** To set the AUX I/O port settings and the analog input calibration to the factory defaults, select Restore Defaults.

Option	Description
<b>Flow Unit</b>	Selects the flow units that show on the display. Options: cubic meters (m <sup>3</sup> ) per day, hour, minute or second or liters (L) per day, hour, minute or second.
<b>4mA Value</b>	Enters the flow volume that agrees with a 4 mA input at the AUX I/O port. Configure the analog output (flow output signal) of the flow meter to have the same flow value for 4 mA.
<b>20mA Value</b>	Enters the flow volume that agrees with a 20 mA input at the AUX I/O port. Configure the analog output (flow output signal) of the flow meter to have the same flow value for 20 mA.

7. When Flow Reading is set to AUX-mA, select Calibrate and obey the screen prompts.

To supply 4 mA and 20 mA to the AUX I/O port:

- a. Connect the auxiliary multi-purpose half cable to the AUX I/O port.
- b. Connect the orange wire (analog input) and blue wire (common) of the cable to an analog signal source that can supply 4 mA and 20 mA.

### 3.1.3 Configure data logging

#### **NOTICE**

Configure the hardware settings before data logging is configured.

Select the measurements (e.g., pH and level) that are recorded to the data log and how often the measurements are saved to the data log (logging interval). Select a maximum of 16 measurements. Measurements that can be recorded are supplied by the:

- Controller
- Sensors connected to the sensor ports
- Sensors connected to the analog inputs of the optional IO9000 module

**Note:** A flow measurement supplied by an external flow meter that is connected directly to the AUX I/O port cannot be recorded.

Only the recorded measurements:

- Show on the Status screen and the Measurement Data (data log) screen.
- Can be used to configure setpoint alarms.
- Can be used for flow-based pacing
- Can be used to control when the sampling program starts (or starts and stops).

1. Push **MENU**.
2. To configure sensors that are not yet connected to the sampler, select the sensor port assignments. Select Programming>Datalog Programming>Change Port Assignments. Select the sensor(s) that will be connected to the Sensor 1 port and the Sensor 2 port.
3. Select a measurement to record as follows:
  - a. Select Channel Logging.
  - b. Select the source of the measurement.
  - c. Select the measurement, then push **Check** to record the measurement.
  - d. Push **Save**.
4. Select the logging Interval for the measurement as follows:
  - a. Select Logging Intervals. The primary and secondary logging intervals show.  
For example "15, 15" identifies that the primary logging interval is 15 minutes and the secondary logging interval is 15 minutes.
  - b. Select the source of the measurement.
  - c. Enter the logging intervals, then push **OK**. Options: 1, 2, 3, 5, 6, 10, 12, 15, 20, 30 or 60 minutes.
    - Primary logging interval—The logging interval that is used when no alarm is configured for the measurement. If an alarm is configured for the measurement, the primary logging interval is used when the alarm for the measurement is not active or when the alarm configuration is not set to Switch Log Interval.
    - Secondary logging interval—The logging interval that is used when the alarm for the measurement is active and the alarm is set to Switch Log Interval.

### 3.1.4 Select and configure the alarms

#### **NOTICE**

Configure data logging before the alarms are configured.

Select and configure the alarms that show on the Status screen and are recorded to the alarm log. There are two types of alarms: system alarms and channel alarms. The list of system alarms follows:

Program start	Pump forward	Entire sample	Distributor error
Program end	Pump reverse	Missed sample	Pump fault
Bottle change	Sample complete	Purge error	Full bottle

The channel alarms are setpoint alarms for the recorded measurements (channels), such as the pH, level and power supply voltage.

**Note:** Channel alarms are set to on or off at the logging interval. Refer to [Configure data logging](#) on page 12. System alarms occur in real time.

1. Push **MENU**.
2. Select Programming>Alarm Programming.
3. Add a system alarm as follows:
  - a. Select System Alarms>Add New Alarm>[Select System Alarm].
  - b. Push **Next**.
4. Add a channel alarm as follows:
  - a. Select Channel Alarms>Add New Alarm>[Select Channel Alarm], then push **Next**.

**Note:** The number that follows a channel alarm identifies the source sensor. For example, Temp 2 is the temperature measurement supplied by Sensor 2. An IO number that follows a channel alarm identifies the analog inputs of the optional IO9000 module.

5. Select an option, then push **Next**. Refer to [Figure 2](#) for an example of a high alarm setpoint.

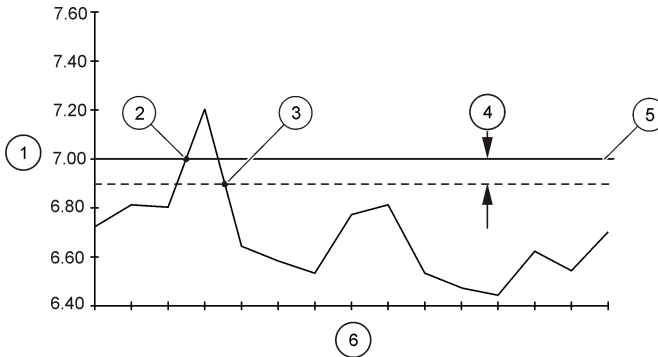
Option	Description
<b>Low/Low</b>	Sets the lowest alarm setpoint and the deadband for the lowest alarm setpoint.
<b>Low</b>	Sets the low alarm setpoint and the deadband for the low alarm setpoint.
<b>High</b>	Sets the high alarm setpoint and the deadband for the high alarm setpoint.
<b>High/High</b>	Sets the highest alarm setpoint and the deadband for the highest alarm setpoint.
<b>Rate of Change</b>	Sets the alarm setpoint, deadband for the setpoint and the amount of time for the rate of change (rain only).

6. Select an option, then push **OK**.

**Note:** More options show when the optional IO9000 module is connected to the AUX port. Refer to the IO9000 module documentation.

Option	Description
<b>Log Only</b>	Sets the alarm to be recorded to the alarm log when the alarm occurs.
<b>Switch Log Interval</b>	Sets the data logging interval to change to the secondary logging interval while the alarm is active. Refer to <a href="#">Configure data logging</a> on page 12.

**Figure 2 High setpoint example**



1 Measurement value	3 Setpoint trigger off	5 Setpoint value
2 Setpoint trigger on	4 Deadband	6 Time

### 3.1.5 Sampling program configuration

#### NOTICE

For flow-based sampling, configure the hardware settings before the sampling program is configured.

#### NOTICE

When an alarm is used to control sampling, configure the alarms before the sampling program is configured.

The sampling program identifies:

- When a sample is collected (pacing)
- The volume of each sample
- The sample distribution among the bottles
- When the sampling program starts
- When the sampling program stops

Complete all the tasks that follow to configure the sampling program.

#### 3.1.5.1 Select the type of program

Select the type of sampling program to configure.

1. Push **MENU**.
2. Go to Programming>Sample Programming.
3. Select the first row.
4. Select an option.

Option	Description
<b>Custom Single</b>	One sampling program.
<b>Custom Dual</b>	Dual sampling program. The bottles in the sampler are divided between two sampling programs. The two sampling programs can operate in parallel, in series or independently (default).
<b>CTVV</b>	One sampling program for a constant time variable volume application.



Option	Description
<b>Stormwater</b>	Dual sampling program for a stormwater application. The bottles in the sampler are divided between the two sampling programs. For example, one sampling program has a fixed time interval between samples. The other sampling program has a fixed flow interval between samples.
<b>Setpoint Sampling</b>	One sampling program for a setpoint (upset) application.

### 3.1.5.2 Enter the bottle and tubing information

Enter the number of bottles in the sampler, the bottle size and the intake tubing size.

1. Push **MENU**.
2. Go to Programming>Sample Programming.
3. Select an option.

Option	Description
<b>Total Bottles</b>	Selects the number of bottles in the sampler.
<b>Bottles per Program<sup>3</sup></b>	Selects the number of bottles used by each sampling program. The bottles in the sampler are divided between the two sampling programs.
<b>Bottle Volume</b>	Enters the volume capacity of each bottle. To change the units, select the units and push the <b>UP</b> or <b>DOWN</b> arrow key.
<b>Tubing</b>	Enters the length and diameter of the intake tubing. <b>Length</b> —Enters the length of the intake tubing from the strainer to the liquid detector. <b>Diameter</b> —Selects the diameter of the intake tubing 6.33 mm (¼ in.) or 9.5 mm (³⁄₈ in.). <i>Note: An accurate length is necessary to get an accurate sample volume.</i>

<sup>3</sup> Available only when Custom Dual or Stormwater is selected. Refer to [Select the type of program](#) on page 14.

### 3.1.5.3 Select the sample pacing

Select when a sample is collected. For example, set the sampling program to collect a sample at a 15-minute interval or a 100-liter flow interval.

1. Push **MENU**.
2. Go to Programming>Sample Programming>Pacing.
3. Select an option.

Option	Description
<b>Time Weighted</b>	Collects a sample at a set time interval, such as every 15 minutes. Select this option for time-weighted sampling. <b>Time Weighted</b> —Sets The time interval between samples (1 minute to 999 hours). <b>Take First</b> —Sets the first sample to be collected immediately or collected after the first time interval.
<b>Flow Weighted</b>	Collects a sample at a set flow interval, such as every 100 liters (or 100 gallons). Select this option for flow-weighted sampling. An external flow meter or an optional flow sensor is necessary. Refer to the sampler documentation to connect a flow meter or flow sensor. <b>Flow Source</b> —Selects the source of the flow measurement signal: AUX I/O port (e.g., AUX-mA), sensor port (e.g., Flow 1) or the optional IO9000 module (e.g., IO 1). A flow measurement supplied through a sensor port or the IO9000 module is only available for selection if the flow measurement is recorded to the data log. Refer to <a href="#">Configure data logging</a> on page 12. <b>Override</b> —When enabled, collects a sample when the specified volume has not been measured within the selected maximum time between samples. Enter the maximum time between samples. When a flow-based sample is collected, the override timer is set to zero. <b>Target</b> —Selects the flow volume between samples (counts or analog input signal). <b>Take First</b> —Sets the first sample to be collected immediately or collected after the first flow interval.
<b>Time Table</b>	Collects a sample at two or more time intervals. Select this option for time-weighted sampling. <b>Time Intervals</b> —Selects the number of time intervals. <b>Edit Intervals</b> —Configures each time interval. <b>Example:</b> The time intervals selected are 50, 70 and 100 minutes. The Take First setting is set to After Interval. The Sample End setting is set to None (continuous sampling). The sampler collects a sample after 50, 120, 220, 270 and 340 minutes and so on after the program starts. When the Sample End setting is set to 6 samples, a sample is collected after 50, 120, 220, 270, 340 and 440 minutes after the program starts and then the sampling program is complete and stops.

Option	Description
<b>Flow Table</b>	<p>Collects a sample at two or more flow intervals. Select this option for flow-weighted sampling. An external flow meter or an optional flow sensor is necessary. Refer to the sampler documentation to connect a flow meter or flow sensor.</p> <p><b>Flow Source</b>—Selects the source of the flow measurement signal: AUX I/O port (e.g., AUX-mA), sensor port (e.g., Flow 1) or the optional IO9000 module (e.g., IO 1). A flow measurement supplied through a sensor port or the IO9000 module is only available for selection if the flow measurement is recorded to the data log. Refer to <a href="#">Configure data logging</a> on page 12. <b>Override</b>—When enabled, collects a sample even if the flow is lower than estimated. Enter the maximum time between samples. When a flow-based sample is collected, the override timer is set to zero.</p> <p><b>Flow Intervals</b>—Selects the number of flow intervals. <b>Edit Intervals</b>—Configures the flow intervals. <b>Take First</b>—Sets the first sample to be collected immediately or collected after the first interval.</p> <p><b>Example:</b> The flow intervals selected are 50, 70 and 100 gallons. The Take First setting is set to After Interval. The Sample End setting is set to None (continuous sampling). The sampler collects a sample after 50, 120, 220, 270 and 340 gallons and so on after the program starts. When the Sample End setting is set to 6 samples, a sample is collected after 50, 120, 220, 270, 340 and 440 gallons after the program starts and then the sampling program is complete and stops.</p>
<b>Event</b>	<p>Collects a sample when one or more of the selected channel alarms occur. Select this option for upset sampling.</p> <p><b>Event Type</b>—Selects the type of event. Options: Setpoint. <b>Event</b>—Selects the channel alarm(s) for the event trigger. To configure more channel alarms, select Add New Alarm and refer to <a href="#">Select and configure the alarms</a> on page 12. <b>Event Trigger</b>—Sets a sample to be collected when any or all of the selected alarms occur.</p>

#### 3.1.5.4 Select the sample volume

Select the volume of a sample. For example, set the sampling program to collect 50 mL samples.

1. Push **MENU**.
2. Go to Programming>Sample Programming>Sample Volume.
3. Select an option.

Option	Description
<b>Fixed</b>	<p>Sets the sample volume to a fixed quantity, such as 500 mL. <b>Volume</b>—Sets the volume of each sample (10 to 10,000 mL).</p>
<b>Variable</b>	<p>Sets the sample volume to increase linearly as the flow rate increases (or decreases) between the low flow rate and high flow rate that is entered. An external flow meter or an optional flow sensor is necessary. Refer to the sampler documentation to connect a flow meter or flow sensor.</p> <p><i>Note: The liquid sensor must be enabled.</i></p> <p><b>Flow Source</b>—Selects the source of the flow measurement signal: AUX I/O port (e.g., AUX-mA), sensor port (e.g., Flow 1) or the optional IO9000 module (e.g., IO 1). A flow measurement supplied through a sensor port or the IO9000 module is only available for selection if the flow measurement is recorded to the data log. Refer to <a href="#">Configure data logging</a> on page 12. <b>Flow Unit</b>—Selects the measurement units for flow. <b>Low Flow</b>—Enter the actual flow rate that agrees with 4 mA. <b>Low Flow Sample</b>—Sets the sample volume to collect when the flow is at the low flow rate. <b>High Flow</b>—Enter the actual high flow rate that agrees with 20 mA. <b>High Flow Sample</b>—Sets the sample volume to collect when the flow is at the high flow rate.</p> <p>For a description of fixed time interval, variable volume sampling, refer to <a href="#">CTVV sampling</a> on page 18.</p>

### 3.1.5.4.1 CTVV sampling

Constant Time Variable Volume (CTVV) sampling collects samples at a fixed time interval. But, the actual volume of each sample is based on the:

- Entered flow range for the site
- Entered sample volume range
- Actual measured flow at the time of sampling

The sample volume collected is based on the measured flow of the stream when the sample is collected. The sample volume increases linearly as the flow rate increases (or decreases) between the low flow rate and high flow rate entered.

When CTVV is used for sampling:

- The liquid detector is always enabled.
- The first sample is collected after the first time interval set in the Pacing setting.
- The flow source can be any flow source with the exception of AUX-Pulse.
- Samples are only collected when the flow is between the entered low flow value and high flow value.

The sampler calculates the sample volume to collect based on the user settings and the actual measured flow. For example, the actual measured flow is 200 gph and the entered values are:

- Low Flow: 150 gph
- High Flow: 300 gph
- Low Flow Sample: 1500 mL (sample volume for low flow)
- High Flow Sample: 3000 mL (sample volume for high flow)

#### Calculation 1: Sample volume per unit of flow

$(\text{High Flow Sample} - \text{Low Flow Sample}) \div (\text{High Flow} - \text{Low Flow}) = 1500 \text{ mL} \div 150 \text{ gph} = 10 \text{ mL/gph}$

#### Calculation 2: Sample volume

$\text{Measured flow at time of sampling} \times \text{Sample volume per unit of flow} = 200 \text{ gph} \times 10 \text{ mL/gph} = 2000 \text{ mL of sample collected}$

### 3.1.5.5 Select the sample distribution—multiple bottles

Select the sample distribution among the bottles.

1. Push **MENU**.
2. Go to Programming>Sample Programming>Distribution.

3. Select an option.

Option	Description
--------	-------------

**Sample-Based** Sets the sampler to divide each sample between a selected number of bottles or put multiple samples in one bottle.

**Bottles per Sample (BPS)**—Sets the sampler to divide a sample equally between a selected number of bottles (e.g., when the sample volume is larger than the bottle volume). Refer to item 2 in [Figure 3](#). **Samples per Bottle (SPB)**—Sets the sampler to put a selected number of samples into each bottle (composite sampling). Refer to item 1 in [Figure 3](#).

When 1 BPS and 1 SPB is selected, the sample is not divided. Each bottle holds one sample (discrete sampling).

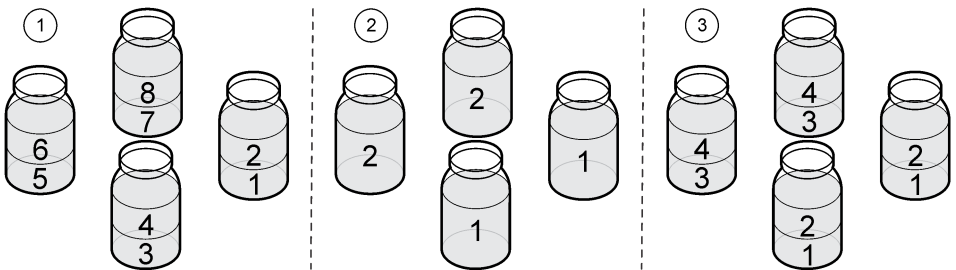
To collect identical sets of composite samples or a composite sample that is larger than the capacity of a single bottle, enter a value that is more than one for BPS and SPB. For example, when 2 BPS and 2 SPB are selected, the sampler puts the first sample in both Bottle 1 and Bottle 2. When the second sample is collected, the sampler puts the sample again in both Bottle 1 and Bottle 2. When the third sample is collected, the sampler puts the sample into Bottle 3 and Bottle 4. Refer to item 3 in [Figure 3](#).

**Time-Based** Sets the sampler to put the sample(s) that are collected during a time interval in each bottle. Options: 5 minutes to 24 hours (default: 1 hour). **Duration**—Sets the time interval. **First Bottle**—Sets the first bottle used in the sampling program.

*Note: If the Program Start setting is a date and/or time in the past (e.g., yesterday at 08:00), the first sample is not put in the first bottle selected. The sampler distributor goes forward one bottle for each time interval between the programmed start time and the actual start time.*

When it is necessary for the bottle numbers (positions) to identify the time (or day) the samples they hold were collected, use time-based distribution (time-switched sampling). Refer to [Figure 4](#) through [Figure 6](#) for examples of time-switched sampling. Refer to [Configure time-switched sampling \(optional\)](#) on page 20.

**Figure 3 Examples—Sample-based distribution**

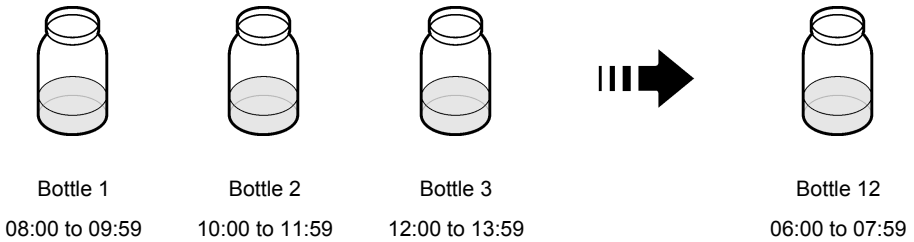


1 Two samples per bottle (SPB: 2, BPS: 1)	3 Two samples per bottle and two bottles per sample (SPB: 2, BPS: 2)
2 Two bottles per sample (SPB: 1, BPS: 2)	

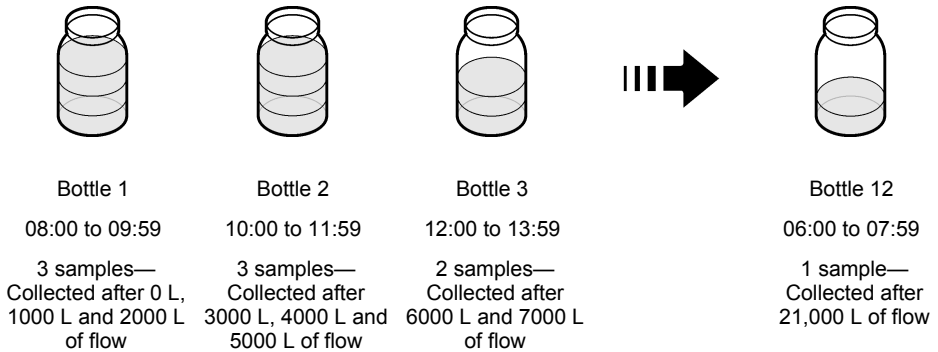
**Figure 4 Example—Time-based distribution, 24-hour pacing and distribution**



**Figure 5 Example—Time-based distribution, 2-hour pacing and distribution**



**Figure 6 Example—Time-based distribution, 1000 L pacing and 2-hour distribution**



### 3.1.5.5.1 Configure time-switched sampling (optional)

#### NOTICE

When a time-switched sampling program must be stopped before it is complete (e.g., to change a user setting), do the steps that follow before the sampling program is started again. Then, future samples are put in the correct bottles. These steps are not necessary when the sampling program is temporarily stopped and then started again.

- Change the Program Start setting to the current date. Do not change the start time.
- If each bottle represents 1 full day (24 hours) of samples, in addition change the First Bottle setting to the bottle number that represents the day (e.g., Thursday or December 4) the next sample will be collected.

When it is necessary for the bottle numbers (positions) to identify the time (or day) the samples they hold were collected, configure the sampler for time-based distribution (time-switched sampling).

1. Push **MENU**.
2. Select Sample Programming>Distribution.
3. Set the options as follows.

Option	Set to:
<b>Distribution</b>	Time-Based
<b>Duration</b>	Enter the time interval that sample is put in each bottle. Options: 5 minutes to 24 hours.
<b>First Bottle</b>	Enter the first bottle used in the sampling program, such as Bottle 1.

4. Push **Back**.
5. Select Program Start.
6. Select After Delay, then push **Next**.
7. Set the options as follows.

Option	Set to:
<b>Delay Type</b>	Date and Time
<b>Date</b>	Enter the start date for the sampling program.
<b>Time</b>	Enter the start time for the sampling program.

8. Go directly to [Select when the program stops](#) on page 23.

### 3.1.5.6 Select when the sampling program starts

Select when the sampling program starts after the RUN/HALT button is pushed.

1. Push **MENU**.
2. Go to Programming>Sample Programming>Program Start.
3. Select an option.

Option	Description
<b>Immediately on 'Run'</b>	The sampling program starts when <b>RUN/HALT</b> is pushed.
<b>On Trigger</b>	The sampling program starts (or starts and stops) when a trigger occurs. The trigger is a selected channel alarm or a signal from an external flow meter or third-party device that is connected to the AUX I/O port. Refer to <a href="#">Start the program on a trigger (optional)</a> on page 22.
<b>After Delay</b>	When <b>RUN/HALT</b> is pushed, the sampling program starts after the selected delay. Refer to <a href="#">Table 11</a> for the delay options.
<b>On Schedule</b>	The sampling program starts on the selected day(s) of the week and time(s). Select a maximum of 12 schedule intervals. <b>Delay</b> —Sets the sampling program to start on the first scheduled day and time after a selected delay. The delay is one time only. Refer to <a href="#">Table 11</a> for the delay options. <b>Schedule Intervals</b> —Sets the number of schedule intervals (1 to 12). <b>Edit Schedule</b> —Sets the start day and time and the stop day and time for each schedule interval.

**Table 11 Delay options**

Type	Description
None	The sampling program starts after no delay.
Data and Time	The sampling program starts after a set date and time.
Time Duration	The sampling program starts after a set amount of time.
Flow Duration	The sampling program starts after a set flow volume occurs. Select the source of the flow measurement. <b>AUX-Pulse (or AUX-mA)</b> —An external flow meter or third-party device connected to the AUX I/O port. <b>Flow 1 (or 2)</b> —A sensor connected to the Sensor 1 (or 2) port. <b>IO 1 (or IO 2)</b> —Analog Input IO 1 (or IO 2) of the optional IO9000 module. <i>Note: A flow measurement that is supplied through a sensor port or the IO9000 module is only available for selection after it is selected to be recorded to the data log.</i>
Slave, Sequential <sup>4</sup>	The sampling program starts after the sampling program of the leading sampler is complete.
Slave, Parallel <sup>4</sup>	The sampling program operates only when the sampling program of the leading sampler operates.

**3.1.5.6.1 Start the program on a trigger (optional)**

To do upset sampling, configure the sampling program to start on a trigger.

1. Push **MENU**.
2. Go to Programming>Sample Programming>Program Start>On Trigger.
3. Select an option.

Option	Description
<b>Setpoint</b>	Sets the sampling program to start when one or all of the selected channel alarms occur.
<b>External AUX</b>	Sets the sampling program to start when the external flow meter or a third-party device that is connected to the AUX I/O port sends a signal to the sampler. Refer to the flow meter documentation to configure the signal.

4. If Setpoint is selected, select and configure each option.

Option	Description
<b>Setpoint</b>	Selects the channel alarm(s) for the trigger. The user-configured channel alarms show. To configure more channel alarms, select Add New Alarm and refer to <a href="#">Select and configure the alarms</a> on page 12.
<b>Start Trigger</b>	Sets the sampling program to start when one or all of the channel alarms occur. Options: All Alarms or Any Alarm.

<sup>4</sup> This option is only applicable when two sampling programs are used. If a slave delay setting is not selected, the two sampling programs operate independently.



Option	Description
<b>Delay</b>	Selects the sampling program to start when the start trigger occurs after a selected delay. Refer to <a href="#">Table 11</a> on page 22 for the delay options.
<b>Control</b>	Sets the sampling program to start (or start and stop) when the trigger occurs. Options: Start & Stop or Start Only.

- If External AUX is selected, select and configure each option.

Option	Description
<b>Delay</b>	Selects the sampling program to start when the signal is sent by the flow meter or a third-party device after a selected delay. Refer to <a href="#">Table 11</a> on page 22 for the delay options.
<b>Control</b>	Sets the sampling program to start (or start and stop) when the signal is sent by the flow meter or third-party device. Options: Start & Stop or Start Only.

### 3.1.5.7 Select when the program stops

Select when the sampling program completes and sample collection stops (e.g., after a quantity of samples are collected or after a time interval).

- Push **MENU**.
- Go to Programming>Sample Programming>Program End.
- Select an option.

Option	Description
<b>None</b>	The sampling program operates continuously.
<b>After Samples</b>	The sampling program stops after a set number of samples are collected.
<b>Date and Time</b>	The sampling program stops at a set date and time.
<b>Time Duration</b>	The sampling program stops after a number of hours (1 to 999 hours).

### 3.1.6 Configure cascade sampling (optional)

When one sampler is not sufficient to collect a large sample volume over a long time interval, connect two samplers and configure them for cascade (series) sampling.

The sampling program on the second sampler starts when the sampling program on the first (leading) sampler is complete (last sample is complete).

**Note:** When there are two sampling programs on the first sampler, the sampling program on the second sampler starts when both sampling programs are complete.

**Item to collect:** Cascade/Synchronized sampling cable (9505100)

- Connect the cascade/synchronized sampling cable to the AUX port on each sampler.
- At the first (leading) sampler:
  - Push **MENU**.
  - Select Hardware Setup>AUX and I/O Port.
  - Make sure that Type is set to AUX.
  - Select Mode>Program Complete.
- At the second sampler:
  - Push **MENU**.
  - Select Hardware Setup>AUX and I/O Port.
  - Make sure that Type is set to AUX.
  - Push **MENU** again.

- e. Select Programming>Sample Programming>Program Start.
- f. Select On Trigger, then push **Next**.
- g. Select Trigger Type>External AUX.

### 3.1.7 Configure synchronized sampling (optional)

When one sampler is not sufficient to collect a large sample volume, when split sampling is necessary or when mixed bottle sets (glass and poly) are necessary, connect two samplers and configure them for synchronized (parallel) sampling.

The samplers collect samples at the same time. Every time the first (leading) sampler collects a sample, the first sampler sends a signal the second sampler to collect a sample.

**Item to collect:** Cascade/Synchronized sampling cable (9505100)

1. Connect the cascade/synchronized sampling cable to the AUX port on each sampler.
2. At the first (leading) sampler:
  - a. Push **MENU**.
  - b. Select Hardware Setup>AUX and I/O Port.
  - c. Make sure that Type is set to AUX.
  - d. Select Mode>Sample Event.
3. At the second sampler:
  - a. Push **MENU**.
  - b. Select Hardware Setup>AUX and I/O Port.
  - c. Make sure that Type is set to AUX.
  - d. Push **MENU** again.
  - e. Select Programming>Sample Programming>Pacing.
  - f. Select Flow Weighted, then push **Next**.
  - g. Select Flow Source>AUX-Pulse.
  - h. Select Target, then enter 1 count.
  - i. Make sure that the Take First option shows " Immediately".

## 3.2 Calibration

### 3.2.1 Volume calibration

Calibrate the sample volume.

**Note:** Temporarily stop the sampling program before calibration. Push **RUN/HALT**, then select Halt Program.

#### 3.2.1.1 Calibrate the sample volume—liquid detector enabled

Calibrate the sample volume with the liquid detector enabled to adjust sample volumes slightly.

1. Push **MENU**.
2. Select Hardware Setup>Liquid Detect>Status. Make sure that the liquid detector is enabled.
3. Put the intake tubing into the sample water or tap water.
 

**Note:** Use the sample water for best accuracy.
4. For the AWRS sampler, put a graduated cylinder under the distributor outlet or composite tube support inside the AWRS cabinet.
5. For the refrigerated sampler, put a graduated cylinder under the distributor outlet or composite tube support in the refrigerated cabinet.
6. For the portable sampler, put the tubing from the outlet side of the pump into a graduated cylinder.
7. Push **CALIBRATION**, then select Volume>Sample Volume.
8. Push **Next**.
9. Enter the volume of sample to collect.

10. Push **Grab**. The pump operates in reverse to purge the intake tube. The pump then operates in the forward direction and collects the sample volume. The pump operates in reverse to purge the intake tube.
11. After the sample is collected, compare the volume of the sample in the graduated cylinder with the sample volume entered.
12. If the collected volume is different from the entered sample volume, enter the volume that was actually collected. Push **Next**. The controller is adjusted to accurately measure all programmed volumes.
13. To verify the calibration, push **Verify**.
14. To save the calibration, push **Finish**.

### 3.2.1.2 Adjust the sample volume calibration (optional)

For the best sample volume accuracy, adjust the sample volume calibration. When the sample volume is less than 200 mL, the manufacturer recommends that the sample volume calibration is adjusted.

1. Select Hardware Setup>Liquid Detect>Status. Make sure that the liquid detector is enabled.
2. For the refrigerated sampler or AWRS sampler, collect three grab samples of the volume that is specified in the sampling program. Refer to [Collect a grab sample](#) on page 30.  
*Note: As an alternative, collect three samples with the sampling program. Refer to step 3.*
3. For the portable sampler, collect three samples in one bottle (or three bottles) with the sampling program. For the best accuracy, collect three samples in one bottle. If necessary, change the sampling program to immediately collect the samples.  
*Note: Do not use grab samples to adjust the sample volume calibration of a portable sampler.*
4. Pour the three samples into a graduated cylinder to measure the total sample volume.
5. Divide the total sample volume by 3 to get the average sample volume.
6. Calculate the adjustment value:

$$(\text{target sample volume} - \text{average sample volume}) \div \text{target sample volume} \times 100 = \text{adjustment value}$$

Where:

Target sample volume = the volume that is specified in the sampling program.

For example, if 200 mL is the target sample volume and the average sample volume is 202 mL, the adjustment value is -1%.

7. Push **MENU**.
8. Push **CALIBRATION**, then select Volume>User Adjust.
9. Enter the adjustment value (e.g., -1%), then click **OK**.
10. For the refrigerated sampler or AWRS sampler, collect another grab sample as follows:
  - a. Push **Verify**.
  - b. Enter the sample volume that is specified in the sampling program.
  - c. Push **Grab**.

*Note: As an alternative, do steps 3–5 again.*

11. For the portable sampler, do steps 3–5 again.
12. If the sample volume collected is not satisfactory when compared to the sample volume that is specified in the sampling program, do steps 2–11 again with five samples.  
Divide the total volume by 5 to get the average sample volume.

### 3.2.1.3 Calibrate the sample volume—liquid detector disabled

When the liquid detector is disabled, calibrate the sample volume by time. The sample volume is calibrated for the volume specified in the current sampling program. If the sample volume is changed in the sampling program, manually calibrate the sample volume again for the new volume.

1. Push **MENU**.
2. Select Hardware Setup>Liquid Detect>Status. Make sure that the liquid detector is disabled.
3. Put the intake tubing into the sample water or tap water.
4. For the AWRS sampler, put a graduated cylinder under the distributor outlet or composite tube support inside the AWRS cabinet.
5. For the refrigerated sampler, put a graduated cylinder under the distributor outlet or composite tube support in the refrigerated cabinet.
6. For the portable sampler, put the tubing from the outlet side of the pump into a graduated cylinder.
7. Push **CALIBRATION**, then select Volume>Sample Volume.
8. Push **Next**. The pump operates in reverse to purge the intake tube. The pump then operates in the forward direction and starts to collect the sample.
9. Push **STOP** when the volume that is specified in the sampling program is collected.
10. Push **Finish** to complete the calibration or **Retry** to do the calibration again.
11. Connect the outlet tubing to the tube fitting on the sampler.
12. Push **Exit** to exit the volume calibration menu.

#### 3.2.1.4 Verify the sample volume

To make sure that the sample volume is accurate, get a grab sample. Do not go back into calibration to check the volume since the volume compensation is reset to zero at the start of a calibration.

1. Push **MANUAL OPERATION**.
2. Select Grab Sample.
3. Put the intake tubing into the sample water.
4. Put the tubing from the outlet side of the pump into a graduated cylinder.
5. If the liquid detector is enabled, enter the volume to be verified.
6. If the liquid detector is disabled, enter the volume that is specified in the sampling program.
7. Push **OK**. The pump cycle starts.
8. Compare the volume that was collected in the graduated cylinder to the expected volume. If the collected volume is not correct, do the volume calibration again.

#### 3.2.2 Calibrate the sensors

Calibrate the sensors connected to the sampler.

1. Push **CALIBRATION** or push **MENU** and select Calibration.
2. Select the sensor to calibrate.
3. Obey the screen prompts to complete the procedure. Refer to the sensor documentation.

#### 3.2.3 Calibrate the cabinet temperature—AWRS sampler

Refer to the service manual available on the manufacturer's website for the calibration procedure.

### 3.3 Start or stop the program

Start the sampling program to collect samples. Temporarily stop the sampling program to remove samples, do manual operation or do a calibration. Stop the sampling program to change the sampling program, the data log settings or the channel alarms.

*Note: When data logging is configured, data logging is done even when the sampling program is temporarily stopped.*

1. Push **RUN/HALT**.
2. Select an option.

Option	Description
<b>Start Program</b>	Starts the sampling program. <i>Note: The sampling program may not start immediately. Refer to <a href="#">Select when the sampling program starts on page 21</a>.</i>
<b>Halt Program</b>	Stops the sampling program temporarily. The status changes to Program Halted.
<b>Resume</b>	Starts the sampling program from the point at which it was stopped.
<b>Start From Beginning</b>	Starts the sampling program from the beginning.
<b>End Program</b>	Stops the sampling program. The status changes to Program Complete.


### 3.4 Show data and alarms

#### 3.4.1 Show the program status

1. Push **STATUS** or select Diagnostics>Status from the main menu.
2. If two sampling programs are in operation, select one of the sampling programs. The status of the sampling program shows. In addition, the sample status, data log status, alarm status and hardware status shows.

Status	Description
<b>Program Running</b>	The sampling program is in operation.
<b>Program Halted</b>	The sampling program was stopped temporarily by the user.
<b>Program Complete</b>	All of the programmed sample cycles are complete, or the sampling program was stopped by the user.

3. To see more information, push the **UP** and **DOWN** arrow keys to select an option, then push **Select**.

Option	Description
	Shows the name of the sampling program, quantity of samples collected and missed samples and the time until the next sample is collected. When selected, the information that follows shows: <ul style="list-style-type: none"> <li>• Program start time</li> <li>• Program start setting (Waiting On) (e.g., None, Delay, Schedule or Setpoint)</li> <li>• Quantity of samples collected</li> <li>• Quantity of missed samples</li> <li>• Quantity of samples still to be collected</li> <li>• Bottle number(s) of the next sample</li> <li>• Time or counts to the next sample</li> <li>• Time or counts to the last sample</li> <li>• Quantity of bottles</li> <li>• Flow information<sup>5</sup>—Current flow and the flow since the sampling program started</li> <li>• Program stop time<sup>6</sup></li> </ul>

<sup>5</sup> Shows when volume table pacing is selected.

<sup>6</sup> Shows after the sampling program is complete or stopped.

Option	Description
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Shows the number of different measurements being recorded, the last time the measurement(s) were recorded and the percentage of the data log memory that is used. When selected, the logging interval and the last value recorded for each measurement shows.



Shows the number of active alarms and the time the most recent alarm occurred. When selected, the status of all the configured alarms show.



Shows the hardware connected to the sampler. For the AWRS sampler, the cabinet temperature shows.

### 3.4.2 Show the sample history

The sample history shows each sample that was collected, the time the sample was collected and if the sample collection was completed or not. The reasons for the missed samples shows. The sample history is automatically erased when the sampling program starts from the beginning.

1. Push **MENU**.
2. Select Review Data>Sample History.
3. Select an option.

Option	Description
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**All Samples**

Shows the sample collection time, the sample number, the bottle number(s) and the sample volume for each sample.

**Missed Samples**

Shows the sample collection time, the sample number and the reason the sample was not collected. The reasons that are given follow:

- **Bottle Full**—The sample was missed because a full bottle was detected.
- **Rinse Error**—The sample was missed because an error occurred during the rinse cycle.
- **User Abort**—The sample was missed because a user pushed the STOP key to end the sample cycle.
- **Arm Faulty**—The sample was missed because the distributor arm did not move correctly.
- **Pump Fault**—The sample was missed because a fault occurred when the pump was operating.
- **Purge Fail**—The sample was missed because an error occurred during the purge cycle.
- **Sample Timeout**—The sample was missed because liquid was not detected within the timeout period.
- **Pump Low Volt**—The sample was missed because the power supply was not sufficient to operate the pump.
- **Low Flow**—The sample was missed due to insufficient flow.

### 3.4.3 Show the measurement data

Show the measurement data to see the measurements recorded to the data log.

**Note:** Measurement data is recorded to the data log in accordance with the selected logging interval. Refer to [Configure data logging](#) on page 12.

1. Push **MENU** and select Review Data>Measurement Data>[Select Instrument]>[Select Measurement]. The selected measurements show in table format or graph format.
2. To change the view, push **Options**, then select an option.

Option	Description
<b>View Type</b>	Changes the view to table format or graph format.
<b>Zoom</b>	Changes the view to one week, one day or one hour of measurements in graph view. <i>Note: This option is only available when the View Type setting is set to Graph.</i>
<b>Jump to newest</b>	Shows the last measurement.
<b>Jump to oldest</b>	Shows the first measurement.
<b>Jump to Date &amp; Time</b>	Shows the measurement recorded at the entered date and time.

3. To erase the data log, push **MENU** and select General Settings>Clear Data. Select Data Log, then push **Yes**.

### 3.4.4 Show the event log

Show the event log to see the events that occurred.

1. Push **MENU**.
2. Select Diagnostics>Event Log.  
The total number of events recorded shows followed by the total number of occurrences for each event type.
3. Select All Events or an event type. The time, date and description of each event shows.
4. To show any additional data for a selected event, select the event and push the **RIGHT** arrow.
5. To erase the event log, push **MENU** and select General Settings> Clear Data. Select Event Log, then push **Yes**.

### 3.4.5 Show the alarm log

Show the alarm log to see the channel alarms that have occurred.

**Note:** Only the channel alarms configured by the user are recorded to the alarm log. Refer to [Select and configure the alarms](#) on page 12 to select and configure the channel alarms that are recorded.

1. Push **MENU**.
2. Select Diagnostics>Alarm Log.  
The total number of alarms recorded and the total number of occurrences for each alarm type show.
3. Select All Alarms or an alarm type. The alarm time and date and the alarm description for each alarm shows.
4. To show any additional data for a selected alarm, select the event and push the **RIGHT** arrow.
5. To show the newest alarm, oldest alarm or the alarms that occurred on a specific date and time, push **Options**, then select an option.
6. To erase the alarm log, push **MENU** and select General Settings> Clear Data. Select Alarm Log, then push **Yes**.

## 3.5 Show system information

1. Push **MENU**.
2. Select General Settings>About.  
The system information shows: model name, model type, serial number, boot firmware version, firmware version and firmware build date.

## 3.6 Save logs and settings to a USB drive

### NOTICE

When the import option is used, all the user settings on the sampler are replaced with the selected user settings on the USB flash drive. The data in the log files is erased.

Use the export option to:

- Save a copy of the log files<sup>7</sup> to a USB flash drive.
- Save a backup copy of the user settings (e.g., sampling program and hardware settings) to a USB flash drive.

Use the import option to:

- Replace the user settings on the sampler with a backup copy of the user settings.
- Replace the user settings on the sampler with the user settings supplied by technical support or from another sampler.

1. Put a USB 2.0 flash drive in the USB port.

**Note:** Only USB 2.0 flash drives can be used with the AS950 controller. For faster performance, use a 2 to 16 GB flash drive.

2. Push **MENU**.

3. Select Export/Import.

**Note:** The more files on the USB flash drive, the longer "Detecting USB flash drive" shows on the display.

4. Select an option.

Option	Description
<b>Export Data</b>	Saves a copy of the user settings, log files, sample history and manufacturer settings to the USB flash drive. The file size of the data saved to the USB flash drive shows on the display. <b>Note:</b> Use <i>FSDATA Desktop</i> to look at the files.
<b>Export Settings</b>	Saves a copy of the user settings to the USB flash drive. Select a filename for the user settings. Options: Settings 1 to 10.
<b>Import Settings</b>	Shows the configuration files that were saved to the USB flash drive. Selects a configuration file and saves it to the controller.
<b>USB Drive Info</b>	Shows the total, used and free (available) memory on the USB flash drive.

## 3.7 Use FSDATA Desktop (optional)

Use FSDATA Desktop to look at sampler data or make reports. Before this task, become familiar with the FSDATA Desktop menus and navigation. Refer to the FSDATA Desktop documentation.

Use a PC with FSDATA Desktop to look at sampler data on a USB flash drive. As an alternative, use a USB A to A cable to connect the sampler to a PC with FSDATA Desktop.

## 3.8 Manual operation

Use manual operation to collect a grab sample, move the distributor arm or operate the pump.

**Note:** Temporarily stop the sampling program before manual operation. Push **RUN/HALT**, then select **Halt Program**.

### 3.8.1 Collect a grab sample

Collect a grab sample to make sure that the sample volume is correct or to bypass the sampling program.

<sup>7</sup> The log files are saved in FSDATA Desktop format.



1. Put the intake tubing into the sample water.
2. For the AWRS sampler, put a graduated cylinder under the distributor outlet or composite tube support inside the AWRS cabinet.
3. For the refrigerated sampler, put a graduated cylinder under the distributor outlet or composite tube support in the refrigerated cabinet.
4. For the portable sampler, put the tubing from the outlet side of the pump into a graduated cylinder.
5. Push **MANUAL OPERATION**.
6. Select Grab Sample.
7. If the liquid detector is enabled, enter the volume to be verified.
8. If the liquid detector is disabled, enter the volume that is specified in the sampling program.
9. Push **OK**. The pump cycle starts (purge-sample-purge).

### 3.8.2 Move the distributor arm

Move the distributor arm manually to put a grab sample in a specific bottle or to make sure that the distributor arm position is correct.

1. Push **MANUAL OPERATION**.
2. Select Move Distributor Arm. The current bottle number is shown.
3. Enter the number of the bottle to move the distributor arm over.
4. Push **Enter**. The distributor arm moves to the selected bottle.

**Note:** To stop the distributor arm at any time, push **STOP**.

### 3.8.3 Start or stop the pump

Operate the pump manually to collect a sample or purge the intake tubing.

1. Push **MANUAL OPERATION**.
2. Select Operate Pump.
3. Select an option.

Option	Description
<b>Pump (Run Forward)</b>	The pump operates in the forward direction to collect a sample and deposit the sample in a sample container.
<b>Purge (Run Backward)</b>	The pump operates in the reverse direction to purge the intake tubing.

4. Push **STOP** to stop the pump.

## Section 4 Troubleshooting

Problem	Possible cause	Solution
The red indicator light flashes.	One or more measurements that the sampler is configured to use (e.g., pH and flow) is not available because the sensor(s) is not connected to the sampler.	Connect the missing sensor to the sampler or make sure that the sampler is not configured: <ul style="list-style-type: none"> <li>• To record sensor measurements to the data log that are not available.</li> <li>• With alarms for sensor measurements that are not available.</li> </ul>
"---" shows on the Status screen.	The measurement is not available or has not been recorded yet.	The measured values shown are the last recorded value. Measurement data is recorded to the data log in accordance with the selected logging interval. Make sure that the measurement is supplied to the sampler.
No measurement data shows.	The data log is empty.	Measurement data is recorded to the data log in accordance with the selected logging interval.
Some measurements supplied to the sampler do not show on the Status screen or the Measurement Data screen.	Only the measurements recorded to the data log show.	Refer to <a href="#">Configure data logging</a> on page 12. To see all the measurements supplied to the sampler by a sensor(s) connected to a sensor port, select <b>Diagnostics&gt;Sensor Ports</b> . To show all the measurements supplied to the sampler by an external instrument(s) that is connected to the AUX I/O port, select <b>Diagnostics&gt;AUX and I/O Port</b> .

### 4.1 Do a diagnostic test

Use the diagnostic tests to examine the operation of individual components.

1. Push **MENU**.
2. Select **DIAGNOSTICS**.
3. Select an option.

Option	Description
<b>Status</b>	Shows the Status screen. Refer to <a href="#">Show the program status</a> on page 27.
<b>Event Log</b>	Shows the event log. Refer to <a href="#">Show the event log</a> on page 29.
<b>Alarm Log</b>	Shows the alarm log. Refer to <a href="#">Show the alarm log</a> on page 29.
<b>Sensor Ports</b>	Tells the sensors connected to the sampler do a measurement and supply advanced information used to identify if the sensor operation is correct. Shows the measurements and information applicable to the measurements. Shows the type and firmware version for each sensor.
<b>AUX (or IO9000 module)</b>	Shows the configuration settings for the AUX I/O port, the flow input signal (0/4–20 mA) and the flow value. In addition, information used by technical support shows (ADC counts, Cal gains and Cal offsets). <b>Note:</b> If the optional IO9000 module is connected to the AUX I/O port, the configuration and status of the analog inputs, analog output, digital outputs and relays show after the IO9000 module is configured.

Option	Description
<b>Distributor</b>	Moves the distributor arm to all the bottle positions regardless of the number of bottles that are selected in the sampling program. <b>Note:</b> To do a diagnostic test for the distributor arm, the sampling program must be configured for multiple bottles.
<b>Keypad</b>	Shows each key that is pushed on the keypad.
<b>Display</b>	Sets each pixel of the display to on and off in different patterns.
<b>Memory</b>	Shows the percent of the controller memory used.

## 4.2 Calibrate the liquid detector

If the samples composition is very different than tap water, calibrate the liquid detector with the guidance of technical support. For example, turbidity more than 1000 NTU or solids more than 2%.

1. Put the intake tubing into the sample water.
2. Push **MENU**.
3. Select Hardware Setup>Liquid Detect>Status. Make sure that the liquid detector is enabled.
4. Select Calibrate>Next. The pump operates in reverse to purge the intake tube. The pump then operates in the forward direction.
5. When the sample goes through the liquid detector and bubbles are not present, push **STOP**. The intake tube is automatically purged. The liquid detector calibration is complete. Make sure that the display shows no errors occurred.
6. Push **Finish** to exit or push **Retry** to do the calibration again.

## Appendix A Appendix

### A.1 Manning roughness coefficients

Refer to [Table 12](#) and [Table 13](#) for the Manning roughness coefficients.

**Table 12 Closed conduit—partly full**

<b>Metal</b>				
Steel	Lockbar and welded	0.010	0.012	0.014
	Riveted and spiral	0.013	0.016	0.017
Cast iron	Coated	0.010	0.013	0.014
	Not coated	0.011	0.014	0.016
Wrought iron	Black	0.012	0.014	0.015
	Galvanized	0.013	0.016	0.017
Corrugated	Subdrain	0.017	0.019	0.021
	Storm drain	0.021	0.024	0.030
<b>Non-metal</b>				
Acrylic	—	0.008	0.009	0.010
Glass	—	0.009	0.010	0.013
Wood	Stave	0.010	0.012	0.014
	Laminated, treated	0.015	0.017	0.020

**Table 12 Closed conduit—partly full (continued)**

Clay	Common drainage tile	0.011	0.013	0.017
	Vitrified sewer	0.011	0.014	0.017
	Vitrified sewer with manholes, inlets, etc.	0.013	0.015	0.017
Brick	Glazed	0.011	0.013	0.015
	Cement lining	0.012	0.015	0.017
Concrete	Culvert, straight and free of debris	0.011	0.011	0.013
	Culvert with bends, connections and some debris	0.011	0.013	0.014
	Sewer with manholes, inlet, straight, etc.	0.013	0.015	0.017
	Unfinished, steel form	0.012	0.013	0.014
	Unfinished, smooth wood form	0.012	0.014	0.016
	Unfinished, rough wood form	0.015	0.017	0.020
	Sanitary sewers coated with sewage slimes	0.012	0.013	0.016
	Paved invert, sewer, smooth bottom	0.016	0.019	0.020
	Rubble masonry, cemented	0.018	0.025	0.030

**Table 13 Lined or built-up channels**

<b>Metal</b>				
Smooth steel surface	Painted	0.011	0.012	0.014
	Not painted	0.012	0.013	0.017
Corrugated	—	0.021	0.025	0.030
<b>Non-metal</b>				
Cement	Neat surface	0.010	0.011	0.013
	Mortar	0.011	0.013	0.015
Concrete	Trowel finish	0.011	0.013	0.015
	Float finish	0.013	0.015	0.016
	Finished, with gravel on bottom	0.015	0.017	0.020
	Unfinished	0.014	0.017	0.020
Wood	Planed, untreated	0.010	0.012	0.014
	Planed, creosoted	0.011	0.012	0.015
	Unplaned	0.011	0.013	0.015
	Plank with battens	0.012	0.015	0.018
Brick	Glazed	0.011	0.013	0.015
	In cement mortar	0.012	0.015	0.018

**Table 13 Lined or built-up channels (continued)**

Masonry	Cemented rubble	0.017	0.025	0.030
	Dry rubble	0.023	0.032	0.035
Asphalt	Smooth	0.013	0.013	—
	Rough	0.016	0.016	—
Vegetal lining	—	0.030	—	0.500
<b>Excavated or dredged</b>				
Earth, straight and uniform		0.016	0.022	0.035
Earth, winding and sluggish		0.023	0.030	0.040
Rock cuts		0.030	0.040	0.050
Not maintained channels		0.040	0.070	0.140
<b>Natural channels (minor streams, top width at flood 30.5 m (100 ft.))</b>				
Fairly regular section		0.030	0.050	0.070
Irregular section with pools		0.040	0.070	0.100







**HACH COMPANY World Headquarters**

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.  
Tel. (970) 669-3050  
(800) 227-4224 (U.S.A. only)  
Fax (970) 669-2932  
orders@hach.com  
www.hach.com

**HACH LANGE GMBH**

Willstätterstraße 11  
D-40549 Düsseldorf, Germany  
Tel. +49 (0) 2 11 52 88-320  
Fax +49 (0) 2 11 52 88-210  
info-de@hach.com  
www.de.hach.com

**HACH LANGE Sàrl**

6, route de Compois  
1222 Vérenaz  
SWITZERLAND  
Tel. +41 22 594 6400  
Fax +41 22 594 6499