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Sigma SD900 Refrigerated Sampler and All Weather Refrigerated Sampler

USER MANUAL

July 2007, Edition 1

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Section 1 Specifications

Specifications are subject to change without notice.

Refrigerated Sampler	
Dimensions (see Figure 1 on page 9)	**Height:** 112 cm (44 in.) **Width:** 61 cm (24 in.) **Depth:** 61 cm (24 in.) **Weight:** 63.3 kg (140 lb)
Refrigerator power requirements (includes 1/6 HP compressor)	100 VAC, 60 Hz, 3.3 A (18 LRA) 115 VAC, 60 Hz, 3.3 A (18 LRA) 230 VAC, 50 Hz, 1.7 A (9 LRA)
Overload protection	Refrigerator: Thermal overload relay, opens at 100–110 °C
Refrigeration system	450 BTU/hr., 120 CFM condenser fan, 3 sided wrap-around plate type evaporator, rigid foam insulation, air sensing thermostat capable of maintaining sample liquid at 4 °C (39 °F) in ambient temperatures up to 50 °C (120 °F); accurate to 0.8 °C (±1.5 °F); magnetic door seal; standard refrigerator cabinet is 22 gauge steel with beige vinyl laminate over-coating (304 stainless steel cabinet optional); refrigeration components and copper plumbing are corrosion protected with phenolic resin conformal coating.
Operating environment	Operating temperature 0–50 °C (32–122 °F). Humidity 0–95 %. RH installation and pollution degree (II, 2). Altitude 2000 m maximum.
All Weather Refrigerated Sampler (AWRS)	
Dimensions (see Figure 2 on page 10)	**Height:** 125 cm (49 in.) **Width:** 71 cm (28 in.) **Depth:** 71 cm (28 in.) **Weight:** 79 kg (175 lb)
Power requirements (includes 1/5 HP compressor)	100 VAC, 60 Hz, 3.8 A or 7.3 A with optional controller compartment heater; 115 VAC, 60 Hz, 3.6 A or 7.6 A with optional controller compartment heater; 230 VAC, 50 Hz, 2.4 A or 4.8 A with optional controller compartment heater
Overload protection	100 and 115 VAC models: 10 A circuit breaker 230 VAC models: 7.5 A circuit breaker
Compressor characteristics	110 °C thermal overload relay 100 and 115 VAC models: 7.1 LRA 230 VAC models: 14.5 LRA
Thermal system	Top mounted compressor/condenser with fan forced air cooled condenser; 3 sided wrap-around evaporator plate; 2" rigid foam insulation; microprocessor controlled thermostat maintains sample liquid at 4 °C (±1 °C); frost free; compression gasket door seal; air cooled condenser is protected against corrosion with a food grade epoxy; all exposed copper tubing is insulated to avoid sweating and condensation.
Cabinet	Fiberglass reinforced plastic with beige UV-inhibited polymer laminate
Operating environment	0–50 °C (32–122 °F); With optional controller compartment heater, -40–50 °C (-40–122 °F). Humidity 0–95 %. RH installation and pollution degree (II, 2). Altitude 2000 m maximum.
Recovery time	Sampler temperature recovers to 4 °C within 5 minutes after the door has been held open for one minute in 24 °C (75 °F) ambient environment.
Pull down time	Air temperature drops from 24 °C (75 °F) to 4 °C (39 °F) within 15 minutes

Sample bottle capacity (see Figure 3 on page 11 and Figure 4 on page 12)	
Single bottle mode	(1) 21 L (5.5 gal) polyethylene or (1) 10 L (2.5 gal) polyethylene or (1) 10 L (2.5 gal) glass bottle
Multiple bottle mode	(2) 10 L (2.5 gal) polyethylene and/or 10 L (2.5 gal) glass bottles (4) 10 L (2.5 gal) polyethylene and/or 10 L (2.5 gal) glass bottles (8) 2.3 L (0.6 gal) polyethylene and/or 1.9 L (0.5 gal) glass bottles (24) 1 L polyethylene and/or 350 mL glass bottles
Intake accessories	
Strainers	316 stainless steel in standard size, high velocity or low profile for shallow depth applications and Teflon®/316 stainless steel in standard size
Sample intake tubing	9.5 mm (3/8 in.) I.D. vinyl or Teflon®-lined polyethylene
SD900 controller	
Enclosure	High-Impact, injection-molded PC/ABS blend; submersible, watertight, dust-tight, corrosion, and ice resistant; NEMA 4X, 6, IP 67
Power requirements	Refrigerated sampler: 15 VDC provided by 8754500 power supply AWRS sampler: 15 VDC provided by integral power supply
Overload protection	6 amp DC line fuse for pump
Pump	Peristaltic high speed, with spring-mounted rollers
Pump rollers	Nylatron, impact/corrosion resistant
Pump enclosure	Track is injection-molded polyphenylene sulfide. Cover is polycarbonate, high impact resistant. Pump enclosure rated IP37.
Pump tubing	9.5 mm I.D. x 15.9 O.D. mm (3/8 in. x 5/8 in.) silicone
Pump tubing life	20,000 sample cycles under the following conditions: • 1 L sample volume • 1 rinse • 6 minute pacing interval • 16 ft of 3/8 in. intake tube • 15 ft of vertical lift • 70 °F sample temperature
Tubing replacement time	< 1 minute using pre-cut pump tube
Maximum vertical lift to draw sample	Minimum of 28 ft, using 29 ft of 3/8-in. vinyl intake tube at sea level at 20–25 °C (68–77 °F)
Pump flow rate	1.25 gpm (4.8 L/min) at 3 ft (1 m) vertical lift using 3/8-in. intake tube
Typical sample volume repeatability	± 5% of 200 mL sample volume using uncalibrated liquid detect with 15 feet vertical lift,16 feet of 3/8-in. vinyl intake tube configured for a single bottle using full bottle shut-off at room temperature and 5000 ft elevation
Typical sample volume accuracy	± 10% of 200 mL sample volume using uncalibrated liquid detect with 15 feet vertical lift,16 feet of 3/8-in. vinyl intake tube configured for a single bottle using full bottle shut-off at room temperature and 5000 ft elevation
Typical transfer velocity	2.9 ft/s (0.9 m/s) with 15 ft (4.6 m) vertical lift, 16 ft of 3/8-in. vinyl intake tubing, 70 °F (21 °C) and 5000 ft elevation
Liquid sensor	Ultrasonic
Liquid sensor body	Ultem® NSF ANSI standard 51 approved, USP Class VI compliant
Internal battery	Lithium
Internal clock	Indicates real time and date

Storage temperature	–30 to 60 °C (–22 to 140 °F)
Operating temperature	0 to 50 °C (32 to 122 °F)
Storage/operating humidity	100% condensing
Graphics display	Graphic dot matrix, 128 x 64 pixel with LED backlight. Self prompting, menu-driven program.
Status display	Indicates the number of samples collected, the number of missed samples, inhibit mode, bottle position, time or counts to next sample and battery voltage
Automatic shutdown	Multiple bottle mode: after complete revolution of distributor arm (unless Continuous Mode is selected). Composite mode: after preset number of samples have been delivered to composite container, from 1 to 999 samples, or upon full container.
User interface	Embossed keypad with one power key, four function keys, and eight navigation keys; LED indicator
Event Logging	Ability to store up to 255 entries in Sample history logging: sample time stamp, bottle number and status (Power On, Power Fail, Firmware Updated, Pump Fault, Distributor Arm Error, Low Memory Battery, Low Main Battery, User On, User Off, Program Started, Program Resumed, Program Halted, Program Completed, Grab Sample, Tube Change Required, Cooling Fail, Heating Fail, Thermal Error Clear)
Connections	Power, auxiliary, serial communications and distributor
Fittings	Barbed fittings for 3/8-in. I.D. flexible tubing
Wetted materials	Typical materials in contact with sample: stainless steel, PE, Teflon, Ultem, Silicon or approved materials that can be tested for leaching properties
Weight	4.2 kg (9 lb, 5 oz)
Dimensions	10-3/8 in. (26.4 cm) L x 11-½ in. (29.2 cm) W x 6-¾ in. (17.1 cm) H
Programming features	
Password protection	6-character; protect changes to program and system settings
Multiple programs	Stores up to three sampling programs
Cascade programs	Two samplers used in combination. The second sampler is initiated after the first sampler completes the program.
Synchronized sampling	Ability to simultaneously take two samples with input from a single flow meter
Sample volume	Programmed in 10-mL increments from 100 to 10,000 mL
Air purge	Air purged automatically before and after each sample; duration automatically compensates for varying intake line lengths.
Intake rinse option	Option to rinse intake line with source liquid prior to each sample, 1 to 3 rinses.
Sample distribution	Composite, samples per bottle or bottles per sample.
Setpoint sampling	Ability to start and/or stop a sample program based on an external trigger.
User start/stop times	Up to 12 user-defined start/stop times/dates, with option to restart at position 1.
Storm water program	Ability to run time-based, first flush program in parallel with main sample program.
Current status	Display parameters relevant to main or storm water programs.
Units of measure	Volume: gallons or mL; length: feet (ft) or cm
Sample retries	Option to repeat sample collection cycle from 1 to 3 times if sample not obtained on initial attempt.
Manual grab sample	Ability to manually deliver a grab sample to a specific bottle location
Run modes	Continuous or non-continuous with user-entered number of samples.

Time pacing	Uniform or variable time intervals.
Flow pacing	Uniform or variable flow intervals.
Auxiliary connector	Power to Sigma 9XX, SD900, flow pulse input, external inhibit, special output, bottle number output and program complete output.
Program delay	Two formats: 1) 1–9,999 flow pulses (in one unit increments); 2) Programmable start time/date
Communication	
Firmware updates	Ability to perform field upgrades using Sample View software
Serial interface	RS232 compatible; allows on-site collection of stored data including event log and sample history. Ability to configure remotely. Supports Modbus for SCADA connectivity.

1.1 Refrigerated sampler dimensions

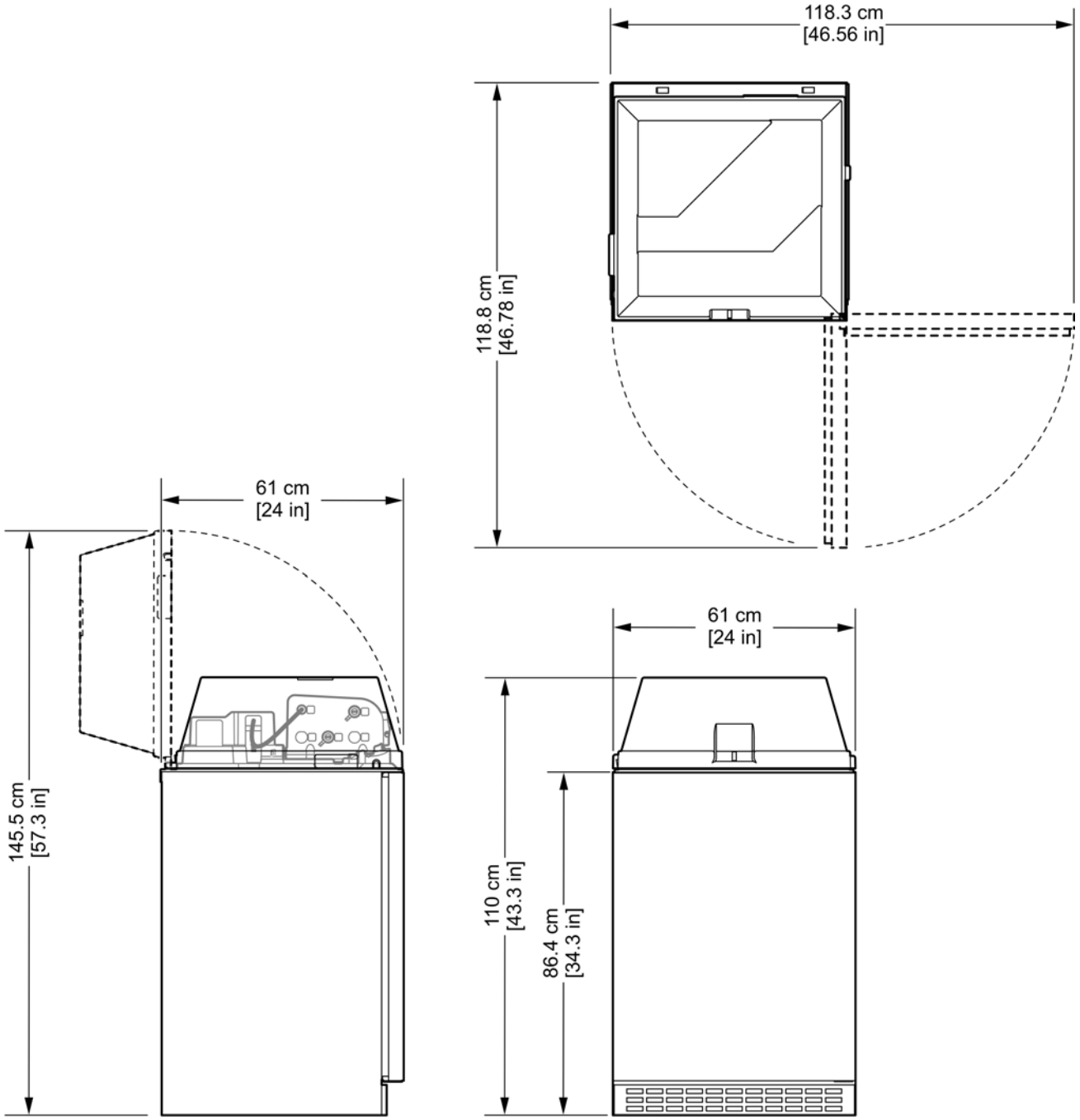


Figure 1 Refrigerated sampler dimensions

1.2 All weather refrigerated sampler dimensions

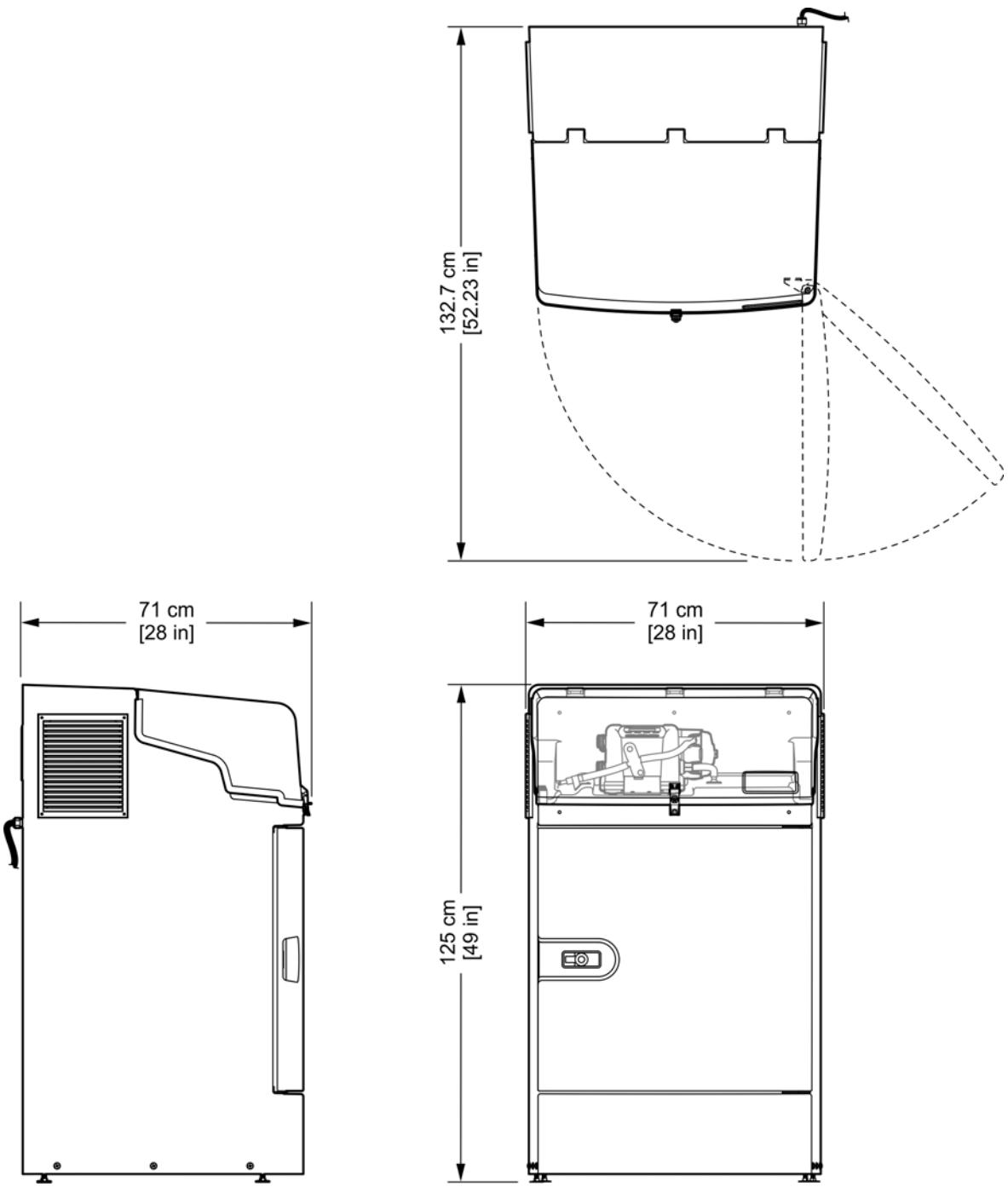


Figure 2 All weather refrigerated sampler dimensions

1.3 Bottle and retainer configurations

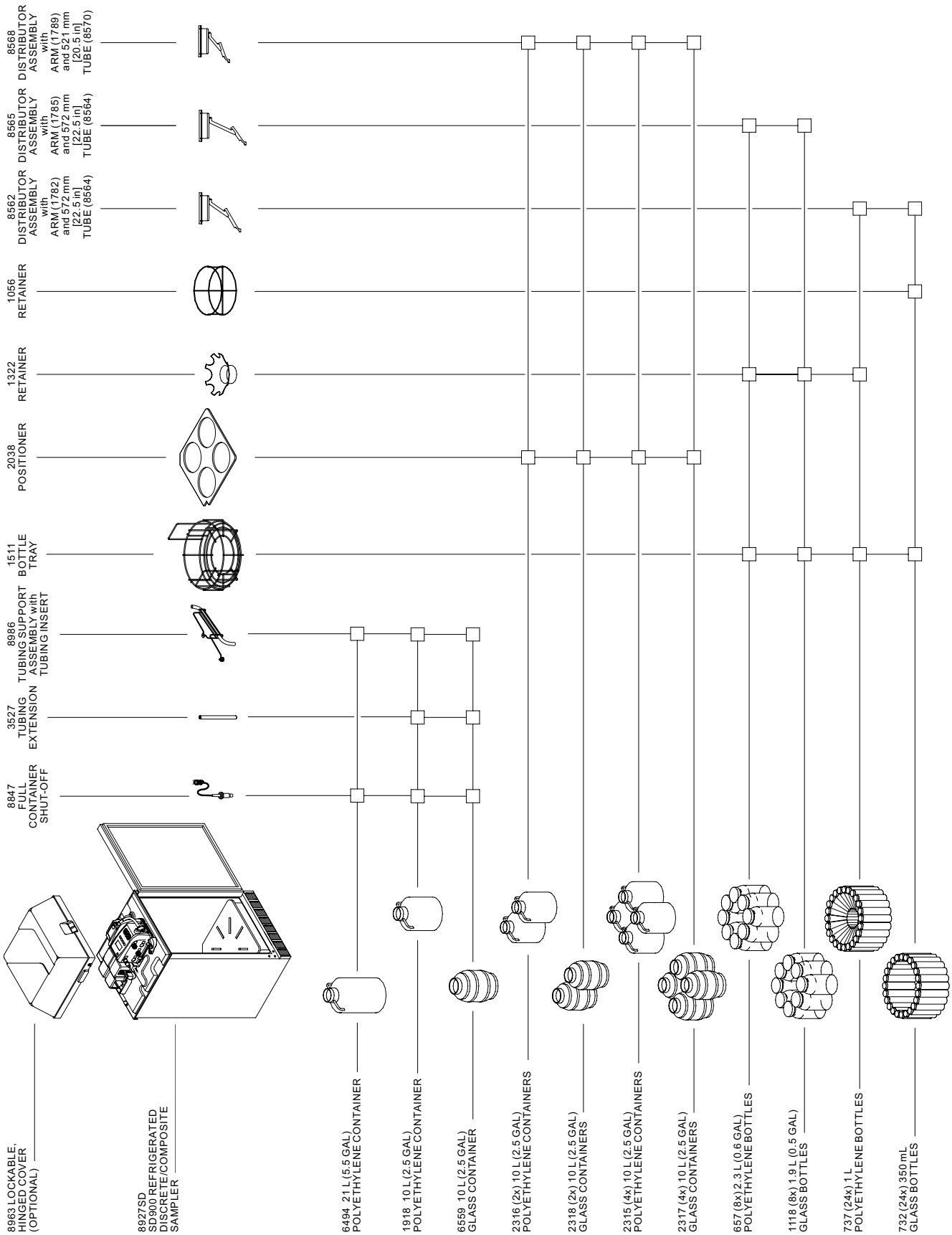


Figure 3 Refrigerated sampler bottle and retainer configurations

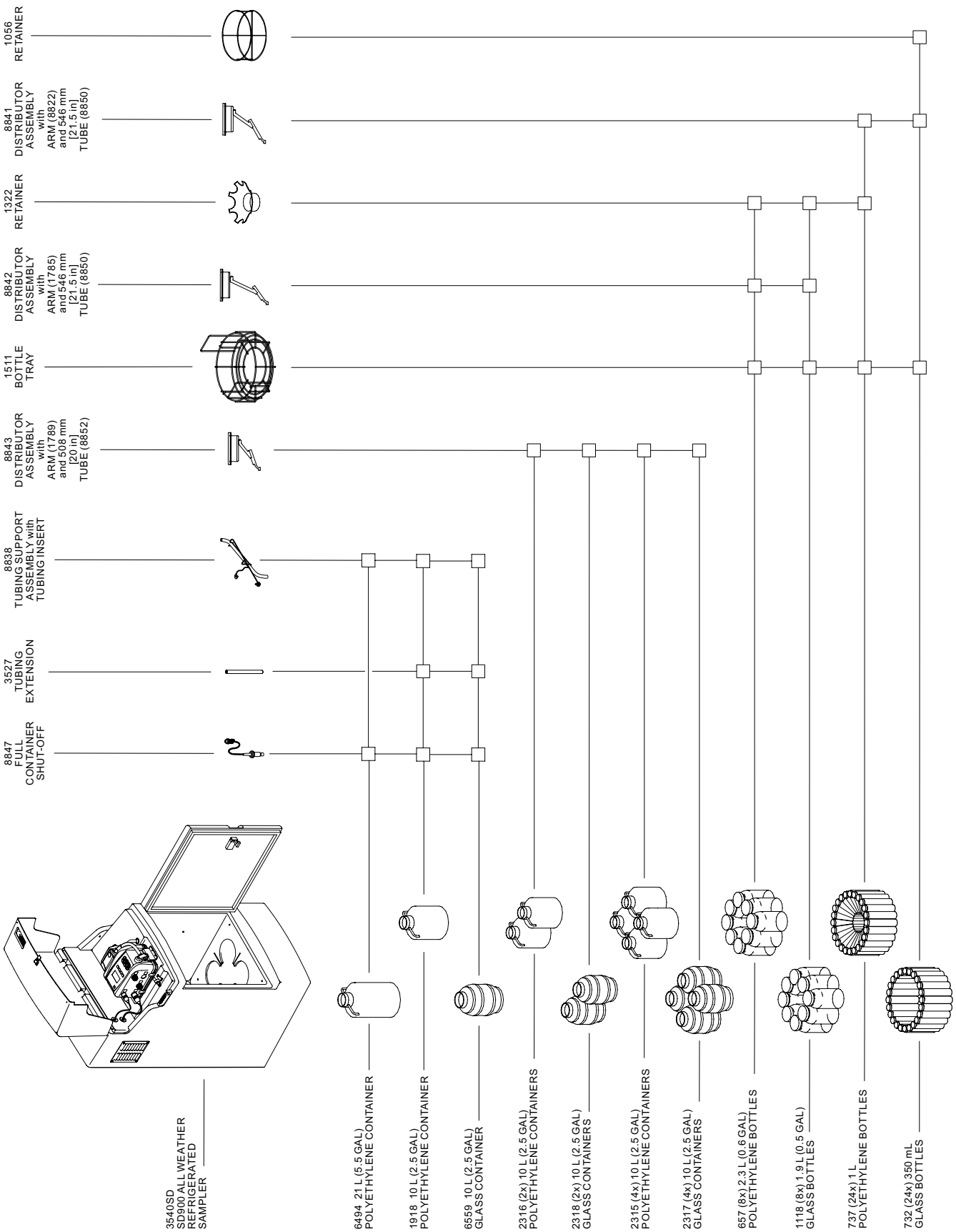


Figure 4 All weather refrigerated sampler bottle and retainer configurations

Section 2 General Information

2.1 Safety information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To make sure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, when noted on the product, indicates that the marked item can be hot and should not be touched without care.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol, when noted on the product, indicated the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.
	This symbol, if noted on the product, indicates a pinch hazard. Keep hands and fingers clear.

2.1.3 Confined space precautions

Important Note: *The following information is provided to guide users of Sigma SD900 Refrigerated Samplers and Sigma SD900 All Weather Refrigerated Samplers on the dangers and risks associated with entry into confined spaces.*

On April 15, 1993, OSHA's final ruling on CFR 1910.146, Permit Required Confined Spaces, became law. This new standard directly affects more than 250,000 industrial sites in the U.S.A. and was created to protect the health and safety of workers in confined spaces.

Definition of a confined space
A confined space is any location or enclosure that presents or has the immediate potential to present one or more of the following conditions:

- An atmosphere with less than 19.5% or greater than 23.5% oxygen and/or more than 10 ppm Hydrogen Sulfide (H_2S).
- An atmosphere that may be flammable or explosive due to gases, vapors, mists, dusts or fibers.
- Toxic materials which upon contact or inhalation, could result in injury, impairment of health or death.

Confined spaces are not designed for human occupancy. They have restricted entry and contain known or potential hazards. Examples of confined spaces include manholes, stacks, pipes, vats, switch vaults, and other similar locations.

Standard safety procedures must always be followed prior to entry into confined spaces and/or locations where hazardous gases, vapors, mists, dusts or fibers may be present. Before entering any confined space check with your employer for procedures related to confined space entry.

2.2 Sampler overview

DANGER
Explosion hazard. The refrigerated sampler and all weather refrigerated sampler are not certified for, nor suitable for use in hazardous classified locations.

DANGER
This sampler is designed for collection of aqueous samples only. Non-aqueous samples may damage the equipment and could result in fire and chemical hazards.

The SD900 sampler automatically collects and preserves liquid samples. The sampler is suitable for collection of conventional and toxic pollutants and suspended solids.

2.2.1 Sampler components

Refrigerated sampler
(Figure 5 on page 18) The refrigerated sampler is designed for indoor use. The sampler controller is mounted on top of a specially designed refrigerator. The sample line passes through the top of the refrigerator and into the refrigerated compartment where the sample container(s) are located. The compartment is surrounded by rigid foam insulation and utilizes a 120 CFM condenser fan.

Sample temperature is controlled by an air sensing thermostat maintaining samples at 4 °C (39 °F) in ambients up to 49 °C (120 °F). The temperature inside the refrigerator is controlled by the thermostat control knob, which is recessed in the front grill on the bottom of the refrigerator. The unit has a magnetic door seal and does not require rear ventilation. The refrigerator interior is food grade plastic and the exterior is vinyl coated galvanized steel (304 stainless steel is optional). As a further barrier against corrosion, the refrigeration components and copper plumbing are treated with a phenolic resin coating.

The controller is powered by a separate power supply located on top of the refrigerator and constrained by the transition plate and power supply retainer, NEMA 4X IP 66.

All weather refrigerated sampler
(Figure 5 on page 18) The all weather refrigerated sampler is designed for indoor and outdoor applications. Conforming to NEMA 4X, 6 standards, the controller withstands submersion, corrosion and ice. Refrigeration components are polymer coated, providing superior corrosive resistance. With the compressor and condenser located above the refrigerated compartment, heat transfer is directed away from the compartment. A microprocessor controlled thermal system maintains samples at EPA mandated 4 °C (39 °F). Top mounted refrigeration components also minimize exposure to the corrosive plant environments.

Controller
The controller is located on top of the refrigerator. Use the controller to program the sampler and for manual operation. The controller contains the following components:

- Pump—operates in the forward or reverse direction to collect a sample, rinse and purge the intake tube.
- Liquid sensor—allows the sampler to dispense accurate sample volumes into the sample bottle(s). Can be calibrated to specific sample conditions in the field.
- Cable connectors—for power, flow meter or communication.
- Desiccant—absorbs internal moisture in the controller and prevents corrosion

2.2.1.1 Controller cover

Refrigerated Sampler
An optional controller cover (Cat. No. 8963) locks and protects the controller from damage and unauthorized use.

All weather refrigerated sampler
The lockable top cover protects the controller compartment from extreme weather as well as unauthorized use. When open, it is supported with a simple rod and clip similar to a car hood support.

2.2.1.2 Controller compartment heater (AWRS only)

The optional 500 watt controller compartment heater provides several benefits in colder climates:

• Prevents residual liquid from freezing in the pump.

• Pump tubing stays resilient, prolonging the life of the tubing, pump rollers, motor, and gear box.

• Prevents ice and snow from building up on the cover.

• Keeps LCD functional and electronics from temperature extremes.

The compartment heater operation is microprocessor controlled and automatic. This is a factory installed option and needs to be specified at time of order.

2.2.1.3 Refrigeration compartment door (AWRS only)

The lockable front door opens by pressing the round button in the center of the latch. When closing the door, flip the latch closed to pull the door tight. Two keys are provided for the door lock. Over time, the door latch may require adjustment (see section 6.8 on page 70).

Section 3 Installation

3.1 Unpack the sampler

The sampler can be set up for single-bottle or multiple-bottle collection. The components for each configuration will vary (see Figure 5 on page 18 for single-bottle or Figure 6 on page 19 for multiple-bottle collection).

Check the sampler packages for the following components:

- Sampler—includes cover (optional on the refrigerated sampler) with controller and distributor or full bottle shut-off
- Bottle(s)—1, 2, 4, 8 or 24
- Power source—AC power supply (refrigerated sampler only)
- Pump tubing—replacement
- Sample intake tubing—vinyl or Teflon-lined
- Silicone grease packet—for desiccant maintenance
- Strainer—stainless steel or Teflon/stainless steel
- User documentation
- Optional anchor bracket mounting kit (AWRS only, Cat. No. 8935)

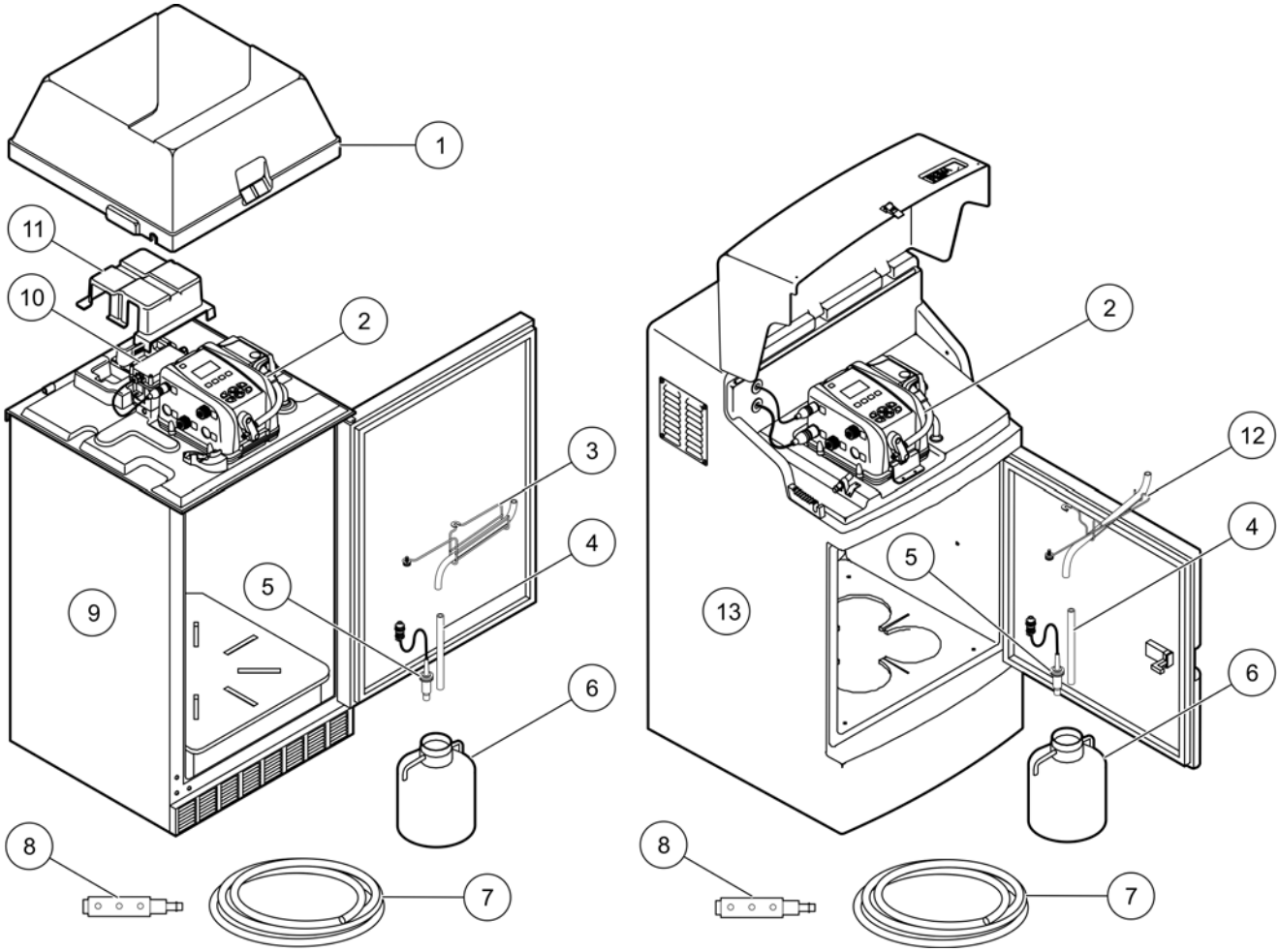


Figure 5 Sampler with single bottle

1	Optional cover (Cat. No. 8963)	**8**	Strainer
2	Controller	**9**	Refrigerated sampler
3	Tubing support (Cat. No. 8986)	**10**	Power source
4	Tubing extension[1] (Cat. No. 3527)	**11**	Power supply retainer
5	Full container shut-off (Cat. No. 8847)	**12**	Tubing support (Cat. No. 8838)
6	Sample bottle	**13**	All weather refrigerated sampler
7	Intake tubing, vinyl or teflon-lined		

[1] Not used with 21 liter (5.5 gal) bottle.

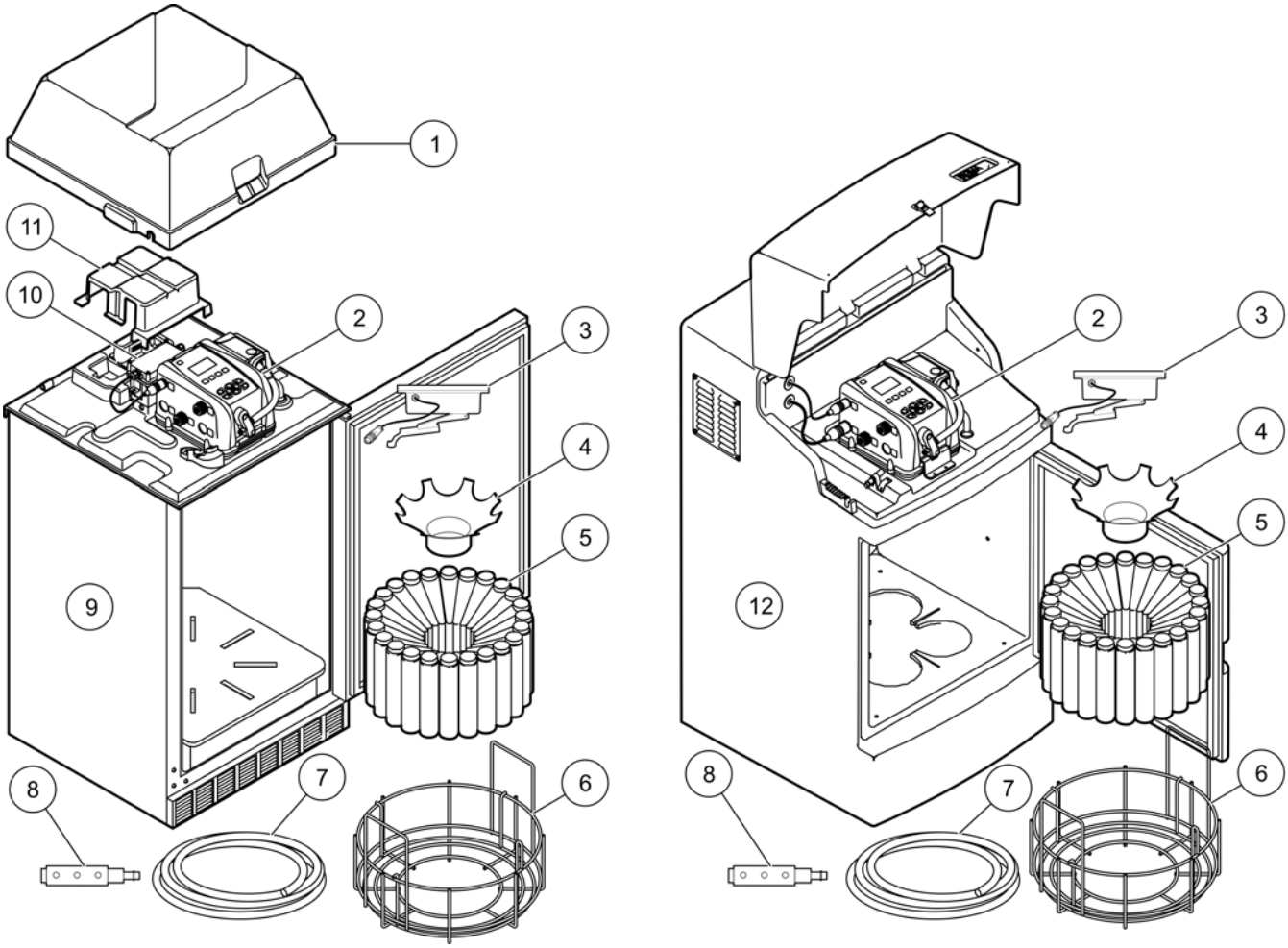


Figure 6 Sampler with multiple bottles

1	Optional cover (Cat. No. 8963)	**7**	Intake tubing, vinyl or teflon-lined
2	Controller	**8**	Strainer
3	Distributor assembly	**9**	Refrigerated sampler
4	Retainer[1]	**10**	Power source
5	Sample bottles	**11**	Power supply retainer
6	Bottle tray (Cat. No. 1511)	**12**	All weather refrigerated sampler

[1] Glass bottles require a different retainer (Cat. No. 1056) than shown in the illustration.

3.2 Installation guidelines

CAUTION
Potential electrical and chemical hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

WARNING
Explosion hazard. This product is not designed for hazardous locations where combustible environments may exist.

Refer to the following guidelines and Figure 7 when evaluating site location.

- If the site is located in a confined space, refer to section 2.1.3 on page 14 for safety information.
- Make sure that the temperature at the site is within the operating temperature range that is specified for the sampler.
- Make sure that the intake tube is as short as possible.
- Maximize the vertical slope of the intake tube from the sampler to the sample source so that the tube drains completely. This prevents cross-contamination of samples and freezing the tube.

  Note: *See Specifications on page 5 for limitations on transport velocity and maximum vertical lift.*

  Note: *If site conditions do not permit the intake tube to have a downward slope, or if the line is pressurized, disable the liquid sensor and calibrate the sample volume (section 4.8.2 on page 50).*

- Install the strainer in the middle of the sample stream (not near the surface or bottom) to make sure that a representative sample is collected.
- Install the sampler on a level surface.

  Note: *The all weather refrigerated sampler includes four leveling feet, which can be independently adjusted to level the sampler. An optional anchor bracket mounting kit (Cat. No.* 8935*) is available for the AWRS for permanent installation.*

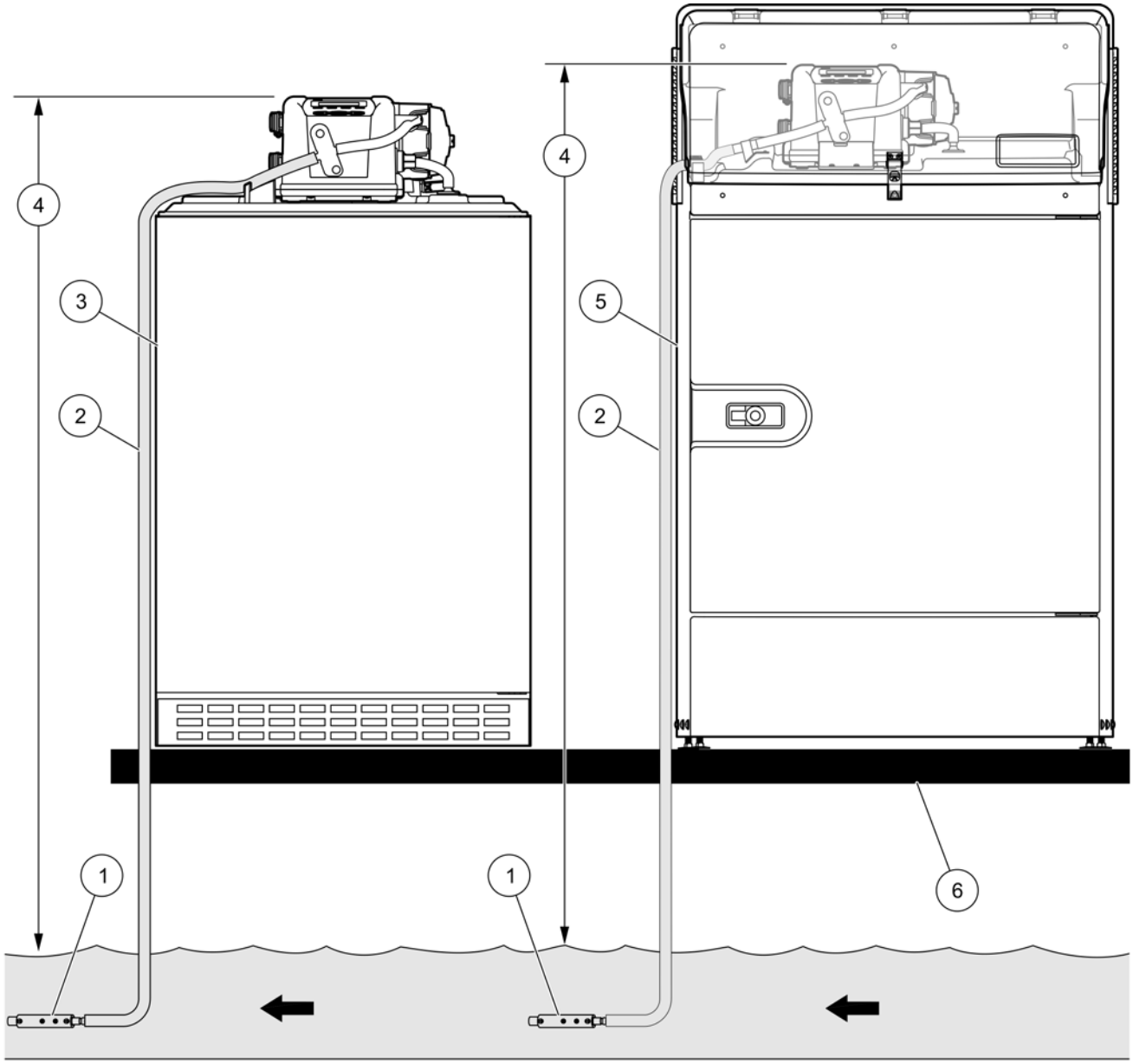


Figure 7 Mounting configuration

1	Strainer	**4**	Vertical lift
2	Intake tubing	**5**	All weather refrigerated sampler
3	Refrigerated sampler	**6**	Mounting surface

3.3 Sampler preparation

CAUTION
Biological sample hazard. Follow safe handling protocols during contact with sample bottles and sampler components. Disconnect the sampler from power to disable the pump before handling.

The sampler is set up at the factory with a single bottle or multiple bottle configuration. To change the bottle configuration:

- Use Figure 3 on page 11 or Figure 4 on page 12 to determine the components that are required for the selected configuration.
- Install the full bottle shut-off device (section 3.3.2.1 on page 22) or distributor assembly (section 3.3.3.4 on page 28).

3.3.1 Clean the sample bottles

Clean the sample bottles and caps using a brush and water with a mild detergent before setting up the sampler. Rinse the containers with fresh water followed by a distilled water rinse. Glass bottles may also be autoclaved.

3.3.2 Single bottle installation

Use a single bottle when one composite sample is needed. A full bottle shut-off signals the controller when to stop sample collection. Refer to Figure 5 on page 18 for a diagram of required components.

Prerequisites:

- One plastic or glass bottle
- Tubing extension (if using 2.5-gallon bottles)

Installation procedure:

1. Clean the sample bottle as described in section 3.3.1.
2. Place the sample bottle in the center of the refrigerator.
3. Install the full bottle shut-off (section 3.3.2.1).
4. Program the sampler.

3.3.2.1 Full bottle shut-off installation

The full bottle shut-off is typically installed at the factory and signals the controller when the bottle is full. Complete the following steps to replace or install a new full bottle shut-off.

Prerequisites:

- Full bottle shut-off device
- Tubing support and tubing

Installation procedure:

1. Install the rubber grommet into the center hole provided in the cap of the composite bottle.

2. Slide the full bottle shut-off, float first, into the bottle through the center of the grommet.
3. Connect the cable on the full bottle shut-off to the bottom of the controller (Figure 8). Turn to tighten.
4. Slide the slot in the tubing support around the retainer pin on the top inside surface of the refrigerator (Figure 8). Make sure that the tube exits through the ends of the tubing support.
5. Position the thumbscrew over the threaded hole and hand-tighten to hold the tubing support in place.
6. Connect one end of the tubing to the inside tube fitting (Figure 8).
7. Insert the other end of the tubing into the off-center hole provided in the cap of the composite bottle.

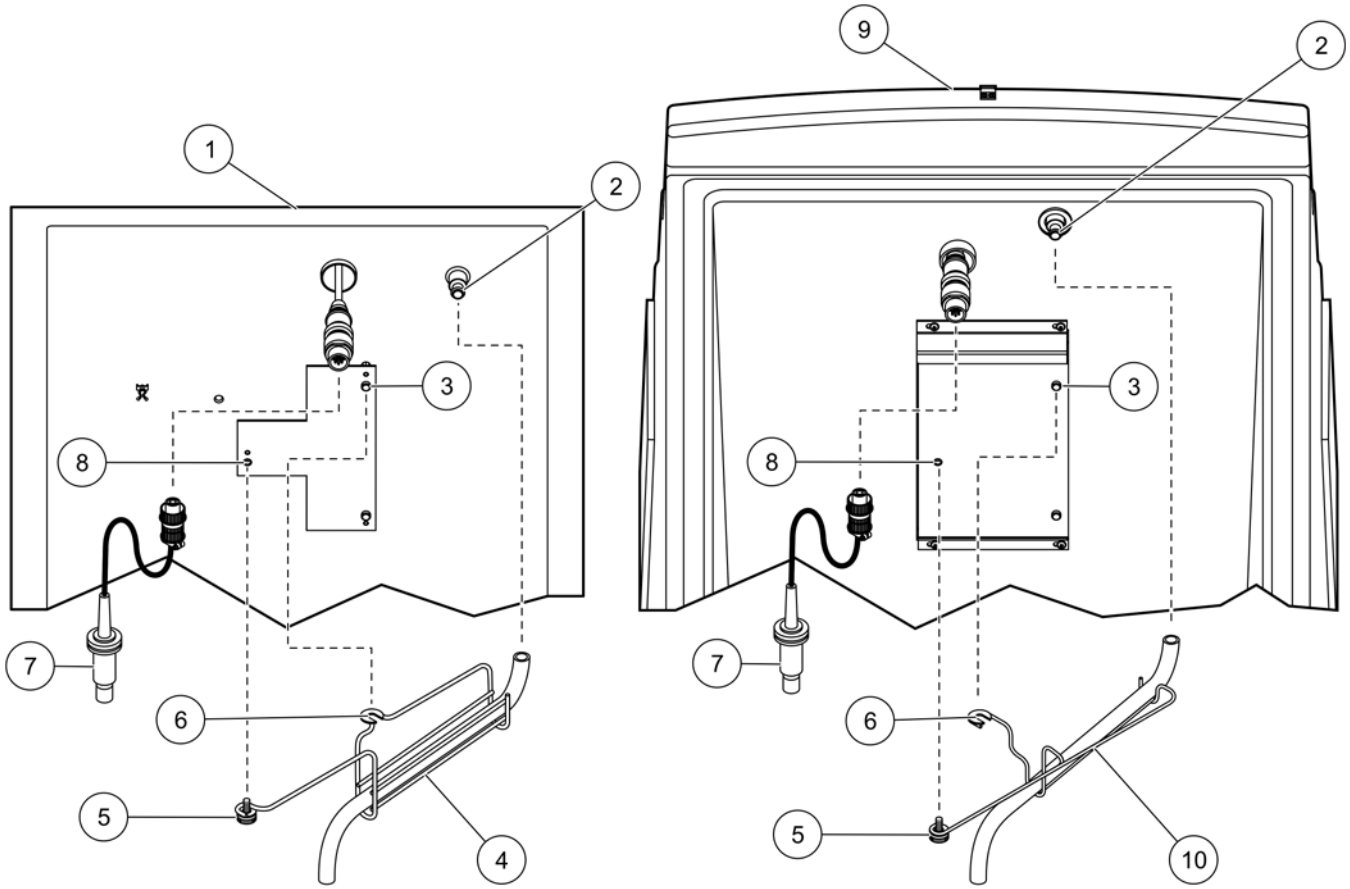


Figure 8 Full bottle shut-off installation

1	Refrigerated sampler	**6**	Slots
2	Inside tube fitting	**7**	Full bottle shut-off assembly
3	Retainer pin	**8**	Threaded hole
4	Tubing support (refrigerated sampler)	**9**	All weather refrigerated sampler
5	Thumbscrew	**10**	Tubing support (AWRS)

3.3.3 Multiple bottle installation

Use multiple bottles to collect samples into separate bottles or into more than one bottle. A distributor positions the sample tube over each bottle. Position the bottles in the sampler as shown in the following installation sections. Refer to Figure 3 on page 11 or Figure 4 on page 12 for a diagram of required components.

3.3.3.1 Two or four bottle installation

Use 2 or 4 bottles to collect samples into 10-liter (2.5-gallon) bottles.

Prerequisites:

- Two or four 10-liter (2.5-gallon) plastic or glass bottles
- Positioner (refrigerated sampler only)

Installation procedure:

1. Clean the sample bottles as described in section 3.3.1.
2. Insert the bottle positioner into the refrigerator compartment, aligning the notch on the back left corner so that it clears the drip tube (refrigerated sampler only).
3. Place the bottles in the refrigerator as shown in Figure 9.
4. Program the sampler.

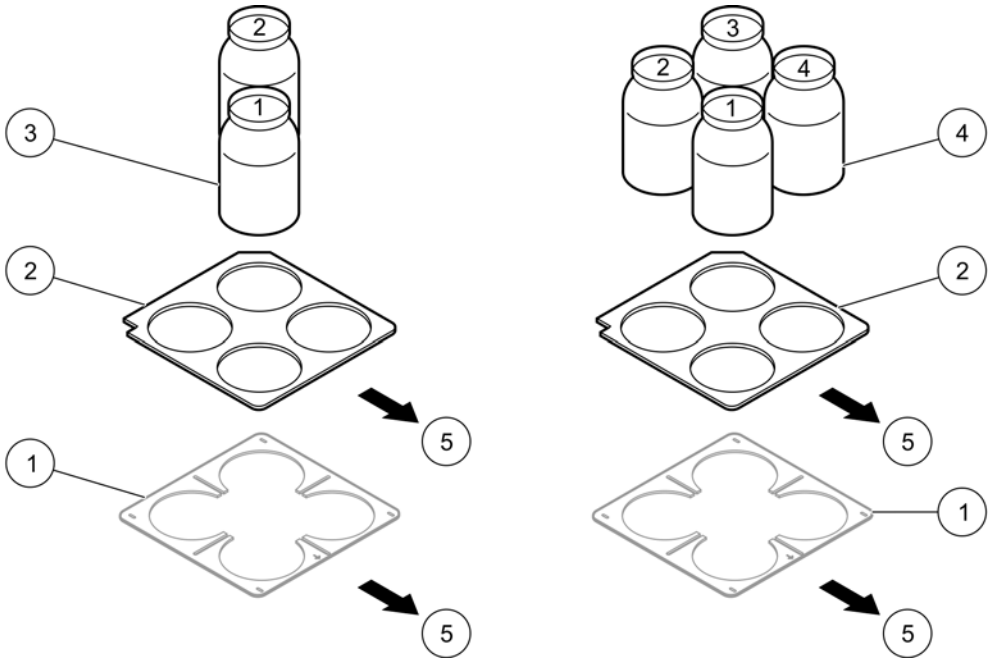


Figure 9 Two and four bottle installation

1	Base of refrigerator compartment (AWRS)	**4**	10-liter (2.5-gal) plastic or glass bottles (4x)
2	Positioner insert (refrigerated sampler) (Cat. No. 2038)	**5**	Front of sampler
3	10-liter (2.5-gal) plastic or glass bottles (2x)		

3.3.3.2 Eight bottle installation

Use 8 bottles to collect samples into 1.9-liter (0.5-gallon) glass or 2.3-liter (0.6-gallon) bottles.

Prerequisites:

- 8 plastic or glass bottles
- Retainer (Cat. No. 1322)

Installation procedure:

1. Clean the sample bottles as described in section 3.3.1.
2. Place the bottles into the bottle tray. Looking down on the tray, bottle one is the first bottle to the left of the bottle one indicator wire (see Figure 10 on page 26).
3. Place the retainer over the bottles.
4. Place the bottle tray in the refrigerator. Align the wires on the bottom of the tray so that they set in the refrigerator compartment base slots.
5. Program the sampler.

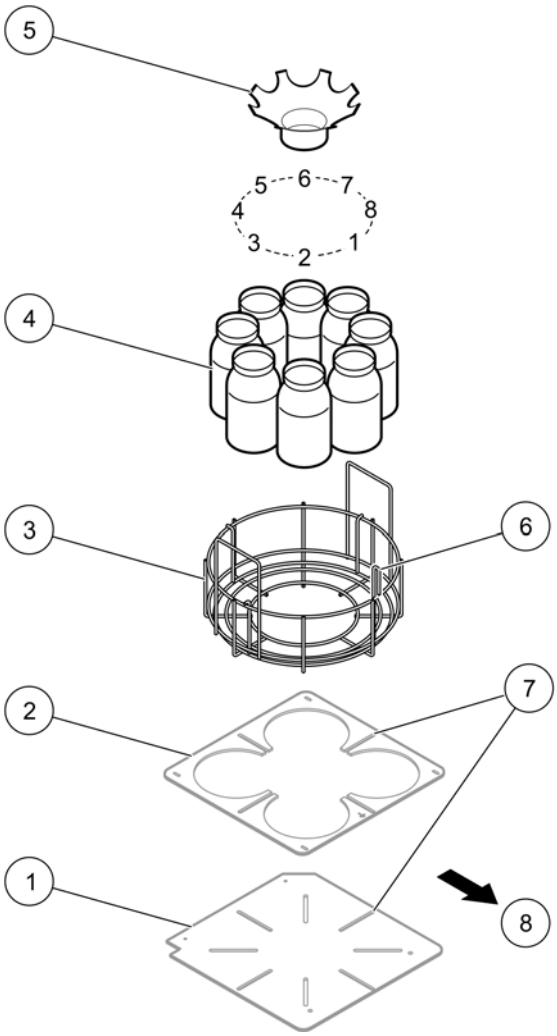


Figure 10 Eight bottle installation

1	Base of refrigerator compartment (refrigerated sampler)	**5**	Retainer (Cat. No. 1322)
2	Base of refrigerator compartment (AWRS)	**6**	Bottle one indicator wire
3	Bottle tray (Cat. No. 1511)	**7**	Positioner slot for bottle tray
4	2.3-L (0.6-gal) poly or 1.9-L (0.5-gal) glass bottles (8x)	**8**	Front of sampler

3.3.3.3 24 bottle installation

Use 24 bottles to collect samples into 350-mL or 1-liter bottles.

Prerequisites:

- 24 plastic or glass bottles
- Retainer

Note: *Refer to* Figure 3 on page 11 or Figure 4 on page 12 *to make sure that the correct sample bottles are used with the correct retainer.*

Installation procedure:

1. Clean the sample bottles as described in section 3.3.1.
2. Place the bottles into the bottle tray. Looking down on the tray, bottle one is the first bottle to the left of the bottle one indicator wire (see Figure 11 on page 27).
3. Place the retainer over the bottles.

   Note: *If using 350-mL glass bottles, place the bottles around the outside of the retainer.*

4. Place the bottle tray in the refrigerator. Align the wires on the bottom of the tray so that they set in the refrigerator compartment base slots.
5. Program the sampler.

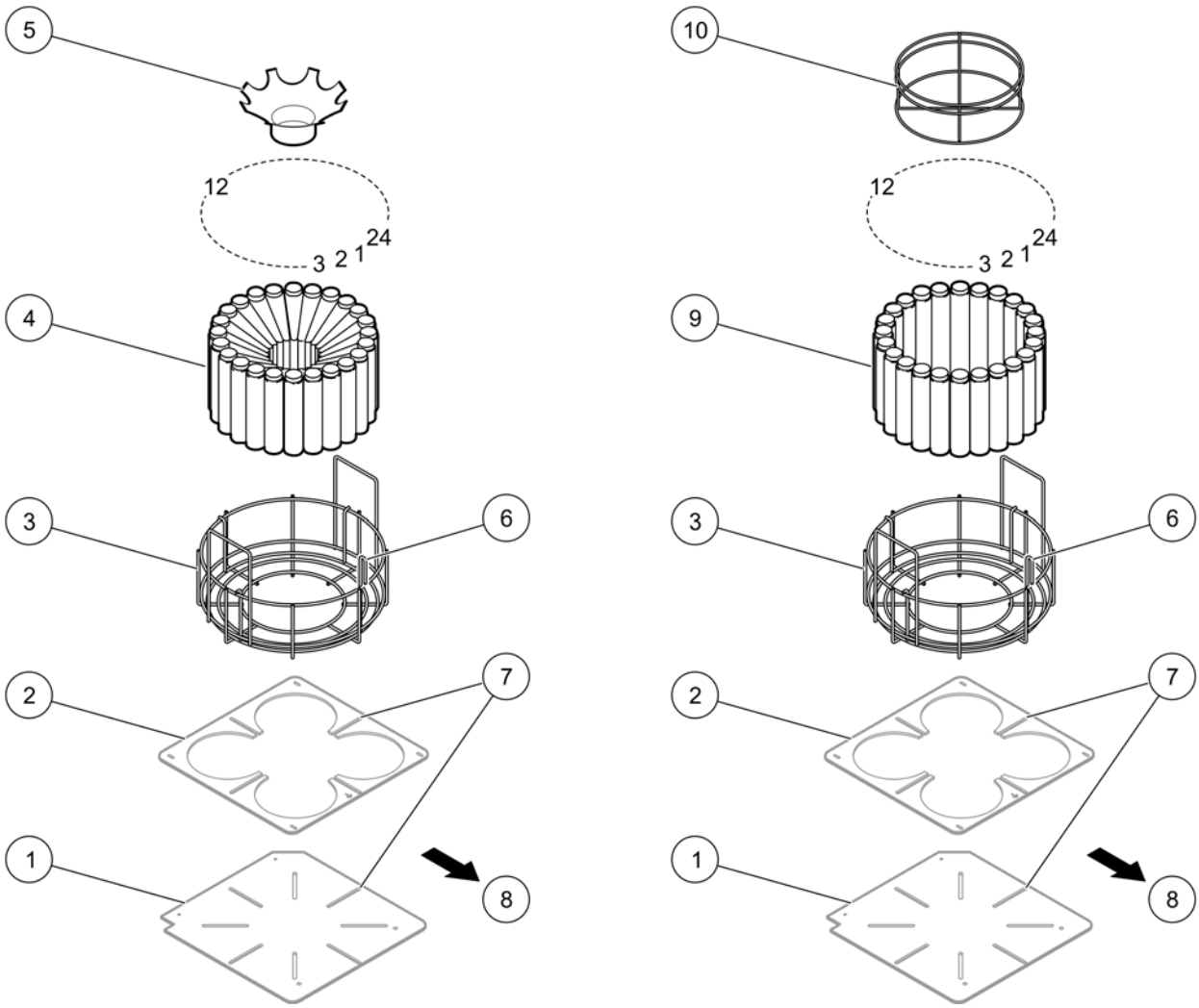


Figure 11 24 bottle installation

1	Base of refrigerator compartment (refrigerated sampler)	**6**	Bottle one indicator wire
2	Base of refrigerator compartment (AWRS)	**7**	Positioner slot for bottle tray
3	Bottle tray (Cat. No. 1511)	**8**	Front of sampler
4	1-L poly bottles (24x)	**9**	350-mL glass bottles (24x)
5	Retainer (Cat. No. 1322)	**10**	Retainer (Cat. No. 1056)

3.3.3.4 Distributor installation

CAUTION
Pinch hazard. Make sure the sampler is powered off before removing or installing the distributor assembly.

The distributor automatically moves the sample tube over each bottle during multiple bottle sampling. The distributor assembly is typically installed at the factory. Complete the following steps to install a new or different assembly.

Prerequisites:

- Distributor assembly—three assemblies are available. Refer to Figure 3 on page 11 or Figure 4 on page 12 to make sure that the correct distributor assembly is used.

Installation procedure:

1. Slide the two slots in the distributor assembly housing under the retainer pins located on the top inside surface of the refrigerator (Figure 12).
2. When fully seated, hand-tighten the thumbscrew on the distributor assembly to hold the distributor in place.
3. Push the distributor tubing on the sampler fitting on the top inside surface of the refrigerator (Figure 12).
4. To make sure that the arm has sufficient freedom of movement, hand-rotate the arm in a circle (both right and left) until it hits the arm stop. If the arm does not rotate freely, reposition the tubing to the other side of the arm so that the arm can rotate.

   Note: *Do not force the arm past the arm stop. The arm stop prevents the arm from rotating more than 360 degrees and pinching the tubing.*

5. To make sure that the distributor is aligned properly, run the manual distributor diagnostic (see section 7.3 on page 73).

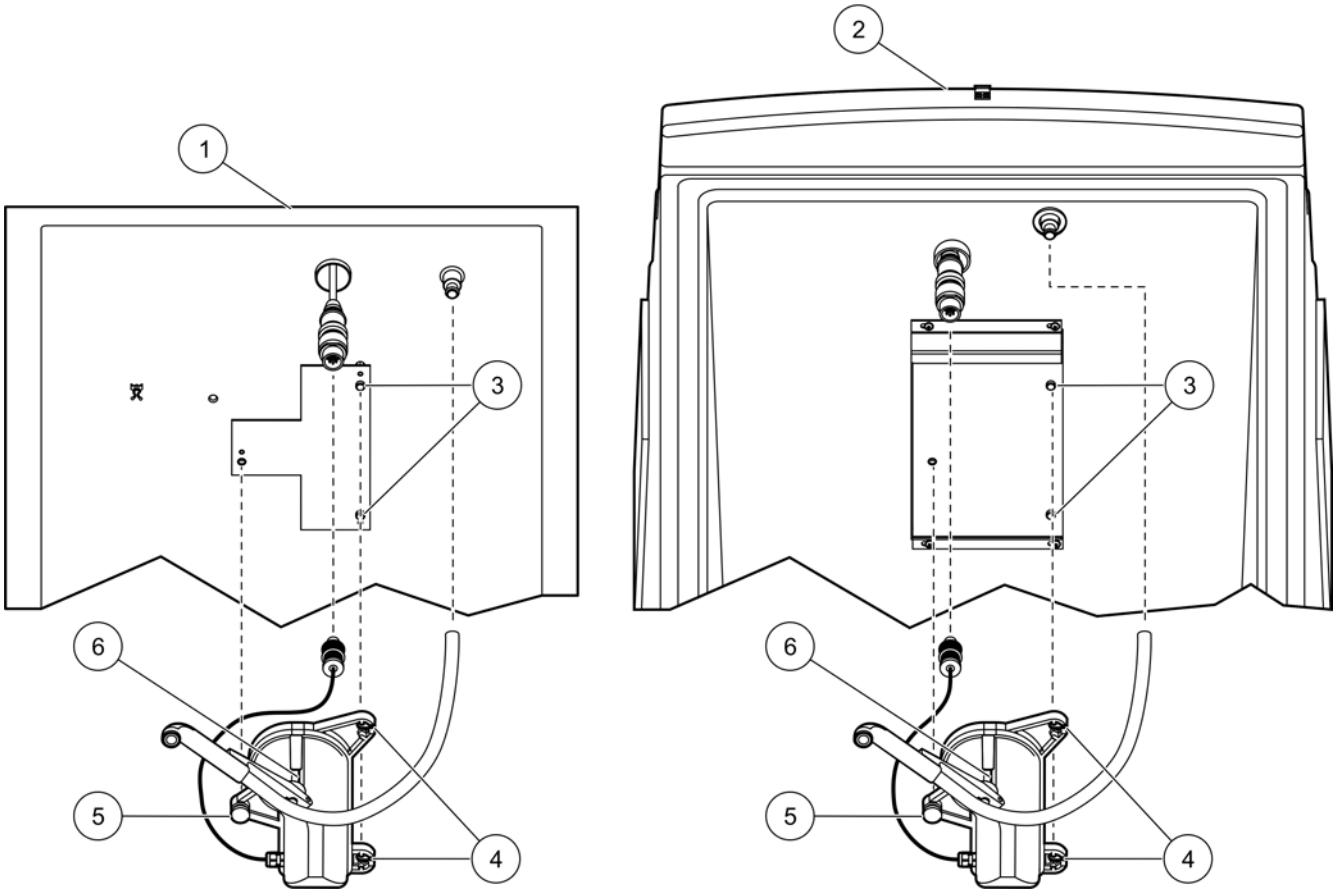


Figure 12 Distributor assembly installation

1	Refrigerated sampler	**4**	Slots
2	All weather refrigerated sampler	**5**	Thumbscrew
3	Retainer pins	**6**	Arm stop

3.4 Intake tubing and strainer installation

Place the intake tubing and strainer directly in the sample source to collect samples. Refer to section 3.2 on page 20 to make sure that samples are free from contamination and are representative of the sample source.

Prerequisites:

- Vinyl or Teflon-lined tubing
- Connection kit (Cat. No. 2186) (for Teflon-lined tubing only)
- Strainer

Note: *See Accessories on page 76 for ordering information.*

Installation procedure:

1. Connect one end of the tubing to the liquid sensor fitting.

   Note: *Use Cat. No. 2186 (connection kit) if using Teflon-lined tubing.*

2. Press the tubing into the strain relief (Figure 13 or Figure 14).
3. Route the tubing so that the tubing is not pinched when the cover is closed.
4. Connect the other end of the tubing to the strainer.

   Note: *Use Cat. No. 2186 (connection kit) if using Teflon-lined tubing.*

5. Place the intake tube and strainer in the main stream of the sample source where the water is turbulent and well-mixed. Make sure that the intake tube does not have kinks or loops.

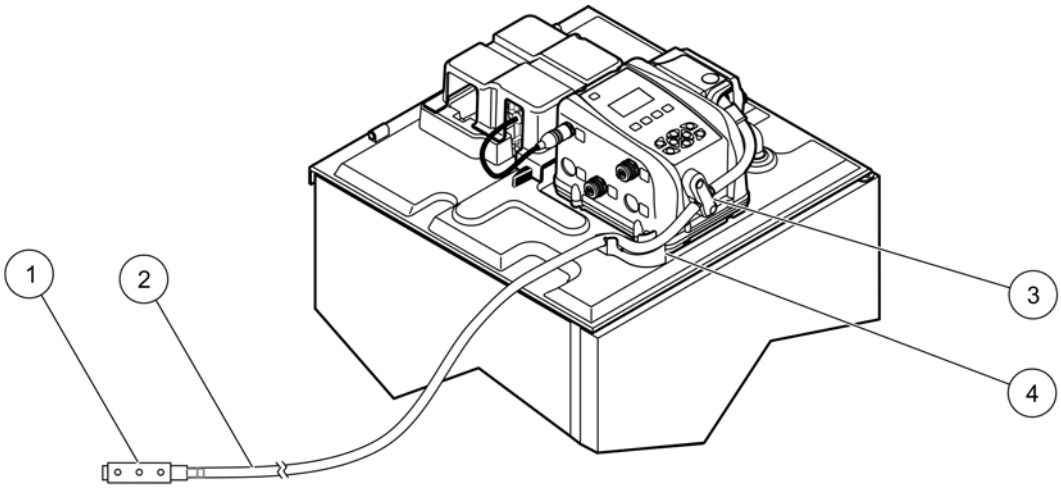


Figure 13 Refrigerated sampler intake tubing installation

1	Strainer	**3**	Liquid sensor
2	Intake tubing	**4**	Strain relief

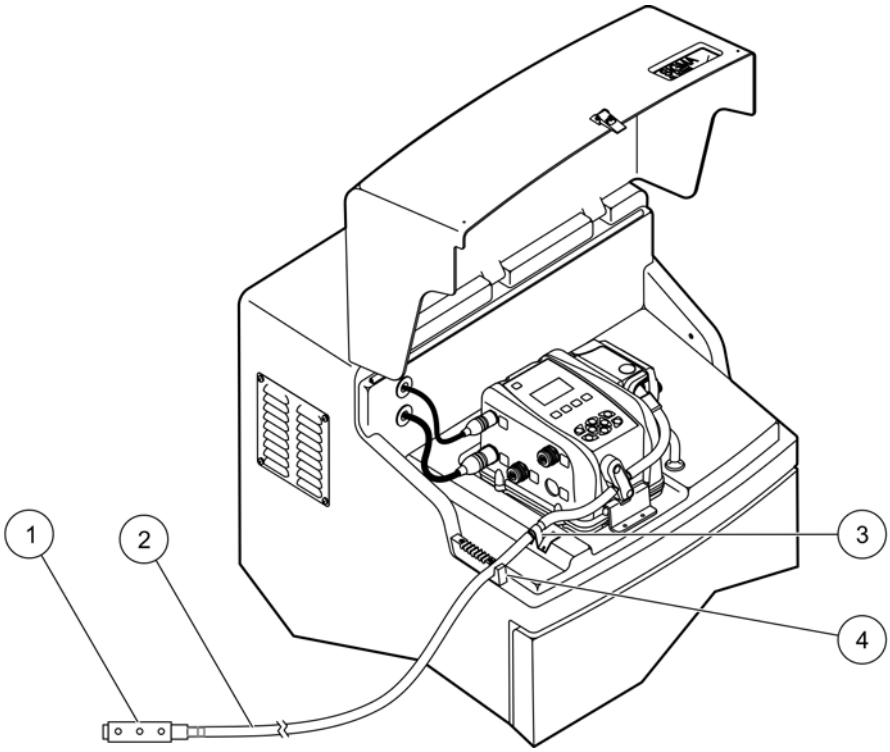


Figure 14 All weather refrigerated sampler intake tubing installation

1	Strainer	**3**	Strain relief
2	Intake tubing	**4**	Intake tubing and auxiliary cable retainer

3.5 Electrical installation

Connect cables to the controller as shown in Figure 15 for the following components:

- Power (section 3.5.1 on page 32, 3.5.1.1 on page 33 and 3.5.1.2 on page 34)
- Flow meter or other device (section 3.5.2 on page 35)
- Communications (section 3.5.3 on page 36)
- Thermal control port for heating and cooling system (AWRS only)

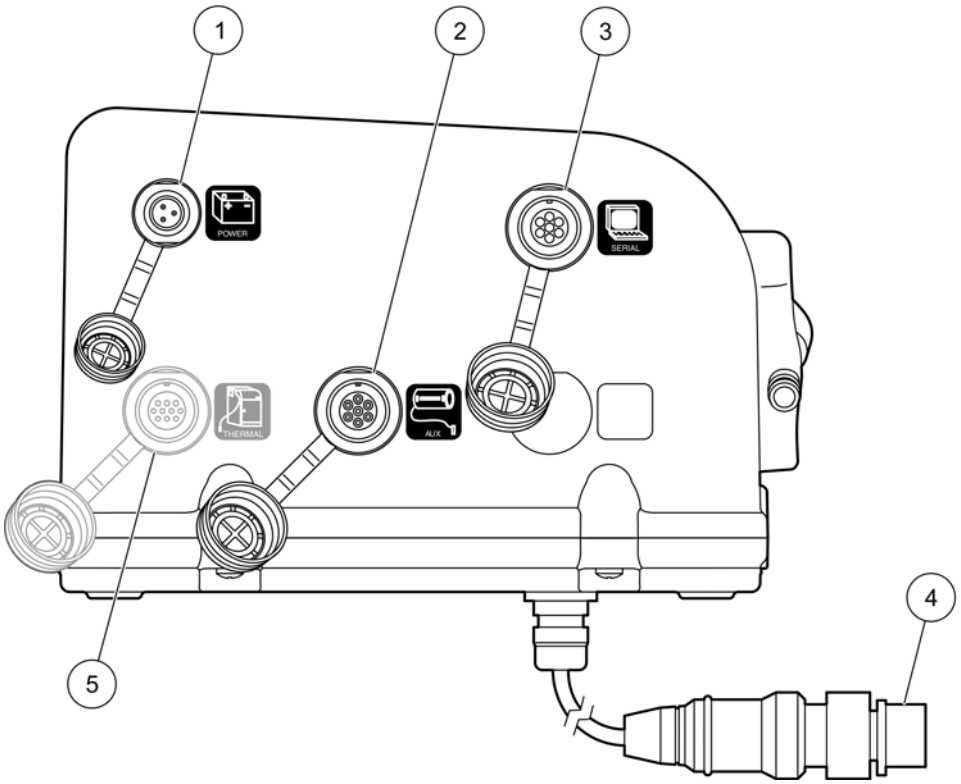


Figure 15 Side view of controller—connectors

1	Power connector	**4**	Distributor/full bottle shut-off connector
2	Auxiliary connector	**5**	Thermal connector (AWRS only)
3	Serial connector		

3.5.1 AC power installation

WARNING
Electric shock hazard. The temperature of the power supply will increase when the sampler pump is operating. If the time interval between sample cycles is too short, the power supply can become overheated and result in an electric shock hazard or power supply failure. Refer to the instructions supplied with the power supply to determine the time that the pump must stay off between sample cycles to prevent overheating.

Electrical transients
When connected to an AC power source, the SD900 controller may be temporarily changed by strong electrical transients caused by sources such as lightning or large electrical motors. These changes can result in a missed sample. Except for the most severe cases, the SD900 controller will recover and continue with the sample program.

A missed sample will be recorded and can be viewed in the status, event log or sample history screens. Use a power line filter or connect the controller to a different branch circuit to reduce the chance of transients.

3.5.1.1 Refrigerated sampler AC power installation

DANGER
Electrocution Hazard. The refrigerated sampler is not suitable for outdoor installations. If the sampler is installed in a wet or potentially wet location, a Ground Fault Circuit Interrupter (GFCI) is required for both the sampler and the SD900 power supply connections.

Use the AC power cords to supply AC power to the controller and the refrigerator. The sampler controller operates on a 15 V DC which is supplied by a power converter.

Prerequisites:
Important Note: *All AC mains power connections require a 15 A (max) circuit breaker and a good earth ground for both safety and proper performance.*

Important Note: *Use only the AC power supply that is specified for this sampler. The 15 V DC power supply output connector must have a 3 circuit connector. An adapter cannot be used to convert an older 2 circuit connector power supply for use with this sampler.*

Important Note: *Since the sampler refrigerator and power supply are not fitted with power switches, the cord plugs must be used as the local disconnect. Be sure that access to the power cord plugs are not blocked or obstructed.*

- AC power supply (Cat. No. 8754500US)

Installation procedure:

1. Remove the power supply retainer (see Figure 5 on page 18).
2. Place the power supply in the compartment behind the controller.
3. Connect the cable from the power supply to the power connector on the controller.
4. Position the power supply retainer over the power supply and secure with the hold-down latches.

3.5.1.2 AWRS power connections

DANGER
Electrocution Hazard. If installed outdoors or in any wet or potentially wet location, a Ground Fault Circuit Interrupter (GFCI) is required for the sampler. If the sampler is installed outdoors, over-voltage protection is required.

Important Note: *Since the AWRS sampler is not provided with a power switch, its cord plug must serve as the local disconnect. Be sure that access to the power cord plug is not blocked or obstructed.*

The AWRS sampler is suitable for outdoor use. The SD900 controller gets its power directly from the AWRS sampler.

All AC mains power connections require a 15 A (max) circuit breaker and a good earth ground for safety and performance.

1. Check the power source to make sure that it satisfies the AC power requirements of the sampler.
2. Make sure that all electrical installations and connections are in accordance with national and local electrical codes.
3. Before performing any connection, disconnect the sampler from the power source.
4. If the area is wet or hands or clothing are wet, do not attempt to make any connection or handle the electrical components of the sampler when connected to AC line power.
5. If the circuit breaker or fuse in the AC power source is tripped, determine the cause before restoring power to the sampler.
6. Make sure the power circuit is grounded and protected with a Ground Fault Interrupter (GFI).

3.5.2 Flow meter installation

The sampler can be connected to a flow meter to start or stop sampling based on the flow volume.

Prerequisites:

- Multi-purpose full cable for Sigma flow meters (or 980 half cable for the model 980 flow meter). To connect to another brand of flow meter, use a multi-purpose half cable and follow the wiring instructions in Appendix A on page 81.
- Optional splitter (Figure 16) to provide additional connections. Two or more splitters may be connected in series.

Note: *See Accessories on page 76 for ordering information.*

Installation procedure:

1. Connect one end of the cable to the flow meter. For connection to the model 980 flow meter, follow the instructions in the model 980 user manual.
2. Connect the other end of the cable to the controller.

   Note: *For connection to a flow meter with an existing 6-pin cable, use the auxiliary adapter cable (6-pin to 7-pin adapter)*

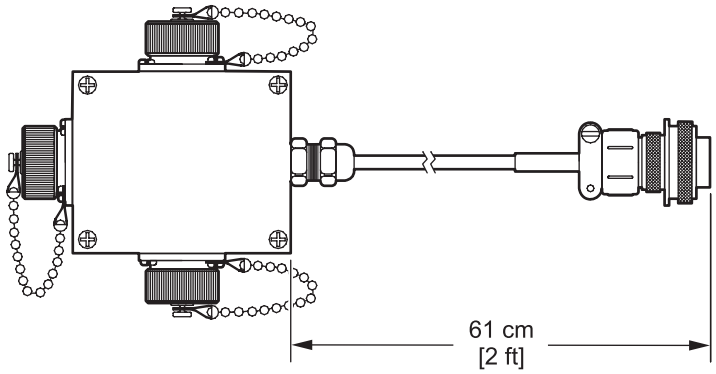


Figure 16 Splitter

3.5.3 Communications installation

The sampler can be connected to a PC or Modbus device for data transfer or programming.

Prerequisites:

- Serial cable (Figure 17)

Note: *See Accessories on page 76 for ordering information.*

Installation procedure:

1. Connect one end of the cable to the PC or Modbus device.
2. Connect the other end of the cable to the controller. The pin assignments for the serial cable are detailed in Table 1.

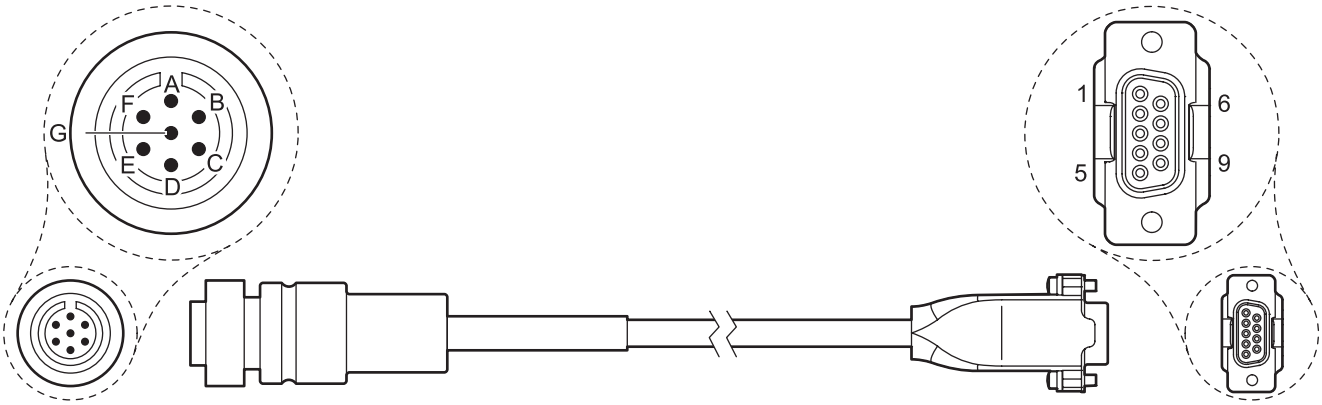


Figure 17 Serial connector cable

Table 1 Serial cable reference

7-pin connector assignment letter	Signal description	DB-9 pin assignment number
B	Signal ground	5
D	RCD	3
F	TXD	2
G	Earth ground	—

Section 4 Sampler operation

4.1 Power on and power off

Important Note: *The AC power supply will become overheated if the sampler pump is operated continuously. Refer to the power supply instruction sheet (DOC306.53.00801) to determine the time interval that must be allowed between sample cycles to prevent damage to the AC power supply and/or to prevent a burn hazard.*

Power on: press **POWER** (Figure 18). The LED will blink.

Power off: press **POWER** and select **YES**. The LED will stay off.

4.2 Controller overview

4.2.1 Keypad description

The keypad and description is detailed in Figure 18.

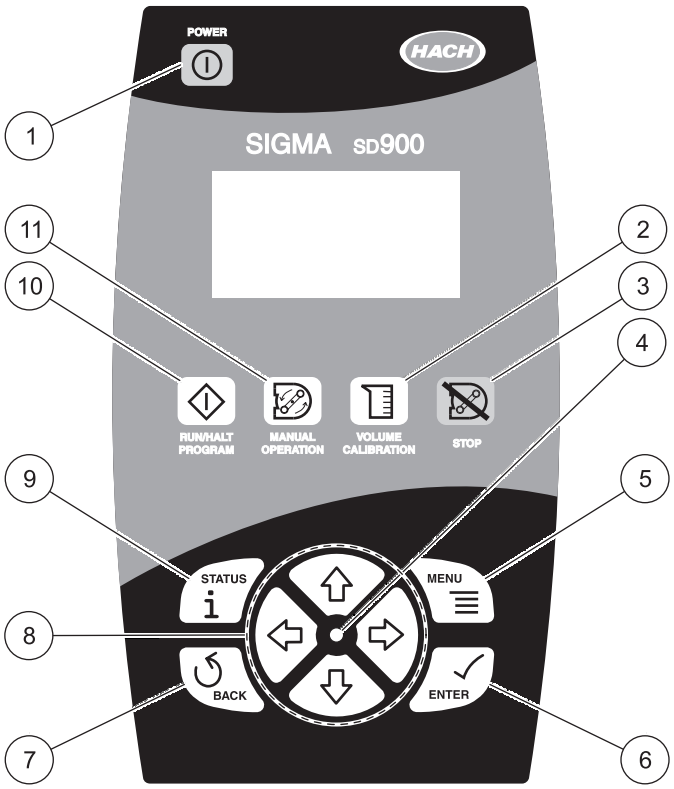


Figure 18 SD900 keypad

1	**POWER**: press to turn controller on or off	**7**	**BACK**: cancel or return to previous screen
2	**VOLUME CALIBRATION**: enter volume calibration menu	**8**	**ARROW KEYS**: moves cursor or scrolls through values
3	**STOP**: stops the pump or distributor if running	**9**	**STATUS**: displays current status of the sample program
4	**LED**: blinks when controller is powered on	**10**	**RUN/HALT PROGRAM**: starts or stops a sample program
5	**MENU**: displays the main menu	**11**	**MANUAL OPERATION**: manual operation of pump or distributor
6	**ENTER**: selects the highlighted or entered value		

4.2.2 Navigation

Use the controller to access all sampler operations. Use the **ARROW** keys, **ENTER** key and **BACK** key to move from one screen to another. An arrow on the display indicates that more screens are available (Figure 19).

Example:

1. Press the **MAIN MENU** key.
2. Press the **DOWN ARROW** key to highlight diagnostics. Press **ENTER**. The diagnostics menu will be shown.
3. Note the down arrow on the bottom of the display (Figure 19). Press the down arrow until additional options are shown.
4. Press the **BACK** key or **MAIN MENU** key to return to the main menu.

Figure 19 Screen navigation

1	Left arrow	**3**	Up arrow
2	Right arrow	**4**	Down arrow

4.2.3 Parameter selection

Parameter selection is made in one of two ways (Figure 20):

- Selection from a list
- Enter a value using the arrow keys

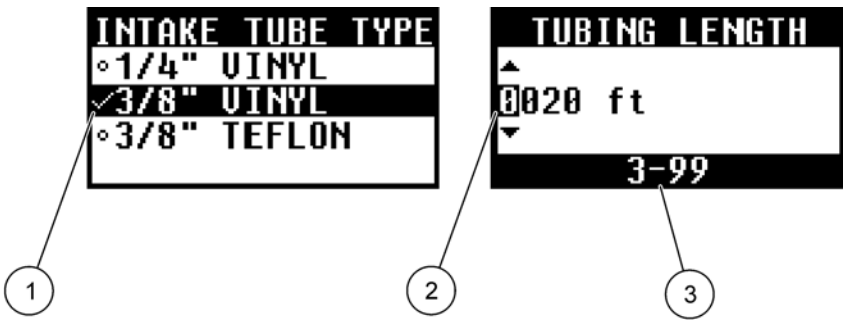


Figure 20 Parameter selection

1	Select item from list	**2**	Enter value with arrows	**3**	Acceptable range

4.3 Main menu overview

The SD900 sampler main menu contains four options for sampler operation, monitoring or data management. Each option is detailed in Table 2.

Table 2 SD900 sampler menu overview

Menu option	Description
Program setup	Create, review, or set up a sampling program
Modify all	Create or edit a sampling program
Modify selected	Edit a portion of a sampling program
Review	Review a sampling program
Presets	Enter or select up to three program templates
Restore defaults	Restore the program default selections
Status	Display the status of the current program
Diagnostics	Review and manage data or test the operation of components
Event log	Display or delete the event log
Sample history	Review the sampling history
Thermal diag	Display the thermal control unit parameters ***Note:*** *Only available on the all weather refrigerated sampler.*
Distrib diag	Test the ability of the distributor to detect each of the 24 bottle positions ***Note:*** *Only active when the sample program is configured for more than 1 bottle.*
Keypad diag	Test the operation of each key
LCD diag	Test the operation of the LCD display screen
Liquid sensor diag	Display calibration data for the liquid sensor
System setup	Change controller settings or calibrate the liquid sensor
Time/date setup	Set the time (24 hour) and date
Communication	Set the baud rate (19200, 38400, 57600 or 115200) and protocol (Modbus RTU or ASCII) for the serial port
Setup base	Specify whether the all weather refrigerated, refrigerated or portable base is used.
Language	Select one of the available languages
Liq sensor cal	Calibrate the liquid sensor
Thermal setup	Set the thermal setpoint or perform thermal calibration ***Note:*** *Only available on the all weather refrigerated sampler.*
Set contrast	Adjust the contrast of the LCD display screen
Password setup	Create or disable a password
Tubing life	Enable optional alarm to indicate when pump tubing needs to be changed

4.4 Sampler programs

Create sampler programs to operate the sampler automatically. Once programmed, install the sampler at the sampling site. Return to collect the samples at regular intervals or when the sampling program is complete. Sampler programs can be stored for later recall (4.4.6 on page 43).

4.4.1 Sampler program overview

Table 3 outlines the menu for creating a basic sampling program.

Table 3 Basic program setup

Menu option	Description
Bottles	Enter bottle information.
Bottle quantity	Select the number of bottles in the sampler (1, 2, 4, 8 or 24).
Bottle volume	Enter the volume capacity of each bottle in milliliters or gallons (0.5–99.8 gal or 50–65000 mL).
Intake tubing	Enter intake tubing information.
Tubing length	Enter the length of the intake tube from the strainer to the liquid sensor (3–99 ft or 100–3000 cm). An accurate length is necessary to obtain accurate sample volumes.
Intake tube type	Select the size and type of tubing (¼ in. vinyl, 3/8 in. vinyl or 3/8 in. teflon)
Program delay	Delay starting the sampling program until specified time and day or until specified number of counts is reached.
Enable/disable	Select enable to use a program delay or disable to omit it.
Date and time	If enabled, enter the date and time when the program will start (24 hour format).
Counts	If enabled, enter the counts from the flow meter when the program will start (1–9999 counts). If counts is selected and the sample pacing is later set to time, the program delay will be disabled.
Sample pacing/collection	Specify whether to collect samples at regular time intervals or regular flow volume.
Time based	Collect samples at regular time intervals.
Pacing interval	Enter the time interval, in hours and minutes (0:01–999:00).
Take first sample	Select whether the program will start immediately or after the first time interval has passed.
Flow based	Collect samples at a specified flow volume (requires external flow meter).
Take sample every	Enter the flow interval that must expire between sample cycles, in counts (1–9999 counts).
Override time	Select enable to force a sample to be collected if the flow volume is unusually low.
Time	If enabled, enter the maximum time between samples (0:01–999:00). Timer is reset each time a sample is collected based on flow counts.
Take first sample	Select whether the program will start immediately or after the first flow interval has passed.
Sample distribution	For multiple bottle sampling, specify how the samples are delivered to the bottles.
Deliver samples to all	Select whether each sample will be delivered to all bottles or not.
Yes	Each sample will be delivered to all bottles.
End after last	Program will stop after the last sample has been collected. Enter number of samples (1–999).
Continuous	Sampler will continue collecting samples until stopped manually.
No	Samples will be delivered to a subset of bottles (see Figure 21 on page 42).
Samples/bottle	Enter the number of samples to be collected in each bottle (1–999).
Bottles/sample	Enter the number of bottles that will contain the same sample.
Liquid sensor	Enable/disabled. If disabled, the sample volume must be calibrated by time.
Sample volume	Enter the volume to be collected per sample. If bottles/sample mode is selected, each bottle receives a full sample volume (100–10,000 mL).
Intake rinses	Enter the number of times the intake tube will be rinsed before each sample is collected (0–3).
Sample retries	Enter the number of sample retries to perform when a failure occurs (0–3).
Site ID	Enter a name for the sampling location (enter up to 12 characters). The site ID is used as the preset name if the program is saved.
Advanced sampling	Access the advanced sampling menu.
Done	Finished creating basic sampling program. Prompts user to start or cancel the program.

4.4.2 Create a sampler program

Create a sampler program to set up the sampler for automatic sampling routines.

Procedure:

1. Select **PROGRAM SETUP** from the main menu.
2. Select **MODIFY ALL**. The first parameter, bottle quantity, will be shown.
3. Select the number of bottles in the sampler. The next parameter, bottle volume, will be shown.
4. Enter the volume of the individual bottle(s). Use the **LEFT AND RIGHT ARROW** keys to move the cursor left or right. Use the **UP AND DOWN ARROW** keys to change the value. Change the units if necessary (gal or mL) with the arrow keys.
5. Continue to select or enter values for each parameter until complete. Refer to Table 3 on page 40 for a complete list of all available options for a basic sample program.

4.4.2.1 Tips and techniques

Refer to Table 4 and Figure 21 for help with sample programming.

Table 4 Tips and techniques for the basic sampling program

Parameter	Tips and techniques
Bottle quantity	When 1 bottle is selected, the full bottle shut-off device is enabled and the distributor is disabled. When more than 1 bottle is selected, the distributor diagnostic is enabled.
Intake tubing	The sampler uses the intake tubing information to determine sample volume. If the intake tubing information is not accurate, the sample volume will not be accurate.
Program delay	If the program delay is set to counts and sample pacing is set to time, the program delay will be disabled.
Sample pacing—flow	Each time a sample is collected based on flow counts, the override timer is reset.
Sample distribution	If the bottle quantity is 1, the sample distribution option will not be available.
	See Figure 21 for a description of samples per bottle vs. bottles per sample.
	Bottles per sample—use bottles per sample when the sample volume is larger than one bottle can hold.
	Samples per bottle—the distributor arm will not advance to the next bottle until the specified number of samples has been delivered to the current bottle.
Liquid sensor	If the liquid sensor is disabled, the sample volume must be calibrated manually.
Sample volume	The sample volume must be entered as mL (1 gal = 3785.4 mL). Make sure that the sample volume does not exceed the bottle volume. Sample volumes are rounded to the nearest 10 mL.

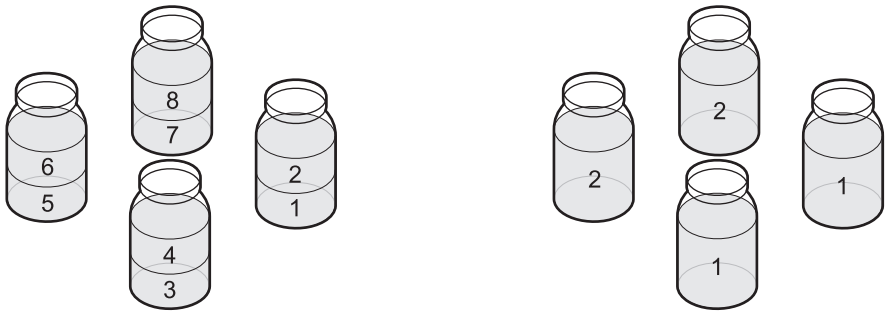


Figure 21 Two samples per bottle (left) vs. two bottles per sample (right)

4.4.3 Modify a program

Use the modify selected option to change an individual parameter for the currently loaded program.

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**.
2. The selected parameters are grouped within the following subheadings. Select one of the available subheadings using the up and down arrow keys.
   - Bottles—quantity and volume
   - Intake tubing—length and type
   - Program delay
   - Sample pacing/collection—time or flow based
   - Sample distribution—for multiple bottle sampling
   - Liquid sensor—enable/disable
   - Sample volume—enter volume
   - Intake rinses—enter number
   - Sample retries—enter number
   - Site ID—enter ID
   - Advanced sampling
3. Change the parameter as shown in section 4.2.3 on page 38.

4.4.4 Review a program

Use the review option to view the selected parameters without making any changes to the program.

Procedure:

1. Select **PROGRAM SETUP**>**REVIEW** from the main menu.
2. Press **ENTER** to view each entry.

4.4.5 Restore default settings

Use the restore option to set all program parameters to the default settings.

Procedure:

1. Select **PROGRAM SETUP**>**RESTORE** from the main menu.
2. Select **YES** to restore the factory default settings.

4.4.6 Store programs as presets

Use the presets option to store up to three sampler programs for later use. If any changes are made to a preset program after it is loaded, the program must be stored again to save the changes.

Procedure:

1. Select **PROGRAM SETUP**>**PRESETS** from the main menu.
2. The three available presets are displayed as **P1**, **P2** and **P3**. Select one of the presets.

   Note: *If a program is already stored, the site ID for that program will appear to the right of the preset number. If no preset program has been stored, the preset field will be empty.*

3. Select **STORE CURRENT** to store the current program as a preset.

4.4.6.1 Load a stored program

Use the load program option to use a preset program as the current program.

Procedure:

1. Select **PROGRAM SETUP**>**PRESETS** from the main menu.
2. Select one of the presets (**P1**, **P2** or **P3**).
3. Select **LOAD PROGRAM** to load the selected preset as the current program. The selected preset program will be loaded and the display will return to the main menu. The program can be modified or used as is.

   If a preset program is loaded and then modified, the program must be stored again (store current) to save the changes.

4.5 Start or stop a program

Use the **RUN/HALT PROGRAM** key to start or stop a program.

Procedure:

1. Press **RUN/HALT PROGRAM** to run, halt, resume or end a sampler program.
2. Select one of the available options:
   - **Start**: starts the currently loaded program. The status changes to running.
   - **Halt**: stops the program temporarily. The status changes to halted.
   - **Resume**: if halted, the program resumes from the point at which it was halted. The status changes to running.
   - **Start over**: if halted, the program starts from the beginning. The status changes to running.
   - **End program**: ends the currently running program. The program status changes to complete.

Note: *A program must be stopped before the program setup or system setup menus can be modified.*

4.6 Manual operation

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

4.6.1 Collect grab samples

Grab samples can be collected to verify sample volume or to collect samples without running a sampling program.

Procedure:

1. Press the **MANUAL OPERATION** key.
2. Select **GRAB SAMPLE**.
3. Place the intake tube into the sample water. Remove the outlet pump tube from the fitting on the sampler and place the tube into a sample container.
4. Enter the volume to be collected and press **ENTER**.

   Note: *The grab sample volume can only be modified if the liquid sensor is enabled. if the liquid sensor is disabled, the grab sample volume will reflect the volume defined using timed calibration.*

5. The pump will purge the intake tube and then collect the specified volume of sample. The pump will then purge the intake tube.

   To stop the pump at any time during the sample cycle, press the **STOP** key.

4.6.2 Move the distributor arm

When configured for multiple bottles, the distributor arm can be moved manually to distribute a grab sample to a specific bottle.

Procedure:

1. Press the **MANUAL OPERATION** key.
2. Select **MOVE DISTRIB**.
3. The current bottle number will be displayed. Enter the bottle number over which to position the distributor arm.
   Press **ENTER**.
4. The distributor arm will move to the selected bottle. To stop the distributor arm at any time, press the **STOP** key.

4.6.3 Start or stop the pump

The pump can be operated outside of a sampling program to collect a sample or purge the intake tubing.

Procedure:

1. Press the **MANUAL OPERATION** key.
2. Select **OPERATE PUMP**.
3. Select the direction to run the pump:
   - **Run forward**: pump operates in the forward direction to collect a sample and deposit into a sample container.
   - **Run backward**: pump operates in the reverse direction to purge the intake line.
4. The screen will display pumping if the forward direction was selected or purging if the reverse direction was selected.
5. The pump will operate until the **STOP** key is pressed.

4.7 View data

Data can be viewed from one of the status screens or from the diagnostics menu.

4.7.1 Status screen

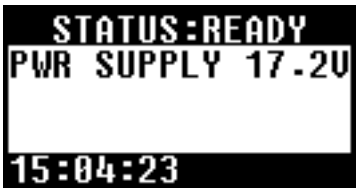
The Status screen can be accessed by pressing the **STATUS** key or by selecting **STATUS** from the main menu.

The status menu will be shown if the main and stormwater programs run simultaneously. The status of either main program or the stormwater program can be viewed by selecting **MAIN** or **STORM** from the status menu.

4.7.2 Status for main program

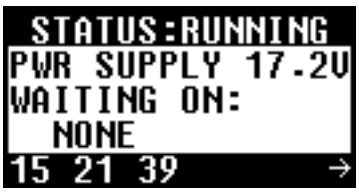
The status screen for the main program gives information about the program depending on the status of the main program. The status information depends on whether the program is in the ready to start, running/halted or complete mode.

4.7.2.1 Ready to start

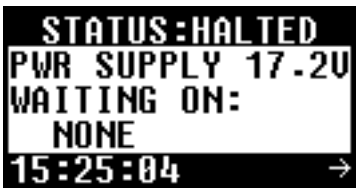


The status reads **READY** when a program is ready to start and also displays the power supply voltage and the current time.

4.7.2.2 Running/halted



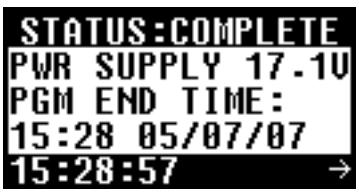
The status reads **RUNNING** or **HALTED** when a program is currently running or has been halted by the user. Use the **RIGHT ARROW** key to access information about the program currently running.



The information displayed includes:

- Power supply voltage
- Inhibit mode (none, setpoint trigger, program delay, user start, storm trigger, full bottle, setpoint delay)
- Sample summary (number of samples tried, missed and remaining)
- Next sample information (sample number, bottle number of next sample)
- Time before next sample
- Program start time

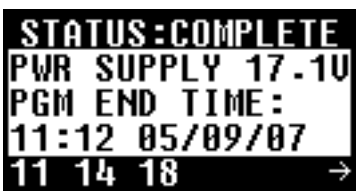
4.7.2.3 Complete



The status reads **COMPLETE** when a program ends after all sample cycles have been completed or when ended by the user. Use the **RIGHT ARROW** key to access information about the program that just ended. The display includes:

- Power supply voltage
- Program end time
- Sample summary (number of samples tried and missed)

4.7.3 Status for stormwater program



The status screen shows information about the stormwater program similar to that shown for the main program (Ready, Running, Halted or Complete).

Use the **RIGHT ARROW** key to access additional information about the program.

4.7.4 Sample history

Sample history displays the sample number, bottle number, result and time/date for each sample. The following results can be shown:

- **Success**—the sample was drawn successfully
- **Bottle full**—the full bottle shut-off was activated
- **Rinse error**—an error occurred during the rinse cycle
- **User abort**—a user pressed the **STOP** key to end the sample cycle
- **Arm faulty**—the distributor arm did not move correctly
- **Pump fault**—a fault occurred when the pump was operating
- **Purge fail**—an error occurred during the purge cycle
- **Sample time out**—liquid not detected within the timeout period
- **Power fail**—a power failure occurred during sampling

If a program is running or has been halted, the sample history is displayed for the currently running sample program. If the program has been completed, the sample history is displayed for the most recently completed sampling program. The sample history is automatically erased when a new program is started.

Procedure:

1. Select **DIAGNOSTICS**>**SAMPLE HISTORY** from the main menu to view the sample history.
2. The sample history will list the sample numbers, bottle numbers and brief result for each sample. Select a sample from the list and press **ENTER** to view complete details.
3. The complete details for the selected sample will be shown.

4.7.5 Event log

The event log records information on the following events:

- **Power on**—power was connected to the controller
- **Power fail**—power was intentionally or unintentionally disconnected from the controller without first turning power off
- **Firmware update**—a new version of firmware was installed
- **Pump fault**—a fault occurred when the pump was operating
- **Arm faulty**—the distributor arm did not move correctly
- **Low memory battery**—the internal battery should be replaced
- **User on**—a user turned the power on using the power key
- **User off**—a user turned the power off using the power key
- **Program start**—the sample program was started
- **Program resume**—a program was resumed from the halt state
- **Program halt**—a program was halted
- **Program complete**—a program was completed
- **Grab sample**—a grab sample was taken

- **Change tube**—the maximum pump cycle counts have expired
- **Cooling Fail**—the temperature of the thermal unit has been above the setpoint continuously for more than 30 minutes
- **Heating Fail**—the temperature of the thermal unit has been below the setpoint continuously for more than 30 minutes
- **Thermal Error Clear**—a Cooling Fail or Heating Fail error has been corrected

4.7.5.1 View the event log

View the event log to see details about the events that have been recorded.

Procedure:

1. Select **DIAGNOSTICS**>**EVENT LOG** from the main menu to view the event log.
2. Select **DISPLAY**.
3. The event log will list the date and event. Select an event from the list and press **ENTER** to see complete details.

   The top bar will show the event number and total number of events in the event log. For example, 01/80 will be displayed for event number 1 and a total number of 80 events.
4. The time/date, event description and any additional data for the selected event will be displayed.

4.7.5.2 Erase the event log

Erase the event log after event details have been reviewed to reduce the number of entries that are shown.

Procedure:

1. Select **DIAGNOSTICS**>**EVENT LOG** from the main menu to erase the event log.
2. Select **ERASE**.
3. Select **YES** to confirm the deletion.

4.8 Volume calibration

Samples can be collected with the liquid sensor enabled (recommended) or disabled. When the liquid sensor is enabled, the volume calibration is optional. When the liquid sensor is disabled, the volume for samples, rinses and stormwater must be calibrated manually.

When the liquid sensor is used for volume calibration, the sensor is adjusted to accurately measure all programmed volumes. When the sensor is disabled and the volume is calibrated by time, all programmed sample volumes must be calibrated individually.

Verify calibrations by measuring the volume from a grab sample (section 4.8.3 on page 51). If calibration using the liquid sensor does not give accurate volumes, the sensor can be calibrated (section 4.9.1 on page 52).

For typical applications, tap water can be used for volume calibration. If the sample composition is significantly different from typical water samples, calibrate the sampler using the liquid to be collected.

Calibration cannot occur while a sample program is running. All programs must be ended before calibration.

4.8.1 Volume calibration using the liquid sensor

Use the volume calibration with the liquid sensor enabled to adjust sample volumes slightly.

Procedure:

1. Make sure the liquid sensor is enabled by selecting **PROGRAM SETUP**>**MODIFY SELECTED**>**LIQUID SENSOR**>**ENABLE**.
2. Press **VOLUME CALIBRATION** and select **CALIBRATION**.
3. Place the tubing inside the sampler cabinet that leads to the sample bottle(s) into a graduated cylinder. Place the intake tube into the sample source or tap water.

   Note: *Use the sample source for best accuracy.*
4. Select **START**.
5. The pump will purge the intake tube and then collect the sample volume that is specified in the sampling program. The pump will then purge the intake tube.

   To halt the calibration at any time, press the **STOP** key.
6. When the sample has been collected, select **DONE**. Compare the volume collected in the graduated cylinder with the sample volume that is entered in the program setup menu.

   Select **REPEAT** to repeat the volume collection if necessary.
7. If the volume that was collected is different from the sample volume in the current program, enter the volume that was actually collected. Press **ENTER**. The sensor is then adjusted to accurately measure all programmed volumes.

   To verify sample volume, collect a grab sample (section 4.8.3 on page 51).
8. Select **START** to start the sampling program or **CANCEL** to exit the volume calibration menu.

4.8.1.1 Reset the calibration

Use the reset cal option to restore the volume calibration to the default factory settings.

Procedure:

1. Make sure the liquid sensor is enabled by selecting **PROGRAM SETUP**>**MODIFY SELECTED**>**LIQUID SENSOR**>**ENABLE**.
2. To undo the calibration, press **VOLUME CALIBRATION** and select **RESET CAL**.
3. The calibration will be reset to the default calibration and the message “value has been reset to 0” will be shown.

4.8.2 Volume calibration based on time

When the liquid sensor is disabled, the main sample volume, the first flush storm volume (if storm water is enabled), and the rinse (if rinses are > 1) must be calibrated manually.

The sample volume is calibrated for the volume specified in the current program. If the sample volume is changed in the program, the sample volume must be recalibrated for the new volume.

Procedure:

1. Make sure the liquid sensor is disabled by selecting **PROGRAM SETUP**>**MODIFY SELECTED**>**LIQUID SENSOR**>**DISABLE**.
2. Press **VOLUME CALIBRATION**. Select one of the displayed volumes to calibrate if more than one is listed.
3. If calibrating a sample volume, remove the outlet pump tube from the fitting on the sampler and place the tube into a graduated cylinder. Place the intake tube into the sample source or tap water.
4. Select **START**. The pump will purge the intake tube and then begin to collect a sample.
5. Stop the pump at the selected volume or rinse location:
   - Sample volume: observe the volume in the graduated cylinder and press the **STOP** key when the volume specified in the main program is collected.
   - Rinse: observe the liquid as it travels up the intake tube and press the **STOP** key when the liquid reaches the liquid detector.
   - Storm volume: observe the volume in the graduated cylinder and press the **STOP** key when the volume specified in the stormwater program is collected.
6. If the pump was stopped at the correct volume, select **DONE**. To repeat the calibration select **REPEAT**.
7. Select another volume to calibrate or select **DONE**.

   Note: *All volumes must be calibrated before exiting the volume calibration menu.*

8. When finished, connect the outlet pump tube to the tube fitting on the sampler.
9. Select **START** to start the sampling program or **CANCEL** to exit.

4.8.3 Verify sample volume

To check the sample size after calibration use the Manual Operation key to take 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.

Procedure:

1. Press the **MANUAL OPERATION** key. Select **GRAB SAMPLE**.
2. Remove the outlet pump tube from the fitting on the sampler and place the tube into a graduated cylinder. Place the intake tube into the sample source or tap water.
3. If the liquid sensor is enabled, enter the volume that needs to be verified. If the liquid sensor is disabled, enter the volume specified in the program.
4. Press **ENTER**. The pump cycle will start (purge-sample-purge).
5. Compare the volume that was collected in the graduated cylinder to the volume specified in step 3. If the volume is acceptable, the sampler is calibrated correctly. If the volume is incorrect, repeat the volume calibration.

4.9 Controller settings

Use the system setup menu to change the following parameters:

- Date and time
- Communication
- Sampler base
- Language (only English is currently available)
- Liquid sensor calibration
- Thermal settings (AWRS only)
- Display contrast
- Password
- Pump tube replacement reminder

Procedure:

1. Select **SYSTEM SETUP** from the main menu.
2. Select one of the available parameters, for example time/date setup. Refer to Table 2 on page 39 for an overview of the system setup menu.
3. Make selections or change values with the arrow keys. Use the **LEFT AND RIGHT ARROW** keys to move the cursor left or right. Use the **UP AND DOWN ARROW** keys to change the value.
4. Select another parameter from the system setup menu, or press **BACK** to return to the main menu.

4.9.1 Liquid sensor calibration

The accuracy of the liquid sensor can vary with the type of liquid that is being sampled. For example, the volume of a highly turbid sample may not be as accurate as that of clear water. In some applications, the liquid sensor may be calibrated using the source liquid to improve detector performance.

Procedure:

1. Make sure the liquid sensor is enabled by selecting **PROGRAM SETUP**>**MODIFY SELECTED**>**LIQUID SENSOR**>**ENABLE**.
2. Select **SYSTEM SETUP**>**LIQ SENSOR CAL** from the main menu.
3. Select **PERFORM CAL**.
4. Place the intake tube into the sample source or tap water (if tap water is representative of the type of samples to be collected).

   Note: *Use the sample source for best accuracy.*

5. Select **START**. The pump will operate in reverse to purge the intake tube.
6. The pump will then operate in the forward direction. Observe the sample flow in the intake tube to verify that it passes the liquid sensor. When the sample passes through the liquid sensor and no bubbles are present, press the **STOP** key.
7. The liquid sensor calibration is complete after the intake tube is automatically purged. Select **DONE** to exit the liquid sensor menu or **REPEAT** to repeat the calibration.

   Note: *To restore the default calibration for the liquid sensor, select* ***SYSTEM SETUP***>***LIQ SENSOR CAL***>***RESTORE DEFAULT*** *from the main menu.*

4.9.2 Set the thermal setpoint (AWRS only)

The setpoint is the temperature that will be maintained inside the refrigerated compartment. The EPA recommends that the samples be stored at 4 °C, which is the default setpoint.

Procedure:

1. Select **SYSTEM SETUP>THERMAL SETUP** from the main menu.
2. Select **SETPOINT**.
3. Enter the setpoint in °C and press **ENTER**. The setpoint can be a value between 2 and 10 °C.

4.9.3 Set password

A password can be enabled to restrict access to the program setup and system setup menus.

Procedure:

1. Select **SYSTEM SETUP**>**PASSWORD SETUP** from the main menu.
2. Select **ENABLE** to activate a password.
3. Select **YES** to set a new password or **NO** to activate the existing password.
4. If yes was selected, enter the old password and press **ENTER**. If changing the password for the first time, enter 900900 as the old password.
5. Enter a new password and press **ENTER**. The new password will be required to access the menus for program setup and system setup.

4.9.4 Tubing life indicator

The tubing life option can be used to set a reminder to replace the pump tubing. The user defines a maximum number of pump cycles after which a message will be shown to replace the pump tubing. After replacing the tubing, the current number of cycles must be reset for the new tubing.

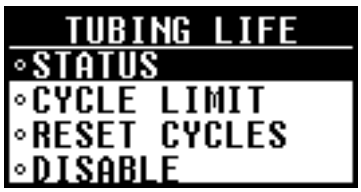
4.9.4.1 Enable the tubing life indicator

Enable the tubing life indicator to set a reminder for when the pump tubing should be replaced.

Procedure:

1. Select **SYSTEM SETUP**>**TUBING LIFE** from the main menu to access the tubing life option.
2. Select **ENABLE** to activate the tubing life indicator.

4.9.4.2 Tubing life status

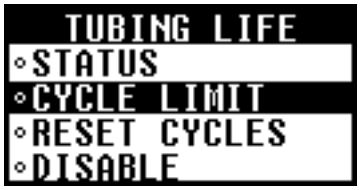


Use the status option to see how many pump cycles have been completed.

Procedure:

1. If the tubing life option is not enabled, select **SYSTEM SETUP**>**TUBING LIFE**>**ENABLE**>**STATUS**. If the tubing life option is enabled, select **SYSTEM SETUP**>**TUBING LIFE**>**STATUS**.
2. The current number of cycle counts on the pump since the tubing life indicator was reset and the cycle limit set by the user are both shown. Press **ENTER** or **BACK** to return to the system setup menu.

4.9.4.3 Tubing life cycle limit

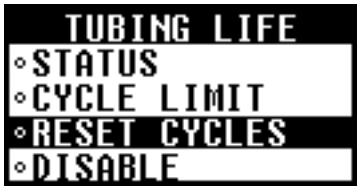


Use the cycle limit option to set the number of pump cycles when the change tube reminder will be shown.

Procedure:

1. If the tubing life option is not enabled, select **SYSTEM SETUP**>**TUBING LIFE**>**ENABLE**>**CYCLE LIMIT**. If the tubing life option is enabled, select **SYSTEM SETUP**>**TUBING LIFE**>**CYCLE LIMIT**.
2. Change the cycle limit to the number of pump cycles after which the pump tubing should be replaced. After setting the limit, press **ENTER** to view the current status and verify the cycle limit.
3. When the number of actual cycle counts equals the cycle limit set by the user, the “change tube” message will be shown when a key is pressed and an entry will be placed in the event log.

4.9.4.4 Reset tubing cycles



When the “change tube” message is shown, replace the pump tubing and then reset the pump cycles.

Procedure:

1. If the tubing life option is not enabled, select **SYSTEM SETUP**>**TUBING LIFE**>**ENABLE**>**RESET CYCLES**. If the tubing life option is enabled, select **SYSTEM SETUP**>**TUBING LIFE**>**RESET CYCLES**.
2. Select **YES** to reset the pump cycle count to 0. Press **ENTER** to view the status screen to verify that the cycle count is set to 0.

Note: *It is important to reset the pump cycles so that the change tube message will be shown at the correct time for the new tube.*

Section 5 Advanced sampling

5.1 Advanced sampling overview

Use the advanced sampling menu for the following operations:

- Send a 12 VDC output signal to start a second sampler, activate a relay or for communications
- Set the sampler to start and stop from an external signal
- Set multiple start and stop times
- Set variable time intervals
- Collect first flush samples from stormwater

5.2 Advanced sampling menu

Table 5 outlines the menu for the advanced sampling operations.

Table 5 SD900 advanced sampling menu

Menu option	Description
Program complete O/P	Send a signal at the completion of a sampling program. The signal can be used to start a second sampler or activate a relay.
Setpoint sample	Start and stop the sampler from an external source
Start on setpoint	Start a sampling program when the external signal falls outside of the setpoint limits. Continue running even when the signal falls within the setpoint limits.
Start/stop	Start sampling when the external signal falls outside of the setpoint limits. Stop sampling when the signal falls within the setpoint limits.
Special output	Send a signal to a connected device.
Each sample	Send signal at the completion of each sample cycle.
Sample pumping	Send signal during the sample intake.
Rinse to purge	Send signal during the entire sample cycle, including all purge and rinse cycles.
Start/stop times	Start and stop a program at user specified dates and times.
Program start/stop	Set up to 12 start and stop times for any one program.
Stormwater	Collect first flush samples at timed intervals. Can be initiated by external device.
Immediate	Start program immediately.
External	Start program from an external device.
Variable intervals	Sample at variable time or flow intervals.
Done	Exit the advanced sampling menu.

5.3 Advanced sampling instructions

To access the advanced sampling menu, select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.

5.3.1 Send output signal at program completion

A 12 VDC signal can be sent through pin F of the auxiliary connector at the completion of a sampling program or when the full bottle shut-off is activated. The signal remains on for 61 seconds.

To enable the ability to transfer sample history to an external Sigma 950 flow meter, program complete must be disabled to enable the bottle number output. In addition, the special output must be enabled and configured to assert after the sample cycle is complete.

The output signal can be used for the following purposes:

- Start another sampler. Cascading samplers require a cascading cable (Cat. No. 8757300). The slave sampler must enable setpoint sampling and start on external trigger.
- Activate a relay or other device when the program is complete.

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.
2. Select **PGM COMPLT O/P**>**ENABLE**.
3. The message “Bottle number output disabled on pin F” will be shown. The bottle number output to send sample history to a Sigma 950 flow meter will be disabled.
4. Select **BACK** or **ENTER** to activate the output signal.

5.3.2 Send output signal with sample cycle (special output)

The special output option sends a 12 VDC signal through pin E of the auxiliary connector during or after a sample cycle. When program complete output is disabled, and program complete is disabled (thereby enabling the program complete output). The sample history will be transferred to the external Sigma 950.

There are three possible configurations:

- After each sample—four second pulse at the end of each sample cycle. This option is used to signal an external device that a sample cycle is complete.
- During sample intake—during the sample intake portion of the cycle only, ignoring all purges and rinse cycles.
- During entire cycle—during the entire sample cycle including all purge and rinse cycles.

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.
2. Select **SPECIAL OUTPUT**>**ENABLE**.
3. Select one of the output options:
   - **AFTER CYCLE**—at the completion of each sample cycle.
   - **SAMPLE PUMPING**—during sample intake only.
   - **ENTIRE CYCLE**—during entire sample cycle.

5.3.3 Operate from external signal (setpoint sample)

The setpoint sample option starts and stops the sampler after receiving a signal from an external device such as a flow meter. The current status indicates when the sample program is being inhibited by an external device.

Note: *Setpoint and stormwater sampling cannot be enabled at the same time.*

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.
2. Select **SETPT SAMPLE**>**ENABLE**.
3. Select one of the setpoint options:
   - **START ON SETPT—**starts a sample program when the signal is received, ignoring all future transitions, and continues until the program is complete.
   - **START/STOP—**starts a sample program when the signal is received and stops the program when the signal is no longer received.
4. Enter a delay time in hours and/or minutes that must expire before the sample program starts. The delay time will begin when the external signal is received. The program will begin after the delay time has passed.

5.3.4 Set multiple start and stop times

The start/stop time option creates an intermittent sampling schedule. The program begins sampling at the first start time and continues until the first stop time. Up to 12 start and 12 stop times can be specified.

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.
2. Select **STRT/STOP TIME**>**ENABLE**.
3. If the sample program is configured for multiple bottles, select **ENABLE** to start sampling at bottle 1 when each start time is reached. Select **DISABLE** to continue the distribution sequence from the last stop time.
4. Enter the time (24 hour) and date for the first start time.
5. Enter the time (24 hour) and date for the first stop time.
6. Repeat steps 4 and 5 until all start and stop times have been entered.

5.3.5 Collect first flush stormwater samples

The stormwater option collects first flush (FF) samples or initial runoff during storm conditions when pollutants are typically at a high concentration. The first flush samples are collected at timed intervals and can be initiated by an external device. A stormwater program can run at the same time as the main program. The stormwater option has the following capabilities:

- Collection of grab samples at up to 24 different time intervals. First flush and main program flow-weighted composite samples are automatically segregated. The first flush sample volume may be set independently of the sample volume for the flow-weighted composite.
- Initiation by an external device. A dry contact closure across pins B and D on the auxiliary connector, held closed for at least 61 seconds, is required.
- When sampling with multiple bottles, the sampler can be programmed to collect one large “first flush” sample (or small multiple samples) at timed interval(s). The number of bottles segregated for the first flush sample is selectable. Concurrently, flow-weighted samples are collected from the beginning of the storm until all remaining bottle(s) are filled, or after a user selected time has elapsed.

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.
2. Select **STORMWATER**>**ENABLE**.
3. Select whether the program will be started immediately or from an external device:
   - **Immediate**—program starts when **RUN** is pressed and **START** is selected.
   - **External**—program starts when signaled by an external device.
4. If configured for a single bottle, enter the number of first flush (FF) samples to collect.
5. If configured for multiple bottles, enter the number of bottles to be used for first flush collection.
6. Enter the multi-bottle distribution mode (Figure 21 on page 42):
   - **Samples per bottle**: more than one sample is collected in each bottle
   - **Bottles per sample**: more than one bottle is used to collect each sample.
7. Enter the number of samples per bottle or bottles per sample.

8. Enter the time interval between each first flush sample cycle.

   Variable intervals may be entered, or the same time may be entered for each interval. The sum of the intervals is equal to the total length of the stormwater collection period. First flush samples are usually collected within 30 minutes of a storm.

   Note: *The number of intervals is determined by the number of bottles and the distribution mode.*

9. Enter the volume of each first flush sample.
10. Select **ENABLE** to set a time limit for stormwater collection. Enter the program time limit. The program will stop when this time limit is reached.

    Select **DISABLE** to allow the program to run until complete without a time limit.

    NPDES requirements typically request monitoring for the first three hours of a storm. If the flow volume is lower than expected, flow-weighted sampling could continue for some time as flow rates drop and sample intervals become longer.

5.3.6 Set variable intervals

Variable time or flow intervals can be set for sample cycles. Intervals will be in hours and minutes if the sample pacing mode is time based. Intervals will be in counts if the sample pacing mode is flow based.

Procedure:

1. Select **PROGRAM SETUP**>**MODIFY SELECTED**>**ADV SAMPLING** from the main menu.
2. Select **VARIABLE INTVL**>**ENABLE**.
3. Enter the time (or count) interval between each sample cycle. Up to 99 intervals can be entered.

WARNING
Only qualified personnel should conduct the tasks described in this section of the manual.

WARNING
Potential shock hazard. Always disconnect power to the sampler before performing any maintenance or service.

CAUTION
Biological sample hazard. Follow safe handling protocols during contact with sample bottles and sampler components. Disconnect the sampler from power to disable the pump before handling.

6.1 Upgrades, Repairs, General Maintenance

Only a qualified technician should service the sampler. For example, steps that require knowledge of CMOS electrostatic discharge precautions and advanced electronics training should only be performed by a qualified technician.

6.2 Sampler cleaning

Refrigerator
Clean the condenser fins and coils as needed with a brush or vacuum to maintain efficient heat transfer.

Sampler cabinet
Clean the internal and external surfaces of the sampler with a damp cloth and mild detergent. Do not use abrasive cleaners or solvents.

Sample bottles
Clean the bottles using a brush and water with a mild detergent, followed by a fresh water rinse and a distilled water rinse. Glass bottles may also be autoclaved.

6.3 Pump maintenance

CAUTION
Pinch hazard. Always disconnect power to the sampler before opening the pump cover.

The tubing in the peristaltic pump will deteriorate over time from the action of the rollers against the tubing. Be sure to replace the pump tubing before it splits to prolong the life of the sampler and prevent contamination of the work area.

6.3.1 Pump tube life

Pump tube life depends on several factors:

- Distance from sample source. Locate the sampler as close to the sample source as possible.
- Vertical lift. Minimize the vertical lift as much as possible.
- Intake rinses. Minimize the number of intake rinses prior to sample collection.
- Sample retries. Minimize the number of sample retries to successfully collect a sample.
- Sample volumes/duration. Minimize the volume of sample and maximize the time between samples.
- Constituents in the sample liquid. Grit and other abrasive solids cause greater wear on the tube when they are squeezed through the pump rollers.

6.3.2 Pump tube replacement

Important Note: *Use of tubing other than that supplied by the manufacturer may cause excessive wear on mechanical parts and/or poor pump performance.*

Inspect the pump tubing and rollers on a regular basis. Replace the tubing when deteriorated, at regular intervals or when the "change tube" message is displayed (section 4.9.4 on page 53).

Prerequisites:

- Pump tubing—pre-cut or bulk (15 ft or 50 ft)

Note: *See Replacement parts on page 75 for ordering information.*

Removal procedure:

1. Turn off the controller power.
2. If using bulk pump tubing, cut a 23.25 inch piece (24.25 inches for the AWRS) and mark the tube with alignment dots at the locations shown in Figure 22 on page 63.
3. Disconnect the old pump tubing from the liquid sensor and from the tube fitting on the sampler housing.
4. Loosen the thumbscrew on the pump cover and open the cover.
5. Pull the tube from the pump tube track while turning the rotor to remove the old tubing from the pump.
6. Clean the silicone residue from the interior of the pump housing and from the rollers (see section 6.3.3 on page 65).

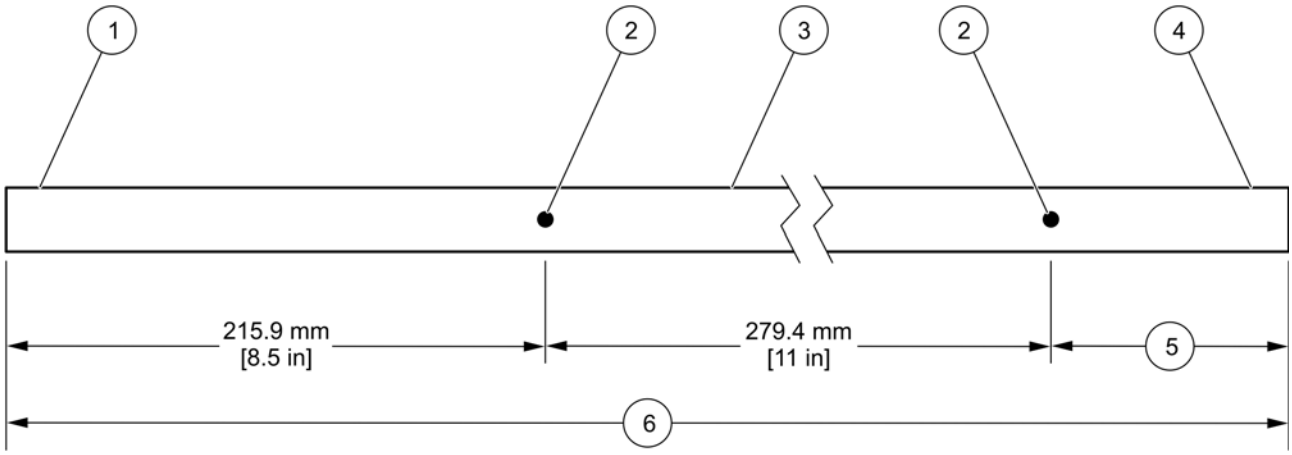


Figure 22 Pump tubing measurement

1	To liquid sensor	**4**	To tube fitting on refrigerator
2	Alignment dot	**5**	95.3 mm (3.75 in.) for refrigerated sampler, 120.7 mm (4.75 in.) for all weather refrigerated sampler
3	Inside pump body	**6**	590.6 mm (23.25 in.) for refrigerated sampler, 616 mm (24.25 in.) for all weather refrigerated sampler

Installation procedure:

1. Connect one end of the tubing to the liquid sensor fitting. Press the tubing into the pump tube guide (Figure 23).
2. Press the tubing into the upper pump tube track. Make sure that the alignment dot is in line with the upper pump tube track as shown in Figure 23.
3. Hold the tubing with one hand while rotating the pump rotor to guide the tubing around the rotor (Figure 23). The guide pins will push the tubing into place.
4. Press the tubing into the lower pump tube track. Make sure that the alignment dot is in line with the lower pump tube track as shown in Figure 23.
5. Close and secure the pump cover with the thumbscrew.
6. Connect the open tube end to the tube fitting on the sampler (Figure 24).

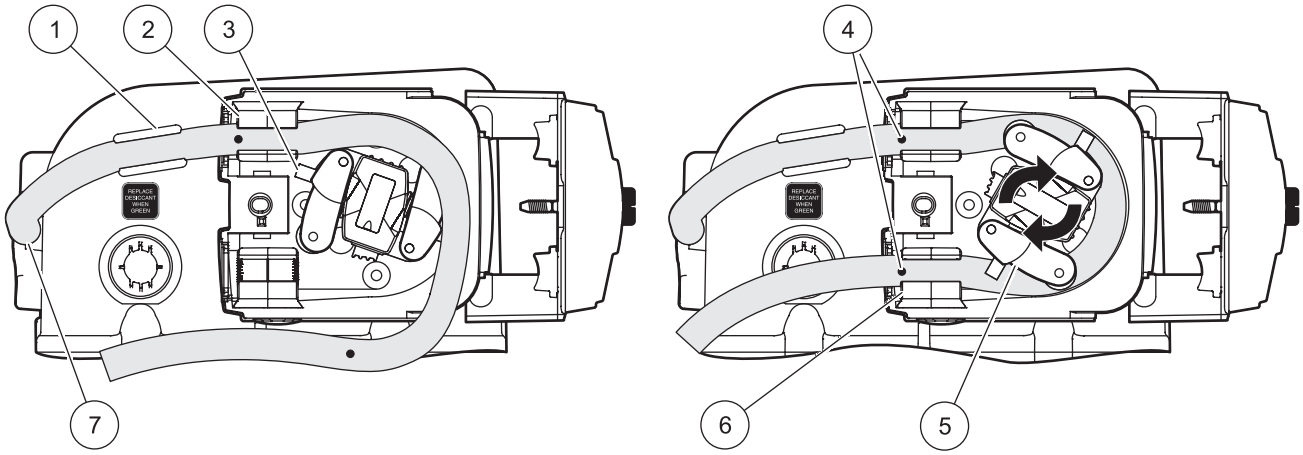


Figure 23 Pump tubing installation

1	Pump tube guide	**5**	Rotor
2	Pump tube track (upper)	**6**	Pump tube track (lower)
3	Guide pin	**7**	Connection to liquid sensor
4	Alignment dot		

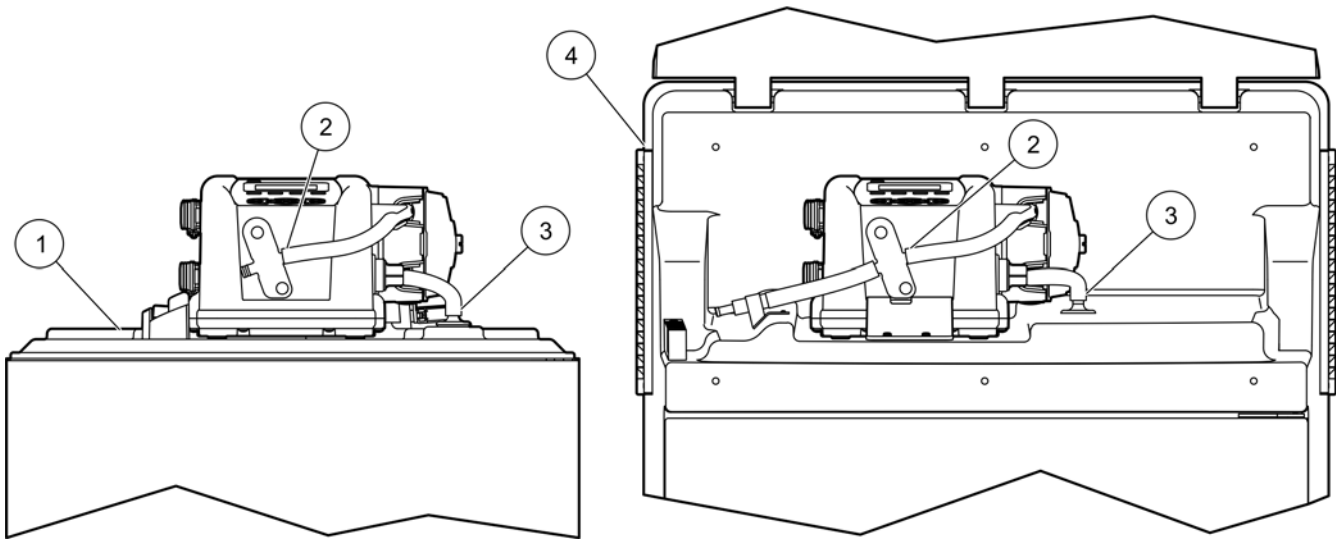


Figure 24 Pump tube installed

1	Refrigerated sampler	**3**	Pump tube to refrigerator fitting
2	Pump tube to liquid sensor	**4**	All weather refrigerated sampler

6.3.3 Rotor removal and cleaning

Remove the pump rotor to thoroughly clean the silicone residue from the pump tube.

Procedure:

1. Remove the pump tube (see section 6.3.2 on page 62).
2. Open the rubber flap on the end of the rotor and remove the screw with a flat-blade screwdriver (Figure 25).
3. Remove the rotor. A collet connects the rotor to the pump shaft and can come off when the rotor is removed (Figure 25).
4. Clean the rotor, pump tube tracks and pump housing with a mild detergent.
5. If the collect was removed in step 3, align the recess in the collet with the tang on the shaft and push the collet on the shaft (Figure 25).
6. Push the rotor on the shaft and secure with the screw. Do not overtighten the screw. Close the rubber flap on the rotor.
7. Install the pump tube (section 6.3.2 on page 62).

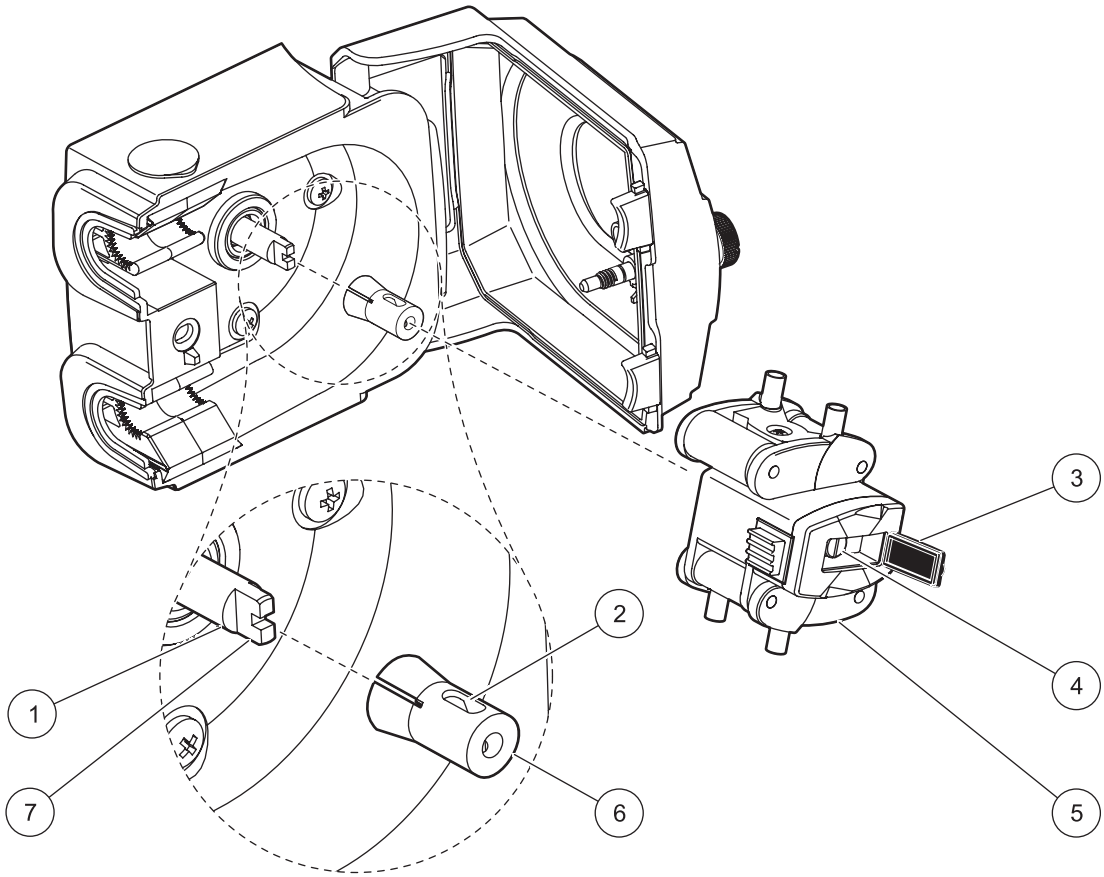


Figure 25 Pump rotor removal

1	Shaft	**5**	Rotor
2	Collet recess	**6**	Collet
3	Rubber flap	**7**	Tang
4	Screw		

6.4 Distributor arm tubing replacement

The distributor arm moves over each bottle during multiple bottle sampling. Inspect the tubing in the distributor arm on a regular basis. Replace the tubing when deteriorated or at regular intervals.

Prerequisites:

- Tubing, distributor arm, pre-cut. Make sure that the correct tube is used for the correct distributor and distributor arm. Refer to Figure 3 on page 11 or Figure 4 on page 12 and to Replacement parts on page 75.

Procedure:

1. Remove the old tubing from the distributor arm.
2. Insert the new tubing into the distributor arm so that the end of the tubing extends out of the nozzle no more than 1/8 inch (Figure 26).

   Note: *Do not let the tubing extend more than 1/8 inch past the nozzle end of the arm. If the tubing extends too far, the tubing will get caught on the bottles and interfere with sampling.*

3. To make sure that the distributor is aligned properly, run the manual distributor diagnostic (see section 7.3 on page 73).

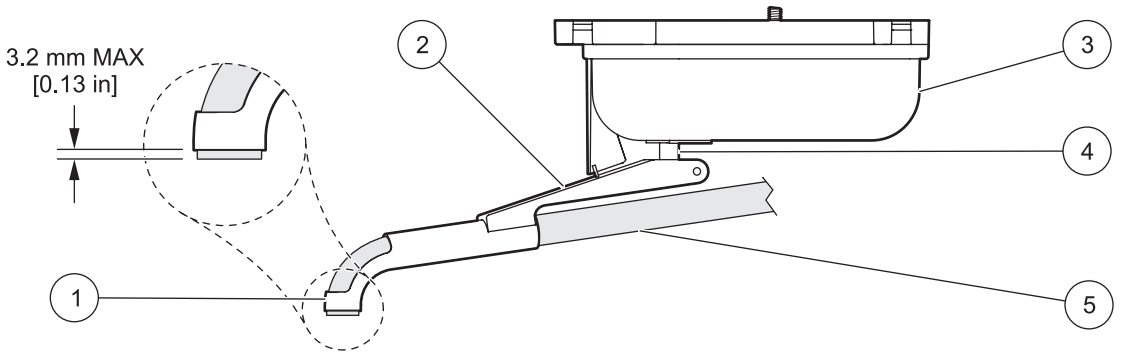


Figure 26 Distributor assembly

1	Nozzle	**4**	Shaft
2	Distributor arm	**5**	Tube
3	Distributor motor		

6.5 Desiccant replacement

A desiccant cartridge is located inside the controller to absorb moisture and prevent corrosion. Over time the desiccant will become saturated with moisture and should be replaced.

Monitor the desiccant color through the clear plastic window (Figure 27). The color will change from yellow to green when the desiccant is saturated.

Prerequisites:

- Desiccant
- Silicone grease

Note: *See Replacement parts on page 75 for ordering information.*

Procedure:

1. Unscrew and remove the desiccant holder from the controller (Figure 27).
2. Remove the plug from the end of the desiccant tube (Figure 28) and discard the spent desiccant.
3. Fill the desiccant tube with fresh desiccant.

   Note: *Fresh desiccant should be yellow.*

4. Replace the plug.
5. Apply grease to the O-ring (Figure 28).
6. Replace the desiccant tube in the controller.

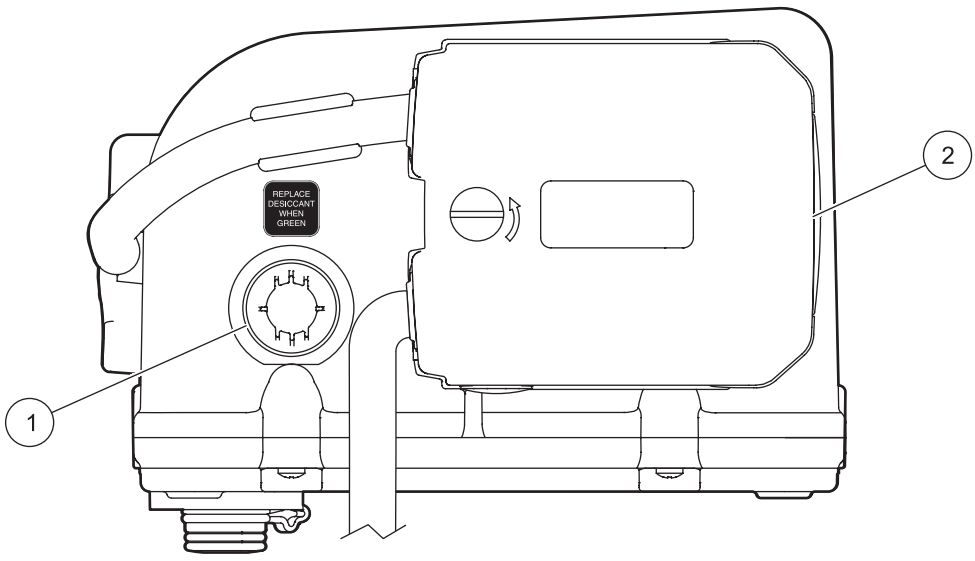


Figure 27 Side view of controller—pump and desiccant

1	Desiccant window	**2**	Peristaltic pump

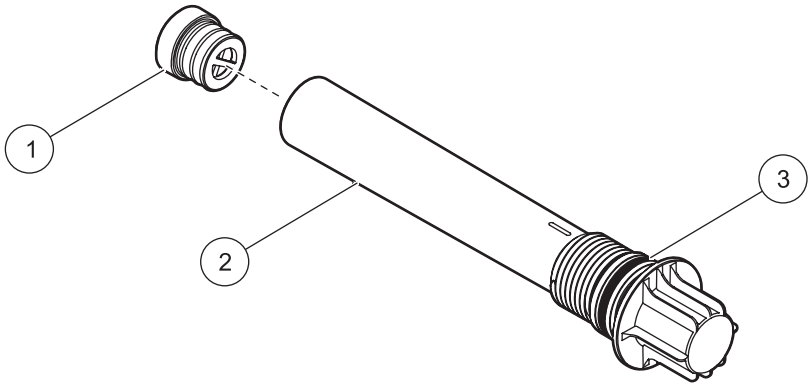


Figure 28 Desiccant holder

1	Plug	**3**	O-ring
2	Desiccant tube		

6.6 Thermal sensor calibration (AWRS only)

To verify the accuracy of the refrigerator compartment temperature, which is indicated on the sampler controller display, place a laboratory grade thermometer into a beaker with 150 mL water into the right rear corner of the refrigerated compartment, and then close the refrigerator compartment door.

Allow the refrigerator to run for 6–7 hours. This will make sure the equilibrium between the temperature in the compartment and the water in the beaker.

Compare the refrigerator temperature readout on the thermal control diagnostic screen (select **DIAGNOSTICS>THERMAL DIAGNOSTICS** from the main menu) with the temperature indicated on the thermometer. If the readings do not agree, it is necessary to calibrate the Reference Temperature Sensor. This cylindrical shaped sensor is located in the refrigerated compartment right rear corner, and is held in place by a clip bracket.

Prerequisites:

- Ice bath in a 500 mL beaker, using a 50/50 mix of crushed ice and water
- Lab grade thermometer

Procedure:

1. Press the **POWER** button to shut off the sampler controller.
2. Remove the Reference Temperature Sensor (RTS) from the bracket, and place the beaker/ice bath next to the bracket.
3. Place the sensor and the lab grade thermometer in the beaker/ice bath.
4. With the sampler controller off and the door closed, wait approximately 30 minutes for the reference sensor and lab thermometer to stabilize with the ice bath temperature.
5. After waiting 30 minutes, mix (swirl) the ice bath.
6. Press the **POWER** button.

7. From the Main Menu, select **SYSTEM SETUP>THERMAL SETUP>CALIBRATION**.
8. The screen displays the current temperature read by the controller. In degrees C, enter the reading indicated on the thermometer in the Ice bath, to the nearest one tenth degree, next to the **ACTUAL** temperature display and press **ENTER**. This completes the calibration procedure.
9. Reinstall the RTS.

6.7 Resetting the circuit breaker (AWRS only)

DANGER
Disconnect AC power from sampler before attempting to reset the internal circuit breaker.

The sampler refrigerator has an internal circuit breaker in the Power Junction Assembly Control Box located in the upper rear compartment (Figure 29). If the circuit breaker is tripped, it must be reset.

Prerequisites:

- Phillips head screwdriver
- Flat head screwdriver

Important Note: *The power junction assembly thermal control box contains electro-static sensitive components. Avoid contact with all printed circuit board components.*

Procedure:

1. Disconnect AC power from the unit.
2. Remove the six screws that hold the panel to the upper rear surface of the unit.
3. Loosen the four screws that hold the cover on the Power Junction Assembly Thermal Switch Control box, which is located on the upper left corner of the unit.
4. The circuit breaker is located on the inside left wall of the Power Junction Assembly Thermal Control box (Figure 29). Reset the circuit breaker by placing the handle in the up (ON, 1) position.
5. Install the Power Junction Assembly Thermal Control box cover.
6. Install the rear panel.

Important Note: *Make sure all screws are secured to ensure the enclosure sealing and protection is not impaired.*

7. Connect AC power to the unit.

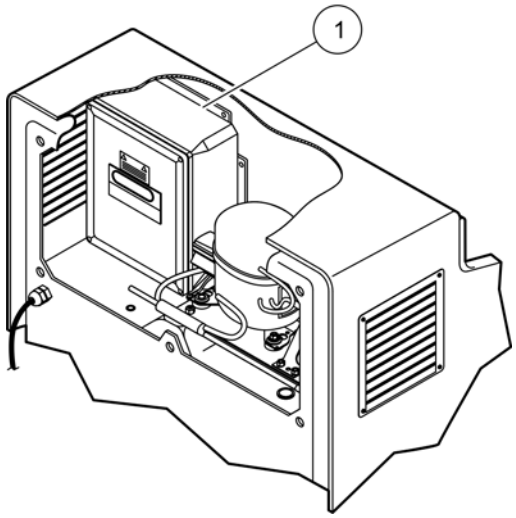


Figure 29 Power junction assembly thermal control box

1	Power junction assembly thermal control box

6.8 Adjusting the refrigeration compartment door (AWRS only)

Since the door gasket may compress slightly over time, an adjustment screw is provided to allow the door to be tightened.

Procedure:

1. Loosen the lock nut (Figure 30).
2. Rotate the tension adjustment screw until that the door shuts tightly.
3. Tighten the lock nut.

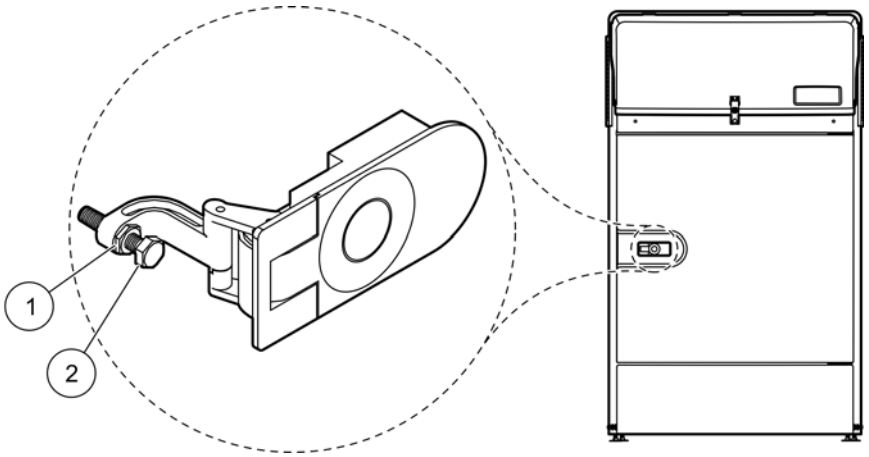


Figure 30 All weather refrigerated sampler door latch

1	Lock nut	**2**	Door tension adjustment screw

Section 7 Troubleshooting

7.1 General troubleshooting

Refer to the information in Table 6 when a problem with the sampler occurs.

Table 6 SD 900 general troubleshooting information

Problem	Cause	Solution
Instrument will not power on with AC power.	Problem may be with the controller, power supply or main power source.	Isolate components to determine which component has the problem.
	Problem with circuit breaker.	Check the circuit breaker in the AWRS and for the main power.
	Problem with electrical outlet.	Check to see if the outlet is receiving power.
	Defective power supply (refrigerated sampler only).	Replace power supply or use a battery.
	Defective controller.	Contact the service center.
Sampler will not create sufficient lift.	Strainer is not completely submerged.	Make sure the strainer is completely submerged.
	Intake tube has a leak.	Replace intake tube.
	Pump tube is worn.	Replace pump tube.
	Pump roller assembly is worn.	Contact the service center.
Inaccurate sample volumes.	Incorrect volume calibration.	Repeat the volume calibration and take a grab sample to verify accuracy.
	Incorrect intake tube length is programmed in the sampler.	Measure the intake tube length and enter in the program setup menu.
	Intake tube is not completely purging.	Make sure the intake tube is on a downward slope as vertical as possible, with no low points where liquid can accumulate.
	Stainer is intermittently submerged.	Install the shallow depth strainer (Cat. No. 2071 or 4652).
	Worn pump tubing and/or roller assembly.	Replace pump tubing; contact service center for roller assembly.
	When the liquid sensor is disabled, variable suction heads will cause variable sample volumes.	Enable the liquid sensor and complete a volume calibration.
	Liquid sensor is not operating properly.	Calibrate the liquid sensor using the same liquid that is being sampled.

7.2 Error messages and notifications

Messages will be shown in the controller display when errors occur or to confirm that an operation is complete. Refer to Table 7 for a description of the possible messages.

Table 7SD 900 error and information messages

Message	Reason	Action
ERROR WRONG RANGE	The value that was entered is outside of the acceptable range.	Press **BACK** or **ENTER**. Enter a valid number that is within the range specified on the bottom of the screen.
BOTTLE NUMBER OUTPUT DISABLED ON PIN F	Message is displayed when program complete output is enabled. The bottle number output on the auxiliary port (pin F) is automatically disabled.	Press **BACK** or **ENTER** to keep program complete output enabled. If bottle number output is preferred, disable the program complete output.
NOT ALLOWED CANNOT ENABLE SETPOINT SAMPLING AND STORM WATER	An attempt was made to enable setpoint sampling and stormwater sampling at the same time.	Disable setpoint sampling or stormwater sampling, then enable the preferred option.
NOT PERMITTED. END THE PROGRAM FIRST TO ACCESS THIS FEATURE	An attempt was made to access a menu such as program setup, system setup, volume calibration or manual operation while a program was running.	Press **BACK** or **ENTER** and select **END PROGRAM** or **CANCEL** to continue the program.
NEED TO CAL. LIQUID SENSOR IS DISABLED. CAL IS REQUIRED!	The liquid sensor was disabled and a manual volume calibration is required.	Calibrate all volumes as specified in section 4.8 on page 48.
NEED TO CAL. LIQUID SENSOR IS ENABLED. SENSOR REQUIRES CAL	The liquid sensor must be calibrated.	Calibrate the liquid sensor as specified in section 4.9.1 on page 52.
DISTRIBUTOR MOVE IS COMPLETE	Confirmation that the distributor arm was moved to a specific bottle position and the move is complete.	Press **BACK** or **ENTER** to acknowledge the information.
NOT ALLOWED. 1 BTL CONFIGURED DISTRIBUTOR NOT RELEVANT.	An attempt was made to move the distributor when the program setup was set to a single bottle.	Change the bottle number configuration in the program setup menu before moving the distributor.
RESET CAL. VALUE HAS BEEN RESET TO 0.	Confirmation that volume calibration with the liquid sensor enabled was reset to 0 in the volume calibration menu.	Press **BACK** or **ENTER** to acknowledge the information. The liquid sensor is no longer calibrated.
NOT ALLOWED. ENABLE LIQUID SENSOR TO PERFORM CAL	An attempt was made to calibrate the liquid sensor when the liquid sensor was disabled.	Enable the liquid sensor in the program setup menu.
BOTTLE NUMBER OUTPUT ENABLED ON PIN F	Confirmation that the bottle number output on pin F of auxiliary port is enabled when the program complete output is disabled.	Press **BACK** or **ENTER** to acknowledge the information.
CANNOT ENABLE. PGM START/STOP AND STORM WATER AT SAME TIME	An attempt was made to enable start/stop time and stormwater at the same time.	Disable start/stop time or stormwater in the advanced sampling menu, then enable the preferred option.
FAULT. PUMP FAULT	The pump failed to operate properly.	Examine the pump for obstructions.
ALARM. CHANGE TUBE	The specified maximum number of pump cycles have expired. The pump tube should be changed.	Change the pump tube and reset the maximum number of pump cycles (section 4.9.4 on page 53).
FAULT. ARM FAULTY	The distributor arm failed to operate properly.	Make sure the distributor arm is connected properly and can move freely in both directions.

Table 7SD 900 error and information messages (continued)

Message	Reason	Action
ERASING LOG. PLEASE WAIT	Confirmation that the event log is being cleared.	Wait for the log to be erased.
ERROR WRONG PWD	An incorrect password was entered.	Press **BACK** or **ENTER** and enter the correct password.
PGM DELAY DISABLED	A program delay was set based on counts but sample pacing/collection was set based on time. The program delay is automatically disabled.	To use a program delay in counts, set the sample pacing/collection to flow based.
STARTING PLEASE WAIT	Confirmation that a program is starting.	Wait for the program to start.
ALARM LOW BATTERY	The main battery power is low.	Replace the battery with a fully-charged battery.
ALARM LOW MEMORY BATTERY	The internal memory battery is low	Contact the service center.
ERROR INVALID SELECTION	The selection is not compatible with the program setup. For example, the base selected in the system setup menu must be compatible with the number of bottles in the program setup menu.	Select a value that is compatible with the values specified in the program setup menu.

7.3 Diagnostic tests

Use the diagnostics option to test for correct operation of the following components:

- Distributor (section 7.3.1)
- Keypad (section 7.3.2)
- Display (section 7.3.3)
- Liquid sensor (section 7.3.4)
- Thermal control (section 7.3.5)

An overview of the available diagnostic tests is shown in Table 2 on page 39.

7.3.1 Distributor diagnostic

Use the distributor diagnostic to check for proper operation of the distributor. The test moves the distributor arm to all 24 bottle positions regardless of the number of bottles that are specified in the program.

Note: *The distributor diagnostic is only active when the sample program is configured for multiple bottles.*

Procedure:

1. Select **DIAGNOSTICS**>**DISTRIB DIAG** from the main menu. The distributor arm will begin moving to all positions.
2. The display will show **ARM MOVING** and then return to the diagnostics menu when the test is complete.

   If the arm is not connected or is not able to move to all positions, the message “arm faulty” will be shown. Review

section 3.3.3.4 on page 28 and section 6.4 on page 66 to make sure the distributor and arm are set up properly.

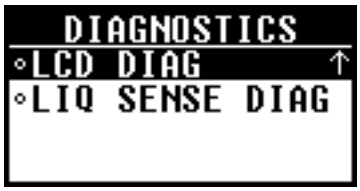
7.3.2 Keypad diagnostic

Use the keypad diagnostic to make sure each key on the keypad is operating correctly.

Procedure:

1. Select **DIAGNOSTICS**>**KEYPAD DIAG** from the main menu.
2. Press each key on the keypad (except the **BACK** key). The display should show the name of the key that was pressed.
3. To exit the test, press **BACK** key.

7.3.3 LCD diagnostic



Use the LCD diagnostic to make sure the controller display is operating correctly.

Procedure:

1. Select **DIAGNOSTICS**>**LCD DIAG** from the main menu to begin the test.
2. Observe the display. Each row will show SD900 and then each pixel will darken. When complete, the display will briefly show “test complete”.

7.3.4 Liquid sensor diagnostic

Use the liquid sensor diagnostic to show the current calibration information for the liquid sensor.

Procedure:

1. Select **DIAGNOSTICS**>**LIQ SENSE DIAG** from the main menu.
2. The display will show the input frequency (MHz), the output voltage (VDC) and the signal to noise ratio for the current calibration.

7.3.5 Thermal diagnostic (AWRS only)

Use the thermal diagnostic to show the thermal control unit parameters: cabinet temperature, evaporator heater temperature, outside (ambient) temperature, thermal setpoint and calibration offset.

Procedure:

1. Select **DIAGNOSTICS**>**THERMAL DIAG** from the main menu.
2. The display will show the thermal control parameters. Use the **UP** and **DOWN** arrow keys to view more parameters.

Section 8 Replacement Parts and Accessories

8.1 Bottle kits

Description	Catalog number Refrigerated	Catalog number AWRS
Single bottle kits (include container and full bottle shut off):		
2.5-gal poly bottle and full bottle shut off	RF010030	n/a
5.5-gal poly bottle and full bottle shut off	RF010060	AW010060
Multi-bottle kits (include container, retainer and distributor arm):		
(4) 2.5-gal poly bottles, retainer and distributor arm	RF040030	AW040030
(24) 350-mL glass bottles, retainer and distributor arm	RF240350	AW240350
(24) 1-L poly bottles, retainer and distributor arm	RF241000	AW241000

8.2 Containers and bottle sets

Description	Catalog number
Container, 10-L (2.5-gal) glass with cap	6559
Container, 10-L (2.5-gal) poly with cap	1918
Container, 21-L (5.5-gal) poly with cap	6498
Bottle set, (24) 1-L poly with caps	737
Bottle set, (24) 350-mL glass with caps	732
Bottle set, (8) 2.3-L (0.6-gal) poly with caps	657
Bottle set, (8) 1.9-L (0.5-gal) glass with caps	1118
Bottle set, (4) 10-L (2.5-gal) glass with caps	2317
Bottle set, (4) 10-L (2.5-gal). poly with caps	2315
Bottle set, (2) 10-L (2.5-gal) glass with caps	2318
Bottle set, (2) 10-L (2.5-gal) poly with caps	2316

8.3 Replacement parts

Description	Catalog number
Desiccant, refill, 1.5 pounds	8755500
Desiccant cap assembly	8754900
Desiccant tube	8742100
Desiccant tube assembly	8741500
Desiccant tube assembly with grease packet	8755600
Grease, silicone, 7 grams (0.25 oz)	000298HY
Pump cover	8755400
Tubing for peristaltic pump, 15 ft	4600-15
Tubing for peristaltic pump, 50 ft	4600-50
Tubing, Teflon-lined intake 3/8-in., 10 ft	921
Tubing, Teflon-lined intake 3/8-in., 25 ft	922
Tubing, Teflon-lined intake 3/8-in., 100 ft	925
Tubing, vinyl intake 3/8-in., 25 ft	920
Tubing, vinyl intake 3/8-in., 100 ft	923
Tubing, vinyl intake, 3/8-in., 500 ft	924
Tubing Connection Kit, for Teflon-lined PE tubing	2186

8.4 Accessories

Description	Catalog number
3-way Splitter Assembly	939
Bottle Tray	1511
Cable, multi-purpose full, 7 pin, 10 ft	8757100
Cable, multi-purpose full, 7 pin, 25 ft	8757000
Cable, multi-purpose half, 7 pin, 10 ft	8756900
Cable, multi-purpose half, 7 pin, 25 ft	8756800
Cable for Cascade Sampling, 7 pin, 25 ft	8757300
Cable for 980 Instrument Half, 7 pin, 10 ft	8758100
Cable for 980 Instrument Half, 7 pin, 25 ft	8757200
Cable, battery adaptor (2 to 3 pin)	8739400
Cable, auxiliary adaptor (6 to 7 pin)	8758000
Cable, RS232 (DB9 to 7 pin), 3 meters	8758200
Flow-thru Module	2471
Full Bottle Shut-off	8847
Retainer, (24) 350-mL glass bottles	1056
Retainer, (24) 1-L poly bottles	1322
Retainer, (8) 2.3-L (0.6 gal) poly, 1.9-L (0.5 gal) glass bottles	1521
SampleView CD with RS-232 Cable	8757500
Strainer, all 316 stainless steel, 6.0 in. long x 0.406 in. OD	2071
Strainer, all 316 stainless steel, 7.94 in. long, x 1.0 in. OD	2070
Strainer, stainless steel, 3.9 in. long x 0.406 in. OD	4652
Strainer, Teflon®/stainless steel, 5.5 in. long x 0.875 in. OD	926
Strainer, Teflon/stainless steel, 11.0 in. long x 0.875 in. OD	903

8.5 Refrigerated sampler accessories

Description	Catalog number
Cover	8963
Distributor Assembly with Arm, 24 bottles	8562
Distributor Assembly with Arm, 8 bottles	8565
Distributor Assembly with Arm, 2, 4 bottles	8568
Distributor Arm for Assembly 8562, with tubing, 24 bottles	8563
Distributor Arm for Assembly 8565, with tubing, 8 bottles	8566
Distributor Arm for Assembly 8568, with tubing, 2, 4 bottles	8569
Distributor Arm for Assembly 8562, 24 bottles	1782
Distributor Arm for Assembly 8565, 8 bottles	1785
Distributor Arm for Assembly 8568, 2, 4 bottles	1789
Distributor Arm Tubing, 22.5-inch, for assy 8562 (arm 1782)	8564
Distributor Arm Tubing, 22.5-inch, for assy 8565 (arm 1785)	8564
Distributor Arm Tubing, 20.5-inch, for assy 8568 (arm 1789)	8570
Lockable Hasp on Refrigerator Door	2143S
Power Supply, 3 pin connector, 100–120 VAC	8754500US
Retainer, (2), (4) 10-L (2.5 gal) glass/poly bottles	2038

8.5 Refrigerated sampler accessories

Description	Catalog number
Retrofit Kit (U.S.)	8759600US
Tubing for Peristaltic Pump, pre-cut for refrigerated sampler	8753800
Tubing Extension	3527
Tubing Support	8986

8.6 All weather refrigerated sampler accessories

Description	Catalog number
All Weather Refrigerated Cabinet, 115 VAC	3548
Anchor Bracket Mounting Kit	8935
Distributor assembly with arm, 24 bottles	8841
Distributor assembly with arm, 8 bottles	8842
Distributor assembly with arm, 2, 4 bottles	8843
Distributor arm for assembly 8841, with tubing, 24 bottles	8844
Distributor arm for assembly 8842, with tubing, 8 bottles	8845
Distributor arm for assembly 8843, with tubing, 2, 4 bottles	8846
Distributor arm for assembly 8841, 24 bottles	8822
Distributor arm for assembly 8842, 8 bottles	1785
Distributor arm for assembly 8843, 2, 4 bottles	1789
Distributor Arm Tubing, 21.5-inch, for assy 8841 (arm 8822)	8579
Distributor Arm Tubing, 21.5-inch, for assy 8842 (arm 1785)	8850
Distributor Arm Tubing, 20-inch, for assy 8843 (arm 1789)	8852
Heater for controller compartment, 120 VAC	8805
Heater for controller compartment, 220 VAC	8808
Tubing for Peristaltic Pump, pre-cut for all weather refrigerated sampler	8753900
Door Assembly	8702
Lid Assembly with Latch	8968
Tube Support with Tube	8838

Section 9 Contact information

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Appendix A Wiring for non-Sigma flow meters

CAUTION
Only qualified personnel should conduct the tasks described in this section of the manual.

Prerequisites:

- Multi-purpose half cable
- Auxiliary adapter cable (6-pin to 7-pin adapter)
- Optional splitter (Figure 16 on page 35) to provide additional connections. Two or more splitters may be connected in series.

See Accessories on page 76 for ordering information.

Procedure:
Use the auxiliary connector diagram in Figure 31 and wiring information in Table 8 to wire the flow meter to the controller.

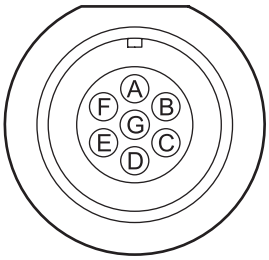

Figure 31 Auxiliary connector (7-pin)

Table 8 Half-cable wiring information for non-Sigma flow meters

Pin	Signal description	Wire color[1]	Purpose	Rating
A	12 VDC power output	Red	Power supply positive output. Powers an external device or flow meter. Must be used in conjunction with pin B (common).	This output is protected by a thermal current limiter. 12 VDC nominal output at 1 A maximum when using battery 8754400 to power the sampler. 15 VDC regulated output at 0.5 A maximum when using AC power to power the sampler.
B	Common	Black	Power supply negative return. When using AC power, this pin is connected to earth ground.	

Table 8 Half-cable wiring information for non-Sigma flow meters (continued)

Pin	Signal description	Wire color[1]	Purpose	Rating
C	Pulse input	Brown	This input triggers sample collection. The signal may be generated by: • An external flow meter or other device with an appropriate control output. • Simple floating (dry) contact closure. The sampler is capable of accumulating from 1 to 9,999 input pulses. This count is advanced at the beginning (rising edge) of the input signal. Each contact closure output from a flow meter represents a specific flow volume. The contact closure signal is sent more frequently for high flow rates, and less frequently for low flow rates. The sample frequency will increase as the flow rate increases and decrease as the flow rate decreases, thus taking samples in proportion to flow rate.	This input responds to a positive pulse with respect to Common (pin B). It is terminated (pulled low) to Common (pin B) through a series 1 kΩ resistor and 7.5 V zener diode. Absolute maximum input: 0 to 15 VDC with respect to Common (pin B). Signal required to activate input: 5–15 V positive going pulse with respect to common (pin B) of at least 50 millisecond duration. Source impedance of driving signal should be less than 5 kΩ. Dry contact (switch) closure of at least 50 millisecond duration between pin A (12 VDC) and pin C (Pulse Input). Contact resistance should be less than 5 kΩ. Contact current will be less than 8 mA DC.
D	Liquid level actuator/auxiliary control input	Orange	This input sends a signal to the microprocessor inside the sampler causing it to "wake up" and begin or resume its sampling program. Applications for this input include: A simple float level switch (dry contacts) may be used to actuate the sampler when liquid is present. Start this sampler after another sampler has finished its program. Start the sampler in response to some user-defined condition from an external device that provides an appropriate control signal. For example a pH meter could be used to initiate sampling in response to a high or low pH condition.	This input is terminated (pulled high) to an internal +5 V supply through an 11 kΩ resistance and protected by a series 1 kΩ resistor and 7.5 V zener diode terminated to Common (pin B). The input responds to a high to low voltage transition with a logic low pulse width of at least 50 milliseconds. Absolute maximum input: 0 to 15 VDC with respect to Common (pin B). Signal required to activate input: External logic signal having 5-15 VDC power source. The drive signal should be normally high. The external driver should be capable of sinking 0.5 mA @ 1 VDC maximum at the logic low level. A logic high signal from a driver with power source of greater than 7.5 V will source current into this input at the rate of: I = (V - 7.5)/1000 where: I is the source current V is the power supply voltage of the driving logic. Dry contact (switch) closure of at least 50 millisecond duration between pin D and pin B (common). Contact resistance should be less than 2 kΩ. Contact current will be less than 0.5 mA DC.
E	Special output	Yellow	Normally at 0 VDC, this line goes to +12 VDC upon any of the selected events described in section 5.3.2 on page 56.	This output is thermally protected against short circuit currents to common (pin B). Limit external load current to 0.2 A. The output is normally logic low (0 VDC) with respect to common (pin B). Active high output levels are: 15 VDC nominal when using AC power to power the sampler 12 VDC nominal when using battery 8754400 to power the sampler.

Table 8 Half-cable wiring information for non-Sigma flow meters (continued)

Pin	Signal description	Wire color[1]	Purpose	Rating
F	Program complete output	Green	Normally an open circuit, this line switches to ground for 90 seconds at the conclusion of the sampling program. Used to “wake up” another sampler to take over sampling or to signal an operator or data logger upon the completion of the sampling program. This pin is also used to signal the bottle full condition in a single bottle/continuous mode, and will transmit the bottle number to a flow meter if the program complete signal is disabled.	This is an open collector output with 18 V zener clamp diode for overvoltage protection. The output is active low with respect to common (pin B). Absolute maximum ratings for output transistor: Sink current = 25 mA DC maximum. External pull-up voltage = 18 VDC maximum.
G	Shield	N/A	Provides connection to earth ground when the sampler is powered using AC power. This connection is only intended for use in controlling RF emissions and susceptibility.	Not intended for use as safety ground. Do not use as a current carrying conductor. Cables greater than 3 meters length connected to the sampler auxiliary port should be shielded. Regardless of length, if a shielded cable is connected to the auxiliary port, the shield (drain) wire should only be connected to earth ground at one end of the cable to avoid ground loop currents.

[1] Wire color refers to the colors of multi-purpose cables Cat. No. 8756800 and 8756900.

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