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1 Product Information

This chapter gives general information about the LiquID Station.

Description

The LiquID (“Liquid ID”) Station from ZAPS Technologies is a multi-parameter fluid analyzer. It is an optical monitoring instrument for continuous, online water-quality monitoring.

Sample fluid goes into the analyzer and flows through a single optical flow cell for analysis. Inside the flow cell, the sample is exposed to high-intensity light at specific wavelengths. The analyzer records absorption, fluorescence, and reflectance responses (hybrid multi-spectral analysis, or HMA) that indicate sample characteristics. Multiple parameters are determined, and the continual flow of measurement data is available for immediate analysis and response.

The analyzer requires electrical power (120 VAC or optional 240 VAC), clean water (such as processed or tap water), an open drain, communications, and a continuously flowing sample stream. It uses no reagents and produces no waste other than the return of the sample flow stream. No operator is required for normal operation.
Hardware options

The LiquID Station has several hardware options that can be added to the basic configuration. Special instructions and information about the following options are included in this manual.

<table>
<thead>
<tr>
<th>Option</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell modem</td>
<td>Provides the default method of communication. Modem is installed inside the analyzer, antenna is installed externally.</td>
</tr>
<tr>
<td></td>
<td>“Connecting the antenna (if included)” on page 18</td>
</tr>
<tr>
<td>Analog communications (4-20 mA)</td>
<td>Provides multiple channels of analog data to a compatible system. Installed externally between analyzer and external system.</td>
</tr>
<tr>
<td></td>
<td>“Setting up 4-20 mA analog output” on page 33</td>
</tr>
<tr>
<td>Temperature stabilizer</td>
<td>Provides necessary thermal stability for an analyzer not installed in a temperature-controlled environment. Integrated into upper cabinet door.</td>
</tr>
<tr>
<td></td>
<td>No special action required</td>
</tr>
<tr>
<td>Clean-in-place option</td>
<td>Removes unusual buildup of contaminants on internal optical surfaces, reducing frequency of manual cleaning. External pump periodically injects cleaning solution into analyzer.</td>
</tr>
<tr>
<td></td>
<td>“Maintaining the clean-in-place accessory” on page 98</td>
</tr>
</tbody>
</table>

Applications

The LiquID Station is configured for each installation. ZAPS specialists work with the customer to understand the sample matrix, define the analyzer configuration, and specify the individual parameters needed for the application. Typical applications include

- Drinking-water monitoring
- Environmental monitoring
- Wastewater monitoring
- Water-reuse monitoring
- Industrial monitoring

Identification

The LiquID Station identification label is located on the right side of the junction box. This label contains the unit’s serial number along with other information. In addition, the serial number is displayed on the front-panel display during operation.

Note: The illustrations in this manual are representative of typical configurations of the LiquID Station. However, the design of any particular unit may differ from those shown in this manual. In addition, ZAPS Technologies may periodically revise the design for improved usability and functionality.
Installation

This chapter describes the complete installation process for a ZAPS Technologies LiquID (“Liquid ID”) Station, a multi-parameter fluid analyzer. It covers how to select and prepare the site, install the analyzer and its communications options, and start operation. If you need information or assistance, contact ZAPS Technologies—see “Getting Support” on page 119.

Preparing the site

The installation site for the analyzer must meet all detailed requirements listed on pages 11 and 12. However, for optimum performance, long life, and reliable operation, choose a site with these ideal characteristics:

- **Clean, dry, stable environment.** The analyzer is designed to tolerate a wide range of environmental conditions. However, installing it in a clean, dry location will reduce maintenance, provide improved longevity, and allow access during poor weather. Installing it in a conditioned space minimizes temperature variations, providing optimum measurement conditions and improved component life. If the local environment is likely to exceed the –5 to 40 °C (23 to 104 °F) operating temperature range, the analyzer must be protected and the temperature managed to stay within these limits.

- **Nearby, gravity-fed source of sample fluid.** If the analyzer is located near the sample source, changes at the source are detected more quickly, and sample fluid may be less affected by chemical or temperature changes during delivery. If sample fluid is delivered to the analyzer by gravity, delivery is simplified and more reliable with no maintenance.

- **Pressurized clean-water source for rinse water.** A clean-water source pressurized to 280–520 kPa (40–75 psi) provides rinse water, used for flushing debris and film from internal optics surfaces. A standard drinking-water supply with an appropriate backflow prevention device is suitable for this purpose. Such a high-pressure source will extend the time between preventive maintenance services.

- **Raised, open drain.** An open drain pipe at an appropriate height facilitates the flow of sample fluid and rinse water through the analyzer, without causing back pressure that might interfere with the smooth, steady flow required for optimum measurements. A proper drain configuration contributes greatly to good sample delivery.

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**Important:** When planning the site, make sure all utility and plumbing lines will be protected from conditions that could interrupt service. For example, exposure of plumbing lines to freezing conditions could stop fluid flow. Physical damage to electrical cables could disrupt operation.
Summary of site requirements

Site requirements are summarized below. For complete details, see “Physical site requirements” and “Utilities requirements” on the following pages.

**Wall support:**
1½"x1½" strut channel or other structural bracing
135–183 cm (54–72 in) above floor
70 cm (28 in) minimum length

**Open drain for outflow of sample fluid and cleaning water:**
Zero back-pressure
Within 1 m (3 ft) of the analyzer*
0.6–1.1 m (24–42 in) above the floor*

**Air temperature:**
-5 to 40 °C (23 to 104 °F)
Temperature inside the analyzer must not exceed 60 °C (140 °F)

**Communication:**
Good signal strength for cellular service provider;
Network connection; or SCADA connection

**Electrical power:**
120 VAC (90–130 VAC)
(240 VAC optional),
1000 watts, 50–60 Hz,
grounded electrical outlet
Within 2 m (6 ft) of the analyzer’s junction box

**A source of sample fluid:**
½-in. female NPT fitting within 3 m (10 ft) of the analyzer
Shutoff valve or device
Steady, continuous flow
14–420 kPa (2–60 psi)
static supply pressure with no rapid fluctuations*
½-in. supply line from the source*

**Clean rinse-water source, such as tap water with appropriate backflow prevention device:**
½-in. female NPT fitting within 3 m (10 ft) of the analyzer
Shutoff valve or device
280–550 kPa (40–80 psi)
pressure
10 L/min (2½ gal/min)
intermittent flow

**Air temperature:**

**Communication:**

**Electrical power:**

**A source of sample fluid:**

**Clean rinse-water source, such as tap water with appropriate backflow prevention device:**

* Contact ZAPS Technologies if the site cannot meet these requirements—ZAPS personnel will work with you to accommodate the site’s limitations.
# Physical site requirements

<table>
<thead>
<tr>
<th>Location</th>
<th>Within range of the fluids being sampled so they can readily be piped to the analyzer.</th>
</tr>
</thead>
</table>
| **Air temperature** | Operating: –5 to 40 °C (23 to 104 °F), provided the temperature inside the unit does not exceed 60 °C (140 °F) or change more than 5 °C (10 °F) per hour.  
   Storage: 10 to 40 °C (50 to 104 °F) indoors, when drained (see page 99). | 
| **Exposure** | Indoors or outdoors, not subject to immersion, flooding, severe weather, or solar heat gain. If the local environment is likely to produce operating air temperatures outside –5 to 40 °C (23 to 104 °F), the analyzer must be protected and the temperature managed.  
   **Note:** If installed outdoors, ZAPS recommends installing in a conditioned enclosure to supplement the weather-resistant cabinet, reduce temperature variations, and allow maintenance in inclement weather. | 
| **Mounting** | Vertical surface for attaching the unit (minimum dimensions):  
   185 cm (73 in) high, 91 cm (36 in) wide | 
| **Load** | Mounting surface can support 140 kg (300 lb) vertical load and 23 kg·m (165 lb·ft) moment, or  
   Floor surface can support 11 kg/cm² (150 lb/in²) for support legs. | 
| **Vibration** | Operating: 9.8 m/s² (1.0 Gs) maximum  
   Storage: 49 m/s² (5.0 Gs) maximum | 
| **Shock** | Operating: 147 m/s² (15 Gs), 11 ms maximum  
   Storage: 245 m/s² (25 Gs), 11 ms maximum | 
| **Access** | Clearance of at least 1 m (3 ft) in front of the unit for access and safety, and 0.4 m (1 ft) on each side for access and safety. | 

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**WARNING:** Operation outside these specifications will void the warranty and may result in damaged equipment or degraded operation.

Below are illustrations showing locations (centimeters and inches) of mounting holes and key dimensions of the basic analyzer and with the optional floor stand (intended for temporary use).
Utilities requirements

The standard fluid analyzer requires the customer to provide certain utilities at the installation site.

<table>
<thead>
<tr>
<th>Electrical power</th>
<th>120 VAC (90-130 VAC) or optional 240 VAC (180-260 VAC), 1000 watts maximum (typical draw 1 A at 120 VAC), 50–60 Hz, grounded electrical outlet within 2 m (6 ft) of the unit’s junction box.</th>
</tr>
</thead>
</table>
| Sample fluid              | One source of sample fluid:  
14–420 kPa (2–60 psi) static supply pressure with minimal fluctuations,*  
½-in. minimum supply line from the source,*  
2 L/min (0.5 gal/min) minimum flow rate,  
4 to 40 °C (39 to 104 °F) sample temperature,  
½-in. NPT (female) fittings within 3 m (10 ft) of the analyzer (for compatibility with ZAPS plumbing kit),  
Shutoff valve or device,  
pH of the fluid between 6 and 9 to prevent premature aging of components,  
No particles intended for abrasion (the presence of such particles may require premature replacement of internal components), and  
Backflow prevention device (where required). |
| Caution: Flow of the sample fluid should be steady and continuous, with no rapid variations, and with no restrictions that could cause bubbles or effervescence. If water hammer can occur, install a water-hammer absorber to prevent damage to the analyzer.  
A proper drain configuration contributes greatly to good sample delivery.  
Note: The time required for the sample fluid to travel the length of the supply piping determines the time lag between events at the source and detection at the analyzer. A shorter distance, greater flow rate, or smaller diameter piping will reduce the time lag. |
| Rinse water               | Clean water source, such as tap water with appropriate backflow prevention device:  
280–550 kPa (40–80 psi) pressure required (for water above 40 °C, 104 °F, contact ZAPS Technologies), 10 L/min (2½ gal/min) intermittent flow,  
½-in. NPT (female) fitting within 3 m (10 ft) of the analyzer (for compatibility with ZAPS plumbing kit), and  
Shutoff valve or device. |
| Drain                     | Open drain for outflow of sample fluid and cleaning water:  
Zero back-pressure,  
Within 1 m (3 ft) of the unit,*  
0.6–1.1 m (24–42 in) above the floor.* For wall mounting, 0.2–0.6 m (6–24 in) above the bottom of the cabinet.* (A 1"- or 2"-diameter PVC pipe emptying into a floor drain is sufficient.) |
| Network                   | Communication via one or both of the following:  
Ethernet option, which requires a Category 5 (Ethernet) cable with a compatible water-resistant RJ-45 plug, or  
Cellular option, which requires a supported cellular service provider within range. |

* Contact ZAPS Technologies if the site cannot meet these requirements—ZAPS personnel will work with you to accommodate the site’s limitations. Also see “Methods for delivering sample fluid” on page 13.
Methods for delivering sample fluid

Caution: It is important for the sample fluid stream to meet the requirements listed below. An uncontrolled sample flow or an improperly designed delivery system can damage the source or analyzer or cause inaccurate measurements.

You must provide a method for delivering a continuous flow of sample fluid to the analyzer. The method you use must meet these requirements:

- The sample fluid stream should remain steady and continuous, with no restrictions that could cause bubbles or effervescence. A proper drain configuration contributes greatly to good sample delivery. See the specifications listed under “Utilities requirements” on page 12.
- During its operation, the analyzer occasionally blocks the sample flow in order to perform other required tasks, such as self-calibration and routine maintenance. The sample source must accommodate these occurrences to prevent damage to the source or to the analyzer.

Listed below are three examples of fluid-delivery methods that have proven to be effective. The method you use may depend on conditions at the site.

- Preferred: Existing feed line. If the pressure and flow are compatible with the analyzer, run a branch line to the analyzer and install a shutoff valve. This method is appropriate for all applications.
- Optional: Submersible pump. If you can install a submersible pump in a reservoir or trough of sample fluid, plumb it to the analyzer and install a shutoff valve. This method is good for sample fluids ranging from clear water to some mixed liquors.
- Optional: Peristaltic pump. If you intend to use a peristaltic pump, it should have an electronic control. Power, direction, and speed control signals may be necessary because peristaltic pumps can have variable flow rates and cannot accept a blocked-flow condition. You should contact ZAPS Technologies about activating and connecting special control output from the analyzer. See “Optional: Controlling an external pump” on page 22. This method is good for difficult sample fluids from some mixed liquors to raw wastewater.

For more detailed information about designing the sample-delivery system, see “Options for pumping sample fluid” on page 107 and “Optimizing the sample stream” on page 110.
Installing the analyzer

**Recommended tools:**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large flat blade screwdriver</td>
<td>T-25 Torx bit with drill or ratchet</td>
</tr>
<tr>
<td>9/16&quot; socket wrench with long extension</td>
<td>Medium diagonal cutters</td>
</tr>
<tr>
<td>9/16&quot; combination wrench</td>
<td>Tubing cutter or utility knife (for 1/2&quot; poly tubing)</td>
</tr>
<tr>
<td>10 mm combination wrench</td>
<td>Pipe-thread tape</td>
</tr>
</tbody>
</table>

Unpacking the crate

**Caution:** When you receive the shipping crate, check the shock sensors. If a shock sensor has been tripped, make a note when you sign for delivery. Notify the shipper and ZAPS Technologies of the tripped shock sensor to schedule an inspection for damage. Do not open the shipping crate if a shock sensor has been tripped. If you do not notify ZAPS Technologies, the warranty will be void.

1. Inspect any shock sensors on the shipping crate. If any sensor is tripped, contact ZAPS Technologies before proceeding.
2. Pry off the wire clips that hold the lid in place.
3. Lift off the lid.
4. Remove the accessories box near the analyzer legs.
5. Remove the covering from the analyzer.
6. If present, remove the two 4-foot boards to the inside floor of the crate.
7. Remove the four bolts securing the analyzer.

WARNING: Do not attempt to move or lift the unit without adequate equipment or personnel. The unit weighs about 140 kilograms (300 pounds). Inadequate equipment or personnel could result in serious personal injury or damage to the equipment.

8. Lift the analyzer and slide the two 4-foot boards across the shipping crate to support the analyzer.

9. If present, remove two floor-stand brackets from the bottom of the crate.

10. If present, remove the skinny antenna box from the top end or side of the crate.

Note: If you intend to ship the analyzer in the future, save the shipping crate and all packing materials.
11. Open the lower cabinet door.
   The upper cabinet door should remain closed. The upper cabinet door should be opened only by ZAPS Technologies personnel or by technicians certified by ZAPS Technologies.

12. Open the junction box on the side of the unit.

13. Carefully remove any packing material and inspect the inside of the unit for hidden shipping damage.

14. Before continuing, close the cabinet doors and close the junction box.

Verify that you received the following items:

- Main cabinet with upper and lower sections, including optional accessories already installed.
- For certain configurations, antenna, cable, and hardware for optional wireless communications adapter.
- Plumbing kit (includes plastic tubing, ½-inch male NPT adapters, and in-line filter for rinse line) for connecting the analyzer to sample, rinse-water, and drain.
- Optics cleaning kit, containing special supplies for periodically cleaning the internal optical surfaces of the analyzer.

Contact ZAPS Technologies if any components are missing or damaged—see “Getting Support” on page 119.
Optional: Installing the floor stand

If an optional floor stand is included with the analyzer, you can use it to stand the analyzer upright without attaching it to a vertical surface.

**WARNING:** Use this floor stand only for a temporary installation. For personal and equipment safety, the LiquID Station must be secured to a vertical support.

1. Lay the analyzer on the shipping crate or other sturdy surface.
2. Attach the base of the floor stand to the analyzer’s foot.
3. Attach the front brace to the analyzer’s leg.
4. Attach the back brace to the analyzer’s leg.

Install a floor stand on each leg.
Installation

Connecting the antenna (if included)

If the analyzer includes a factory-installed cellular communications option, install and connect the antenna included in the crate.

1. Find the antenna mounting plate with antenna sleeve, and position it on the back of the strut closest to the junction box, above or below the wall mount. The sleeve should face the front of the analyzer. Position the plate as high as possible.

2. Locate the antenna cable coming out the bottom of the junction box. Route it up through the sleeve and connect it to the end of the antenna. Secure the antenna in the sleeve.

Note: The antenna can be mounted separately from the unit, if desired. It can be as far as 15 meters (50 feet) from the analyzer if you use an antenna extension cable. The antenna must be mounted vertically.

Moving the analyzer

WARNING: Do not attempt to move or lift the unit without adequate equipment or personnel. The unit weighs about 140 kilograms (300 pounds). Inadequate equipment or personnel could result in serious personal injury or damage to the equipment.

Move the analyzer using one of the approved methods shown below.
Mounting the analyzer

1. Prepare the mounting surface for attaching the cabinet. For most installations, install a horizontal strut channel or bar on the wall. The channel or bar must be at least 70 cm (28 in) long and suitable for attaching the unit. It should be 135-183 cm (54-72 in) above the floor.

WARNING: Do not attempt to move or lift the unit without adequate equipment or personnel. The unit weighs about 140 kilograms (300 pounds). Inadequate equipment or personnel could result in serious personal injury or damage to the equipment.

2. Using a forklift or high-capacity dolly, move the unit into position at the mounting surface.

3. Lift the unit or hold it up on its legs, then use a wrench to adjust the mounting plates on the struts so they align with the horizontal mount you installed.

4. Attach the unit to the mount using adequate hardware, such as 3/8-inch bolts or lag screws.

5. Adjust the cabinet so it is vertical within 2°, front-to-back and side-to-side. Adjust the feet or mounts, and insert shims as needed.

6. Bolt the feet to the floor so they cannot move.

WARNING: Securely fasten the unit, top and bottom, so it cannot shift in any direction. If the unit works loose, it could result in serious personal injury, damage to the equipment, or inaccurate data.
Making connections with Fast & Tite fittings

The next steps during installation require connecting the sample source, rinse source, and drain line to the analyzer. These connections normally use Fast & Tite fittings. Follow the instructions below for connecting plastic tubing to Fast & Tite fittings. No tools are required to connect a fitting.

Connecting tubing

The following steps show how to make a new connection to a Fast & Tite fitting.

1. Cut off the end of the tubing at a right angle with no burrs.
2. Remove the nut, grab ring, spacer, and O-ring from the Fast & Tite fitting. You may have to pull the O-ring from the fitting.
3. In the order shown below, install the parts onto the end of the tubing.
   - Caution: The beveled side of the spacer must face the grab ring, and the teeth on the grab ring must face the spacer.
   - Note: Slide the grab ring no more than about 10 mm (½ inch) onto the tubing. If you slide it too far, you may have great difficulty adjusting the parts for a good connection.
4. Adjust the position of the parts so the stacked parts are about 5 mm (¼ inch) from the end of the tubing.
5. Insert the tubing into the fitting.
   - Caution: Work carefully to avoid cross-threading the nut onto the fitting and possibly damaging the threads. Turn the nut in the opposite direction until the threads seat, then screw it on.
6. Thread the nut onto the fitting part way, but not tight. The threads should engage smoothly and easily.
7. Firmly push the tubing into the fitting until it hits bottom inside the fitting.
8. Tighten the nut hand tight, then turn the nut no more than an additional ¼ turn by hand.

Opening a connection

The following steps show how to disconnect a Fast & Tite connection.

1. Unscrew the nut completely, then pull the tubing out of the fitting.
2. If the O-ring or spacer remain in the fitting, remove them and install them on the end of the tubing.
3. To reconnect the tubing, insert the end into the fitting and tighten the nut hand tight plus no more than an additional ¼ turn.
Connecting the supply lines

The following steps describe how to connect the sample, rinse, and drain lines for the standard analyzer configuration.

Note: Follow these guidelines when connecting supply lines:

- For every inlet line (sample fluid and rinse water), include an external control for turning the supply on and off. For example, you can include a ball valve in the line, or provide a switch for a pumped supply. An external shutoff facilitates maintenance and repair of the analyzer.
- Do not restrict the flow of the sample fluid near the analyzer. The analyzer normally allows sample fluid to flow freely. Any restriction just ahead of the analyzer may cause a drop in pressure at the inlet, possibly causing dissolved gasses to effervesce and influence the measurements.

If the analyzer you are installing is not a standard configuration, its connections may differ from those described here.

Make the following connections with the upper cabinet door closed.

Caution: If you thread a fitting directly into an inlet or outlet on the unit, always apply opposing torque to the fitting on the unit to prevent it from twisting. If you allow a fitting to twist, you could cause damage to internal components or connections.

1. Open the door of the lower cabinet and find the labels marking the DRAIN, RINSE, and SAMPLE fittings.
2. At the outlet fitting marked “DRAIN” on the bottom of the cabinet, remove the shipping plug and connect a drain line for sample fluid and rinse water that run out from the analyzer. You can use ½-in. black polypropylene or polyethylene tubing included in the plumbing kit. The drain must be an open drain (no back pressure).
3. At the clean rinse-water supply, connect the ½-inch NPT nipple and in-line rinse-water filter from the plumbing kit. Observe the direction of the arrow on the filter.
4. At the inlet fitting marked “RINSE” on the bottom of the cabinet, remove the shipping plug and connect the rinse-water filter/supply to the analyzer. You can use a ½-inch NPT adapter and 3/8-inch or ½-in. black polypropylene or polyethylene tubing included in the plumbing kit, depending on the size of the rinse inlet. Do not turn it on or apply pressure yet.
5. At the inlet fitting marked “SAMPLE” on the bottom of the cabinet, remove the shipping plug and connect a source for the primary fluid to be analyzed. You can use a ½-inch NPT adapter and ½-in. black polypropylene or polyethylene tubing included in the plumbing kit. Do not turn it on or apply pressure yet.
6. Put labels or identifying marks on both ends of the tubing for the sample, rinse, and drain lines. Use arrows to show flow toward the analyzer for the sample and rinse lines, and away from the analyzer for the drain line. If labels are included in the plumbing kit, you can use them for this purpose.

At this stage, the analyzer is installed and connected—all of the supply lines are connected but not yet turned on, and electrical power is not yet connected. Go to “Startup and testing” on page 25 for information about checking the installation and starting operation.

Optional: Controlling an external pump

If an external pump delivers sample fluid to the analyzer, the pump can be controlled by the analyzer if special software is set up on the analyzer by ZAPS personnel. The software is capable of turning the pump on and off and, if needed, setting the pump to normal and reverse directions (such as might be needed for a peristaltic pump).

⚠️ **Caution:** The electrical load you connect to the relay should not exceed the maximum ratings of the relay contacts—see “Characteristics of the relay contacts” on page 35 for contact ratings.

If your analyzer has been set up for external-pump control, use the information below to wire your pump to the analyzer. Contact ZAPS Technologies for details about connections for different types of pumps.

🔍 **Note:** On some units, the relays are installed facing the opposite direction from those shown below. Check the locations of the gold tabs.
## Installation

<table>
<thead>
<tr>
<th>Relay 05</th>
<th>State (Example Connection)</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Relay 05 Diagram" /></td>
<td><img src="image2.png" alt="Example Connection" /></td>
<td>Pump Off</td>
</tr>
<tr>
<td><img src="image1.png" alt="Relay 05 Diagram" /></td>
<td><img src="image2.png" alt="Example Connection" /></td>
<td>Pump On</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relay 06</th>
<th>State</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Relay 06 Diagram" /></td>
<td><img src="image4.png" alt="Example Connection" /></td>
<td>Pump Normal Direction</td>
</tr>
<tr>
<td><img src="image3.png" alt="Relay 06 Diagram" /></td>
<td><img src="image4.png" alt="Example Connection" /></td>
<td>Pump Reverse Direction</td>
</tr>
</tbody>
</table>

For a peristaltic pump, an additional, optional connection is available for controlling the pump speed. Contact ZAPS Technologies for information about speed-control connections for your specific analyzer.

You can use one or both relays, and you can use one or both poles in each relay. Notice that the analyzer’s relays do not supply power to the external pump—they simply provide contacts that indicate the desired pump actions.

**WARNING:** High voltages (120–240 VAC) are present inside the junction box whenever external power is supplied. Touching a high-voltage electrical connection could cause death or serious injury. Disconnect power before making connections inside the junction box. Wiring should be performed by a qualified technician.

1. Make sure the analyzer is turned off by pressing in the power button and unplugging the power cord.
2. Turn off your external-pump circuit.
3. Open the junction box on the analyzer.
4. Loosen the large compression nut on the cable feed-through at the bottom of the junction box.
5. Fit the cable or wires from your pump through the seal in the feed-through, then reseat the seal. Tighten the large nut securely.
6. Inside the junction box, route the wires to the desired screw terminals on the two relays on the swing-out panel and tighten them in place. Make sure the wires do not restrict the swing-out panel.
7. For a programmable peristaltic pump, change its settings to allow control by the analyzer.

For example, for a Watson-Marlow model 620UN pump, three settings:
Setup>Analogue>Input: select 0-10V (this sets 0V=160 rpm, 10V=165 rpm).
Optional: Controlling an automatic grab sampler

If you have an external grab sampler plumbed to the sample supply line (not the drain line), the grab sampler can be controlled by the analyzer if special software is set up on the analyzer by ZAPS personnel. The software is capable of triggering a grab sample using the Web Interface for the analyzer—see “Control tab” on page 58. For each trigger, the relay contacts switch momentarily to activate the grab sampler.

Caution: The electrical load you connect to the relay should not exceed the maximum ratings of the relay contacts—see “Characteristics of the relay contacts” on page 35 for contact ratings.

If your analyzer has been set up for controlling an external grab sampler, use the information below to wire your sampler to the analyzer. Different grab samplers have different signal requirements—see the instructions for your grab sampler to determine the required electrical connections.

Note: On some units, the relays are installed facing the opposite direction from those shown below. Check the locations of the gold tabs.

<table>
<thead>
<tr>
<th>Relay</th>
<th>Required by Grab Sampler</th>
<th>Example (Not Triggered)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay 06</td>
<td>Normally-Open Contacts: Sampler triggered by momentarily closing the connection between wires. <strong>Example:</strong> Relay completes a circuit that activates a trigger in the sampler.</td>
<td><img src="image" alt="Diagram of Relay 06" /></td>
</tr>
<tr>
<td></td>
<td>Normally-Closed Contacts: Sampler triggered by momentarily opening the connection between wires. <strong>Example:</strong> Relay opens a circuit that normally provides an Inhibit signal.</td>
<td><img src="image" alt="Diagram of Relay 06" /></td>
</tr>
</tbody>
</table>

If necessary, ZAPS Technologies can set the analyzer to use Relay 05 instead.

Note: During any system check in which the analyzer is off, the pump-control circuitry is not active. You may have to manually activate your sample pump as needed. (For example, for a Watson-Marlow pump, set Stop Disable to Yes.)

Notice that the analyzer’s relay does not supply power to the external equipment—it simply provides contacts that indicate the desired action.

WARNING: High voltages (120–240 VAC) are present inside the junction box whenever external power is supplied. Touching a high-voltage electrical connection could cause death or serious injury. Disconnect power before making connections inside the junction box. Wiring should be performed by a qualified technician.
Installation

1. Make sure the analyzer is turned off by pressing in the power button and unplugging the power cord.
2. Turn off the external grab sampler.
3. Open the junction box on the analyzer.
4. Loosen the large compression nut on the cable feed-through at the bottom of the junction box.
5. Fit the cable or wires from your grab sampler through the seal in the feed-through, then reseat the seal. Tighten the large nut securely.
6. Inside the junction box, route the wires to the desired screw terminals on the two relays on the swing-out panel and tighten them in place. Make sure the wires do not restrict the swing-out panel.

Note: During any system check in which the analyzer is off, the grab sampler control is not active. You may have to manually activate your sampler as needed.

Startup and testing

Checking the system

The following tests are conducted with the lower cabinet door open and with power unplugged or turned off.

WARNING: High voltages (120–240 VAC) are present inside the junction box and upper cabinet whenever external power is supplied. These voltages are exposed if you open the cabinet. Do not touch any high-voltage electrical connections if you open the junction box or upper cabinet. Touching a high-voltage electrical connection could cause death or serious injury.

1. Open the lower cabinet door.
2. Turn on pressure from the external RINSE water supply. Check for leaks.

Note: If a fluid to be analyzed is hazardous, you may want to substitute a clean water supply temporarily during the test for leaks in the steps below.

3. Turn on pressure from the external SAMPLE source. Check for leaks.

Caution: In the following steps, do not repair any leak inside the fluid analyzer. Contact ZAPS Technologies about an internal leak. If any person other than a ZAPS-certified technician makes any repair on the unit, the warranty will be void.

4. Observe for 5 minutes and verify that no leaks occur inside the cabinet or at outside fittings.
   If a leak occurs, turn off the supplies immediately. Repair only external leaks—do not repair any leak inside the cabinet. Contact ZAPS Technologies about an internal leak.
5. Verify that fluid flows freely from the drain. If no fluid flows from the drain, check again after applying power to the analyzer in the next section below.
6. Close all doors on the cabinet.
Starting the system

You should leave the cabinet doors closed while you start the analyzer.

**Caution:** If the analyzer temperature is below 5 °C (41 °F), warm the analyzer to at least this temperature before applying power. Starting the analyzer while it is below its operating temperature range could damage the equipment.

1. Check the electrical outlet to make sure the outlet works and has proper polarity and grounding.
2. Turn on all fluid supply lines.
3. Before plugging in the power cord, check that the power button on the bottom of the junction box is pushed in (turned off).
4. Plug the analyzer’s power cord into the power outlet.
5. On the bottom of the junction box, pull down the power button.
   This turns on power and starts the analyzer. This may take several minutes. In a quiet environment, you may hear buzzing noises—this is normal. Fluid should flow from the drain outlet.

**Note:** Depending on the configuration, the analyzer may or may not automatically start making measurements whenever it turns on. To change this setting, contact ZAPS Technologies—see “Getting Support” on page 119.

**Caution:** If the analyzer fails to operate, do not attempt to repair the electronics inside the analyzer. Contact ZAPS Technologies about any electronics failure. If any person other than a ZAPS-certified technician makes any repair on the unit, the warranty will be void.
Installation

**Caution:** In the following step, do not restrict the flow of the sample fluid near the analyzer. The analyzer normally allows sample fluid to flow freely. Any restriction just ahead of the analyzer may cause a drop in pressure at the inlet, possibly causing dissolved gasses to effervesce and influence the measurements.

6. If necessary, adjust the pressure of the sample supply to obtain the flow rate you want.
   - The fluid analyzer may not analyze the sample if the incoming line pressure is less than 14 kPa (2 psi), causing insufficient flow. You can confirm the flow by temporarily attaching a flow meter in the incoming supply.
   - The velocity of the sample fluid determines the time lag between events at the source and detection at the analyzer. A greater flow rate or smaller diameter piping will reduce the time lag.

**Note:** To turn off power, push up on the power button on the bottom of the junction box. This turns off power to all internal components, although sample fluid normally continues running through the analyzer and into the drain.

**Operations checklist**

Make sure you leave the analyzer in the following state so it can perform its normal operations:

- The power cord is plugged into a powered outlet.
- The power button on the junction box is not pushed in.
- The RINSE water supply is turned on.
- The SAMPLE supply is turned on.
- The drain line is working.
- If present, the antenna for the cellular modem is connected.
- The display screen on the junction box is working.

The fluid analyzer automatically analyzes incoming sample fluids. The small display screen on the front of the junction box presents real-time operating information.

The display is normally blank or off whenever the analyzer is powered down or in the process of starting up.

**Note:** If the analyzer includes a cellular communications option, several small indicator lights are present inside the junction box—you can see them when the door is open. These lights indicate normal activity of the internal cellular modem.

The fluid analyzer also may send measurement data to the secure ZAPS web server. You can view and collect the data using a web browser on a computer connected to the Internet—see “Using the Web Interface” on page 41 for complete information.
Connecting communication options

The analyzer continually analyzes the sample stream and computes parameter values. It communicates its data and receives commands via one or more communications options. The following topics describe these options and show how to set up the connections:

- Internet access (page 28)
- Modbus communications (page 32)
- 4-20 mA output (page 33)
- VPN communications (page 34)
- Relay signals (page 35)

Several possible communication configurations are discussed in greater detail under “Choosing analyzer communications” on page 113.

For information or assistance, contact ZAPS Technologies—see “Getting Support” on page 119.

Connecting to the Ethernet port

The analyzer’s Ethernet port can be used for a wired Internet connection, for a Modbus connection, or possibly for other connections.

To connect a cable to the Ethernet port on the analyzer, unscrew the cover from the RJ-45 socket on the bottom of the junction box. For maximum weather protection, use a Category 5 Ethernet cable with a water-resistant collar:

- Purchase a collared plug (such as McMaster-Carr #5697T51) to terminate your site’s Ethernet cable, then connect it to the analyzer—or
- Purchase an Ethernet cable with a compatible collared plug (such as McMaster-Carr #5697T26) and connect it to the analyzer.

See the topics that follow for additional requirements for using the Ethernet port for Internet or Modbus communications.

Configuring the Internet connection

The analyzer must be connected to the Internet in order to transmit its data and receive control instructions. The following topics contain network-related settings that must be made to support the Internet communications. Two types of Internet connections are supported:

- Cellular modem connection
- Network connection inside a firewall

Note: The configuration settings described in this section are normally implemented by the network administrator.
Installing a modem and antenna (on-site)

Note: If a modem was preinstalled inside the junction box at the factory, it is already configured for use and you should have already installed the antenna—see “Connecting the antenna (if included)” on page 18. No additional setup is required for a factory-installed modem.

A cellular modem is normally used by the analyzer for external communications, especially following installation. If a modem is not preinstalled at the factory, you can install one on-site. In addition, an external antenna must be connected to the modem.

The analyzer is designed for the installation of a Sierra Wireless AirLink LS300 cellular modem and a WPSantennas M54 antenna. This is the preferred type of modem and antenna. If you intend to install a different type of modem, contact ZAPS Technologies for installation and configuration information.

Note: The network configuration settings described in the steps below are normally implemented by the network administrator.

1. Confirm that your cellular service provider will provide the following:
   - A routable, public IP address for your modem.
   - Support for at least 1 GB/month data usage.
2. If your cellular service provider requires a SIM card in the modem, install it. Do this by removing the SIM cover on the modem, plugging in the SIM card, and replacing the cover.
3. Configure the AirLink LS300 modem by performing the following sequence of steps at a bench:
   - Connect power to the modem. Wait for the indicator lights to stabilize.
   - Connect a LAN cable directly from the modem to a computer.
   - No antenna connection is required.
   - In a browser window on the computer, type this address:
     \[192.168.13.31:9191\]
     and press Enter. This shows the Sierra Wireless login screen.
   - For username, type “user”. For password, type “12345”.
   - Using the tabs across the top of the screen and the menu items down the left side of the screen, check or select the settings shown in the table below.
## Installation

<table>
<thead>
<tr>
<th>Tab at top…</th>
<th>Menu item at left…</th>
<th>Action…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Home</td>
<td>Initial screen—no action required. (With no antenna connected, many entries will be undefined.)</td>
</tr>
<tr>
<td>WAN/Cellular</td>
<td>WAN/Cellular</td>
<td>EV-DO Diversity should be Disabled. If not, change it and click Apply.</td>
</tr>
<tr>
<td>LAN</td>
<td>DHCP/Addressing</td>
<td>Host Connection Mode should be All Hosts Use Private IPs. If not, change it and click Apply.</td>
</tr>
<tr>
<td>Services</td>
<td>ACEmanager</td>
<td>OTA ACEmanager Access should be Both HTTP And SSL. If not, change it and click Apply.</td>
</tr>
<tr>
<td>Services</td>
<td>Dynamic DNS</td>
<td>Open pull-down Service menu, click IP Manager. Then make the following settings:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Device Name analyzer’s 6-digit serial number</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Domain eairlink.com</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 1 edns1.eairlink.com</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 1 Update Only On Change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 1 Update (mins) 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 1 Key (verify not empty)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 2 edns2.eairlink.com</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 2 Update Only On Change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 2 Update (mins) 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Manager Server 2 Key (verify not empty)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Then click Apply.</td>
</tr>
<tr>
<td>Admin</td>
<td>Change Password</td>
<td>For security, change the “12345” password and click Change Password. Record the new password in a safe place.</td>
</tr>
</tbody>
</table>

- Click Reboot near the top-right corner of the window. Wait for the modem lights to stabilize, which may take 2 minutes or more.
- Optional: Log in again using the computer and check that all the changed settings are correct.

4. Unplug the power cable and LAN cable from the modem.
5. At the analyzer, turn off the analyzer by pressing in the power button, then unplug the power cord
6. Open the junction box.
7. Unscrew the thumbscrew and swing out the front panel.
8. At the top of the box, find the two screws that fasten the modem bracket to the back panel. Unscrew the two screws and remove the bracket.
9. Attach the modem to the bottom side of the bracket. Indicator lights on the modem should face toward the left side of the analyzer.
10. Reinstall the bracket with modem inside the junction box.
11. Outside the bottom of the junction box, loosen or remove the large retaining nut at the bottom of the large cable feed-through.
12. Carefully remove a section of the rubber seal so your antenna cable can go through—leave enough cable inside the box to reach the modem. Then replace the seal so the cable has a snug fit, and tighten the retaining nut.
13. Inside the junction box, find these three unattached cables and attach them to the modem:
   - Power cable
   - LAN cable
   - Antenna cable (use the normal antenna connector, not the GPS connector)

14. Arrange the three cables safely inside the junction box, then secure the hinged panel.

15. Close the junction box.

16. Depending on the height of the main wall mount, adjust the position of the antenna mounting plate on the strut at the back of the analyzer, above or below the wall mount. Position the bracket as high as possible.

17. Attach the two brackets for the M54 antenna to the front of the mounting plate.

18. Install the metal antenna sleeve into the brackets.

19. Take the loose end of the antenna cable coming out the bottom of the junction box. Route it up through the sleeve and connect it to the end of the antenna. Secure the antenna in the sleeve.

20. **Important**: Notify ZAPS Technologies that you installed a modem and that you set its Device Name to the analyzer’s serial number.

---

**Note**: The antenna can be mounted separately from the unit, if desired. It can be as far as 15 meters (50 feet) from the analyzer if you use an antenna extension cable. The antenna must be mounted vertically.

---

**Network connection inside a firewall**

The analyzer provides an external water-resistant RJ-45 socket that can be used to make a wired connection to a local network. This requires ZAPS Technologies to modify the analyzer’s standard configuration.

---

**Caution**: The following settings are intended only for new installations. If you change current settings for an existing installation, connections may be lost.

1. Configure these ports on your local network firewall:
   - Open port 443 outbound.
   - Open and forward port 22 inbound.
   - Optional: Open and forward port 44999 inbound.

2. Connect the analyzer to the local network by plugging a LAN cable into the external RJ-45 socket on the analyzer. See “Connecting to the Ethernet port” on page 28.

3. Contact ZAPS Technologies to reconfigure the analyzer to be compatible with your local network. See “Getting Support” on page 119.

---

**Note**: If you are using a Modbus connection to a SCADA system, the external RJ-45 socket is not available for a connection to an independent local network.
Configuring Modbus communications

The analyzer supports communications using Modbus protocol over a TCP/IP network connection. This protocol enables the analyzer to communicate with a SCADA (supervisory control and data acquisition) system or similar equipment. However, a Modbus connection does not provide a method for controlling the analyzer from the SCADA equipment.

Making Modbus connections

The analyzer connects to a Modbus TCP/IP bridge device via the analyzer’s Ethernet port. The bridge device provides the interface to the SCADA system, as shown in the illustration below. For example, Prosoft offers several types of Modbus TCP/IP interface modules.

1. Contact ZAPS Technologies to verify or reconfigure the analyzer so it is compatible with your SCADA system. See “Getting Support” on page 119.
2. Plug a LAN cable into the analyzer’s Ethernet port and into the Ethernet port on the bridge device. See “Connecting to the Ethernet port” on page 28.

For detailed information about connections and configurations of the Modbus equipment, see the instructions provided with the bridge device.

Designing the Modbus communications

The Modbus TCP/IP bridge device must be programmed to communicate with the analyzer according to the analyzer’s Modbus protocol. In addition, the SCADA system normally has a customized visual interface for displaying different types of information to operators.

The analyzer uses a customized Modbus protocol for communicating three types of information with the bridge device:

- Measured parameter data from the analyzer.
- Analyzer status information.
- External data made available to the analyzer.

Note: The custom Modbus specifications for each analyzer are supplied with the analyzer. The specifications include addresses and definitions for all Modbus registers.

Note: If the analyzer is not connected to the Internet via a cell modem or LAN connection, the analyzer must be equipped with a front-panel display with integrated buttons. This enables operators to control the analyzer and to perform certain tasks, such as preventive maintenance.
Setting up 4-20 mA analog output

Using a ZAPS 4-20 mA accessory, the analyzer can transmit continuous analog data to external monitoring equipment, such as a SCADA system. Such one-way analog communication has no known security risk. This type of connection does not provide a method for controlling the analyzer from the SCADA equipment.

Overview of the 4-20 mA accessory

The ZAPS 4-20 mA accessory provides an analog interface for the analyzer. By adding the interface, the analyzer can send real-time analog output for several selected measurement parameters to the monitoring equipment.

As shown in the diagram below, the analyzer and 4-20 mA accessory provide several continuous analog signals on the 4-20 mA channels. The magnitude of each signal represents the present value of its assigned parameter.

At certain times, no measurement value will be available from the analyzer. For example, no measurements are taken during periodic cleaning cycles, during periodic calibration cycles, or if measurements are suspended. If no measurement value is available for about the past 15 minutes, the analyzer sets the 4-20 mA output to 4 mA (or other customer-specified values) on all channels. This condition indicates a special situation, and operators or the external equipment should be aware of this special case.

The customer selects the measurement parameters represented by the 4-20 mA output signals. The customer also selects the minimum and maximum parameter values represented by 4 mA and 20 mA. These settings are programmed into the analyzer by a ZAPS representative.

Note: If the analyzer is not connected to the Internet via a cell modem or LAN connection, the analyzer must be equipped with a front-panel display with integrated buttons. This enables operators to control the analyzer and to perform certain tasks, such as preventive maintenance.

Installing the 4-20 mA accessory

The 4-20 mA accessory is installed outside the analyzer, either near the analyzer or somewhere between the analyzer and the external monitoring equipment where power is available.
When choosing a location for mounting the module, consider its distances from the analyzer, monitoring equipment, and source of power. The RS-485 signal between the analyzer and the 4-20 mA module can be transmitted up to 1200 m (4000 ft) using single-twisted-pair RS-485 cable. The distance for 4-20 mA signals from the 4-20 mA module to the monitoring equipment is mainly limited by only the wire resistance.

Detailed instructions for installing and connecting the 4-20 mA accessory is included with the accessory.

**Configuring VPN communications**

Certain maintenance functions require ZAPS personnel to have remote access to the analyzer. For example, a hardware or performance problem requires information gathering and troubleshooting. Remote access also facilitates updating software and maintaining virus protection.

If the analyzer is not connected to the Internet, you can establish a site-to-site VPN (virtual private network) for remote access to the analyzer. A VPN connection ensures that only authorized ZAPS personnel at the ZAPS factory have outside access to the analyzer.

For information about setting up a VPN connection, contact ZAPS Technologies—see “Getting Support” on page 119.
Connecting the output relays

The analyzer can be configured to control certain external equipment. It uses two DPDT relays labeled “Relay 05” and “Relay 06”, located inside the analyzer junction box. The DPDT contacts are electrically isolated from the internal circuitry of the analyzer. The analyzer activates or deactivates the relays depending on pre-defined conditions in the analyzer.

You can use a relay connection to activate, control, or shut down certain types of external equipment.

Characteristics of the relay contacts

Each DPDT (double-pole, double-throw) relay provides two sets of NC (normally closed) and NO (normally open) contacts—see the schematic in the next topic. The electrical load you connect to the relay should not exceed the following maximum ratings of the relay contacts.

<table>
<thead>
<tr>
<th>Contact ratings</th>
<th>Resistive load</th>
<th>Inductive load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated load</td>
<td>10 A at 110 VAC</td>
<td>7.5 A at 110 VAC</td>
</tr>
<tr>
<td></td>
<td>6 A at 240 VAC</td>
<td>5 A at 240 VAC</td>
</tr>
<tr>
<td></td>
<td>10 A at 24 VDC</td>
<td>5 A at 24 VDC</td>
</tr>
<tr>
<td></td>
<td>0.6 A at 120 VDC</td>
<td>0.4 A at 120 VDC</td>
</tr>
<tr>
<td>Rated carry current</td>
<td>10 A</td>
<td>10 A</td>
</tr>
<tr>
<td>Max. contact voltage</td>
<td>250 VAC</td>
<td>250 VAC</td>
</tr>
<tr>
<td></td>
<td>125 VDC</td>
<td>125 VDC</td>
</tr>
<tr>
<td>Max. contact current</td>
<td>10 A</td>
<td>10 A</td>
</tr>
</tbody>
</table>

The following graph shows the maximum switching capacity under different operating conditions.
Connections for the relay contacts
The relay connections are accessible inside the junction box on the analyzer. The connections are made at the relay socket. This diagram shows the locations of the DPDT contact connections (common, normally open, normally closed). During pre-defined conditions, the relay is activated, and the normally open contacts close.

Note: On some units, the relay is installed facing the opposite direction from that shown above. Check the location of the gold tab.

To connect relay contacts to an external circuit, follow these steps.

WARNING: High voltages (120–240 VAC) are present inside the junction box whenever external power is supplied. Touching a high-voltage electrical connection could cause death or serious injury. Disconnect power before making connections inside the junction box. Wiring should be performed by a qualified technician.

1. Turn off the analyzer by pressing in the power button and unplugging the power cord.
2. Turn off your external circuit.
3. Open the junction box on the analyzer.
4. Loosen the large compression nut on the cable feed-through at the bottom of the junction box.
5. Fit your cable or wires through the seal in the feed-through, then reseat the seal. Tighten the large nut securely.
6. Inside the junction box, route the wires to the desired screw terminals on the relay socket and tighten them in place. Make sure the wires do not restrict the swing-out panel.
Removing the internal modem (if required)

If ZAPS requests that you remove the internal modem and antenna from the analyzer and return them to ZAPS, follow the steps below.

1. Turn off the analyzer by pressing in the power button, then unplug the power cord.
2. Open the junction box.
3. Unscrew the thumbscrew and swing out the first panel.
4. Find the two screws that fasten the modem bracket to the back panel. Unscrew the two screws and remove them.
5. Unplug the three cables attached to the modem:
   - Antenna cable (unscrew the connector)
   - LAN cable (pinch the tab)
   - Power cable (pinch the tab)
6. Remove the modem and bracket from the cabinet and set them aside.
7. Arrange the power cable and LAN cable safely inside the junction box, then secure the swinging panel.
8. Outside the bottom of the junction box, loosen or remove the large retaining nut at the bottom of the large cable feed-through.
9. Carefully withdraw the antenna cable from the bottom of the junction box, temporarily removing only as many of the sealing pieces as necessary. Be careful not to dislodge all of the sealing pieces.
10. Insert a “plug” into the seal to fill the hole from the antenna cable—it should have a snug fit—then tighten the retaining nut. (For the plug, you could use a machine screw of an appropriate size.)
11. Loosen and remove the antenna from the mounting sleeve and disconnect the cable.
12. Remove the antenna bracket where it attaches to the vertical strut on the back of the analyzer.
13. Close the junction box, then plug in and restart the analyzer.
3 Operation

The LiquID Station requires little or no attention while performing its basic task of measuring multiple parameters for the sample fluid and making the measurement data available for analysis. Measurements are performed automatically and repeatedly to create a continuous history of the sample’s characteristics.

This chapter covers these areas of operation:
- Starting, stopping, and controlling the analyzer (below and page 40)
- Remote access to measurement data and controls (page 41)
- Other methods of access (page 67)
- Special operations (page 68)

Starting and stopping the analyzer

The analyzer normally operates without operator intervention, continually taking measurements of the sample fluid and communicating those measurements externally. This section describes how to start and stop the analyzer.

Starting up the analyzer

The analyzer normally starts automatically when power is turned on.

1. Make sure the sample supply and rinse water supply are turned on.
   Normally, sample water flows out the drain outlet. If there is no flow, make sure it flows after the analyzer is powered in the following steps.

2. Plug in the power cord.

3. Pull down the red power button on the bottom of the junction box.
Operation

Shutting down the analyzer

The preferred method for shutting down the analyzer involves stopping sampling before removing power. If this is not possible, power can simply be removed.

1. Shut off the sample line to the analyzer.
2. If you have an Internet connection to the web server and can see the Web Interface screen, go to the Control tab, and perform these actions:
   - Expand Advanced and click Put the Station in IDLE Mode. This halts sample measurements. Wait for the indicated status to change to IDLE.
   - Expand Advanced and click Stop Sample Flow…. This allows fluid to drain from the analyzer.
3. Push in the red power button on the bottom of the junction box.
4. Unplug the analyzer’s power cord.
5. Shut off the rinse-water line to the analyzer.

Using the display buttons (if present)

Some analyzers are equipped with a display that has a button array. The buttons enable you to directly control certain aspects of analyzer operation while you are at the analyzer location.

1. Open the door on the junction box.
   - If the display is mounted on the back of the door, the display has no buttons. Stop here.
   - If the display is mounted on the internal swing panel, the display has a button array as shown below. Continue to the next step.
2. Press any button while the normal display is shown. This opens a menu of options.
3. Press ↑ or ↓ to move the > pointer to any menu option, then press 0 to activate that option—see the explanations below, –or–
   - Do not press any buttons for 15 seconds (or press 0) to exit the menu and return to the normal display.

The following table explains the menu structure and operation.
<table>
<thead>
<tr>
<th>Menu Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| Manual Optics Clean | Stops current activity, takes exclusive control of the analyzer, and prepares for manual optics cleaning by an operator. This displays a message showing preparation status, then displays the following two options when the analyzer is ready for you to clean the optics:  
  Done Cleaning  Select after you have finished cleaning the optics. Begins a calibration sequence that adjusts for the cleaned optics. See “Cleaning the internal optics surfaces” on page 81. (Also gives up control of the analyzer.)  
  Cancel Cleaning Returns the analyzer to its previous state if you decide not to clean the optics at this time. (Also gives up control of the analyzer.) |
| Advanced Options    | Displays a new menu with the following options:  
  Rinse Cycle       Stops current activity, rinses off the internal optics with water and air, then resumes the previous activity. (Stubborn deposits may require manual cleaning.) |
| Go to IDLE Mode     | Suspends measurements (Idle mode) or restarts measurements (Run mode) for an indefinite period. Automatic maintenance-type operations can occur in either mode. Idle mode is the preferred state before shutting off power. |
| Go to RUN Mode      | Reboot System        Restarts the computerized control component of the analyzer. This is less severe than turning the analyzer off and on, and is useful for fixing certain unexpected conditions. |
|                     | SW Information       Displays version information about the proprietary software on the analyzer, sometimes requested by factory personnel. |

**Using the Web Interface**

The analyzer continually takes measurements from the sample stream and stores the measurement data internally. That data is made available externally by the analyzer’s Web Interface. You use a web browser on your computer to view and collect the data on your computer. You can also control certain aspects of the analyzer’s operation. See the diagrams below.

If your analyzer has access to the ZAPS web server, the analyzer reports its data to the ZAPS server. To view and collect the data, open a web browser on your computer and log in to that server’s web address (mpm.zapstechnologies.com).

If your analyzer isn’t connected to the ZAPS server, it stores its data internally. The analyzer may be configured to make its data available for access by other equipment—see “Viewing data in other ways” on page 67.
Operation

Note: The Web Interface screens displayed on your computer by the ZAPS web server are periodically revised for improved usability and functionality. The information in this section is accurate at the time this manual is published, but the Web Interface is subject to change in the future.

The screens shown in this section are representative of what you will see for your analyzer. But because your analyzer’s configuration may be customized, the specific parameters you see will probably differ from those shown here.

Logging in

You view measurement data by logging in to the ZAPS server. The only tool you need is a computer or other device with a wired or wireless Internet connection.

1. Connect your computer or device to the Internet or to your local area network, using either an Ethernet cable connection or a wireless connection.

Note: The address for the ZAPS web server below starts with “mpm” (not “www”).

2. In a web-browser window on your computer, log in to the ZAPS web server. Type

   mpm.zapstechnologies.com

   and press Enter or Return.

   You may want to set a bookmark for the address so you can connect easily in the future.

3. When prompted, type your assigned login name and password.
   Your login name and password were provided to you on paper or electronically after your analyzer was installed.

After you connect to the ZAPS server, you can view or download measured data in several ways. This section describes the Web Interface screens you see after logging in:

- Quick Glance tab (below).
- Monitor tab (page 45).
- Data tab (page 48).
- Quick Review tab (page 51).
- Alerts tab (page 54).
- Control tab (page 58).
- Grab Sample tab (page 61).
Note: If a warning or error condition occurs at the analyzer, an error message is shown near the top of the screen for most tabs of the Web Interface—see “Interpreting error codes” on page 101.

Quick Glance tab

The Quick Glance tab provides a summary of the latest values of all measurement parameters plus a list of active alerts.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Support</td>
<td>Opens the <em>Operation and Maintenance Manual</em> in another window or tab.</td>
</tr>
<tr>
<td>2 Monitor link</td>
<td>Jumps to Monitor tab (equivalent to clicking Monitor tab).</td>
</tr>
<tr>
<td>3 Logout</td>
<td>Closes the connection to the server.</td>
</tr>
<tr>
<td>4 Print</td>
<td>Prints the current page, including parts that do not fit on your screen.</td>
</tr>
<tr>
<td>5 Row of main tabs</td>
<td>Jump to different screens showing different information—see other headings in this chapter.</td>
</tr>
<tr>
<td>6 Station</td>
<td>Shows the name of the analyzer whose data is displayed. Click to select a different analyzer.</td>
</tr>
<tr>
<td>7 Status</td>
<td>Shows the current status of the analyzer. Examples: Online – analyzer is taking measurements. Offline(none) – measurements are stopped, analyzer is idle but ready. Offline(calibration) – measurements temporarily suspended for internal maintenance. Offline(clean) – measurements temporarily suspended for internal maintenance. Offline(error) – measurements are stopped, analyzer requires attention before it can continue. Unavailable – analyzer is off or not communicating with server.</td>
</tr>
<tr>
<td>8 Last transmission</td>
<td>Shows the date and time of the most recent measurements received by server.</td>
</tr>
</tbody>
</table>
### Operation

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updates</td>
<td>Shows the interval at which the displayed data is automatically refreshed with updated data. Under normal conditions, new parameter values are measured every few minutes. Click to select a different interval.</td>
</tr>
<tr>
<td>Go</td>
<td>Refreshes the display using current settings. For many web browsers, the display refreshes automatically after changing any setting.</td>
</tr>
<tr>
<td>Current sample port</td>
<td>Shows the name of the sample source.</td>
</tr>
</tbody>
</table>

For each measured parameter...

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter name and units</td>
<td>Name or abbreviation for the measured parameter plus units of measure. Certain units may be condensed for brevity. (See “Understanding reported parameters” on page 67.) The color of the heading indicates whether an alert is active for the parameter: yellow (warning condition) or red (critical condition). (See “Alerts tab” on page 54.)</td>
</tr>
<tr>
<td>Current value</td>
<td>Numeric value of the most recent measurement for the parameter. (Some parameters may have descriptive, non-numeric values.)</td>
</tr>
<tr>
<td>Today’s average value</td>
<td>The average of all values measured since the start of the current day, a time interval that gets longer as the day progresses. (The start of the day is normally defined at the factory as 9:00 AM.)</td>
</tr>
<tr>
<td>Yesterday’s average value</td>
<td>The average of all values measured during the 24 hours ending at the start of the current day.</td>
</tr>
<tr>
<td>Graph</td>
<td>Plots the measured values of the parameter during the past 4 hours. Gaps in the trace indicate measurement cycles in which the parameter is not available, such as during internal maintenance cycles, during times when another sample stream was being measured, when measurements were turned off, or when the analyzer was turned off. If an alert with upper or lower control limits is active for the parameter, those limits may appear in the graph as horizontal dashed lines.</td>
</tr>
<tr>
<td>chart link</td>
<td>Jumps to the Monitor tab showing current graphical data for the parameter.</td>
</tr>
<tr>
<td>data link</td>
<td>Jumps to the Data tab showing current numeric data for the parameter.</td>
</tr>
<tr>
<td>Alert indicator</td>
<td>If present, indicates that an alert condition currently exists for the parameter.</td>
</tr>
</tbody>
</table>

For each active alert...

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert name</td>
<td>The assigned name of the alert. The color of the name indicates the level of alert condition: yellow (warning condition) or red (critical condition). (See “Alerts tab” on page 54.)</td>
</tr>
<tr>
<td>Chart link</td>
<td>Jumps to Monitor tab with the corresponding parameter shown.</td>
</tr>
<tr>
<td>Details link</td>
<td>Jumps to a page that gives a two-line summary of the alert information: Station, Alert name, Alert creation date Date/time of alert occurrence, Condition causing alert, Type of alert (Click any tab to leave the summary page.)</td>
</tr>
</tbody>
</table>
Monitor tab

The Monitor tab displays graphs of measurement data over an interval of time.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Support</td>
<td>Opens the <em>Operation and Maintenance Manual</em> in another window or tab.</td>
</tr>
<tr>
<td>2 Monitor link</td>
<td>No action (already on Monitor tab).</td>
</tr>
<tr>
<td>3 Logout</td>
<td>Closes the connection to the server.</td>
</tr>
<tr>
<td>4 Print</td>
<td>Prints the current page, including parts that do not fit on your screen.</td>
</tr>
<tr>
<td>5 Row of main tabs</td>
<td>Jump to different screens showing different information—see other headings in this chapter.</td>
</tr>
<tr>
<td>6 Station</td>
<td>Shows the name of the analyzer whose data is displayed. Click to select a different analyzer.</td>
</tr>
</tbody>
</table>
| 7 Status | Shows the current status of the analyzer. Examples:  
  Online – analyzer is taking measurements.  
  Offline(none) – measurements are stopped, analyzer is idle but ready.  
  Offline(calibration) – measurements temporarily suspended for internal maintenance.  
  Offline(clean) – measurements temporarily suspended for internal maintenance.  
  Offline(error) – measurements are stopped, analyzer requires attention before it can continue.  
  Unavailable – analyzer is off or not communicating with server. |
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Start</td>
<td>Specifies the date/time at the left end of the graph—or, if blank, specifies that the current time appears at the right end of the graph. The time at the opposite end of the graph is determined by the Scale setting. Type the entry, or click the calendar to select the date and time. (This field may be highlighted when it is not blank—when the current time is not plotted).</td>
</tr>
</tbody>
</table>
| 9 << < [ ] > >> | Shows a different time interval on the graph and automatically updates the Time setting:  
  
  << – jump back in time one full Scale time interval.  
  < – jump back in time one-hal the Scale time interval.  
  [ ] – jump so the current time is at the right end of the graph.  
  > – jump forward in time one-half the Scale time interval.  
  >>> – jump forward in time one full Scale time interval. |
| 10 Scale | Shows the interval of time spanned by the graph—and also specifies how far the << and >> links jump backward and forward. Click to select a different time scale. If you select a long time interval, Statistic is automatically set to Daily. |
| 11 Last transmission | Shows the date and time of the most recent measurements received by server. |
| 12 Updates | Shows the interval at which the displayed data is automatically refreshed with updated data. Under normal conditions, new parameter values are measured every few minutes. Click to select a different interval. |
| 13 Go | Refreshes the display using current settings. For many web browsers, the display refreshes automatically after changing any setting. |
| 14 Metric 1 | Shows the name of the primary parameter depicted in the graph. Click to select a different primary parameter. (See “Understanding reported parameters” on page 67, and also see the next item.) |
| 15 Metric 2 Metric 3 | If selected, shows the name of second and third parameters depicted in the graph. The colors of the fields match the colors of the traces in the graph. Click to select a different parameter—choose Select to delete secondary parameters. |
| 16 Statistic | Shows whether unsmoothed or smoothed data is plotted in the graph. Click to select a different option (Daily is the only option for longer time intervals):  
  None – Each data point is the actual measurement with no smoothing, no averaging.  
  Average (Mean) – Each data point is the average calculated over a time interval ending at the indicated time. Click Period to change the time interval.  
  5 Point Mean – Each data point is the average of the five data points ending at the indicated time.  
  Daily – For each day, the average of all values is shown. This gives one value per day. (To see daily minimum and maximum values, go to the Data tab.) |
<p>| 17 Metrics | Alternately shows or hides the options for including data for additional analyzers and parameters. Click to change. |
| 18 Metric 4 Metric 5 Metric 6 | If selected, shows the name of additional analyzers whose data is displayed. Click to select an analyzer. After an analyzer is selected, click to select a parameter for that analyzer. |
| 19 Filter options | Alternately shows or hides the options for displaying data. Click to change. |
| 20 Show shapes | Specifies when to show a symbol at each data point: only for shorter Scale intervals (Auto), for all Scale intervals (On), or never (Off). Click to select. |</p>
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Show original data points</td>
</tr>
<tr>
<td>22</td>
<td>Show outliers</td>
</tr>
<tr>
<td>23</td>
<td>Show common range</td>
</tr>
<tr>
<td>24</td>
<td>Show floor and ceiling…</td>
</tr>
<tr>
<td>25</td>
<td>Graph title</td>
</tr>
<tr>
<td>26</td>
<td>Vertical axis</td>
</tr>
<tr>
<td>27</td>
<td>Graph trace</td>
</tr>
<tr>
<td>28</td>
<td>Horizontal axis</td>
</tr>
<tr>
<td>29</td>
<td>Legend</td>
</tr>
<tr>
<td>30</td>
<td>Secondary vertical axes</td>
</tr>
</tbody>
</table>
Data tab

The Data tab displays a list of numeric measurement data over an interval of time. The numeric data can be downloaded to your computer.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Support</td>
</tr>
<tr>
<td>2</td>
<td>Monitor link</td>
</tr>
<tr>
<td>3</td>
<td>Logout</td>
</tr>
<tr>
<td>4</td>
<td>Print</td>
</tr>
<tr>
<td>5</td>
<td>Row of main tabs</td>
</tr>
<tr>
<td>6</td>
<td>Station</td>
</tr>
<tr>
<td>7</td>
<td>Status</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Start</td>
<td>Specifies the date/time at the beginning of the listing—or, if blank, specifies that the current time appears at the end of the listing. The time at the opposite end of the listing is determined by the Scale setting. Type the entry, or click the calendar to select the date and time. (This field may be highlighted when it is not blank—when the current time is not listed).</td>
</tr>
<tr>
<td>End</td>
<td>Only if Scale is set to Custom and Start is not blank, specifies the date/time at the end of the listing. Otherwise, the time at the end of the listing is determined by the Scale setting. Type the entry, or click the calendar to select the date and time.</td>
</tr>
</tbody>
</table>
| << ≤ [ ] ≥ >> | Specifies a different time interval for the listing and automatically updates the Start (and End) setting:  
  
  << – jump back in time one full Scale time interval.  
  ≤ – jump back in time one-half the Scale time interval.  
  [ ] – jump so the current time is at the right end of the graph.  
  > – jump forward in time one-half the Scale time interval.  
  >> – jump forward in time one full Scale time interval. |
| Scale   | Shows the interval of time spanned by the graph—and also specifies how far the << and >> links jump backward and forward. Click to select a different time scale. Click and select Custom if you want to specify Start and End dates/times. |
| Statistic | Shows whether unsmoothed or smoothed data is listed. Click to select a different option:  
  None – Each data point is the actual measurement with no smoothing, no averaging.  
  Average (Mean) – Each data point is the average calculated over a time interval ending at the indicated time. Click Period to change the time interval.  
  5 Point Mean – Each data point is the average of the five data points ending at the indicated time.  
  Daily – For each day, the average of all values is shown plus the minimum and maximum values are shown. This produces three columns for each parameter. |
<p>| Last transmission | Shows the date and time of the most recent measurements received by server. |
| Updates | Shows the interval at which the displayed data is automatically refreshed with updated data. Under normal conditions, new parameter values are measured every few minutes. Click to select a different interval. |
| Go      | Refreshes the display using current settings. For many web browsers, the display refreshes automatically after changing any setting. |
| Metric 1 | Shows the name of the primary parameter marked in the Show Columns checkboxes. Click to select a different primary parameter. You can choose additional parameters for the listing by using the Show Columns checkboxes. |
| Metric 2 | If selected, shows the name of second and third parameters marked in the Show Columns checkboxes. The colors of the fields match the colors in the list of parameters. Click to select a different parameter—choose Select to delete secondary parameters. You can choose additional parameters for the listing by using the Show Columns checkboxes. |
| Metric 3 | If selected, shows the name of additional analyzers whose data is displayed. Click to select an analyzer. After an analyzer is selected, click to select a parameter for that analyzer. |
| Metrics | Alternately shows or hides the options for including data for additional analyzers and parameters. Click to change. |</p>
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter options</td>
<td>Alternately shows or hides the options for displaying data. Click to change.</td>
</tr>
<tr>
<td>Show shapes</td>
<td>No effect—included for compatibility with Monitor tab.</td>
</tr>
<tr>
<td>Show original data points</td>
<td>If Statistic option lists smoothed data (not set to None), also lists original unsmoothed data. Click On to list smoothed and unsmoothed data, click Off to list only the smoothed data.</td>
</tr>
<tr>
<td>Show outliers</td>
<td>No effect—included for compatibility with Monitor tab.</td>
</tr>
<tr>
<td>Show common range</td>
<td>No effect—included for compatibility with Monitor tab.</td>
</tr>
<tr>
<td>Show floor and ceiling…</td>
<td>No effect—included for compatibility with Monitor tab.</td>
</tr>
<tr>
<td>Sample Port</td>
<td>Shows the sample source whose data is included in the listing or download. Click to select a different option, if available.</td>
</tr>
<tr>
<td>Entries</td>
<td>Shows what types of entries are included in the listing or download: All – Measurement entries, calibration entries, and all other types of entries are included. Readings – Only measurement entries are included, meaning parameter values are shown for every data point. Non-readings – All entries except measurement entries are included, meaning no parameter values are listed for any data point. Calibration Only – Only calibration entries are listed; no measurement entries are included.</td>
</tr>
<tr>
<td>Show Columns</td>
<td>Shows which parameters are included in the listing or download. Mark each parameter you want to include, clear each parameter you want to omit. This lets you focus on parameters of current interest. (See “Understanding reported parameters” on page 67.)</td>
</tr>
<tr>
<td>Check/Uncheck All</td>
<td>Marks or clears the checkboxes for all parameters—except those selected by the Metric 1, Metric 2, and Metric 3 options.</td>
</tr>
<tr>
<td>Legend</td>
<td>Defines the meanings of entries in the Sample column of the listing.</td>
</tr>
<tr>
<td>Column headings</td>
<td>Identifies the information in each column of the listing. All lists include date/time, analyzer status, and sample port. For each parameter that is included, shows the parameter name and units of measure. Certain names and units may be condensed for brevity.</td>
</tr>
<tr>
<td>Data entries</td>
<td>For each data point, lists all applicable values (only the first 3 days for longer time periods). Parameter values are measured only when the analyzer status is normal. Values above the upper detection limit or below the lower detection limit for the parameter are listed as “ADL” (above detection limit) or “BDL” (below detection limit). If multiple analyzers are selected, date/time values cannot be synchronized, so data for additional analyzers may not align with primary data.</td>
</tr>
<tr>
<td>Download Excel</td>
<td>Downloads all the data for the specified time interval (more than shown in the listing for longer time intervals) and creates a Microsoft Excel (XLSX) file on your computer. This is useful for archiving data. You can open this type of file in spreadsheet applications such as Microsoft Excel and OpenOffice Calc. If multiple analyzers are selected, data for each additional analyzer and parameter is downloaded into a separate file.</td>
</tr>
</tbody>
</table>
Quick Review tab

The Quick Review tab highlights measurements for all parameters that have significant statistical variations from preceding measurements. Statistically derived limits reflect the expected range of upcoming values based on recent values, and measurements falling outside the range are flagged for evaluation by operators.
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row of main tabs</td>
<td>Jump to different screens showing different information—see other headings in this chapter.</td>
</tr>
<tr>
<td>Status</td>
<td>Shows the current status of the analyzer. Examples: Online – analyzer is taking measurements. Offline(none) – measurements are stopped, analyzer is idle but ready. Offline(calibration) – measurements temporarily suspended for internal maintenance. Offline(clean) – measurements temporarily suspended for internal maintenance. Offline(error) – measurements are stopped, analyzer requires attention before it can continue. Unavailable – analyzer is off or not communicating with server.</td>
</tr>
<tr>
<td>Start</td>
<td>Specifies the date/time at the left end of the graph—or, if blank, specifies that the current time appears at the right end of the graph. The time at the opposite end of the graph is determined by the Scale setting. Type the entry, or click the calendar to select the date and time. (This field may be highlighted when it is not blank—when the current time is not plotted).</td>
</tr>
<tr>
<td>&lt;&lt; &lt; [ ] &gt; &gt;&gt;</td>
<td>Shows a different time interval on the graph and automatically updates the Time setting: &lt;&lt; – jump back in time one full Scale time interval. &lt; – jump back in time one-half the Scale time interval. [ ] – jump so the current time is at the right end of the graph. &gt; – jump forward in time one-half the Scale time interval. &gt;&gt;&gt; – jump forward in time one full Scale time interval.</td>
</tr>
<tr>
<td>Scale</td>
<td>Shows the interval of time spanned by the graph—and also specifies how far the &lt;&lt; and &gt;&gt; links jump backward and forward. Click to select a different time scale.</td>
</tr>
<tr>
<td>Last transmission</td>
<td>Shows the date and time of the most recent measurements received by server.</td>
</tr>
<tr>
<td>Updates</td>
<td>Shows the interval at which the displayed data is automatically refreshed with updated data. Under normal conditions, new parameter values are measured every few minutes. Click to select a different interval.</td>
</tr>
<tr>
<td>Go</td>
<td>Refreshes the display using current settings. For many web browsers, the display refreshes automatically after changing any setting.</td>
</tr>
<tr>
<td>+ Filter options</td>
<td>Alternately shows or hides the options for displaying data. Click to change.</td>
</tr>
<tr>
<td>Show shapes</td>
<td>Specifies when to show a symbol at each data point: only for shorter Scale intervals (Auto), for all Scale intervals (On), or never (Off). Click to select.</td>
</tr>
<tr>
<td>Show original data points</td>
<td>No effect—including for compatibility with Monitor and Data tabs.</td>
</tr>
<tr>
<td>Show outliers</td>
<td>Expands the vertical axes to show all data points, including outliers that are inconsistent with the trend of surrounding data points—and, in doing this, may obscure variations in the general trend. Click On to show all data points, even extreme values; click Off to not show extreme data points.</td>
</tr>
<tr>
<td>Show common range</td>
<td>Uses the same vertical scale for two or more parameters with the same name, such as from two different analyzers. This facilitates comparing values. Click On to use a common scale, click Off to use separate automatic scaling.</td>
</tr>
<tr>
<td>Show floor and ceiling…</td>
<td>If upper and lower detection limits are defined for parameters in the graph, expands the vertical axes and plots dashed lines at the upper and lower limits. Click On to show the limits, click Off to not show the limits.</td>
</tr>
</tbody>
</table>
For each measured parameter...

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Graph title</td>
<td>Shows the analyzer name and the sample stream whose data appears in the graph.</td>
</tr>
<tr>
<td>21 Vertical axis</td>
<td>Shows the name of the parameter shown in the graph and shows the vertical scale for that parameter. The scale is automatically defined based on the measurement values.</td>
</tr>
<tr>
<td>22 Graph trace</td>
<td>Plots the measured values of the parameter. Gaps in the trace indicate measurement cycles in which the parameter is not available, such as during internal maintenance cycles, during times when another sample stream was being measured, when measurements were turned off, or when the analyzer was turned off.</td>
</tr>
<tr>
<td>23 Horizontal axis</td>
<td>Shows the horizontal time scale for the graph. The range is defined by the Time and Scale settings.</td>
</tr>
<tr>
<td>24 Legend</td>
<td>Shows the trace color, parameter name, and units of measure—including the upper and lower statistical limits and flagged data points. Certain names and units may be condensed for brevity.</td>
</tr>
<tr>
<td>25 Upper control limit</td>
<td>Shows upper end of range for expected current value based on statistics from preceding values. Steady values produce a small range, and fluctuating values produce a larger range.</td>
</tr>
<tr>
<td>26 Flagged data points</td>
<td>Indicate measurement values that are above or below the expected range based on statistics from preceding values. A box surrounds each such data point, and an adjacent number gives the numeric value.</td>
</tr>
<tr>
<td>27 Lower control limit</td>
<td>Shows lower end of range for expected current value based on statistics from preceding values. Steady values produce a small range, and fluctuating values produce a larger range.</td>
</tr>
</tbody>
</table>
Alerts tab

The Alerts tab displays a list of alerts that are defined for the analyzer and shows their status. Each alert is based on specific conditions that, when they occur, trigger a notification—and, when the conditions change or no longer exist, trigger another notification.

**Note:** Only users with “alert” permission can create and edit alerts. If your screen has no links for adding, copying, or editing alerts, you can only view alert details, not change them.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Support</td>
<td>Opens the <em>Operation and Maintenance Manual</em> in another window or tab.</td>
</tr>
<tr>
<td>2 Monitor link</td>
<td>Jumps to Monitor tab (equivalent to clicking Monitor tab).</td>
</tr>
<tr>
<td>3 Logout</td>
<td>Closes the connection to the server.</td>
</tr>
<tr>
<td>4 Print</td>
<td>Prints the current page, including parts that do not fit on your screen.</td>
</tr>
<tr>
<td>5 Row of main tabs</td>
<td>Jump to different screens showing different information—see other headings in this chapter.</td>
</tr>
<tr>
<td>6 Station</td>
<td>Shows the name of the analyzer whose alerts are displayed. Click to select a different analyzer.</td>
</tr>
<tr>
<td>7 Updates</td>
<td>Shows the interval at which the displayed data is automatically refreshed with updated data. Under normal conditions, new parameter values are measured every few minutes. Click to select a different interval.</td>
</tr>
<tr>
<td>8 Go</td>
<td>Refreshes the display using current settings. For many web browsers, the display refreshes automatically after changing any setting.</td>
</tr>
<tr>
<td>9 Add</td>
<td>If present, opens a new screen for setting up conditions that define a new alert. See the first screen and explanation below.</td>
</tr>
<tr>
<td>10 Status</td>
<td>Shows whether individual alerts are triggered. A colored box around the Status and Sparkline entries indicates a critical (red) or warning (yellow) condition currently exists. A blank entry indicates the alert is not triggered. Click a Status entry to display details about the triggered alert.</td>
</tr>
<tr>
<td>11 Enabled</td>
<td>Shows whether individual alerts are in effect (“true”) or have been disabled (“false”). A disabled alert does not trigger notifications.</td>
</tr>
<tr>
<td>12 Name</td>
<td>Shows the label assigned to individual alerts. Click a name to display details about the alert conditions.</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>13</td>
<td>Statistic</td>
</tr>
</tbody>
</table>
| 14 | Actions | If links are present, provide methods for changing alerts or duplicating alerts:  
  Edit – opens a new screen for changing details that define an alert. The actual details depend on the type of alert.  
  Copy – opens a new screen with alert details copied from the corresponding alert, for the purpose of changing certain details and creating a new alert. However, the notification recipients are not copied, they must be defined. |
| 15 | Type | Shows the nature of the conditions associated with individual alerts. See the next table below for more details. |
| 16 | Sparkline | For types of alerts that depend on parameter values, plots the measured values of the parameter during the past 4 hours, plus shows dashed lines at the limits for alert conditions. For other types of alerts, shows “Not available.” A colored box around the Status and Sparkline entries indicates a critical (red) or warning (yellow) condition currently exists. |

If the Add link is present on the Alerts tab, it opens this screen for specifying the type of alert you want to create.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>List</td>
</tr>
</tbody>
</table>
| 2 | Alert config type | Specifies the nature of the conditions associated with the alert—click to select:  
  UNAVAILABLE – no data received from the analyzer for more than a specified period of time.  
  OFFLINE – receiving data from the analyzer, but the analyzer has been doing something other than taking measurements for more than a specified period of time.  
  VCL – a measurement has fallen outside continuously varying statistical bounds calculated from preceding measurements, indicating a deviation from expected behavior.  
  UPPER_LOWER_LIMIT – a measurement has fallen outside specified levels, indicating a moderate “warning” condition or a severe “critical” condition.  
  ERROR_CODE – an unexpected condition has occurred that affects normal operation of the analyzer, as signified by a specific error code. |
| 3 | Submit | Opens a new screen for specifying the exact conditions and other details based on the type of alert selected. See the next screen and explanation below. |
| 4 | Cancel | Discards all information on the screen and jumps back to the list of alerts. |
If the Add link is present on the Alerts tab, a screen similar to this is displayed after you select the type of alert you want to create. The exact details depend on the type of alert.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>List</td>
</tr>
<tr>
<td>2</td>
<td>Enabled</td>
</tr>
<tr>
<td>3</td>
<td>Station</td>
</tr>
<tr>
<td>4</td>
<td>Alert Type</td>
</tr>
<tr>
<td>5</td>
<td>Title</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| 6       | Conditions for alert  
  Specifies the exact conditions that trigger this new alert. The actual information depends on the type of alert:  
  UNAVAILABLE alert  
    Minutes before alarm – minimum period of time required to trigger alert.  
    (Suggestion: 12)  
  OFFLINE alert  
    Minutes before alarm – minimum period of time required to trigger alert.  
    (Suggestion: 12)  
    Minimum data points – minimum number of missed measurement cycles to trigger alert. (Suggestion: 3)  
  VCL alert  
    Parameter – parameter whose values can trigger alert. Click to select.  
    Maximum minutes – how far back (from the data point) to seek an appropriate number of data values for usable statistics. Statistics are calculated for the latest (minutes/5) data values, approximately, in that interval. (Range: 20 to 1440)  
    Sigma warning – number of standard deviations above or below the mean to trigger a “warning” alert.  
    Sigma critical - number of standard deviations above or below the mean to trigger a “critical” alert.  
  Note: Only one sigma value is required.  
  UPPER_LOWER_LIMIT alert  
    Parameter – parameter whose values can trigger alert. Click to select.  
    Port – sample source that can trigger alert. Click to select.  
    Upper warning limit – parameter above this value triggers a “warning” alert.  
    Lower warning limit – parameter below this value triggers a “warning” alert.  
    Upper critical limit – parameter above this value triggers a “critical” alert.  
    Lower critical limit – parameter below this value triggers a “critical” alert.  
  Note: Only one limit is required. The unit of measure for the limits is the same as those shown for the parameter on other tabs.  
  ERROR_CODE alert (see “Interpreting error codes” on page 101)  
    Include All – all error codes trigger alert except those listed in Exclude.  
    Include Non-Customer Resolvable – all error codes 200 and higher (“proprietary” codes) trigger alert except those listed in Exclude.  
    Include – all error codes listed here trigger alert in addition to any error codes enabled by previous two checkboxes. Use “-” to signify a range, “,” to signify separate codes or ranges (examples: 1-199 for all actionable codes, or 1,4,10,11 for selected codes).  
    Exclude – any error codes listed here never trigger alert, even if selected by previous three options. Use “-” to signify a range, “,” to signify separate codes or ranges (examples: 200- to exclude “proprietary” codes, or 1,2,12- to exclude selected codes.). |
| 7       | Regular Emails  
  Specifies recipients of alert notifications via e-mail. Enter complete e-mail addresses. |
| 8       | Sms Emails  
  If this option is present, specifies recipients of alert notifications via text messages. Enter complete SMS addresses. |
| 9       | Submit  
  Creates the new alert based on the information provided, then returns to the list of alerts. |
| 10      | Cancel  
  Discards all information on the screen and jumps back to the list of alerts. |
Control tab

Normally, the analyzer operates continually with no intervention. The Control tab provides remote access for controlling certain functions of the analyzer when such action is needed.

**Note:** Only users with special permission have an active Control tab on their Web Interface screen. If your screen has no active Control tab, you cannot manage the analyzer as described in this section.

**Note:** Allow time for the analyzer to respond to requests for changes. In some cases, the analyzer can make a change only at the end of a measurement cycle, which could take a minute or more to complete.

For certain versions of analyzer software, the server establishes a continuous connection with the analyzer whenever the Control tab is displayed. In some situations, before the Control tab is displayed, you may be required to type a login and password to establish this connection.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Support</td>
</tr>
<tr>
<td>2</td>
<td>Monitor link</td>
</tr>
<tr>
<td>3</td>
<td>Logout</td>
</tr>
<tr>
<td>4</td>
<td>Print</td>
</tr>
<tr>
<td>5</td>
<td>Row of main tabs</td>
</tr>
<tr>
<td>6</td>
<td>Station</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| 7 Status | Shows the current status of the analyzer. Examples:  
Online – analyzer is taking measurements.  
Offline(none) – measurements are stopped, analyzer is idle but ready.  
Offline(calibration) – measurements temporarily suspended for internal maintenance.  
Offline(clean) – measurements temporarily suspended for internal maintenance.  
Offline(error) – measurements are stopped, analyzer requires attention before it can continue.  
Unavailable – analyzer is off or not communicating with server. |
This displays a new screen that shows status, then displays a button to click after the manual cleaning is completed. See “Cleaning the internal optics surfaces” on page 81. |
| 9 + Advanced | Shows or hides additional buttons for less frequently used operations. Click to show or hide buttons. Normally, advanced buttons are automatically hidden after a short time. |
| 10 Initiate a Rinse Cycle | Stops current activity, rinses off the internal optics with water and air, then resumes the previous activity. (Stubborn deposits may require manual cleaning.) |
| 11 Put…IDLE Mode Put…RUN Mode | Suspends measurements (Idle mode) or restarts measurements (Run mode) for an indefinite period. Automatic maintenance-type operations can occur in either mode. Idle mode is the preferred state before shutting off power. |
| 12 Stop Sample Flow Restart Sample Flow | If the analyzer is in Idle mode, stops the sample stream from flowing through the analyzer or starts the stream. When the sample stream is stopped, fluid drains from the analyzer. Restarting measurements automatically restarts the sample stream if it is stopped. |
| 13 Pause Auto-Maintenance Resume Auto-Maintenance Extend Pause… | Suspends or restarts automatic maintenance cycles (calibrations and rinse-purge cycles) that normally occur periodically according to a predefined schedule. Cycles are paused for 1 hour unless they are restarted sooner. The 1-hour period is restarted by the Extend Pause… action. Automatic maintenance cycles require no operator involvement. Normal measurements and sample flow are suspended during maintenance cycles. |
| 14 Grab Sampler | If present, controls an external grab sampler wired to the analyzer—see “Optional: Controlling an automatic grab sampler” on page 24.  
Initiate Grab Sample – triggers a grab sample collection (momentarily closes relay contacts), but only if the number of samples already collected is less than the maximum number.  
Samples Taken – shows the number of samples collected since last reset.  
Max Samples – shows the maximum number of samples that can be held by the grab sampler.  
Reset Grab Sampler – resets the number of samples taken to zero. Do not reset until after emptying the sample containers. |
<p>| 15 Refresh | If present, updates the displayed information immediately. |
| 16 Mode | Shows current primary function of the analyzer: Run (taking measurements), Idle (measurements stopped, analyzer ready), Unavailable (analyzer off or starting up, or not communicating), Startup, Shutdown. |
| 17 Activity | Shows current task within the current primary function. Examples: Take Reading, Clean, Calibration, Configure (reloading configuration information), None (idle, no activity), Error (analyzer requires attention, no activity). |</p>
<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
</table>
| 18 Drain Valve | Shows the current position of the internal drain valve:  
Sample or Normal – the sample stream is flowing through the analyzer.  
Drain – the sample flow is stopped and fluid is draining from the analyzer. |
| 19 Auto-Maintenance | Shows the current status of automatic maintenance cycles (calibrations and rinse-purge cycles) that normally occur periodically. Automatic maintenance cycles require no operator involvement:  
Enabled – automatic maintenance cycles occur according to a predefined schedule.  
Disabled by… – automatic maintenance cycles have been suspended by the operator shown. |
| 20 Exclusive Control | Shows the operator who has suspended normal operation and taken control:  
None – normal operation has not been suspended.  
user login – the named operator has suspended normal operation. |
| 21 Connected (disconnect) | Shows that a connection from the Web Interface to the analyzer exists.  
Click disconnect to log out and free the connection to the analyzer. If you do not disconnect, the connection terminates after about 10 minutes of inactivity. To reconnect, click the Control tab. |
| 22 Last transmission | Shows the date and time of the most recent measurements received by server. |
Grab Sample tab

The Grab Sample tab provides a place to enter parameter data resulting from laboratory analysis of grab samples obtained from the sample stream. It gives you a place to record grab sample data on the ZAPS server and a way see how that data correlates with measurements produced by the analyzer.

It also provides an optional process for refining the analyzer’s algorithms used to calculate parameter values, refinements that can, for example, account for the actual composition of the sample matrix being analyzed. If algorithms are refined by correlating analyzer measurements and laboratory results, the parameters are considered to be “commissioned”.

**Note:** Only users with special permission have an active Grab Sample tab on their Web Interface screen. If your screen has no active Grab Sample tab, you cannot work with grab sample data as described in this section.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Support</td>
<td>Opens the <em>Operation and Maintenance Manual</em> in another window or tab.</td>
</tr>
<tr>
<td>2 Monitor link</td>
<td>Jumps to Monitor tab (equivalent to clicking Monitor tab).</td>
</tr>
<tr>
<td>3 Logout</td>
<td>Closes the connection to the server.</td>
</tr>
<tr>
<td>4 Print</td>
<td>Prints the current page, including parts that do not fit on your screen.</td>
</tr>
<tr>
<td>5 Row of main tabs</td>
<td>Jump to different screens showing different information—see other headings in this chapter.</td>
</tr>
<tr>
<td>6 Station</td>
<td>Shows the name of the analyzer whose grab sample information is displayed. Click to select a different analyzer.</td>
</tr>
<tr>
<td>7 Parameter</td>
<td>Lists parameters that can be commissioned, meaning the algorithms can be refined to account for changes to the actual sample matrix.</td>
</tr>
<tr>
<td>8 Status</td>
<td>For each parameter, shows its current commissioning status: Factory calibration (no algorithm changes), Commissioning pending (grab sample data submitted for analysis), or Field commissioned (algorithms refined using grab sample data).</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>9</strong> Action</td>
<td>For each parameter, shows the next action for commissioning that parameter. Enter grab sample data displays the data-entry screen for entering data from grab samples, explained below. Commission and Recommission display the commissioning screen for analyzing and finalizing the data, explained farther below. “Commission parameter first” means the current parameter depends on the named parameter, so you cannot commission the current parameter until after you commission the named parameter. Click to start the action.</td>
</tr>
<tr>
<td><strong>10</strong> Show Parameter</td>
<td>Selects the parameters to show in the grab sample data listing below. Click to select.</td>
</tr>
<tr>
<td><strong>11</strong> Column headings</td>
<td>Label the data shown in the grab sample listing: the date and time of the grab sample, parameter names and units of measure, and optional notes.</td>
</tr>
<tr>
<td><strong>12</strong> View Chart</td>
<td>Opens the Monitor tab for the corresponding parameter showing analyzer data with grab sample data points superimposed as symbols. This provides a visual comparison between measured values and grab sample values.</td>
</tr>
<tr>
<td><strong>13</strong> Data listing</td>
<td>Shows grab sample data that has been entered (reverse chronological order).</td>
</tr>
<tr>
<td><strong>14</strong> Enter Data</td>
<td>Displays the data-entry screen, which provides two methods for entering grab sample data: typing data in an online form, or sending bulk data in a spreadsheet. See the description below.</td>
</tr>
<tr>
<td><strong>15</strong> Edit Data</td>
<td>Displays the data-editing screen, which enables you to change or delete grab sample data previously entered. The data-editing screen has a layout similar to the online-entry screen described farther below.</td>
</tr>
<tr>
<td><strong>16</strong> Download Data</td>
<td>Downloads all grab sample data for all parameters and creates a comma-separated-values (CSV) file on your computer. You can open this type of file in word-processing applications and in spreadsheet applications such as Microsoft Excel and OpenOffice Calc.</td>
</tr>
</tbody>
</table>
The data-entry screen shown below provides two methods for entering grab sample data:
- Typing individual grab sample data points into an online form.
- Sending bulk grab sample data in a spreadsheet.

**Hint:** If you determine that a parameter value derived from a grab sample is not accurate, you should not enter that value or you should delete that value. Otherwise, that bad value may adversely affect the correlation between grab sample values and analyzer measurements.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter Grab Sample Data Online...</strong></td>
<td></td>
</tr>
<tr>
<td>1 Select Parameters</td>
<td>Shows the parameters for which you can enter data. Mark each parameter for which you want to enter data at this time.</td>
</tr>
<tr>
<td>2 Check/Uncheck All</td>
<td>Marks or clears the checkboxes for all parameters.</td>
</tr>
<tr>
<td>3 Parameter list</td>
<td>Shows names and units of measure for each parameter for which you can enter grab sample data, possibly including parameters that cannot be commissioned. Mark each parameter for which you want to enter data at this time. Click a checkbox to mark or unmark the parameter.</td>
</tr>
<tr>
<td>4 Enter Grab Sample Data</td>
<td>Displays the online-entry screen for typing grab sample data for the parameters you selected. See the description below.</td>
</tr>
</tbody>
</table>

| **Enter Grab Sample Data via Spreadsheet...** | |
| 5 Select the date format | Selects the date format you prefer to use when entering grab sample data into the spreadsheet. The date format is noted in the spreadsheet so dates can automatically be decoded after uploading. Click to select. |
| 6 Download Spreadsheet Template | Creates a comma-separated-values (CSV) file on your computer with headings for date, time, parameter values (and units of measure), and comments. Use this spreadsheet file to enter grab sample data. You can open this type of file in spreadsheet applications such as Microsoft Excel and OpenOffice Calc. |
| 7 Select spreadsheet file... | After entering your data into the spreadsheet, click Browse and select the CSV file on your computer that contains the grab sample data you want to add for the analyzer. |
| 8 Upload Spreadsheet | After selecting the spreadsheet file, transfers the grab sample data from the selected CSV spreadsheet to the accumulated grab sample data for the analyzer. The spreadsheet must follow the basic formatting conventions of the original downloaded template. |
The online-entry screen shown below provides a method for entering individual grab sample data points in an online form.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Date</td>
<td>Specifies the date and time at which a grab sample was collected and one or more parameters were measured. The date must follow the indicated formatting. For each entry, you can type the entry or you can click the calendar icon and select the date and time.</td>
</tr>
<tr>
<td>2 Parameter values</td>
<td>Specify the parameter values determined for each grab sample. An empty cell means no value is available for that parameter for that grab sample collection. Values must be based on the same units of measure used by the analyzer, as shown in the column headings.</td>
</tr>
<tr>
<td>3 Comments</td>
<td>Contains optional information useful to you, but not used for analysis.</td>
</tr>
<tr>
<td>4 Submit</td>
<td>Adds the displayed data to the accumulated grab sample data for the analyzer.</td>
</tr>
<tr>
<td>5 Cancel</td>
<td>Discards the displayed data.</td>
</tr>
</tbody>
</table>
The commissioning screen shown below provides a method for reviewing grab sample data for a parameter and the option of starting the commissioning process for that parameter.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plot of data points</td>
</tr>
<tr>
<td>2</td>
<td>Scatter plot of data points</td>
</tr>
<tr>
<td>3</td>
<td>Symbol key</td>
</tr>
<tr>
<td>4</td>
<td>Calculate Based On Last</td>
</tr>
<tr>
<td>5</td>
<td>Check/Uncheck All</td>
</tr>
<tr>
<td>Element</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6 Update With</td>
<td>Indicates whether or not an individual data pair is used in the statistical analysis. Mark the checkbox to include the data pair, unmark it to exclude the data pair. Click a checkbox to mark or unmark it. Click Update Chart/Table to compute the new statistical analysis.</td>
</tr>
<tr>
<td>7 Date/Time</td>
<td>Shows the date and time when the grab sample was collected.</td>
</tr>
<tr>
<td>8 Grab Sample</td>
<td>Shows the parameter value derived from the grab sample.</td>
</tr>
<tr>
<td>9 Station Reference Data</td>
<td>Shows the parameter value measured by the analyzer at the closest time to the indicated date and time.</td>
</tr>
<tr>
<td>10 % Deviation</td>
<td>Shows the percentage difference of the analyzer value relative to the grab sample value. Ideally, each deviation would be close to zero.</td>
</tr>
<tr>
<td>11 Comments</td>
<td>Shows optional comments entered with the grab sample data.</td>
</tr>
<tr>
<td>12 Data Fit</td>
<td>Shows the results of analyzing a scatter plot of the selected data pairs and calculating the best fit of a linear relationship between the grab sample values and the analyzer values. The “goodness” of the fit is represented by the statistical R-squared value, ideally close to 1.</td>
</tr>
<tr>
<td>13 Update Chart/Table</td>
<td>After marking or unmarking data pairs, updates the statistical regression summary accordingly. (This does not affect the plot.)</td>
</tr>
<tr>
<td>14 Accept/Commission</td>
<td>If you choose to refine the analyzer’s algorithms for calculating this parameter’s values in order to more closely match the grab sample data, click Accept/Commission. This initiates a process in which the data is further analyzed and the algorithms refined.</td>
</tr>
</tbody>
</table>
Viewing data in other ways

Connecting to the Web Interface, as described earlier, is the default method for viewing measurement data. However, if your analyzer is equipped with certain communications options, you may access measurement data using other methods, including the following:

- 4-20 mA current loop connected to your SCADA system or other equipment.
- Modbus interface connected to your SCADA system or similar equipment.

For examples of systems using these methods, see “Choosing analyzer communications” on page 113. See your system administrator for more information about viewing data via these methods.

Understanding reported parameters

The analyzer is delivered with a specific internal configuration designed to support your application. It contains internal components tailored for measuring the parameters you require for characterizing your sample fluid.

Parameters can be separated into two basic groups, discussed below:

- Parameters characterizing the sample stream
- Parameters indicating information about the analyzer

Note: ZAPS Technologies continually works to improve the features and functionality of its products, including the development of new and improved parameters. At certain times, ZAPS may add new parameters on your analyzer for your consideration, depending on whether the analyzer’s configuration supports those parameters. At other times, ZAPS may notify you that new parameters may be available, but only if your configuration is upgraded. Contact ZAPS Technologies if you have questions about parameters—see “Getting Support” on page 119.
Parameters characterizing the sample

Most LiquID parameters indicate the composition of the sample fluid or other properties of the sample stream. These parameters are selected and implemented according to your application.

The following list shows examples of possible parameters. It is likely that your analyzer will have a different list of parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia (NH3)</td>
<td></td>
</tr>
<tr>
<td>Biochemical Oxygen Demand (BOD)</td>
<td></td>
</tr>
<tr>
<td>Carbonaceous Biochemical Oxygen Demand (cBOD)</td>
<td></td>
</tr>
<tr>
<td>Chemical Oxygen Demand (COD)</td>
<td></td>
</tr>
<tr>
<td>Chlorine (CHL)</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll-a (CHLa)</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll-b (CHLb)</td>
<td></td>
</tr>
<tr>
<td>E. coli (ECOLI)</td>
<td></td>
</tr>
<tr>
<td>Nitrate + Nitrite (NO3)</td>
<td></td>
</tr>
<tr>
<td>Specific UV Absorbance (SUVA)</td>
<td></td>
</tr>
<tr>
<td>Total Organic Carbon (TOC)</td>
<td></td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td></td>
</tr>
<tr>
<td>Ultraviolet Absorbance (UVA)</td>
<td></td>
</tr>
<tr>
<td>Ultraviolet Transmission (UVT)</td>
<td></td>
</tr>
</tbody>
</table>

Parameters monitoring the analyzer

Only a small number of reported parameters give information about the analyzer. However, these parameters are helpful for maintaining efficient operation of the analyzer.

Note: The analyzer monitors these parameters and displays appropriate messages on the Web Interface when needed. For some situations, operation continues—in other situations, operation may stop until required action is taken.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>Indicates the “cleanliness” of the internal optics on a scale of 0 to 1. It is suitable for creating an alert to remind you when the internal optics require cleaning. If the parameter falls to near 0.45 (or sooner if recommended by ZAPS), the internal optics should be cleaned, even if the normal 1-month cleaning cycle has not completed. After a thorough cleaning and calibration, this parameter should increase nearer 1.00.</td>
</tr>
<tr>
<td>PM Index</td>
<td>If available, indicates long-term light intensity relative to its original intensity, measured after every optics cleaning. If the value falls below 0.50 (or other value recommended by ZAPS), the lamp should be replaced, even if the normal 1-year preventive maintenance interval has not completed. A weak lamp may limit the sensitivity of the analyzer.</td>
</tr>
<tr>
<td>Error Code</td>
<td>If available, indicates conditions that require the attention of an operator. It is suitable for triggering alerts to inform you of important conditions. This parameter has a value of 0 during normal operation. However, certain conditions cause a non-zero value, and the value indicates the type of attention required. The occurrence of a non-zero parameter value may adversely affect performance or cause measurements to stop—prompt attention is recommended. For a list of error codes and actions, see “Interpreting error codes” on page 101.</td>
</tr>
</tbody>
</table>

You can view a graph of these parameters or see their numeric values using the Web Interface—see “Using the Web Interface” on page 41.

As an example of creating an alert, you can create an UPPER_LOWER_LIMIT alert for the Clean parameter with a lower warning limit of 0.45 and a lower critical limit of 0.35. This would cause a warning notice for marginally low cleanliness, and cause a critical notice for seriously low cleanliness.
Special operations

The analyzer normally operates without operator intervention, continually taking measurements of the sample fluid and communicating those measurements externally. This section describes how to control the analyzer and perform special operations.

Controlling the analyzer operation

The analyzer normally operates without operator intervention. However, if you need to change some aspect of its operation, consider these options:

- If the analyzer has a display with buttons, you can use these buttons to control the analyzer—see “Using the display buttons (if present)” on page 40.
- You can control the analyzer remotely using the controls provided by the Web Interface—see “Control tab” on page 58.

Collecting grab samples

The analyzer does not provide internal access for collecting grab samples. However, you can collect sample fluid outside the analyzer.

![Warning icon]

**WARNING:** If the sample fluid is toxic or otherwise harmful, take precautions to avoid contact or contamination.

**Note:** When collecting grab samples, be sure to follow the collection protocols recommended by your analyzing laboratory.

Using the grab-sample spigot (if present)

This is the preferred method of collecting grab samples if the analyzer is equipped with a grab-sample spigot. If present, the spigot is attached to the sample inlet under the bottom of the lower cabinet.

1. Use the grab-sample spigot to direct a sample into a container. This action is not affected by the operation of the analyzer.
2. Record the precise time and date each sample is collected.

**Note:** If the short tubing coming from the spigot looks dirty, you can replace it with clean tubing.
Using the drain line
If no grab-sample spigot is present on the analyzer, you can collect grab samples from sample fluid exiting the drain line.
1. On a computer, open the Web Interface for the analyzer—see “Using the Web Interface” on page 41.
2. Go to the Control tab, expand Advanced and click Pause Auto-Maintenance Functions. This prevents splashing caused by unexpected maintenance cycles during your sampling.
3. At the analyzer, find where the drain hose from the analyzer enters the open drain.
4. For each sample, remove the hose from the open drain, clean it, and insert it into the grab-sample container.
5. When the container is sufficiently full, put the drain hose back into the open drain.
6. Record the precise time and date each sample is collected.
7. When sampling is completed, at the computer, on the Control tab expand Advanced and click Resume Auto-Maintenance Functions.

Using an automatic grab sampler
If you have an automatic grab sampler, you can connect it to the analyzer and trigger grab samples using the Web Interface. To set up the grab sampler, you must do the following:
- Plumb a supply of sample fluid to the inlet of the grab sampler. You can install a Tee-fitting in the supply line going to the analyzer, or, if available, connect the outlet of the analyzer’s grab-sample spigot to the grab sampler inlet. Do not connect to the drain line.
- Wire the trigger input on the grab sampler to the relay inside the analyzer—see “Optional: Controlling an automatic grab sampler” on page 24.
- Contact ZAPS Technologies to activate the optional grab-sampler software on the analyzer—see “Getting Support” on page 119.

After the grab sampler is set up, you can trigger the collection of grab samples using the Web Interface—see “Control tab” on page 58.
Commissioning parameters

Commissioning is an optional process that helps align the analyzer’s measurement values for a specific parameter with the results from a local laboratory. It is a process that refines the analyzer’s algorithms used to calculate parameter values, refinements that can, for example, account for the actual composition of the sample matrix being analyzed. If algorithms are refined by correlating parameter values and laboratory measurements, the parameter is considered to be “commissioned”.

To commission one or more parameters, follow these general steps:

1. **Collect grab samples.** Collect a significant number of grab samples—see “Collecting grab samples” on page 69. Carefully record the exact date and time of each grab sample.
   
   For best results, collect grab samples that reflect typical highs and lows of parameter values to ensure good correlation at extreme conditions. Samples should exhibit daily and longer-term cycles, if possible. In general, fewer samples with more varying values are more useful than more readings within a narrow range of values.
   
   Sample times should be recorded to the nearest minute. Samples should be taken while the analyzer is taking readings, not while it is idle for an extended period due to preventive maintenance, for example.

2. **Analyze the samples at a laboratory.** Have a laboratory analyze the grab samples and determine the values of the parameters for each grab sample.
   
   If possible, get multiple values for each of several grab samples to assess the repeatability of the laboratory methods.
   
   Check that the units of measure reported by the laboratory match those used by the analyzer. If they don’t, convert the grab sample data.

3. **Enter the grab sample data.** Enter the grab sample data for those parameters using the Grab Sample tab on the Web Interface—see “Grab Sample tab” on page 61.
   
   For a small number of grab samples, you can enter data directly on the Grab Sample tab. For a larger number of grab samples, it may be more convenient to enter the data into a spreadsheet, then upload the spreadsheet on the Grab Sample tab.

4. **Review and commission the parameters.** For each parameter, on the Grab Sample tab click Commission or Recommission and review the data, then click Accept/Commission.
   
   If additional information is needed for commissioning, you may be contacted by ZAPS Technologies.
Challenge testing

Follow the procedures below while measuring a single parameter for a “bucket sample” using the LiquID Station, an analyzer from ZAPS Technologies. A bucket sample is a static sample that is separate from the continuous sample supply normally connected to the analyzer.

Note: The steps described below assume you are familiar with general operation and maintenance procedures for the analyzer.

Important factors to consider

The analyzer is designed and configured to meet the needs of specific applications, just like other test instruments. The flexibility of the analyzer to concurrently measure multiple compounds is based in part on spectrophotometric techniques applied to complex water matrices. Each instrument is configured for an expected matrix, and the combination of application-specific configurations and the comprehensiveness afforded by the spectrophotometric approach provide unsurpassed detection sensitivity to the presence of contaminants in that matrix. However, any analysis performed on a substantially different matrix, such as laboratory-prepared samples or synthetic standards, may deviate from normal levels of accuracy, possibly yielding unexpected results for some samples—the same type of situation that can occur with any test instrument.

Consider these factors if you get unexpected results from your testing:

- The spectrophotometric techniques used by the analyzer are different from the technologies used by most other fluid analyzers. The analyzer is configured to respond to a sample containing a typical combination of real-life compounds. It analyzes the sample as a complete matrix and responds based on the interactions with that matrix. It does not look for individual compounds in isolation, as other analyzers might.
- Chemical standards are typically designed for specific analytic techniques and equipment. As a result, they may not be compatible with the analyzer.
- Although reported parameters from the analyzer may show no apparent response to a sample, it is possible that the analyzer recorded variations in certain internal responses. Internal responses are visible only to ZAPS personnel.
- The analyzer does not typically require a filtration system, whereas other instruments may require larger particles be filtered out. Any particles contained in the sample may affect reported values.

Required materials

- Pump and sample container capable of providing a sustained flow rate of 1 to 5 L/min through the analyzer for 15 to 30 minutes. Use polypropylene or polyethylene tubing to connect the pump to the analyzer. If you use a peristaltic pump, use peroxide-cured silicone tubing in the pump.
- A sufficient quantity of prepared sample fluid to maintain the flow rate and time listed above. The water used for establishing the reference baseline and for making the sample fluid should have a makeup similar to the everyday operating sample stream.
- A second bucket for collecting and disposing of the processed sample or rinse water.
• You may also want spare parts for Fast & Tite fittings, used to connect tubing to the analyzer. New parts should be used to connect new tubing to fittings on the analyzer. The grab rings can be damaged if you try to remove them and reuse them with other tubing—see “Making connections with Fast & Tite fittings” on page 20. For spare parts, contact Parker Hannifin Corp. or visit one of these websites:

http://www.parker.com/portal/site/PARKER/menuitem.7100150cebe5bbe2d6806710237ad1ca/?vgnextoid=f5c9b5bbec622110VgnVCM10000032a71dacRCRD&vgnextfmt=EP&vgnextdiv=&vgnextcatid=1304190&vgnextcat=FAST+TITE+FITTINGS&Wtky=
https://www.valinonline.com/images/support_docs/FastTite_data.pdf

**Caution:** Certain types of fluids and external tubing may cause interactions that might damage or contaminate the analyzer. If you have any questions or concerns about compatibility of sample fluids or external tubing, contact ZAPS Technologies—see “Getting Support” on page 119.

### Fluid flow

**Caution:** If the properties of the sample fluid can be affected by high-intensity light or by recirculation, do not recirculate the sample through the analyzer.

The test setup you use depends on the restrictions imposed by the sample fluid being tested.

• If the properties of the sample fluid can be affected by high-intensity light or by recirculation, connect the drain outlet of the analyzer to a “drain” bucket. Do not recirculate such a sample through the analyzer.

• If the sample fluid is not so affected, the drain line can be looped back to the sample bucket. However, direct the drain line against the side of the bucket or as far from the intake line as possible to prevent air bubbles from being drawn into the intake tube, which can make the measurements unstable.

• For optimum flow, you may have to adjust the elevations of the pump or sample bucket.

• If the sample fluid contains ingredients that are not quickly dispersed uniformly throughout the sample, it is critical to mix or homogenize the sample continuously, perhaps vigorously, in the bucket during testing. Insufficient mixing may produce varying results, while excessive agitation may introduce undesirable bubbles into the sample.

**Caution:** Due to possible high concentrations of chemicals, dispose of used sample fluid in accordance with all local, state, and federal regulations. Do not run sample fluid into an external drain unless you know the fluid complies with all applicable regulations.

### Step 1. Initial setup

1. About an hour or two before the intended testing, manually clean the internal optics surfaces—see “Cleaning the internal optics surfaces” on page 81. Wait for the resulting calibrations to complete, about an hour after cleaning.
2. In a web-browser window on your computer, log in to the ZAPS web server at mpm.zapstechnologies.com using the login and password provided by ZAPS Technologies.

Note: The login you use must have Control tab privileges in order to perform this procedure.

3. Near the top of the screen, select the analyzer you are using.

4. On the Control tab, perform these actions:
   - Expand Advanced and click Put the Station in IDLE Mode.
   - Expand Advanced and click Pause Auto-Maintenance Functions. (If the testing approaches 1 hour, go back to the Control tab and click Extend Pause... to extend the pause another hour.)

Caution: Be sure to pause automatic maintenance functions before continuing. If an automatic cleaning or calibration cycle occurs during testing, it can disrupt your measurements, spray sample fluid, and possibly damage your pump. If your testing approaches 1 hour, you should extend the pause to block maintenance functions for another hour.

5. At the analyzer’s source, turn off the sample supply and rinse-water supply to the analyzer.

6. Disconnect the sample supply from the SAMPLE inlet. (Leave the RINSE water supply connected.)

7. Connect a clean pump to the SAMPLE inlet. Use polypropylene or polyethylene tubing for making connections.

8. Disconnect the drain line from the DRAIN outlet and connect a new length of tubing.

9. Depending on whether or not you will be recirculating the sample fluid, place the tubing from the DRAIN outlet either into the sample bucket (circulating) or into the drain bucket (not recirculating). See “Fluid flow” above for details.

Caution: Wear appropriate personal protective equipment when disconnecting normal sample and drain lines from the analyzer. A residual amount of normal sample fluid remains inside the analyzer after the cleaning cycle.
Step 2. Flush the system, establish a baseline

1. Fill the sample bucket with the “baseline” water, which should have a makeup similar to the everyday operating sample stream.
2. Start the pump.
3. On the Control tab, expand Advanced and click Put the Station in RUN Mode. This starts measurements.
4. Go to the Monitor tab and select the parameters you want to observe.
5. After several minutes or more, residue should be fully flushed out of the system, and the parameters should stabilize near their “zero” values. If values continue to decrease, continue flushing until they stabilize. These stable values are your reference baseline.
6. When finished taking measurements, on the Control tab, expand Advanced and click Put the Station in IDLE Mode.
7. Stop the water flow and drain the supply and return lines. You can do this by removing the pump intake from the water until no flow comes out the drain, then shutting off the pump.
8. On the Control tab, perform these actions:
   - Expand Advanced and click Stop Sample Flow…. Wait for remaining fluid to drain from the lines.
   - Expand Advanced and click Restart Sample Flow….

Step 3. Measure the sample

Caution: Do not measure a sample without first flushing the system. Residue in the system may affect readings for the next sample, including the normal sample stream.

1. Prepare a quantity of test sample water in the sample bucket—the amount depends on the pump design and whether or not the sample will be recirculated. If you use a purchased sample, carefully follow any preparation instructions provided with the sample. This water should have a makeup similar to the everyday operating sample stream.
2. Turn on the pump and adjust the flow to be 1 to 5 L/min.

Note: The presence of air bubbles in the drain flow can indicate a condition that interferes with proper measurement. If air bubbles are present, try increasing the flow rate or increasing the height of the pump and sample container.

3. When the sample fluid starts flowing out of the drain tubing, on the Control tab, expand Advanced and click Put the Station in RUN Mode. This starts measurements.
4. On the Monitor tab, select the parameters and observe their values for up to 30 minutes. Go to the Data tab if you want to see numeric values.

Note: If you choose to “spike” the sample during testing to observe the response, go to Monitor tab or Data tab on the Web Interface and set the Statistic option to None.
5. After a short period, the parameter values should stabilize, without significant increases or decreases. The stable values, observed over at least five measurement cycles, are the sample values—for each parameter, subtract the baseline value from the sample value to determine the net effect of the sample. For assistance with interpreting your test results, contact ZAPS Technologies—see “Getting Support” on page 119.

6. When finished taking measurements, on the Control tab, expand Advanced and click **Put the Station in IDLE Mode**.

7. Stop the sample flow and drain the supply and return lines. You can do this by removing the pump intake from the fluid until no flow comes out the drain, then shutting off the pump.

**Note:** If you want to measure additional samples, go back to “Step 2. Flush the system, establish a baseline” and repeat the steps.

### Step 4. Restore normal operation

1. Disconnect the temporary lines from the SAMPLE inlet and DRAIN outlet of the analyzer.

2. Reconnect the normal sample supply and original drain line to the analyzer.

3. At the source, turn on the sample supply and the rinse-water supply to the analyzer.

4. On the Control tab, perform these actions:
   - Expand **Advanced** and click **Put the Station in RUN Mode**.
   - Expand **Advanced** and click **Resume Auto-Maintenance Functions**.

**Display with Buttons**

For step 6:
Open the menu, select **Advanced Options**, Go to IDLE Mode.
This chapter describes the preventive maintenance required for the LiquID (“Liquid ID”) Station, a multi-parameter fluid analyzer from ZAPS Technologies.

- Weekly and monthly preventive maintenance is normally performed by trained local personnel—see “Schedule for frequent maintenance” on page 78.
- Longer-term preventive maintenance must be performed by a qualified technician because sensitive internal components are involved—see “Schedule for long-term maintenance” on page 86.
- If your analyzer includes a clean-in-place option, it requires periodic attention—see “Maintaining the clean-in-place accessory” on page 98.

Note: ZAPS Technologies may recommend different schedules for certain installations depending on unique operating conditions at those sites.

Critical aspects of the analyzer’s operation are continually monitored to ensure quality performance. If key measures of performance fall below defined levels, the analyzer displays appropriate messages on the Web Interface and may stop operation, if necessary, to prevent suspect results. In most such situations, you can avoid interruptions by performing preventive maintenance and following up on displayed messages promptly.

The sections below show general schedules for preventive maintenance. The time required will vary with the skill and experience level of the service personnel, ease of access to the analyzer, and the working environment. The estimated times are approximate.

Reminder: Every year, get an updated version of the Operation and Maintenance Manual, including updated preventive maintenance information. Go to the following location:


Hint: While you are working on the analyzer, use the special ZAPS doorstop to hold the cabinet door open. The doorstop, included in the optics cleaning kit, prevents the door from swinging open or closed unexpectedly.

- Open the door past 90°, then slide the doorstop down between the door and the face of the cabinet. Do not forget to remove it before closing the door.
Maintenance

Schedule for frequent maintenance

It is important that you perform routine preventive maintenance on a regular schedule. This ensures the analyzer delivers regular and consistent data with minimal interruption.

The characteristics of the sample fluid greatly affect the interval between manual optics cleanings. Some complex samples might require cleaning on a weekly basis, whereas monthly cleanings might be sufficient for some cleaner sample fluids.

Every Week

<table>
<thead>
<tr>
<th>Task</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually inspect for pests and leaks</td>
<td>79</td>
</tr>
<tr>
<td>Check quality of sample fluids</td>
<td>80</td>
</tr>
</tbody>
</table>

Estimated time: 5 minutes

Every Month—sooner if required*

<table>
<thead>
<tr>
<th>Task</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean internal optics</td>
<td>81</td>
</tr>
<tr>
<td>Check the rinse-water filter</td>
<td>80</td>
</tr>
</tbody>
</table>

Estimated time: 15 minutes

* You should clean the internal optics if the Clean parameter falls to near 0.45 or sooner if recommended to you by ZAPS—see the note below.

Note: The Clean parameter is a standard analyzer parameter that indicates the “cleanliness” of the internal optics—see “Parameters monitoring the analyzer” on page 68.

The internal optics should be cleaned at least monthly, or when the parameter falls to near 0.45, or sooner if recommended by ZAPS. After a thorough cleaning, this parameter should increase nearer 1.00.

The Clean parameter shows the trend of the optics cleanliness over time, allowing you to plan maintenance in advance. You can view this parameter’s value using the Web Interface—see “Using the Web Interface” on page 41.
Short-term maintenance procedures

This section describes how to perform short-term preventive maintenance procedures. See the schedules above to determine how often to perform each procedure.

<table>
<thead>
<tr>
<th>Supplies</th>
<th>ZAPS identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optics cleaning kit (required)</td>
<td>8004 plus serial number</td>
</tr>
<tr>
<td>Refill pack (optics cleaning kit consumables)</td>
<td>8027</td>
</tr>
<tr>
<td>Cleaning solvent (rubbing alcohol, etc.)</td>
<td>*</td>
</tr>
<tr>
<td>Canned air</td>
<td>*</td>
</tr>
<tr>
<td>Optional: cotton swabs</td>
<td>*</td>
</tr>
</tbody>
</table>

* Not available from ZAPS.

Inspecting for pests and leaks

Inspect the analyzer for signs of entry, damage, and nests from insects, rodents, birds, and other pests. Also inspect for signs of fluid leaks. Leaks that are not repaired can cause damage to the equipment.

1. Examine the exterior of the cabinet, especially where fluids, power, and communication lines enter or exit the unit.
2. Open the upper and lower cabinets and the junction box. Examine the interior, especially in confined corners.
3. Take action to prevent further access or damage:
   - Seal openings
   - Remove nests
   - Repair any damage
4. Examine the exterior of the cabinet where sample and drain lines connect.
5. Open the lower cabinet and examine these places for leaks or stains:
   - All tubing connections
   - All threaded connections
   - The floor of the cabinet
   - The flow cell and fiber-optic bundle connection

Caution: Any repair inside the cabinet must be performed only by ZAPS Technologies personnel or by technicians certified by ZAPS Technologies. Work done by other personnel could damage the equipment and void the warranty.

6. If you find a significant leak, shut down the analyzer, then turn off the input fluid source until repairs are made.
Checking sample quality
For best performance from the analyzer, you should verify that the sample fluids entering the analyzer continues to meet minimum specifications required by the analyzer.

- At least 2 psi static pressure (maximum 60 psi), or as approved by ZAPS Technologies.
- ½-inch minimum supply line from the source, or as approved by ZAPS Technologies.
- Flow must be steady and continuous, with no restrictions that could cause bubbles or effervescence.

Checking the rinse-water filter
The rinse-water filter captures incidental debris in the rinse-water supply, especially when the analyzer is first installed.

- Unscrew the cap at the downstream end of the filter body, remove the filter, and flush with clean water as needed to clear any debris.
Cleaning the internal optics surfaces

The face of the fiber-optic assembly and the lens are directly exposed to sample fluids inside the analyzer’s flow cell. Automatic rinse cycles use high-pressure rinse water to flush debris from these optics surfaces. However, rinse cycles usually do not prevent the build-up of biological films and mineral deposits on the surfaces. To maintain optimum performance, you must periodically open the analyzer and mechanically clean these surfaces as described below. It’s like you can rinse your teeth with water every day, but you really need the dentist to clean them periodically.

Note: The Clean parameter is a standard analyzer parameter that indicates the “cleanliness” of the internal optics. You can view this parameter’s value using the Web Interface—see “Using the Web Interface” on page 41.

The internal optics should be cleaned at least monthly or when the parameter falls to near 0.45 or sooner if recommended by ZAPS. After a thorough cleaning and calibration, this parameter should increase nearer 1.00.

Required materials

Caution: When cleaning the optics, use only the tools and supplies included in the ZAPS optics cleaning kit, refill pack, or specified below. Other substances can damage the optical surfaces in the analyzer.

The following items are included in the ZAPS optics cleaning kit:

- Plastic cleaning tool
- Hex wrench (if needed)
- Nitrile rubber gloves
- Optical cleaning wipes
- Sterile cotton balls
- Cleaning liquid
- O-rings

In some situations described in the steps below, you may need to supply additional material:

- CLR Calcium, Lime & Rust Remover from Jelmar or equivalent hard-water cleaner (such as ZEP Calcium, Lime and Rust Remover from Home Depot)

A refill pack provides a supply of consumables from the optics cleaning kit. Contact ZAPS Technologies—see “Getting Support” on page 119.

Reminder: Every year, get an updated version of the optics cleaning instructions at the following location: www.zapstechnologies.com/wp-content/uploads/ZAPS_OpticsCleaningInstr.pdf
Cleaning process
The following steps require an Internet connection to the Web Interface—see “Using the Web Interface” on page 41.

Part 1: Use the Web Interface to prepare the analyzer
1. On a computer, log in to the analyzer web server and view the Web Interface screen.

Note: In the next step, the analyzer may take up to a minute or longer to respond, depending on the software version. Wait for the analyzer to respond.

2. Go to the Control tab and click Prepare the Station for a Manual Optics Clean. When the preparation is completed and the cleaning steps are displayed, continue below.

Caution: During the optics cleaning process, do not turn off or remove power from the analyzer—except during annual preventive maintenance. If you turn off the analyzer, the automatic calibration sequence may be disrupted when you resume operation.

Part 2: Remove the lens holder
3. Get ready to remove the lens holder:
   - Important: Turn off the sample and rinse-water supply lines. (If the drain line has a shutoff, turn it off also.)
   - Open the analyzer’s lower door.
   - Put on a pair of nitrile gloves.
   - Put one or two paper towels inside the bottom of the lower cabinet to catch and clean up the small amount of fluid that will drain out of the flow cell.

Caution: When removing or installing the lens holder in the flow cell, do not allow the lens to touch the sides of the flow cell. Any contact may contaminate or damage the lens and require replacement.

WARNING: For an analyzer with a motorized lens holder (XR assembly), pictured farther below, (1) do not unplug any of its cables, and (2) do not loosen the four long screws holding the motor. Otherwise, serious damage to the equipment is likely to occur.
4. On the bottom or side of the flow cell (see two examples below), use the knurled knobs or a hex wrench to remove the screws holding the base of the lens holder to the flow cell, then carefully pull the lens holder out of the flow cell.

![flow cell examples](image)

5. Place the lens holder in a safe place (see the illustrations below):
   - For a fixed lens holder, stand it upright on its base in a safe place where it is protected from accidental contact—do not touch or bump the lens.
   - For a motorized lens holder, lay it on its side in the bottom of the lower cabinet—do not touch or bump the lens. *Do not unplug any of the cables.*

![lens holder illustrations](image)

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**Note:** If the lens holder was difficult to remove from the flow cell, or if the lens holder or flow cell has any mineral deposits on its surfaces, perform the following steps before continuing the cleaning process:

1. Thoroughly moisten an optical wipe with CLR Calcium, Lime & Rust Remover from Jelmar (or an equivalent hard-water cleaner, such as ZEP Calcium, Lime and Rust Remover).

2. Drape the CLR wipe over the cleaning tool and cotton ball (as shown farther below), then insert the wipe and tool into the flow cell and wipe the inside surfaces. Keep the wipe in contact with the surfaces for about 30–60 seconds.

3. Use the CLR wipe to wipe the lens and holder. Keep the wipe in contact with the surfaces for about 30–60 seconds.

After cleaning with CLR, perform all of the optics cleaning steps below—this will remove all traces of CLR.
Part 3: Clean the fiber-optic surface with cleaning fluid and tool

6. Get ready to clean the fiber-optic surface:
   - Vigorously shake the bottle of cleaning liquid included in the kit. Continue until no deposits remain at the bottom of the bottle.
   - Place a cotton ball in the center of a new optical wipe, then place the cleaning tool so one end touches the cotton ball. If the end of the tool is recessed, put the cotton ball in the recess. Drape the wipe over the full length of the tool.

7. Shake the special cleaning liquid, then use it to soak the wipe at the end of the tool.
8. Insert the cotton-ball end of the tool and wipe into the bottom of the flow cell until it touches the surface of the fiber-optic bundle inside at the top of the flow cell. (If the tool is too long to fit, cut it off shorter.)
9. Twist the tool and wipe several times while pushing inward. Make sure the wipe turns with the tool. Then remove the tool and wipe.
10. Repeat steps 7–9 using a new wipe.

Part 4: Clean the lens, holder, and O-ring, then install

Caution: Do not touch the fiber-optic surface with your hands or any other material except the special optical wipes provided in this kit. Use only the ZAPS optics cleaning liquid provided in this kit. Any unapproved material or cleaner may contaminate or damage the surface and require replacement.

11. Wet a new optical wipe with the special cleaning liquid, then use it to thoroughly scrub the face of the lens using only finger pressure.
12. Clean the body of the lens holder (the part that fits inside the flow cell) by wiping it with the same optical wipe.
13. If required, remove the old O-ring from the base of the holder and install a new O-ring from the kit. If several sizes are included, choose the same size as the old O-ring.
14. Wipe any debris from the O-ring and insert the lens holder into the flow cell—do not touch or bump the lens.
15. Install the screws that fasten the holder to the flow cell. Tighten them sequentially to compress the O-ring evenly: Hand-tighten all screws—then, for screws with hex-socket heads, tighten about ¼ turn more on each screw using a hex wrench (you should feel increased resistance at each screw).

![Screws with plain heads and hex-socket heads]

16. Get the analyzer ready to restart:
- In a convenient location, record the date you cleaned the optics.
- Clean up and close the analyzer cabinet.
- Turn on the sample and rinse-water supply lines. (If the drain line has a shutoff, turn it on also.) Check for leaks.
- If the analyzer is powered off, turn it on.

Part 5: Restore normal operation

17. On the Control tab of the Web Interface, click Manual Optics Clean Complete. Wait for the progress bar to complete and display the normal Control tab. The status initially shows the calibration activity, then eventually changes back to normal (taking measurements).

18. Check the Web Interface after 15–30 minutes to verify the cleaning was good. Depending on the software version, the calibration could take up to 30 minutes before parameter measurements resume.

Caution: During the first 15–30 minutes of the calibration, the analyzer checks the effectiveness of the cleaning. If the cleaning is not adequate, operation stops and a message is displayed on the Web Interface and front-panel display telling you to repeat the entire cleaning process. In this situation, operation will not resume until you clean the optical surfaces thoroughly.

Important: Notify ZAPS Technologies if you installed any new hardware as part of this maintenance. ZAPS will update the analyzer software to account for the new hardware.
## Maintenance

### Schedule for long-term maintenance

**Caution:** The maintenance tasks listed below must be performed only by trained technicians. Work done by untrained personnel could damage the equipment and void the warranty. Sensitive internal components are involved.

#### Every 12 Months*

<table>
<thead>
<tr>
<th>Task</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>First step: Prepare for maintenance</td>
<td>87</td>
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<td>Replace lamp-side filter-wheel belt</td>
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<td>Replace lamp**</td>
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<tr>
<td>Replace lamp-breather pump</td>
<td>92</td>
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<tr>
<td>Replace lamp-breather filters</td>
<td>93</td>
</tr>
<tr>
<td>Rebuild rinse compressor, replace check valves</td>
<td>94</td>
</tr>
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<td>Inspect and clean rinse valve</td>
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<tr>
<td>Inspect and clean rinse jets</td>
<td>96</td>
</tr>
<tr>
<td><strong>Final steps:</strong> Clean, calibrate, and update the analyzer</td>
<td>97</td>
</tr>
</tbody>
</table>

**Estimated time: 4 hours**

* Or as recommended by ZAPS.

** The lamp should be replaced if the PM Index parameter falls to 0.50 or sooner if recommended to you by ZAPS, even if the normal maintenance interval has not completed. See “Parameters monitoring the analyzer” on page 68.
Long-term maintenance procedures

This section describes how to perform long-term preventive maintenance procedures. Contact ZAPS Technologies to obtain replacement parts—see “Getting Support” on page 119.

<table>
<thead>
<tr>
<th>Recommended tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small straight-blade screwdriver</td>
</tr>
<tr>
<td>#2 Phillips screwdriver (10-inch)</td>
</tr>
<tr>
<td>Ball-end hex wrench sets (SAE and metric)</td>
</tr>
<tr>
<td>T-20 Torx driver</td>
</tr>
<tr>
<td>1-inch combination wrench</td>
</tr>
<tr>
<td>Adjustable wrench</td>
</tr>
<tr>
<td>Utility knife</td>
</tr>
<tr>
<td>Vacuum cleaner</td>
</tr>
<tr>
<td>Cleaning solvent (rubbing alcohol, etc.)</td>
</tr>
<tr>
<td>Canned air</td>
</tr>
<tr>
<td>Cotton swabs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Replacement parts (in preventive maintenance kit)</th>
<th>ZAPS identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp kit</td>
<td></td>
</tr>
<tr>
<td>If lamp housing is screwed to lamp supply</td>
<td>8003-1*</td>
</tr>
<tr>
<td>If cable is between lamp housing and supply</td>
<td>8003-2*</td>
</tr>
<tr>
<td>Lamp-breather filter kit (2 filters, bracket)</td>
<td>8001*</td>
</tr>
<tr>
<td>Lamp-breather pump</td>
<td>8008*</td>
</tr>
<tr>
<td>Filter-wheel belt</td>
<td>8200*</td>
</tr>
<tr>
<td>Rinse compressor rebuild kit</td>
<td>8100*</td>
</tr>
<tr>
<td>Check valves</td>
<td>8122*</td>
</tr>
<tr>
<td>* Parts included in 8031 preventive maintenance kit</td>
<td></td>
</tr>
</tbody>
</table>

First step: Preparing for maintenance

**WARNING:** Be sure to flush out the flow cell before opening it for maintenance. If the sample fluid contains any harmful substances, residual pressure or contact with sample fluid could cause illness or injury. **CAUTION:** Be sure to turn off power before unplugging wires during maintenance. Unplugging wires with power turned on can damage components.

Follow these steps before you perform maintenance that requires you to open the flow cell or unplug wires, such as before annual preventive maintenance.

1. On a computer, log in to the analyzer web server and view the Web Interface screen.
2. Go to the Control tab and click **Prepare the Station for a Manual Optics Clean**. When the preparation is completed and the cleaning steps are displayed, continue below.
3. **Important:** Turn off the sample and rinse-water supply lines.
4. Turn off the analyzer’s power button and unplug the power cord.
Replacing the lamp-side filter-wheel belt

The flexible drive belt inside the lamp-side filter-wheel assembly is subjected to harsh conditions caused by the intensely strong lamp. Preventive replacement is recommended.

1. Shut down the analyzer and unplug the power cord.
2. Pull the lamp-breather hose off the back of the lamp housing.
3. Pull the lamp-breather hose off the bottom of the filter-wheel assembly.
4. Unplug the cable from the filter-wheel assembly.
5. Use a 10-inch #2 Phillips screwdriver to fully loosen the four screws joining the two rectangular plates and filter-wheel assembly.

6. If the lamp housing is mounted directly to the lamp supply (no cable, as shown in the illustration above), do the following:
   - Unplug the cable from the top of the lamp supply.
   - If present, disconnect the ground wire near the top of the lamp supply.

   If, instead, the lamp housing has a cable connecting it to the lamp supply, go to the next step below.

7. Lift the upper rectangular plate and attached lamp housing off the filter-wheel assembly.

   **Note:** If you are also replacing the lamp for preventive maintenance and the lamp does not have a cable attached, the steps for that procedure can be performed at this time (page 91).

8. Remove the filter-wheel assembly from the analyzer.
9. Use a hex wrench to remove the four screws securing the upper and lower filter-wheel cases.
Caution: In the following steps, take extreme care not to deposit any dust or debris on the filters located in the filter wheel. Any contamination of the filters may compromise the accuracy of the analyzer.

10. On a clean surface, place the assembly with the motor facing down, then carefully lift off the top case.

11. Inside the case, next to the drive sprocket, loosen the three screws holding the motor. Completely remove two screws—but not the screw next to the long side of the case and closer to the filter wheel. The motor should pivot on this remaining screw.

12. Pivot the motor to remove tension on the drive belt.

13. Remove the drive belt.

Important: While the mechanism is open, visually inspect the individual filters to see if any are obviously damaged in any way. If any are damaged, contact ZAPS Technologies.

14. Install the new drive belt around the filter wheel and onto the drive sprocket.

15. If necessary, use cleaning solvent, cotton swabs, and canned air to remove any particles inside the case.

Caution: During reassembly, make sure the assembly is oriented correctly between the rectangular plates. The motor should be on the bottom of the assembly when installed in the analyzer.

16. Perform the previous steps in reverse order to reassemble the components.
Replacing the lamp

The intensity of the lamp decreases gradually over time. The system automatically monitors the intensity and adjusts measurements to maintain accuracy. Preventive replacement minimizes disruptions to the measurement process and ensures optimum sensitivity.

The steps for replacing the lamp depends on the type of lamp system in the analyzer:

- Lamp socket is connected to the lamp supply by a cable—page 90.
- Lamp socket is attached to the lamp supply (no visible cable)—page 91.

**Lamp with cable**

1. Shut down the analyzer and unplug the power cord.
2. Use a 1/16-inch hex wrench to loosen the setscrew holding the lamp socket in the lamp housing.
3. Pull the socket up and out of the housing.

⚠️ **Caution:** Hold the new lamp only with rubber gloves or soft paper. If you touch the new lamp with your fingers, oil from your fingers will shorten the life of the lamp considerably.

4. Replace the lamp in the socket.
5. Perform the previous steps in reverse order to reassemble the components.

⚠️ **Caution:** Make sure the socket is fully seated inside the housing. Otherwise, the internal alignment will be incorrect.

**Caution:** Do not over-tighten the setscrew—just make it snug. Otherwise, you could strip the hex socket.
6. **Important:** Clean and recalibrate the analyzer before returning it to service. See the following caution.

⚠️ **Caution:** It is imperative to clean and recalibrate the analyzer after installing a new lamp. Otherwise, the analyzer may not meet specifications.
- If you are performing annual preventive maintenance, be sure to do the final steps—“Final steps: Clean, calibrate, and update” on page 97.
- If you are replacing only the lamp, turn on power and go to “Cleaning the internal optics surfaces” on page 81.

---

### Lamp with no cable

**Note:** Whenever the lamp is being replaced for preventive maintenance, the lamp-side filter-wheel belt is normally also replaced. If so, the following steps can be performed after the filter wheel assembly is removed from the analyzer (page 87).

1. Shut down the analyzer and unplug the power cord.
2. Unplug the connector from the top of the lamp supply.
3. If present, disconnect the ground wire near the top of the lamp supply.
4. Pull the lamp-breather hose off the back of the lamp housing.
5. Use a hex wrench to remove the two 8-32 socket-head cap screws that hold the lamp housing to the rectangular plate, then remove the assembly from the analyzer.

6. Use a hex wrench to remove the two 6-32 socket-head cap screws that hold the lamp housing to the lamp supply.
7. Gently remove the lamp housing from the lamp supply. It pulls straight off.
8. Unplug the old lamp from the lamp supply.

**Caution:** Hold the new lamp only with rubber gloves or soft paper. If you touch the new lamp with your fingers, oil from your fingers will shorten the life of the lamp considerably.

9. Perform the previous steps in reverse order to reassemble the components.

10. **Important:** Recalibrate the analyzer before returning it to service. See the following caution.

**Caution:** It is imperative to clean and recalibrate the analyzer after installing a new lamp. Otherwise, the analyzer may not meet specifications.

- If you are performing annual preventive maintenance, be sure to do the final steps—“Final steps: Clean, calibrate, and update” on page 97.
- If you are replacing only the lamp, turn on power and go to “Cleaning the internal optics surfaces” on page 81.

---

**Replacing the lamp-breather pump**

The pump normally operates continuously. It circulates air through the lamp housing and flushes out contaminants. Preventive replacement is recommended.

1. Shut down the analyzer and unplug the power cord.
2. Unplug the connector in the power cable near the pump.

**Caution:** The IN and OUT hoses must be reinstalled in the correct positions. Otherwise, components could prematurely degrade and performance could be compromised.

3. Pull the two hoses off the pump. Note or mark the IN and OUT hoses.
4. Pinch and pull out the four rubber feet from the pump platform, then remove the pump.
5. Position the new pump on the platform and pull the rubber feet through the holes.
6. Perform the previous steps in reverse order to reassemble the components.
Replacing the lamp-breather filters

The capacities of the intake and exhaust filters for the lamp-breather function are diminished over time. These filters must be replaced with new filters periodically to maintain their performance.

1. Shut down the analyzer and unplug the power cord.

**Important:** If both filters have a hose extending to the bottom of the cabinet, find the filter that does not connect to the black hose at its upper end. Then do the following at that filter:

1. Remove the hose extending to outside the bottom of the cabinet—and do not replace it. (Use a short piece of the hose to plug the hole in the bottom of the cabinet.)
2. Remove the fitting from the filter where the hose connected—and do not replace it.

This is a permanent change to the air-intake path.

2. In the lower cabinet, pull off the hoses from the two canister filters. (Mark or note the hose positions so you can reconnect them properly.)
3. Remove the two filters:
   - If one end of each filter is screwed directly onto a stationary fitting, unscrew the filters from those fittings.
   - If the two filters are held in a plastic bracket, remove the screws holding the bracket, remove the assembly, then install a new metal bracket in the cabinet. The part with the plumbing fittings goes toward the top. (The filters screw into the stationary fittings on the bracket.)
   - If the filters are individually held by clamps, loosen each clamp and remove the filters.
4. If the new filters do not have fittings already installed, unscrew the fittings from the old filters and install them on the new filters.
5. Install the new individual filters.
6. Reconnect the hoses.
Rebuilding the rinse compressor

The compressor forces air into the flow cell via the rinse-water tubing. Moisture and wear can affect the performance of the pump. Periodically replacing key internal components and external check valves ensures continued performance.

1. Shut down the analyzer and unplug the power cord.
2. Disconnect the rinse tubing at the far end of the check valve farthest from the compressor.
3. Using a T-20 Torx driver, remove the four screws holding the head on the compressor. (You do not have to remove the compressor from the analyzer.)
4. Remove the head from the compressor.

Note: In the following step, check the inlet and outlet markings on the new head to ensure proper installation. Also check the direction of the check valves.

5. Remove the fitting from the outlet of the old head, then install the new check valve(s) on the new head. The new check valve(s) may differ from the old check valves.

6. Remove the fitting from the inlet of the old head and install it on the new head.

Note: In the following step, tighten the four screws evenly to ensure a good seal.

7. Install the new head on the compressor and reconnect the rinse tubing to the check valve.
Inspecting and cleaning the rinse valve

The rinse valve is a potential location for accumulation of debris, possibly causing the valve to leak water into the flow cell. Periodically inspecting and cleaning out the rinse valve promotes proper performance.

1. Shut down the analyzer and unplug the power cord.
2. **Important:** Turn off the input rinse-water source outside the analyzer.
3. Pry the red cap off the rinse valve.
4. The nameplate has a tapered hole that fits into a groove in the solenoid stem and retains the coil housing.
   While pushing in on the valve’s coil housing, lift the lower edge of the nameplate and slide the lower edge toward the solenoid stem—the nameplate should slip off the stem.

5. Remove the coil housing from the stem.
6. Remove the spring from the stem.
7. Unscrew the solenoid stem from the valve body. The inner plunger comes off with it.

8. Inspect the face of the plunger, O-ring, and seat of the valve body. Clean out any debris. Contact ZAPS Technologies if any parts are damaged or excessively worn.
9. Perform the previous steps in reverse order to reassemble the valve. Make sure the spring is in place before installing the coil housing.
Inspecting and cleaning the rinse jets

At the flow cell, the small openings in the two rinse jets have the potential for becoming partly blocked, possibly affecting the effectiveness of the rinse process. Periodically inspecting and cleaning out the rinse jets promotes proper performance.

1. Shut down the analyzer and unplug the power cord.
2. **Important:** Turn off the input rinse-water source outside the analyzer.
3. Find one rinse jet at the flow cell and disconnect the two hoses that connect to its T-fitting.

4. Unscrew the rinse jet from the flow cell. The O-ring may stay on the rinse jet, or it may remain inside the flow cell.

5. Inspect the small orifice in the rinse jet. If any material appears in the orifice, clean the orifice using a small hex wrench or small drill bit, then flush with compressed air or pressurized water.

**Hint:** To inspect the rinse jet, cover one side of the T-fitting with your finger and shine a flashlight into the other side of the fitting. If the orifice is clean, you should see light when you look into the orifice.

6. Screw the rinse jet into the flow cell finger tight, then tighten an additional \( \frac{1}{4} \) turn. The T-fitting should align with the two hoses.

7. Reconnect the two hoses. Make sure the Fast & Tite parts are positioned correctly—see “Making connections with Fast & Tite fittings” on page 20.

8. Repeat the previous steps for the other rinse jet.
Final steps: Clean, calibrate, and update

After performing an annual preventive maintenance, and before returning the analyzer to service, you must do the following:

**Caution:** It is imperative to clean and recalibrate the analyzer after installing a new lamp or after performing annual preventive maintenance—otherwise, the analyzer may not meet specifications. However, following annual preventive maintenance, the first steps for cleaning the optics should have already been performed at the start of maintenance:

- Manual optics-cleaning preparation was already performed using the Web Interface or display buttons.
- Power is turned off—not normally done for routine optics cleaning.

1. Manually clean the optics according to “Cleaning the internal optics surfaces” on page 81—*except skip the preparation steps*. Do the following:
   - Remove the lens holder.
   - Clean the fiber-optic surface inside the flow cell.
   - Clean the lens, lens holder, and O-ring.
   - Install the lens holder into the flow cell.

2. Turn on the sample and rinse-water supply lines.

3. Turn on power to the analyzer. Do this before trying to restart normal operation.

4. On the Control tab of the Web Interface, click **Manual Optics Clean Complete**. Wait for the progress bar to complete and display the normal Control tab. The status initially shows the calibration activity, then eventually changes back to normal (taking measurements).

5. **Important:** Notify ZAPS Technologies about the new hardware you installed. ZAPS will update the analyzer software to account for the new hardware.

**Suggestion:** Put a sticker inside the lower-cabinet door as a reminder for the next annual maintenance 1 year in the future.
Maintaining the clean-in-place accessory

If a clean-in-place (CIP) accessory is installed on your analyzer, it injects a cleaning solution designed to remove contaminants from internal optical surfaces. It is intended for analyzers that are subject to unusually rapid buildup of contaminants on those surfaces.

The clean-in-place system consists of an external tank and pump, which are connected to the analyzer by tubing and an electrical cable. The specific cleaning solution, the frequency of injections, and their volume have been set up according to your particular situation.

**WARNING:** Use only a cleaning solution specified by ZAPS, and only in accordance with its Safety Data Sheet. Cleaning solutions may be hazardous to personnel, and unapproved cleaning solutions may cause damage to the CIP system or analyzer.

<table>
<thead>
<tr>
<th>Task</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check and refill the tank</td>
<td>(As needed)</td>
</tr>
<tr>
<td>Depending on how fast the level of cleaning solution normally falls in the tank, be prepared to routinely refill the tank with the specified cleaning solution before the level reaches the “refill” mark.</td>
<td></td>
</tr>
<tr>
<td>Watch for normal cleaning behavior</td>
<td>(As needed)</td>
</tr>
<tr>
<td>Observe the behavior of the Clean parameter—see “Parameters monitoring the analyzer” on page 68. Go to the Monitor tab of the Web Interface and observe the behavior of the Clean parameter over time. You may be able to detect the periodic increases in the value resulting from the periodic clean-in-place activity.</td>
<td></td>
</tr>
<tr>
<td>Respond to unusual behavior</td>
<td>(As needed)</td>
</tr>
<tr>
<td>Take action if you notice a change in the behavior of the Clean parameter. A unusual decline in the Clean value may indicate a problem with the clean-in-place system. Check for a low level of cleaning solution in the tank, a blocked plumbing line, or an unplugged electrical line.</td>
<td></td>
</tr>
</tbody>
</table>

**Caution:** If the level of the cleaning solution falls below the pump intake, or if the pump loses its prime, perform the following steps to restore operation:

1. Refill the tank.
2. Open (unscrew the knob fully) the bypass valve above the pump.
3. Inside the analyzer junction box, push the CIP switch lever so the pump runs—hold the lever for at least 15 seconds.
4. **Important:** Close the valve (screw the knob clockwise).

**Note:** In some installations, the analyzer may automatically display a warning message or stop operation if any of the following conditions occur:

- The level of the cleaning solution becomes too low—refill the tank.
- The flow of the cleaning solution becomes blocked—clean out the path.
- The pump becomes disconnected or doesn’t pump—fix the problem.
- The temperature gets too low—wait a while after the temperature recovers.
Storing the analyzer

Before storing the analyzer, it is important to avoid damage by preparing it for storage conditions.

**WARNING:** Use the following steps to drain all fluids from the analyzer before storing it long-term. Do not store the analyzer at sub-freezing temperatures. Otherwise, internal components may be damaged.

1. Using the Web Interface, go to the Control tab, expand **Advanced**, and click **Put the Station in IDLE Mode**. This halts sample measurements. Wait for the indicated status to change to IDLE.
2. Shut off and disconnect the sample supply at the analyzer.
3. Connect a clean water supply to the sample inlet and run clean water through the analyzer for up to 4 hours. This removes most contaminants that might multiply inside the analyzer during storage.
4. Shut off all water and sample supplies, then disconnect all tubing from the analyzer inlets and drain outlet.
5. Using the Web Interface, on the Control tab expand **Advanced** and click **Initiate a Rinse Cycle**. Wait for the cycle to complete.
6. Optional: If the analyzer is to be stored in conditioned space (10 to 40 °C, 50 to 104 °F), turn it off by pushing in the power button, then unplug the power cord.

**Caution:** If the analyzer is to be stored at lower temperatures (–5 to 10 °C, 23 to 50 °F), leave it plugged in and turned on in Idle mode. This reduces the chance of internal condensation, which can damage components.
5 Fixing Problems

The fluid analyzer normally performs its functions with few interruptions. This chapter gives suggestions for fixing certain problems that might occur.

Getting information at the analyzer

The analyzer has a small display screen on the front of the junction box. It presents real-time operating information. The actual content depends on the analyzer’s configuration. An example is shown below.

```
S/N=213141
M=RUN
A=TAKE_READING
```

The display is normally blank or off whenever the analyzer is powered down.

Note: If an error code is shown on the screen, see “Interpreting error codes” below.

Note: If the analyzer includes a cellular communications option, several small indicator lights may be present inside the junction box. These lights indicate normal activity of the internal cellular modem.

Interpreting error codes

The analyzer keeps track of unusual operating conditions using error codes. It may display error information in the front-panel display and via the Web Interface (in a banner near the top of the screen).

An error code of 0 occurs during normal operation. Certain unexpected conditions cause a non-zero value, and may cause measurements to stop. The value indicates the type of attention required to fix the condition and resume measurements. The following table contains a list of error codes and recommended actions.

The error code returns to 0 when as the condition no longer exists. For example, an optics-warning or optics-alarm condition returns to 0 after the internal optics are manually cleaned and the analyzer is recalibrated.
## Fixing Problems

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Condition</th>
<th>Recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>Clean-optics warning</td>
<td>Clean internal optics soon. See “Cleaning the internal optics surfaces” on page 81.</td>
</tr>
<tr>
<td>2</td>
<td>Pressure alarm</td>
<td>Check for low sample pressure, restore normal pressure. See “Methods for delivering sample fluid” on page 13.</td>
</tr>
<tr>
<td>3</td>
<td>Clean-optics alarm</td>
<td>Clean internal optics now. See “Cleaning the internal optics surfaces” on page 81.</td>
</tr>
<tr>
<td>4</td>
<td>Temperature alarm</td>
<td>Check ambient temperature, air flow, shut down if necessary. If outdoors, consider installing a cover to reduce solar heating.</td>
</tr>
<tr>
<td>5</td>
<td>General fault</td>
<td>Contact ZAPS for assistance. See “Getting Support” on page 119.</td>
</tr>
<tr>
<td>6</td>
<td>Inadequate cleaning alarm</td>
<td>Clean internal optics again, more thoroughly. See “Cleaning the internal optics surfaces” on page 81.</td>
</tr>
<tr>
<td>7</td>
<td>Drain valve error</td>
<td>Turn power off, then on. If error recurs, contact ZAPS for assistance.</td>
</tr>
<tr>
<td>8</td>
<td>Detector resetting</td>
<td>Wait up to 30 minutes while system resets and resumes operation.</td>
</tr>
<tr>
<td>9</td>
<td>Detector resetting</td>
<td>Wait up to 30 minutes while system resets and resumes operation.</td>
</tr>
<tr>
<td>10</td>
<td>Rinse pressure low</td>
<td>Check rinse-water filter, source, connections; restore pressure. See “Utilities requirements” on page 12 for water pressure specs.</td>
</tr>
<tr>
<td>11</td>
<td>Extreme pH</td>
<td>pH of sample too low or high, shut off sample source until within range. See “Utilities requirements” on page 12 for pH limits.</td>
</tr>
<tr>
<td>12</td>
<td>Maintenance warning</td>
<td>Perform annual preventive maintenance soon. See “Schedule for long-term maintenance” on page 86.</td>
</tr>
<tr>
<td>13</td>
<td>Maintenance alarm</td>
<td>Perform annual preventive maintenance now. See “Schedule for long-term maintenance” on page 86.</td>
</tr>
<tr>
<td>14</td>
<td>Low-signal alarm</td>
<td>Perform rinse cycle. If error recurs, replace lamp. See “Control tab” on page 58.</td>
</tr>
<tr>
<td>15</td>
<td>Marginal-signal alarm</td>
<td>Replace lamp now. If error recurs, contact ZAPS for assistance. See “Replacing the lamp” on page 90.</td>
</tr>
<tr>
<td>16</td>
<td>Lamp filter-wheel error</td>
<td>Turn power off, then on. If error recurs, check lamp-side filter-wheel belt. See “Replacing the lamp-side filter-wheel belt” on page 88.</td>
</tr>
<tr>
<td>17</td>
<td>Detector filter-wheel error</td>
<td>Turn power off, then on. If error recurs, check detector-side filter-wheel belt. Contact ZAPS for instructions.</td>
</tr>
<tr>
<td>18</td>
<td>Bad sample</td>
<td>Sample is not measurable. Check sample source. Rinse cycles occur repeatedly until condition is cleared.</td>
</tr>
<tr>
<td>19</td>
<td>Insufficient sample supply</td>
<td>Check sample source for low flow, low pressure, blockage and restore flow. See “Methods for delivering sample fluid” on page 13.</td>
</tr>
<tr>
<td>104</td>
<td>High liquid temperature</td>
<td>Check for cause of high sample temperature, restore normal temperature. If outdoors, consider covering or insulating the sample line.</td>
</tr>
<tr>
<td>200 and above</td>
<td>Contact ZAPS</td>
<td>Contact ZAPS for assistance. See “Getting Support” on page 119.</td>
</tr>
</tbody>
</table>
Troubleshooting suggestions

The fluid analyzer is designed for reliable operation. If you have a problem, check the list of basic problems below, then try the suggested solutions one at a time. Several suggestions refer to tabs on the Web Interface. For further assistance, contact ZAPS Technologies—see “Getting Support” on page 119.

Note: You can perform certain troubleshooting steps at your computer. Other steps must be performed at the analyzer site, perhaps by trained technicians at your location.

If the analyzer is not working
- Check with your system administrator that the cellular service or network where the analyzer is connected is working.
- At the analyzer, make sure the ac power source is turned on and the power button on the bottom of the junction box is not pushed in. The display screen on the junction box should be on.
- If the analyzer has a LAN cable connected, check its connection.
- If the analyzer has an antenna connected, check the antenna installation and its cable connections. Check that the lights on cellular modem are working inside the junction box.
- At the analyzer, turn the power off, then turn it on again.
- Check that everything is set up properly for operation—see “Operations checklist” on page 27.
- Turn off the analyzer, then have an electrical technician check the fuses or breakers inside the junction box.
- Contact ZAPS Technologies for assistance.

If you can’t connect to the ZAPS web server
- If the analyzer isn’t responding, check that it is powered and connected properly. See “If the analyzer is not working” above.
- For a wireless connection, make sure the service provider is operating.
- Verify your computer’s network connection by visiting a different web address. If that doesn’t work, check your computer’s cables and connections.
- If your ZAPS login or password isn’t working, check with your system administrator or with ZAPS Technologies about the problem.
- If the ZAPS web server isn’t available, check with ZAPS Technologies.

If current data isn’t shown on the Web Interface
- If you have access to more than one analyzer, check that Station is set to the desired analyzer near the top of the Web Interface screen.
- Check for older measurement data. Find out when the measurements stop.
- Check the status of the analyzer shown on your screen. If the status is Offline or Unavailable, see “If the analyzer status is shown as Offline” or “If the analyzer status is shown as Unavailable” on page 105.
Fixing Problems

- At the analyzer, make sure the incoming sample source has sufficient pressure to flow through the analyzer and allow accurate measurements. See the next symptom.
  **Important:** If the pressure or flow rate is too low, no measurements are taken.

**If there is little or no flow**
- Check the status of the analyzer shown on your screen. Sample flow stops during rinse and calibration.
- At the analyzer, make sure the ac power source is turned on and the power button on the bottom of the junction box is not pushed in. Flow may stop after the analyzer is turned off, but it should restart at startup.
- Check the drain for any condition that could cause back pressure.
- Try increasing the sample pressure at the inlet.
- Try back-flushing the analyzer.

**If certain measurement values seem wrong**
- If you have access to more than one analyzer, check that Station is set to the desired analyzer near the top of the Web Interface screen.
- Make sure you are viewing the correct measurement parameter and the correct time period. The graphs or data listings are labeled.
- Clean the internal optics and recalibrate to confirm an accurate reference. See “Cleaning the internal optics surfaces” on page 81.
- Check your sample source to ensure it is flowing through the analyzer sufficiently. Low pressure or high viscosity can make the flow rate too low for accurate measurement.
- Check that the sample flow is not excessively restricted near its entry into the analyzer and does not contain bubbles.
  **Important:** Any restriction just ahead of the analyzer may cause a drop in pressure at the inlet, possibly causing dissolved gasses to effervesce, interfering with accurate measurement. See “Optimizing the sample stream” on page 110.
- Check your sample source to ensure samples are not being corrupted accidentally.
- If all sample values seem wrong, make sure the clean water source is not contaminated. Uncontaminated water is required for proper operation.
- Go to the Control tab, expand Advanced, and click **Put the Station in Idle Mode**. Then, at the analyzer, turn the power off, then turn it on again.
- Contact ZAPS Technologies for assistance.

**If an error code or error message appears on the Web Interface or on the analyzer’s front-panel display**
- See “Interpreting error codes” on page 101 for a list of error conditions and recommended actions.
Fixing Problems

If the analyzer status is shown as Offline

- For this situation, the analyzer is usually performing a standard operation that temporarily interrupts it from analyzing the sample input. For example, the analyzer could be performing a calibration. Normally, offline conditions should end automatically.

- On the Web Interface, check whether a message near the top of the screen indicates an error condition. If so, take appropriate action—see “Interpreting error codes” on page 101.

- If the analyzer status is shown as “Idle” on the front-panel display or on the Web Interface screen, someone could have deliberately set the analyzer in this offline state. If you are sure someone else is not performing maintenance or repair, you can resume normal operation by expanding Advanced and clicking **Put the Station in Run Mode**.

If the analyzer status is shown as Unavailable

For this situation, communication between the analyzer and the ZAPS web server has been lost.

- On the Web Interface, update the screen by clicking **Go**.

- Check with your system administrator that the analyzer is not undergoing maintenance or repair.

- Check that the analyzer is powered and connected properly. See “If the analyzer is not working” on page 103.
6 Detailed Information

This chapter includes a collection of special topics with in-depth discussions and explanations.

Options for pumping sample fluid

The controlled delivery of sample fluid is a critical element for the optimum operation of the LiquID Station, a fluid analyzer from ZAPS Technologies. The preferred method for delivering sample fluid to the analyzer is tapping into a pressurized supply and running a pressurized branch line to the analyzer. Otherwise, you may have to pump sample fluid from the source to the analyzer. Use the guidelines and examples in this section while designing a pump-assisted fluid-supply system for your analyzer. This section is related to “Methods for delivering sample fluid” on page 13.

Caution: It is important for the sample fluid stream to remain steady and continuous, with no restrictions that could cause bubbles or effervescence. ZAPS requires the supply line to have a diameter of ½ inch or larger. If you have any questions or concerns about your site plan, contact ZAPS Technologies—see “Getting Support” on page 119.

General pump guidelines

Consider the following guidelines while designing a pump-assisted supply system.

- The source for the sample fluid can be a “reservoir” that holds the sample fluid, or it can be a “stream” of flowing sample fluid. In either situation, the pump draws sample fluid from a fixed intake at the source and sends it to the analyzer.
- Submersible and non-submersible pumps can be used. The choice depends on several factors, including the makeup of the sample fluid, the elevation of the analyzer above the source, and the desired flow rate.
- Tubing used for the sample supply line should have no leachable chemicals that might contaminate the sample fluid, such as plasticizers in garden hoses.
- A proper drain configuration at the analyzer contributes greatly to good sample delivery.
Bypass considerations

When designing a pumped supply, consider the need for a bypass path to protect the pump whenever the analyzer shuts off the sample flow through the analyzer.

- Some types of pumps can tolerate blocked flow. Other types have an internal bypass mechanism that recirculates fluid whenever its output flow is blocked. No external bypass is required for such pumps. However, providing a separate bypass path near the analyzer will reduce the delay in getting relevant results after flow is restored through the analyzer.

- For other pumps, you should provide an external bypass that provides an alternate path for sample fluid back to the source. You can use a pressure-sensitive valve that opens when the normal flow is blocked, providing an alternate flow path back to the source. Or you can use a simpler method, a full-time bypass path that always directs part of the flow back to the source (see example 1 below). Both methods ensure that the pump flow is never fully blocked.

- If the sample fluid travels through a long length of ½-inch tubing from the pump to the analyzer, consider putting the bypass near the analyzer. This would ensure good flow through the pump and prevent the fluid from stagnating in the tubing whenever flow through the analyzer stops.

Examples of pump installations

The following paragraphs give examples of possible installations with pumped sample supplies. Consider these examples when designing a pump installation. If you need assistance, contact ZAPS Technologies—see “Getting Support” on page 119.

Example 1: Submersible pump

This installation uses a submersible pump to draw sample fluid from a holding tank or trough. The pump runs continuously. A simple bypass, if required, allows the pump to run continuously—see the details in the diagram below.

Recommended pumps:

- **Standard conditions:** Marine-grade submersible pump. BJM Pumps model R250-115 (115 VAC, 4 A, 1/3 HP, 8 m/26 ft max lift)

- **Mild chemical exposure:** Marine-grade Noryl submersible pump. BJM Pumps model IGF-32-9NL (115 VAC, 5 A, 0.4 HP, 8 m/27 ft max lift)

- **Typical surface waters:** Screened, self-cleaning submersible pump. RotorFlush model O1608-16 US (115 VAC, 5 A, 1/2 HP, 7 m/24 ft max lift) with 300-micron stainless intake screen

![Diagram of submersible pump installation](image)
Example 2: Peristaltic pump

This installation uses a peristaltic pump to deliver sample fluid. A peristaltic pump can be useful for situations with difficult sample-fluid characteristics or problematic site requirements.

A rugged peristaltic pump is required, and it should be equipped with a four-roller head, preconfigured peristaltic elements, and a built-in controller for remote actuation. Short lengths of resilient tubing at the pump inlet and outlet help absorb pressure fluctuations.

Because a peristaltic pump cannot tolerate a blocked flow, the system uses special software in the analyzer to direct an internal controller in the pump. (Contact ZAPS Technologies to activate this software.) This enables the analyzer to start and stop the pump at appropriate times and to reverse the pump periodically to back-flush the sample intake. It is recommended that a ZAPS automatic back-flush system be installed on the analyzer to ensure robust back-flushing.

Recommended pump:

- Watson-Marlow model 620UN peristaltic pump with built-in electronic controller (115/230 VAC, 2.2/1.1 A), 620RE4 pump head, Marprene TM LoadShure elements (902.P120.PPC), interface hoses (069.6171.PTC)
Optimizing the sample stream

This section describes how certain conditions of the sample flow through the LiquID Station can degrade measurement performance. Corrective suggestions are provided. This section is related to “Methods for delivering sample fluid” on page 13.

Optimum sample supply

For optimum performance of the LiquID Station, it is important for the sample fluid stream to remain steady and continuous, with no rapid variations, and with no restrictions that could cause bubbles or effervescence. The required static supply pressure is 14–420 kPa (2–60 psi), with a 1/2-inch minimum supply line from the source. In addition, a properly configured open drain promotes good sample flow.

Here are two examples of conditions that affect the sample stream and can degrade performance, and they are discussed in detail below:

- Significant, rapid variations in the supply pressure
- Restrictions in the supply line

**Note:** A poorly conditioned sample stream or a poor drain configuration often affects the accuracy of measurements reported by the LiquID Station. This might cause high, low, or fluctuating values, depending on the parameter. A well-conditioned sample flow and properly configured open drain are extremely important for proper performance.

Variations in supply pressure

Several conditions can contribute to rapid variations in the sample-supply pressure, including non-uniformity of the sample fluid, pump design, poorly regulated conditions at the pump, unfavorable location of the sample intake, and poor drain configuration.

Rapid pressure variations can cause cavitation within the flow cell of the LiquID Station—the flow cell is where measurements are made by the instrument. Cavitation causes air bubbles, air bubbles which are not normally in the sample fluid. Air bubbles have a direct effect on the optical measurements because they displace sample fluid and respond differently photometrically from sample fluid. (Chemical laboratory tests are not affected by air bubbles because the air dissipates from open containers of water.)

As an example of this effect, the graphs below from wastewater sites show how variations in sample pressure can affect performance. In the graphs, these parameters are shown:

- Photon Efficiency – relative average count of photons during a measurement burst
- Photon Std Deviation – standard deviation of photon count during a measurement burst
- Sample Pressure – observed pressure in the sample stream

The first graph shows results from a LiquID Station with relatively controlled sample pressure. Although the pressure varies from about 21 to 27 kPa (3.0 to 3.9 psi), it always remains high. The Photon Efficiency varies less than...
±10 percent, and the Photon Std Deviation shows a consistent value of about 5 (meaning the photon count has a consistent spread from burst to burst).

The second graph shows results from a LiquID Station with significant variations in sample pressure—see the Sample Pressure trace. The pressure varies from almost 0 to over 25 kPa (0 to 3.6 psi), and this occurs rapidly and frequently. The Photon Efficiency varies more than ±25 percent. More significantly, the Photon Std Deviation varies from 5 to 12 or more, which means the spread in the photon count varies wildly from burst to burst. This type of occurrence is usually associated with the random effects from air bubbles in the flow cell.

The third graph shows results from a site at which the pump was changed to address significant pressure variations. The conditions before and after the change are markedly different. Sample Pressure is steady at a higher level after the change, Photon Efficiency has less variation, and Photon Std Deviation is stable, all indicating a more controlled sample flow. This example illustrates the significant improvement in performance that is possible by eliminating rapid and frequent pressure variations.
If varying sample pressure is a problem, assess the sample-supply system and consider changes that could reduce the variations. For example, installing a submersible cutter pump in a wastewater system can provide reliable pressure and flow while improving the uniformity of the sample fluid. Or relocating the sample intake could avoid introducing sludge, debris, or air bubbles into the sample stream.

**Restrictions in supply line**

A restriction in the sample line, especially near the Liquid Station, can cause air bubbles or effervescence that persist in the sample fluid when it enters the flow cell, where measurements are made by the instrument. Restrictions can be caused by inappropriate plumbing. As a result, measurement performance can be degraded.

If air bubbles in the sample fluid are affecting measurements, consider whether supply pressure variations might be causing the problem, as discussed above. Also assess the sample line and sample flow from the source to the instrument. For example, a partially closed ball valve can cause effervescence—a ball valve should be fully open or fully closed. Or insert into the sample line an air separator or similar apparatus, which could remove air bubbles that might occur.
Choosing analyzer communications

The LiquiID Station supports several different methods for communicating with external systems. Using these methods, it can transmit measurement data and status information for evaluation and analysis, it can receive commands that control its operation, and it can receive software upgrades from ZAPS Technologies.

Basic communications methods

The analyzer provides the following basic methods of communications:

- Cable connection to a local network
- Wireless cellular modem and antenna (for local cellular service)
- Modbus protocol over TCP/IP cable
- 4-20 mA output (via RS-485 output to a separate 4-20 mA module)

The examples in the next topic show how these basic methods can be used to design different communications solutions.

Examples of communications designs

For your installation, the importance of several factors can influence the design of a particular communications solution, including the following:

- Type of available Internet access.
- Need to view data and control the analyzer using the Web Interface.
- Need to collect data on a SCADA system.
- Desire to keep LiquiID software up-to-date.
- Need to protect local networks from unauthorized access.

The examples below show how you can use the different communications methods to create solutions that satisfy different system requirements.
**Example 1: Cell modem**
The analyzer has bidirectional communication with the ZAPS web server using a cellular modem embedded in the analyzer.

**Setup:** Requires an optional cellular modem compatible with local cellular service (see “Installing a modem and antenna (on-site)” on page 29).

**Benefits:** No setup required at the analyzer for a factory-installed modem. Data analysis and instrument control can be performed using the Web Interface. Software can be kept current by ZAPS Support.

**Limitations:** No SCADA support.

**Relative local-network security risk:** Minimal. Local networks are not exposed.

---

**Example 2: Local network**
The analyzer has bidirectional communication with the ZAPS web server using a connection to a local network.

**Setup:** Uses the built-in LAN port. Requires certain ports on the local network firewall be configured for the ZAPS web server (see “Network connection inside a firewall” on page 31).

**Benefits:** Data analysis and instrument control can be performed using the Web Interface. Software can be kept current by ZAPS Support.

**Limitations:** No SCADA support. Ports on the local network firewall must be configured for the ZAPS web server.

**Relative local-network security risk:** Moderate. Certain ports in the network firewall are open to the outside world.
Example 3: Modbus to SCADA system

The analyzer has bidirectional communication with a SCADA system using Modbus protocol over a TCP/IP connection.

**Setup:** Uses the built-in LAN port. Requires connecting a bridge device compatible with the SCADA system and programming it according to the analyzer’s Modbus protocol (see “Configuring Modbus communications” on page 32).

**Benefits:** No setup required at the analyzer. Data analysis can be performed via the SCADA system.

**Limitations:** Does not provide instrument control via SCADA. No access to data or control via the Web Interface. No remote access for software upgrades. SCADA programming required. Internet connection must be provided during commissioning. Requires a display with buttons on the analyzer for operational control and maintenance.

**Relative local-network security risk:** Minimal. No connection to outside world. Local networks are not exposed.

Example 4: 4-20 mA to SCADA system

The analyzer has only one-directional communication to a SCADA system using the 4-20 mA outputs from an optional ZAPS 4-20 mA module.

**Setup:** Requires installing the ZAPS 4-20 mA module with its RS-485 adapter (see “Setting up 4-20 mA analog output” on page 33). Requires connecting a 4-20 mA bridge device compatible with the SCADA system and programming as needed.

**Benefits:** Data analysis can be performed via the SCADA system. Minimal security risk due to one-way analog communication.

**Limitations:** One-way communication does not provide instrument control via SCADA. No access to data or control via the Web Interface. No remote access for software upgrades. SCADA programming required. Internet connection must be provided during commissioning. Requires a display with buttons on the analyzer for operational control and maintenance.

**Relative local-network security risk:** Minimal. The one-way analog connection has no known security risk. No connection to outside world. Local networks are not exposed.
**Example 5: Cell modem and Modbus/SCADA system**

The analyzer has bidirectional communication with the ZAPS web server using a cellular modem and with a SCADA system using Modbus protocol over a TCP/IP connection.

**Setup:** Uses the built-in LAN port, and requires an optional cellular modem compatible with local cellular service (see “Installing a modem and antenna (on-site)” on page 29). Requires connecting a bridge device compatible with the SCADA system and programming it according to the analyzer’s Modbus protocol (see “Configuring Modbus communications” on page 32).

**Benefits:** No setup required at the analyzer for a factory-installed modem. Data analysis can be performed using the Web Interface and via the SCADA system. Instrument control can be performed using the Web Interface or a display with buttons. Software can be kept current by ZAPS Support.

**Limitations:** SCADA programming required.

**Relative local-network security risk:** Moderate to High. Analyzer is connected to the outside world, and SCADA network is connected to the analyzer. Other local networks are not exposed.

**Note:** If the cellular modem were turned on only intermittently for software upgrades and commissioning, exposure to the outside world would be very limited, and the relative security risk would be reduced to Low to Moderate. However, a display with buttons would be required on the analyzer for operational control and maintenance.
Example 6: Local network and 4-20 mA/SCADA system

The analyzer has bidirectional communication with the ZAPS web server using a connection to a local network and one-directional communication to a SCADA system using the 4-20 mA outputs from an optional ZAPS 4-20 mA module.

Setup: Uses the built-in LAN port. Requires certain ports on the local network firewall be configured for the ZAPS web server (see “Network connection inside a firewall” on page 31). Requires installing the ZAPS 4-20 mA module with its RS-485 adapter (see “Setting up 4-20 mA analog output” on page 33). Requires connecting a 4-20 mA bridge device compatible with the SCADA system and programming as needed.

Benefits: Data analysis can be performed using the Web Interface and via the SCADA system. Instrument control can be performed using the Web Interface or a display with buttons. Software can be kept current by ZAPS Support.

Limitations: Ports on the local network firewall must be configured for the ZAPS web server. No instrument control via the SCADA system. SCADA programming required.

Relative local-network security risk: Low to Moderate. Certain ports in the network firewall are open to the outside world. The SCADA network is effectively isolated from the analyzer because the one-way analog connection has no known security risk.
7 Getting Support

If you need information about any products from ZAPS Technologies, please contact ZAPS Technologies at one of the locations listed below.

**General product information**

<table>
<thead>
<tr>
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<th>Information</th>
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<tbody>
<tr>
<td><strong>Web</strong></td>
<td><a href="http://www.zapstechnologies.com">www.zapstechnologies.com</a></td>
</tr>
<tr>
<td><strong>Phone</strong></td>
<td>866.390.9387 (available 24/7)</td>
</tr>
<tr>
<td><strong>Email</strong></td>
<td><a href="mailto:sales@zapstechnologies.com">sales@zapstechnologies.com</a></td>
</tr>
<tr>
<td><strong>Mail</strong></td>
<td>ZAPS Technologies, Inc.</td>
</tr>
<tr>
<td></td>
<td>Marketing Dept.</td>
</tr>
<tr>
<td></td>
<td>213 Water Avenue NW</td>
</tr>
<tr>
<td></td>
<td>Albany, OR 97321 U.S.A.</td>
</tr>
</tbody>
</table>

**Service**

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<th>Information</th>
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<tbody>
<tr>
<td><strong>Phone</strong></td>
<td>866.966.5424 (available 24/7), answered by service rep or call-back within 4 hours (Monday–Friday 8:00am–5:00pm Pacific Time)</td>
</tr>
<tr>
<td><strong>Email</strong></td>
<td><a href="mailto:service@zapstechnologies.com">service@zapstechnologies.com</a></td>
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<td><strong>Mail</strong></td>
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