O·I·Analytical

Introducing the Eclipse: A New Generation of Purge-and-Trap Sample Concentrators

Application Note 19120203

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Eclipse
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Introduction

Although analysis of VOCs by purge-and-trap (P&T) is considered a mature technique, advances in the methodology and refinement of the instrumentation are still being developed. This application note introduces the OI Analytical Model 4660 Eclipse™, a new generation of P&T sample concentrators that takes VOC analysis technology to a higher level of sophistication.

The new OI Analytical Eclipse P&T Sample Concentrator (Figure 1) is a completely new design that preserves all of the analytical advantages of its predecessor, the Model 4560, while introducing multiple new features that enhance ease-of-use, automation, and technical performance. Its new analytical capabilities and features include a full-color, touchscreen Windows® CE-based graphic user interface (GUI), completely automated pH measurement of water samples, foam sensing and foam busting capabilities, liquid sensing to prevent overfills, and a completely new design focussed on simplifying maintenance and service. Highlights of the new features are described below.

Figure 1. Eclipse Purge-and-Trap Sample Concentrator

Graphical User Interface

The new Eclipse features a full-color, touchscreen Windows® CE-based graphical user interface. Previous P&T generations employed an awkward, button- and menu-driven interface with only one- or two-line displays that could be difficult and cumbersome to learn and navigate. The innovative touchscreen interface is a standard feature on the Eclipse and allows full control of all instrument and related autosampler functions, including status monitoring, from a minimum number of full-color screens. All of these screens are very easy to read and understand. In addition, the software is available with multiple language support for international laboratories. The Eclipse includes a matching Windows-based optional PC software program, functional through the unit's full LAN capability for remote monitoring or integration into LIMS systems. Examples of some of the graphic user interface screens are shown in Figures 2–5.

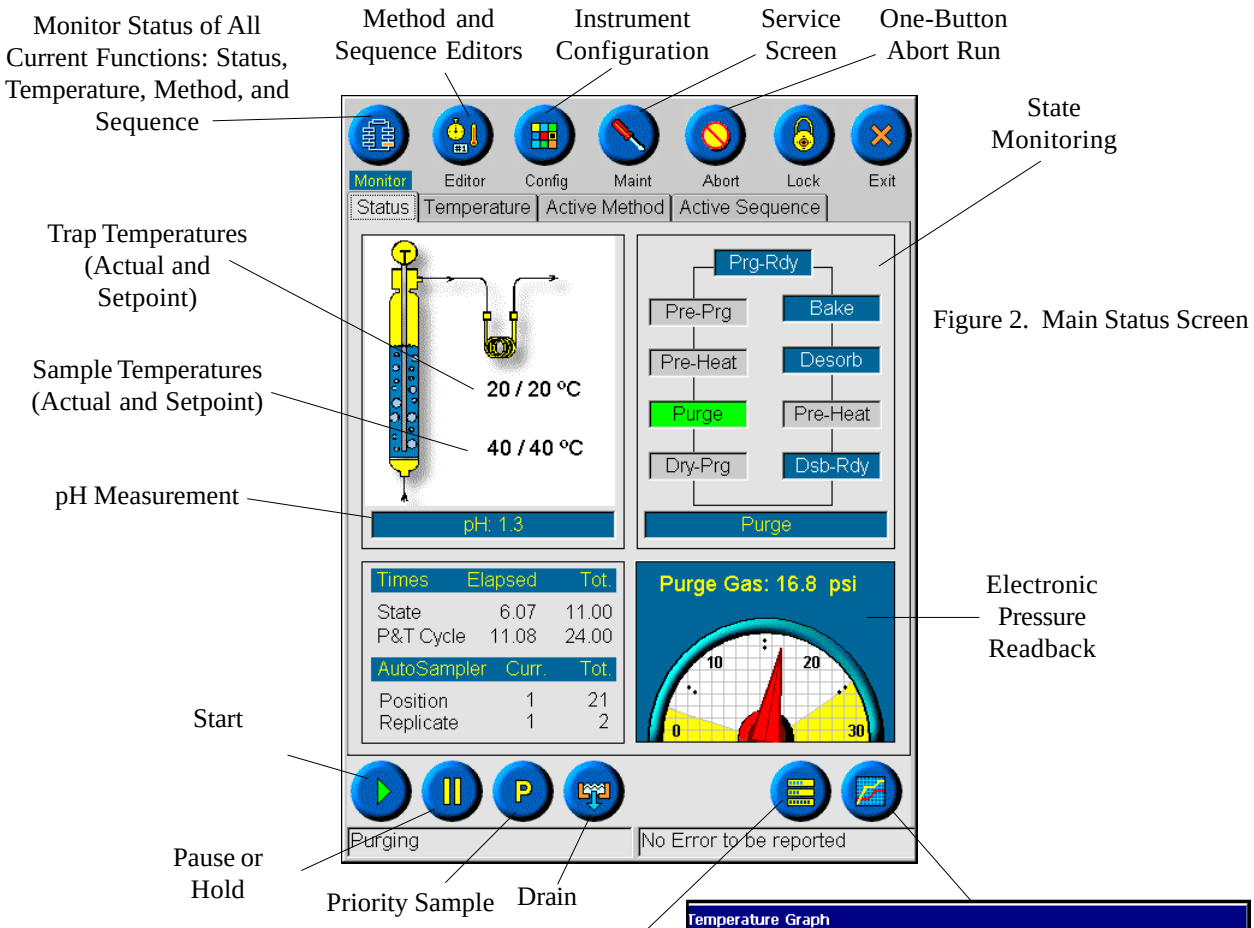

Figure 2. Main Status Screen

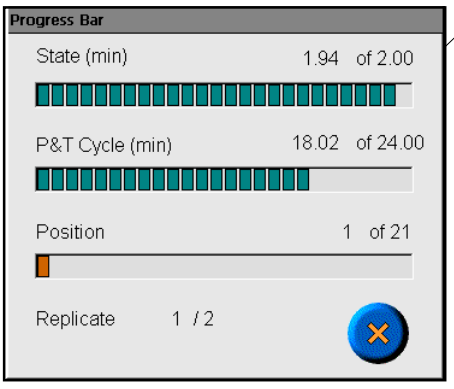

Figure 2a. Graphical Display of the State, Cycle, and Sequence Progress

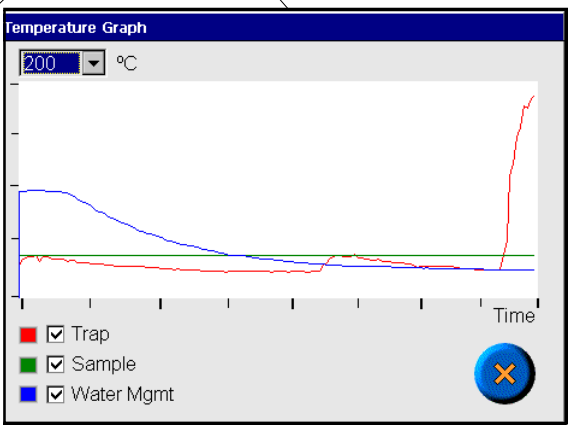

Figure 2b. Graphical Display of the Trap, Sample, and Water Management Temperature

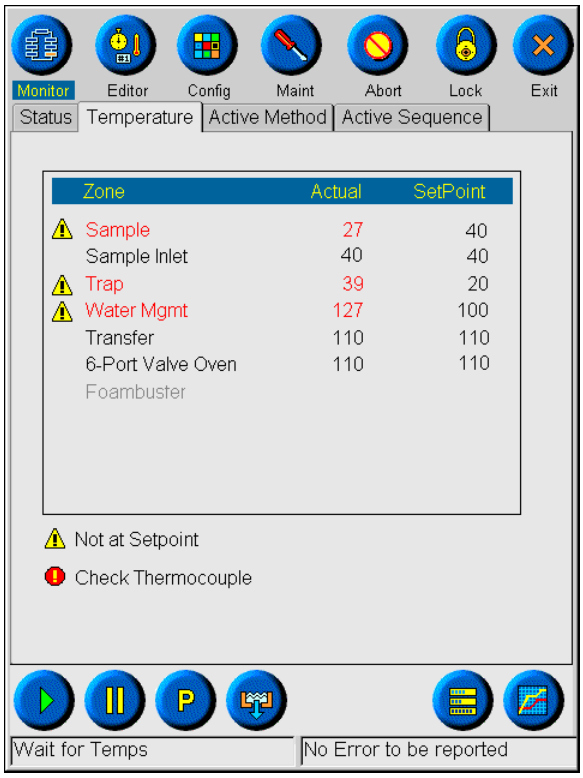

Figure 3. Temperature Status Screen Simultaneously Lists Setpoints and Actual Temperatures for All Heated Zones with Warnings for Temperatures That Are Not at the Setpoints.

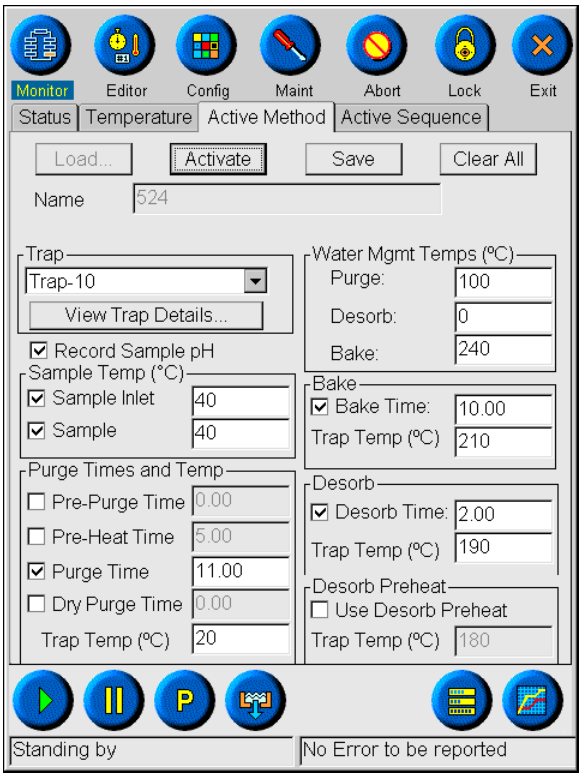

Figure 4. Active Method Screen. All Method Parameters are Available on One Screen and Can Be Modified in Real Time.

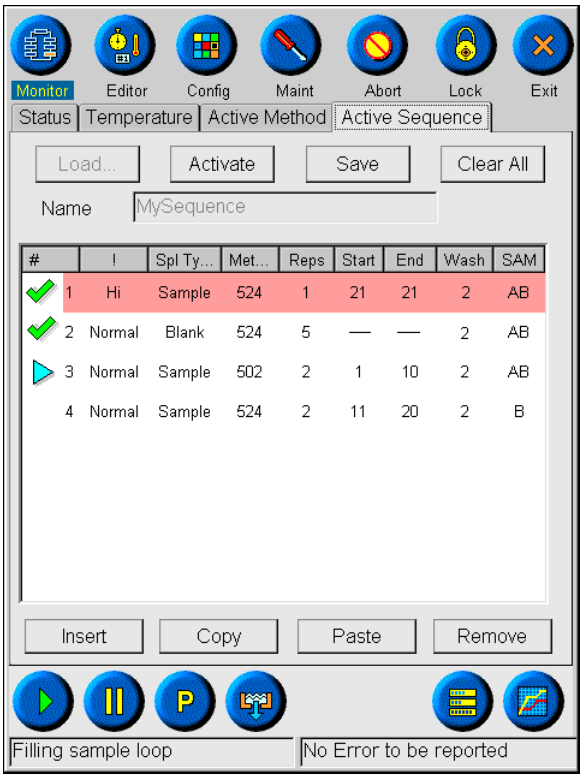

Figure 5. Active Sequence Screen. High or Normal Priority Samples can be Added to the Sequence at Any Time.

The pH Express Option (Patent Pending)

One of the Eclipse's premier features is the pH Express™, which completely automates pH measurements of water samples, a step that until now had to be performed manually (Figure 6). Many USEPA VOC methods require that samples be preserved with acid to a pH <2 (preservation at basic pH is also being considered), and a duplicate sample aliquot is sometimes collected in the field just for measuring the pH. Alternatively, the sample vial has to be opened in the laboratory and the pH measured before or after the analysis, a time-consuming and labor-intensive step. With the pH Express, the entire process is fully automated and incorporated into the VOC analysis, eliminating the need to collect additional samples for pH measurement or to take the pH reading manually. pH readings are electronically logged in the instrument for data reporting or exporting.

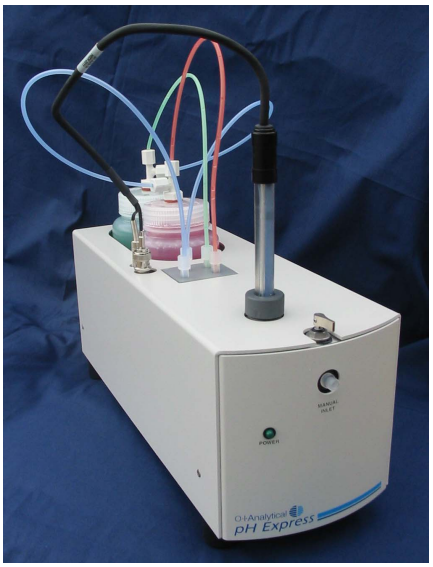

Figure 6. pH Express Option for Automated On-Line Measurement of Sample pH

When a sample is drained from the Eclipse's sparge vessel during desorb, a representative aliquot of the liquid is diverted to a cell where the pH reading is taken. The sample is then drained to the waste receptacle in the usual manner, and the lines are purged with gas and flushed with the autosampler's rinse water.

- Uses two buffer solutions as calibrants.
- pH range from 0 to 14.
- Calibrated manually with prompts from the user interface, or programmed to auto-calibrate at user-defined intervals.
- Date and time stamps of the pH readings, which are stored in the P&T log file for subsequent reporting or retrieval.
- The Eclipse stores up to 500 pH readings.

Sparge Overfill Sensing (SOS) Option

One problem encountered with earlier P&Ts was the lack of automatic sensing of liquid in the sparge vessel. When using an autosampler, accidental double filling of the glassware and flooding of the trap could occur if the previous sample had not been completely drained. The Eclipse offers an optional Sparge Overfill Sensor (SOS) that mounts to the chassis behind the sparge vessel (Figure 7). The capacitive sensor recognizes when there is liquid in the sparge tube. The unit's software checks for the presence of liquid in the sparge vessel prior to allowing the autosampler to transfer a new sample aliquot. If the previous sample has not been drained, users can specify whether to stop the sequence completely or to drain the sparge vessel and continue, thus avoiding overfills.

- Spring loaded to ensure flush mounting with the sparge vessel.
- Senses the presence or absence of sample in the sparge vessel.
- Compatible with 5-mL or 25-mL glassware.
- Overfill prevention options include stopping the sequence, or draining the sparge vessel and continuing the sequence

The Foam Buster and Foam Sensor Options (Patent Pending)

It us usually impossible to tell in advance if a sample is going to foam during analysis. Once foaming occurs, it may be too late to prevent contamination of the internal sample pathway upstream from the sparge vessel. The Eclipse features two new options that not only sense when foaming has occurred, but can actually "bust up" the foam before it travels into and contaminates internal sample pathway lines. The Foam Buster™ and Foam Sensor options appear in Figure 7.

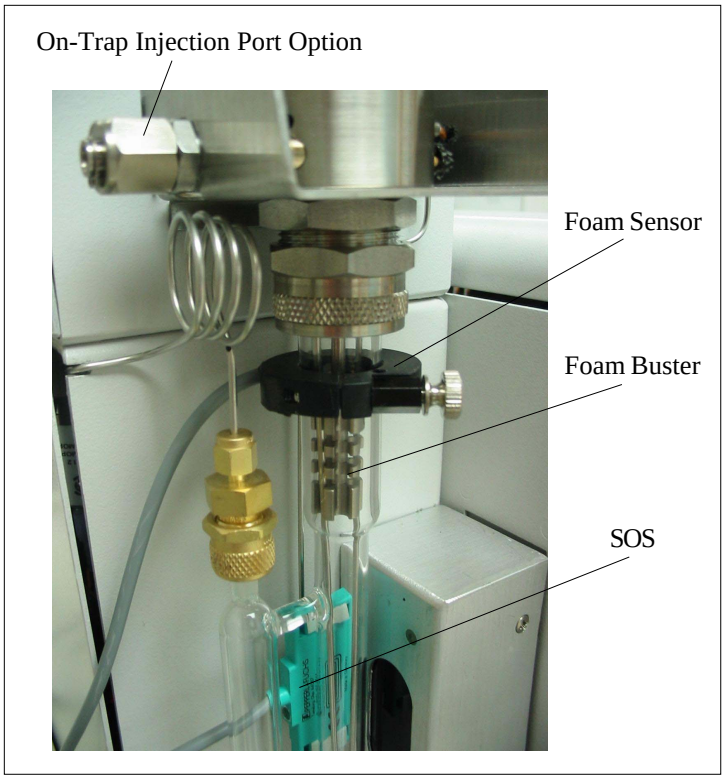

Figure 7. Sparge Overfill Option, Foam Buster Option, Foam Sensor Option, and the On-Trap Injection Port Option

The nickel-plated Foam Buster is suspended above the sample near the top of the sparge vessel, but below the sparge mount, and is heated to an adjustable temperature. When foam from a purging sample reaches the heated unit, thermal energy transfers to the surface of the foam causing it to rupture. The heat from the Foam Buster breaks up the foam, which then condenses and slides back down into the vessel.

- Breaks up foam from samples with equivalent of up to 5% Snoop®.
- Variable temperature (125°–150°C recommended).
- Accommodates a sparge needle and sample thermocouple, allowing the optimal gas flow to the trap.
- Fits both 5-mL and 25-mL sparge vessels.
- Can be used with the Foam Sensor for two lines of defense against foam.

The Foam Sensor option is a small ring attached to the glassware just below the sparge mount and above the Foam Buster. The ring contains an optical sensor that detects the presence of foam and sends a signal to the Eclipse to stop the run before the foam can damage or contaminate the sample pathway.

- Fits all standard glassware.
- Two user-defined options when foam is detected: stop the sequence, or drain and continue. The drain-and-continue option includes starting a run on the GC to keep the sample sequence intact, as well as baking the trap to prepare for the next sample.
- Easy to add or upgrade in the field.
- Any foam event creates an entry in the Eclipse log with date and time stamp for matching with the corresponding GC run.
- Can be used alone or with the Foam Buster for added anti-foam protection.

On-Trap Injection Port Option

The removable on-trap injection port shown in Figure 7 is an optional feature that lets users manually syringe inject analytes onto the trap, a common troubleshooting technique. The Eclipse's design allows the option to be removed during normal operation.

- Removable design eliminates the potential for contamination from septum bleed, leaks from the connections or pierced septum, additional dead volume in the sample pathway, and introduction of adsorptive sites.
- Easily accessible on the side of the sparge mount.

Improved Serviceability

The entire Eclipse P&T Sample Concentrator has been designed from the ground up with serviceability and easy maintenance as fundamental guiding principles. From the new modular chassis design to the one-touch button options in the software, everything has been designed with the user in mind. A partial list of some of the new maintenance and service features follows:

- Individual electronic and pneumatic modules that can be easily swapped in just a few minutes by simply loosening four captive fasteners and disconnecting two cables.
- Standard, automated, one-button leak check.
- Lowest internal sample pathway volume ensures chromatographic integrity.
- Multiple one-button features on the service screen, including system bake out and trap conditioning.
- Instrument log that records all events, faults, and errors with a date and time stamp, including an electronic logbook.
- Electronic pressure sensor to monitor and report purge gas pressure is standard with every instrument. Multiple alarm capabilities—audible, visual, and functional (i.e., samples are not run if there is no purge gas).
- Full access for manual operation of all valves, fans, heated zones, and states from an easy-to-understand graphic service/maintenance screen (see Figures 8, 8a, and 8b).

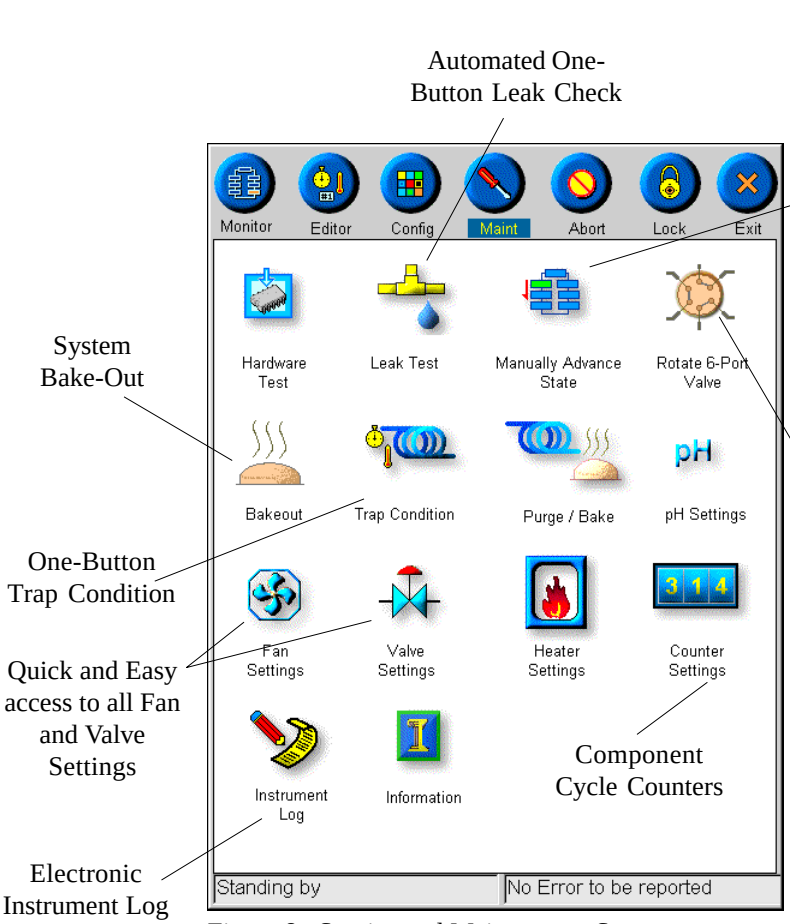

Figure 8. Service and Maintenance Screen

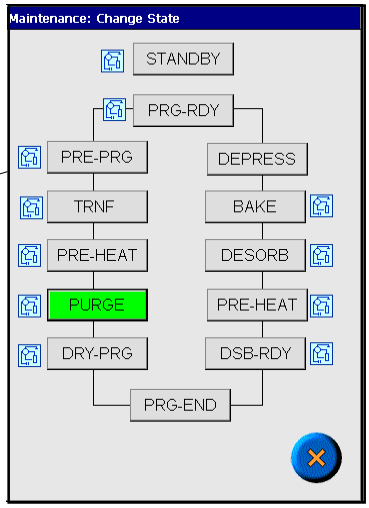

Figure 8a. Manually Advance to Any State

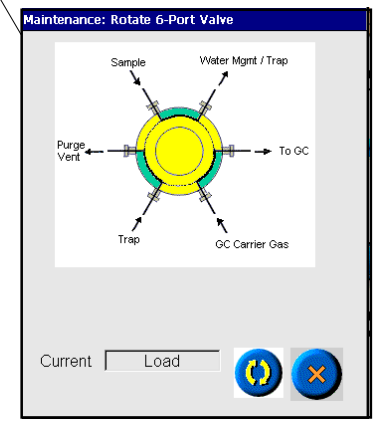

Figure 8b. Manually Rotate the Six-port Valve

- New durable isolation valves that are resistant to corrosion.
- Purge vent and bake-out vents easily accessible for measuring gas flows and troubleshooting.
- New water management design is more resistant to contamination and has increased water capacity for samples run at higher temperatures.
- Easier access to the water management fitting for servicing.
- Manual advance directly to any state without scrolling through all of the previous states.
- New stainless steel alloy used for the sparge mount is more resistant to corrosion.
- Drain valve/path is completely outside the chassis so that no liquid sample ever comes near the electronics.

Conclusions

OI Analytical has been the leader in the innovative design of P&T sample concentrators and autosamplers used for the analysis of VOCs since 1987. Today, the OI Analytical Model 4660 Eclipse P&T Sample Concentrator represents the most advanced technology available for the concentration of VOCs, with unsurpassed performance, automation, productivity, and reliability. Here are the reasons to choose the Eclipse over any other P&T system:

- Fastest cycle time in the industry.
- Dual P&T capability available (PT Express).
- Proven, reliable performance.
- Easy-to-use and understand graphical user interface with touchscreen.
- Fully automated pH sensing.
- Foam busting and foam sensing.
- Sparge Overfill Sensor (SOS).
- Electronic log that keeps track of all events, faults, and errors.
- Easy, fast access to all components for simplified servicing.
- Minimum number of tools required for maintenance.
- One-touch maintenance and service features.

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