Automation Works

High-Performance HMI Screens Benefit Water/Wastewater Operators

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You've been working with the same human–machine interface (HMI) screens for more than a decade. There's money in the budget this year, and now your integrator is updating the entire supervisory control and data acquisition (SCADA) system, including all the screens, based on ANSI/ISA-101 and high-performance HMI standards. Scared of change and being phased out? Relax because this change is all about making you a superhero in your organization—a high-performance operator.

Whether maintaining a water treatment, distribution, water collection, or wastewater system or plant, operators are a critical part of providing an adequate and safe supply of water. Today, operators face ever-increasing process complexity. In small plants, a single operator might be responsible for maintaining all the treatment processes and equipment. It's a stressful job, and mistakes can cause emergency situations, such as leaks, spills, equipment malfunctions, and dangerous safety and health conditions.

Mistakes are made for various reasons. According to the UK-based organization Health and Safety Executive, one type of mistake is knowledge-based, which occurs when an operator doesn't accurately interpret a situation, either through poor training, biases, insufficient information, or information overload. A rule-based mistake occurs when the wrong rule is followed, often with confidence. In addition, slips or lapses can occur when a task is familiar and requires little thought or when an operator confuses similar tasks and gives the wrong response.

BECOMING A HIGH-PERFORMANCE OPERATOR

Poor-performing HMI screens are cited as significant contributing factors to mistakes. ANSI/ISA-101, *Human Machine Interfaces for Process Automation Systems*, is a standard that addresses how information (not just data) is presented to operators. The standard consists of recommendations for providing an operator with the visualization tools and information needed to improve safety, quality, productivity, and reliability. Consider the following suggestions:

Simplification. Simplification allows an operator to save time and better resolve problems and alarms. Simplification can be done in various ways. For example, operators can eliminate "noise" with basic shapes and a basic color palette; use colors only to highlight defects in critical process areas; repeat basic shapes for common objects like pumps, wells, and motors; and simplify pipe drawings to highlight primary flows. Another option is to implement an equipment model so trending, knowledge performance indicators (KPIs), and alarms are shown in context with the appropriate assets and equipment.

HMI vendors and integrators typically provide customers with a library of smart objects that can be duplicated across multiple screens, providing a standard way to visualize common objects. ANSI/ISA-101 suggests shelving as a way to silence nuisance alarms without shutting them off or disabling them, leading to a safer work environment. KPI cards transform data into information, helping operators quickly understand the process.

A High-Performance Mindset

The ANSI/ISA-101 standard addresses how information (not just data) is presented to operators.

1. **Follow standard color palette.**
   Start to simplify the interface.

2. **Confirm standard navigation.**
   Introduce equipment model navigation.

3. **Enable card style control areas of each process.**
   Build library of objects for easy rollout.

4. **Develop alarm philosophy.**
   Notify on the most critical events.

5. **Enable full KPI cards.**
   Transform the information that helps an operator understand the process with a glance.

Dashboards. Many long-standing HMI systems start with an overview screen covered in titled buttons or laid out as geographical icons on a map. This approach works well when data are minimal, but as complexity grows, it leads to productivity loss and increases the risk of missing an alarm.

An HMI dashboard, as shown in the accompanying figure, can turn raw data into useful information that's easily seen and understood. A well-designed dashboard is a combination of live and historical data with situational awareness. Through the use of a limited set of intuitive and recognizable colors, operators can easily spot alarms and actionable conditions.

Alarms and Trending. Alarms are often represented in an alarm summary that dictates an operator's necessary actions. Alarms are always stored and viewed through the alarm summary, but alarm thresholds are an important way to optimize conditions. Occasionally, operators may find themselves disrupted by unexpected alarms in which the culprit is often a large list of data values that take up valuable HMI real estate without providing any context or situational awareness. To increase productivity, operators can display such lists in gauge form to show where the value is in relation to the optimal range, along with the alarm thresholds.

Trending is used to analyze circumstances such as a heavy rainfall or a failed piece of equipment. Trending can also be used to compare different control outputs and find similarities. Operators have different ways of searching for the data they need. For example, they can reach outside their SCADA systems, which can be out of context with the real-time information provided by the HMI. Operators typically study KPIs such as chlorine, pressure, and storage levels. It helps if the HMI screen shows a four-hour trend adjacent to a gauge that displays a current value with alarm and operating limits. The alignment of objects is also key, as most people in the Western world visually track in a "Z" shape—left to right, then down the page.

Process Rings. Process rings show a situation's status. Operators can incorporate these rings into their HMI by combining two or more related process values. For example, process rings can be used to display the status of water filters. Different rings can represent flow, pressure, and turbidity. When the rings are presented in a layout with other filters, operators can recognize different conditions at a glance.

Navigation. With smartphone applications setting a fast pace of technological change, operators may expect to navigate their HMI the same way. A common example found on most mobile websites is the so-called "hamburger button," consisting of three horizontal lines that resemble a hamburger in a bun. This approach is used to implement a tiered HMI navigation schema that takes up little space and offers a common and easy way to browse process areas with less mouse clicking.

TRY A NEW APPROACH

Many utilities only conduct a SCADA HMI upgrade occasionally. As a result, screens present stale and unproductive information to which seasoned operators have become accustomed while new operators find it difficult to learn, leading in both cases to mistakes. If it's time for an HMI overhaul, consider an approach that limits colors, removes complexity from screens, and changes the way you interact with your processes.