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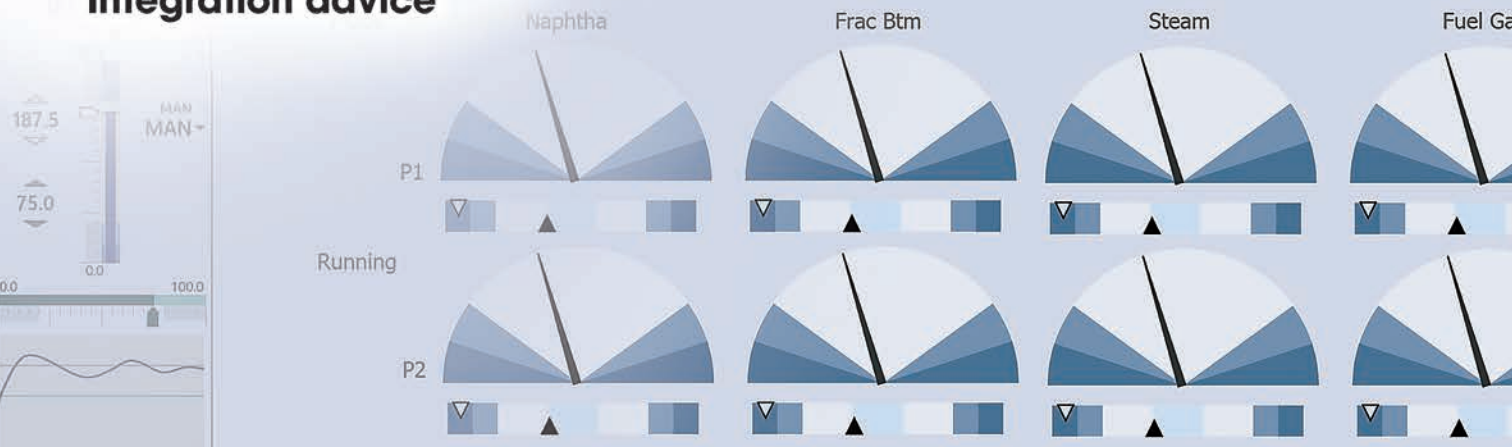
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Three elements of a modern HMI for improved operations

Advancements in human-machine interfaces (HMIs) lead to increased productivity, simplified graphics configuration, and mobility.

Today, operators are being asked to do more and consider more data in their decisions. When a human-machine-interface (HMI) is designed based on best practices and guidelines, it can help improve how operators process information and improve operations.

In a control system, the HMI is a gatekeeper that prevents operators from being inundated with data and a guide for performing safe actions.

Trends in the automation industry are leading to HMI developments that improve process safety and operations in facilities. HMI improvements in areas such as human-centered design (HCD), graphics configuration, and graphics portability enable engineers and operators to become even more productive.

At the heart of HMI development is HCD research that includes teamwork among automation designers, academia, and users. One group performing this type of research is the Center for Operator Performance (COP), a research consortium that addresses human capabilities and limitations through research, collaboration, and human factors engineering. With the solid foundations of research and user testing, an HMI can be designed that is fit for modern requirements.

Designing an HMI from the ground up, rather than tacking on a pre-built HMI, means less configuration rework later and native integration with the system, simplifying the process for engineers and operators.

HMIs can increase productivity

The distinction between effective and ineffective displays is how the data results in actionable information. Modern HMIs are designed with the following HCD principles in mind to deliver a highly efficient operations experience centered around the users' needs.

Visual attention: What items do operators notice, or not notice, on a screen that they interact with on a shift? The answers impact how automation and process challenges are overcome and how potential costly errors are handled. For example, research shows advantages to using muted colors across most of the screen and saving more salient colors to attract operator attention to abnormal situations (Figure 1).

Pattern recognition: The use of patterns in displays improves the speed and accuracy of an operator to assess conditions. In a traditional interface, the operator needs to read and compare numbers. Modern HMIs use familiar patterns (Figure 2) so the display itself becomes information that requires less interpretation.
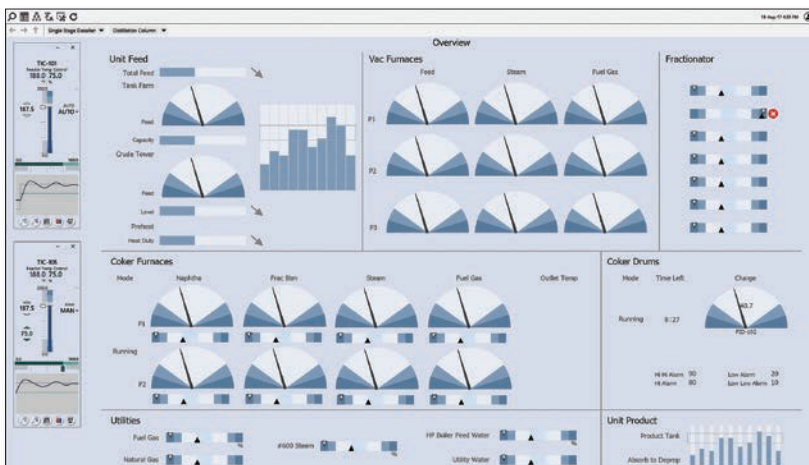
Figure 1: In Emerson's upcoming DeltaV Live Operator Interface, previewed at Emerson Exchange in October 2017, operators find alarms easily and determine status quickly with use of color and pattern recognition. Note the fractionator in the alarm. All graphics courtesy: Emerson Automation Solutions

Display navigation: With operator spans or boundaries of control increasing, operators often must navigate through hundreds of displays. Best practices recommended by the Center for Operator Performance and standards by the International Society of Automation (ISA) suggest organizing displays into a hierarchy of information, based on equipment areas. The purpose of the hierarchy is so that an operator can quickly access the display needed and take appropriate action.

Unfortunately, the hierarchy is not always adopted because most HMIs have not been designed from the ground up for hierarchical navigation and don't offer efficient tools to create them. Modern HMIs can simplify the hierarchy-creation process.

Simplify graphics configuration

The demands for control system HMI functionality and display complexity continue to increase. However, graphics configuration tools have not kept pace with what is needed—quite often requiring engineers to use programming languages to create complex graphics solutions. This is changing with modern HMIs, which are designed to enable engineers to easily create an HCD-based environment. These environments allow operators to be more productive and optimize operations overall due to the following.

Less reliance on scripting: Graphics configuration should not require a degree in software programming to create, tailor, or adapt to different operational philosophies. Users expect a more intuitive interface when configuring displays that need little, if any, programming and allow project schedules to be met with certainty. HCD principles enable certain tasks to be simplified, such as those involving scripting, and provide graphics configuration tools that deliver complex functionality without requiring volumes of scripts.

Tailorable by the operator: Rather than an engineer configuring displays for all operator tasks and the operator having to wait for the engineer to implement changes, manufacturers are giving the operator more power. An engineer can configure the operator's workspace to allow the operator to customize portions of it as required.

Change management: Equipment changes and control strategies evolve throughout the lifecycle of a facility. Displays must be modified accordingly. Modern graphics tools can provide built-in, user-friendly capabilities to reduce the amount of time required to configure displays.

Displays outside the control system

To meet changing user expectations, system information is needed more frequently outside of the control room and on interfaces other than an
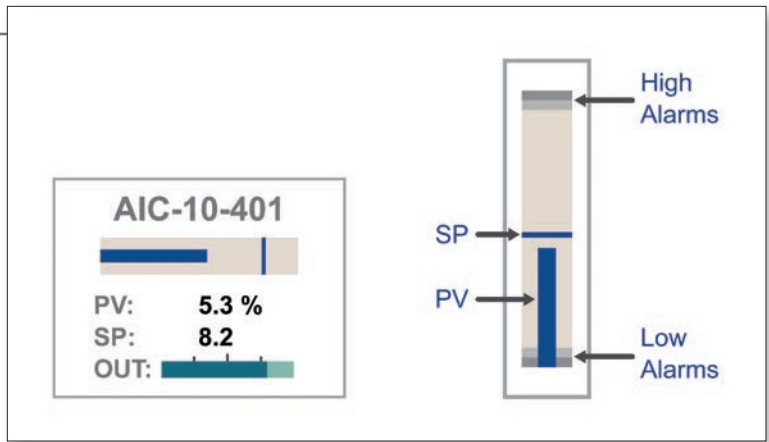
Figure 2: Two forms of improved loop representation that simplify the operator's task in determining status.

operator's workstation. The interface must meet the needs of workers who are accustomed to having information at their fingertips virtually anywhere.

However, increasing concerns around cybersecurity have created new requirements and have made it more difficult to securely send process control information outside of the control room. Modern control systems have added network layers of protection along with other security protections. Modern mobility solutions are designed based on these more secure architectures and can provide viewing access easily, without having to convert displays into new formats.

Older control systems often were not designed or installed with these cybersecurity requirements in mind. In response, previously available access to remote displays is being disabled, even though plant personnel still need access to the system's information.

Modern HMI designs build mobility into displays so they can be adapted to the evolving needs of different plant environments and be scaled over time. By implementing systems with secure display portability now, facilities will not have to redo them later to incorporate mobile device accessibility.

When the control system's HMI meets the needs of operators and engineers, operations as a whole naturally improves.

Operators can recognize issues faster, easily process information, and readily adapt to changes. In addition, through HMI advancements, engineers can adopt industry graphics standards and best practices more easily. Operating the process becomes safer, more intuitive, and effective by improving situational awareness and turning data into useful information, allowing operators to make assertive decisions—quickly and easily. **ce**

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