PLANT OPERATOR CONSOLES: KEY TO GREATER OPERATIONAL EFFECTIVENESS
Latest technology advancements help improve productivity, efficiency and safety

White Paper
Abstract/Introduction

With today’s complex technology, plant operators are busier than ever. They have a myriad of tasks to complete during a normal shift, which can make it difficult to take the right actions at the right time. Many plants suffer from inconsistent response to upsets and incidents. The workload placed on operators also limits their role in achieving production key performance indicators (KPIs) for efficiency, quality, safety and production.

The typical process plant has multiple repositories of data, and the volume of data is increasing each year and becoming more fragmented. There is a growing need to bring all this information together and make sense of it, and make faster and better decisions.

Forty years ago, industrial facilities moved from individual panel boards to Distributed Control Systems (DCSs) to improve their operations. A similar transition is occurring today, as a new breed of Human-Machine Interface (HMI) delivers better information in better context, so operators can make smarter decisions and run closer to process limits for longer periods of time.

Modern plant operator consoles bring together several technologies – large ultra high-definition screens, improved ergonomics and enhanced display formats – to increase situational awareness, reduce operator fatigue, increase worker mobility, and enable operators to react more quickly to changing plant and process conditions.
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Background

Data about plant performance is key to making smart operational choices, but in most cases, operators have access only to piecemeal information about their units and processes – examining performance without a view to the larger picture of operational targets or safety issues.

The current economic climate is pushing plant management to dramatically improve the quality and efficiency of their production processes. Fundamental economic and regulatory forces are unrelenting in punishing industrial organizations that fail to make sound operational and business decisions.

Any business running a process plant wants to maximize asset uptime, reduce maintenance costs and avoid unplanned outages. Operational excellence is becoming an expectation and not just a buzzword in the industry. This requires a clear understanding of the facility’s process variables, operational constraints and production targets.

Demands on Plant Operators

In addition to assuring the plant or facility remains within its desired operating limits, control room operators must be able to quickly and safely respond to – and recover from – all abnormal events and situations. Modern manufacturing facilities require professionals who can run processes in the safest, most efficient way possible.

The responsibilities of plant operators continue to grow:

- Working grueling 12-hour shifts
- Dealing with large numbers of displays with an enormous amount of data
- Responding to hundreds of alarms that need to be managed.
- Running the plant within multiple different operating limits
- Executing procedures that may not have been undertaken for years

Control room personnel routinely deal with conditions affecting the safety and productivity of the facilities they operate. This can include an increase in alarms, uncontrolled changes to the process, poor performance due to inefficient control strategy configuration, and missing information on the status of automation and the health of the control system in general.

A key role for operators is ensuring companies realize the utmost value from production assets. They are now required to have a greater business focus, which means assuming responsibility for everything from quality to cost issues.

Unfortunately, plant control room environments are often poorly designed, with operator stations and human-machine interfaces (HMIs) unwelcoming and uncomfortable at best – and at worst a recipe for operator fatigue and reduced effectiveness.

Further complicating matters, seasoned operations staff are retiring in large numbers, and industrial firms are finding it difficult to recruit new employees willing to work on legacy equipment lacking modern ergonomic and human-centered design principles.
Industrial facilities can employ advanced operator console technology to eliminate islands of automation, move to a distributed environment, and involve more people in the decision-making process.

Advancing Console Technology

The challenge for designers of control room consoles remains a balancing act: How do you present operators with all the information they need, while excluding what they don’t? Raw data, alarms and other inputs must be transformed into actionable information in context in real-time – easily interpreted in an integrated environment regardless of source.

Using the control room HMI to make business decisions based on large amounts of available data and deliver cost-effective solutions to the operation has led to fundamental changes in work processes.

Leading automation suppliers like Honeywell Process Solutions have developed advanced operator consoles with direct consideration of human factors. Their goal is to elevate operators to a new level of capability that eliminates complexity – allowing them to get the information they need in context to make better decisions. This is an innovative approach that delivers better operational performance with fewer control room stations.

The new generation of console has been designed to improve operator effectiveness over a greater scope of responsibility. It employs a combination of technologies to increase situational awareness and enable faster response to changing conditions:

- Large, ultra-high definition screens allow flexible layouts of overview and detail displays as well as related applications and video
- Advanced display technology integrates operating limits and targets directly into overview displays for at-a-glance status assessment and process operation closer to the optimum
- Predetermined displays for context-specific process issues, advanced alarm management, pan and zoom and touchpad capabilities allow better prevention and analysis of abnormal situations
- Ergonomic designs improve operator comfort and reduce fatigue

There is an ongoing effort to increase the effectiveness of industrial personnel with solutions that will enable maximum output from operating units while being intuitive and responsive even when upsets, outages and other incidents occur. This is all about reshaping the control room experience by bringing together innovative software and a world-class design within the latest operator consoles.

Latest Design Enhancements

Honeywell is a leader in the automation industry when it comes to advancing operator console and HMI design. The company’s Experion® Orion Console was designed based on operator inputs generated from numerous visits to plant control rooms around the world and across industries, in both newer and older facilities.

Intended for the upgrade of legacy control room equipment to protect the user’s intellectual property investments, the console’s footprint allows older Honeywell consoles to be replaced in place without the need for additional floor space. Existing HMI, user station and process displays are supported to avoid expensive rework.

The Experion Orion Console was specifically developed to help process plants operate at the optimum limit for longer periods of time. Its technology also meets the growing need for remote operations, accommodating a single operations center that can monitor and interact with process equipment hundreds or
even thousands of miles away, and allow the centralization of operations and expertise.

For example, the Experion Orion Console is capable of integrating key planning, environmental or safety limits from a robust limit management application. Limits are available on the process trend, faceplates and process graphics. Whatever operators are doing, they are made constantly aware of the optimum operating range and other limits as they are approached. The console’s limit support features provide comprehensive real-time information in context on the impact of any limit and the exact steps to address it. This is in contrast to existing approaches where limits are communicated periodically by email, in spreadsheets on the business network, or even written on a whiteboard.

The Experion Orion Console was designed based on operator inputs resulting from visits to plant control rooms around the world.

The Experion Orion Console facilitates better management of abnormal situations by enabling the operator to detect these situations sooner and take action more quickly. A single visual workspace provides an uninterrupted view of all key information. For instance, an overview display with crucial economic- and safety-related data can be permanently displayed so the operator never loses situational awareness.

Honeywell’s console also fully integrates a wide range of applications to minimize loss of situational awareness. Unlike the typical practice of hosting applications on a computer apart from the console, this solution unifies information from business applications, external historians or advanced process control. The application interface can be invoked and shut down as needed and will only run in nominated windows. It never interferes with the operation of the process control system. While using applications, complete situational awareness of the state of the process is maintained.

A built-in feature known as orchestration allows a full set of process displays to be called up with a single action to allow the operator to quickly address any issues that have arisen. Such a technique contrasts with having to call up displays one-by-one on a traditional console.

The console’s alarm help integration features allow operators to access comprehensive information on the optimal response for every alarm – updated in real-time from the alarm management application. The information can be obtained with a single click from any place on the system, including the alarm summary and process/system graphics. This is a dramatic improvement over looking up information in potentially out-of-date manuals, drawings or on separate systems.

The Experion Orion Console also utilizes modern touch panel technology (an optional keyboard is available). With a single touch action on the touch panel, operators can both identify and select the parameter to be changed. This is much more direct and faster than scrolling, clicking and selecting in the traditional manner.

Having all critical operational information effectively integrated into the control room console means operators can shift their focus from process manipulation and logging to decision-making that drives improved business outcomes.

**Human Factors Improvements**

Human error is much more common than equipment failure in most industrial facilities. Consequently, the development of an optimized interface between the processes, the equipment being controlled and the operators is vital for ensuring productivity, safety and operability to avoid adverse impacts on people, the process or the company.

Ergonomics involves the interaction of human factors (the physical and mental capacities and limitations of the worker) with the machines and equipment in the work environment. It requires an understanding of
Experience throughout the process industries has shown that the design of control systems in production plants directly impacts the likelihood of human errors by operators.

All aspects of how employees function and how they interact with various tools and systems when performing their normal duties. With this understanding, day-to-day tasks can be performed in a safe and efficient way.

The design and selection of the control room console demonstrates the key advantages of ergonomic design. Console operator productivity and safe operation of the plant depend on careful consideration of the selection, layout, and design of the tools provided to the operator.

The Experion Orion Console is based on direct consideration of the human factors in control room operations. The console complies with ergonomic guidelines such as ISO 11064 for operating position, screen location and workspace height. The look and feel of the console is lightweight and contemporary to optimize the control room work environment.

To address operator fatigue and the related reduction in effectiveness, especially during long night shifts, Honeywell designed its console with both sitting and standing operating positions. There are two or three position options depending on the number of screens and keyboards the operator requires. Actuators are used to raise or lower the work surface and screens to a pre-configured or a manually selected height. In addition to reducing fatigue, working from a standing position also mitigates potential health and safety concerns from extended periods of time spent seated.

The consideration of human factors in the console design is extended to the installation of cables and other equipment. Easy access for wiring simplifies installation and maintenance. Replacing a monitor can be done in much less time than it takes on a traditional console.

The Experion Orion Console has also been designed to be future-proof so there are no dependencies on specific form factors or size of monitors, computers and thin clients. An integral auxiliary equipment unit is used for panel-mount hardware such as hard-wired switches, radios and public address systems. Different options of the unit support consoles in both a curved and a straight alignment.

It is important to advance console functionality while applying human factors to increase comfort for people.

In addition, an alarm light panel mounted on top of the console changes color using subtle fixed illumination to provide an indication of the current alarm state of the console. This can be seen from anywhere in the control room allowing the operator to leave the console to assist a colleague while maintaining situational awareness. At a glance, everyone in the control room knows who might need help. This visual alarm indication is an alternative to the disruptive audible annunciation and further improves situational awareness and the ability to deal with potential problems.

Together, these design characteristics keep the operator efficient, comfortable and able to run the plant most effectively.

Proven Operating Advantages

Following the launch of the Experion Orion Console, Honeywell enlisted a qualified third-party to conduct a comprehensive, validated study of the console in terms of learn-ability, performance, usability, and acceptance involving plant operators experienced with its TDC 3000 Universal Station. The study was limited to personnel with an average of five years experience on the legacy console and no prior experience on Experion consoles.

Operators were given two hours of training on the Experion Orion Console, and then asked to perform a range of operational tasks on both the new and legacy consoles in a “within subjects” study design. The testing metrics analyzed the time to complete tasks, task rate, usability, and operator acceptance.

The study found that operator performance
and response to the Experion Orion Console was overwhelmingly positive:

- Performance of the Experion Orion Console was better than the legacy console on all operational performance metrics analyzed
- Usability of the Experion Orion Console rated at 92 out of 100 compared with 64 for the legacy console
- Operators reported a very high level of acceptance of and enthusiasm for the Experion Orion Console

The Experion Orion Console outperformed the legacy console with operators who had an average of five years experience on the legacy console, but only two hours experience on the Experion Orion Console. Performance on the Experion Orion Console would likely improve further as operators become more familiar with it – especially for more complex interactions such as parameter/mode changes.

Benefits to Industrial Firms

Today’s advanced console technology offers a complete solution to improve operator performance: A common, high-performance HMI; advanced alarm management; easy and intuitive navigation, real-time, actionable information; training simulation; and ergonomics. The entire control room environment can be delivered in a single, integrated system with a choice of ready-made embedded functionalities.

The specific benefits of modern console design include:

- Improving situational awareness and control across the process
- Controlling a plurality of systems with minimal effort, and maximum productivity and safety
- Operating all applications and processes through a single common HMI
- Achieving efficient production transitions with limits and targets built into overview displays
- Expediting response to potential or actual abnormal situations
- Meeting HSE requirements and reducing fatigue-related absences
- Enabling quick access to remote facilities and systems if necessary
- Implementing out-of-the-box console furniture integrated with control software
- Enhancing reliability and redundancy capabilities
- Optimizing control room collaboration
- Simplifying maintenance and infrastructure scalability
- Reducing installation and maintenance costs

Experience has shown the correct ergonomic console set-up helps reduce operator fatigue, improve focus and increase performance. It is important to advance console functionality while applying human factors to increase comfort for people.

Conclusion

The need for improved productivity, efficiency and safety in the process industries is more prevalent than ever: customers, shareholders and business partners demand it. Because the HMI is the operator’s window to plant processes – and profitability – an effective operator console is critical to business success.