

Improve Operations Performance



Six Approaches for Reduced Cost and Improved Productivity

DELTA V[™]


EMERSON[™]
Process Management



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Where to Begin With Cybersecurity Implementation When it Impacts All Areas of Control

Discover best practices to methodically reduce cyber threats from your process.

We have all read about high-profile cyber-attacks. Recent events have made it plain that cyber-attacks are increasing in scope and sophistication. Everyone is vulnerable — personally and professionally. Attackers need to find just a single opportunity, and there are no signs that the practice will stop.

What many in our industry may not know is that protecting process control systems from a cyber-attack is not a one-time endeavor. Protection must be in place all day, every day and be improved on consistently. Even after cybersecurity improvements are in place, each employee — regardless of job title — has an impact on system security.

Therefore, we are on a path together. From now on, control system cybersecurity is not a single project. It is a daily challenge. For cyber-protection to be effective, we must pay constant attention to control system cybersecurity measures and how they are installed, maintained, and enforced.

“There is a global cybersecurity labor epidemic. More than 200,000 U.S. cybersecurity jobs are unfilled. The cybersecurity workforce shortage is expected to reach 1.5 million unfilled positions by 2019.”

— *Forbes: The Business of Cybersecurity*

Vigilance against Cyber-Attacks

The effects of a cyber-attack are painful, but they are separate from the pains of anticipating and protecting against cyber-attacks. In trying to be secure, many in our industry have experienced the expense — both with respect to capital and human resources — of calculating and implementing plans.

Security issues halting operations — Facilities cannot allow security improvements to disrupt production or shut down the plant because output relates to profitability, and yields must be met. Where should resources be spent: gaining the knowledge required to recover after an attack or spending time securing the environment before an event? Understanding your options is required for a complete risk assessment.

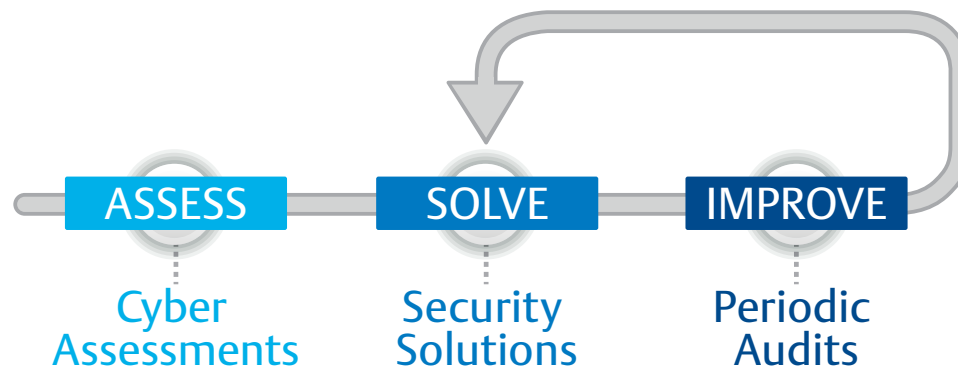
Compliance difficulties — The operations department must meet customer requirements, implement corporate mandates, and adhere to industry standards related to cyber security. But if the group does not have expertise, they lack understanding in implementation. All these activities cost money with no immediate visible or tangible return.

In developing and implementing tactics, sometimes Information Technology (IT) policies do not make sense in the operations environment. And when the corporate IT group follows standards, they might not take into account operation's needs. Operations wants continuous production, while IT does not face the same uptime goals.

No in-house expertise — Obtaining and retaining the right cybersecurity knowledge is difficult, especially if the company culture has other priorities. A culture change is required to embed cybersecurity into everyone's job. Few people have time to add to their regular responsibilities, plus cybersecurity is a new combination of expertise areas.

Emerson's Cybersecurity Solutions Help Improve Operations Performance

While it is possible to strengthen process control systems and reduce risks, no organization can guarantee security. Everyone wants cybersecurity, but there are no easy solutions. Cyber-threats, viruses, and malware evolve fast. Our countermeasures must evolve as quickly. Emerson's cybersecurity strategy simplifies the process into a continuous three-step process: assess, solve, and improve.



Emerson's Cybersecurity Management is a complete solution that fosters a continuous improvement and maintenance cycle.

The cyber assessment forms the foundation of the action plan and determines the hardware and software solutions. The cycle continues to improve cybersecurity posture until the customer's risk tolerance is achieved.

Maintain Production

Emerson has developed a cyber assessment to determine system vulnerability to a potential cyber-attack. The cyber assessment highlights potential blind spots, prioritizes issues to be mediated and addressed, and suggests improvements. Through this assessment, resources are freed up to do their jobs while increasing reliability.

As the requirements for cybersecurity have evolved, Emerson's internal processes for developing and securing the DeltaV™ distributed control system (DCS) have also evolved. Each DeltaV version delivers improved cybersecurity features; continuously upgrading your control system ensures greater security throughout your plant lifecycle.

Emerson solutions are built for purpose so you can continue to be measured on output and profitability while your system is protected. For example, the DeltaV hardened workstations are defined based on industry benchmarks and operational system recommendations so that only specific services and communication ports are enabled. Disabling USB ports is a good example of best practice that can be considered to avoid cyber-attacks coming from possibly infected removable media.

Emerson's expertise helps ensure your system is designed, implemented, and maintained more securely. Solutions and services deliver a defense-in-depth strategy to secure your critical infrastructure. DeltaV features such as system hardening, network lockdown, and intrusion prevention drive system availability. Plants, therefore, run as designed with fewer disruptions.

Recommended practices can be put into place to dramatically reduce cyber-threat risks. In case of a cybersecurity issue, there are processes ready to help reduce downtime, such as the Backup and Recovery process which help customers recover workstations and servers quicker than reinstalling everything from scratch.

Meet Internal and External Requirements

The most effective plans must be tailored to each company's situation and budget. When cybersecurity plans are tailored to the situation and are guided by industry standards, the

result is a cost-effective solution that fits within production schedule and business priorities.

Cybersecurity standards are growing in number and complexity, and corporate IT standards are increasingly pushed to the control system layer. Emerson simplifies the deployment of best practices to enable alignment with both emerging standards and internal policies. Emerson continuously updates and publishes DeltaV System Security best practices as the threat and standards landscape evolves.

Whether securing new or existing facilities, best practice alignment begins with the cyber assessment. The assessment results paint a picture of gaps in your attack surface, leading directly to best practice solutions with DeltaV hardware, software, and services. When an audit procedure is created, Emerson works with the IT department so they understand and approve it. In that way, the compliance plan meets both operations and IT goals.

Develop and Grow Expertise

Very few organizations have the expertise to complete a cybersecurity assessment, plan, and implementation. Working with Emerson allows you to leverage global expertise to develop and grow your internal processes and knowledge base. For example, Emerson's securely layered reference network architecture can be used as a starting point to create or adjust internal guidelines or processes. Moreover, secure remote access can be achieved by using built-in features without exposing the control system to unauthorized outsiders.

Emerson's expertise and best practices help to drive standards. We share expertise with our users to encourage their in-house knowledge and experience with the system built-in security features, such as smart switches and firewalls.

Emerson Can Strengthen Your System's Cybersecurity

We invite you to contact us for information about this critical and ever-changing topic. From the initial assessment through implementation, Emerson helps users reduce their staff-expertise requirements and can assist with training and support.

Learn more at www.emersonprocess.com/operationsperformance



Minimize Risks and Maximize Operational Effectiveness by Improving Communication

Electronic logbooks streamline shift handovers, ensure accountability, and increase situational awareness.

Every day, multiple people in multiple locations use your facility's automation systems. How do they share information about what events have occurred and how they have responded? No simple task. Control rooms are full of paper logbooks in which operators have recorded events and documented their responses. Page after page, book after book, filled with important knowledge – only useful if someone can find the right entry and decipher the handwriting.

At an extreme, tragic events can result from missed communication. More common, are the general headaches around manual shift logs that can result in inefficient day-to-day operations. Unless carefully managed, data tends to get lost in the paper trail. Facilities see productivity eroded and profits drained through errors brought on by these painfully routine conditions:

“Sixty percent of all accidents or serious incidents occur within 30 minutes of a shift change, or as a direct result of poor or incorrect shift handover information.”

— St. James Software

Poor shift change communication — Inadequate knowledge sharing at shift handover negatively affects safety, product quality, delivery, and throughput. Manually transferring information to the new shift personnel is error-prone, and important items can be easily misinterpreted, improperly prioritized, or simply missed.

Confusion in assignments and accountability — In some facilities, operators cannot focus on the key activities because they are unsure of priorities. As a result, they often must react to situations rather than actively manage their responsibilities. At the end of a shift, the supervisor must ensure that scheduled tasks were completed, difficult at best when logbook entries are manual and inconsistent.

Difficult-to-share knowledge — Operators often cannot find key historical information in a series of paper notebooks, used to keep track of essential information. In addition, this unsecured, hard-to-read, and unreliable format is nearly impossible to share across the plant or with different facilities. Further prolonging problem solving and increasing the risk, context is missing from operator observations and process equipment data.



Tired of incomplete, hard-to-read paper log books? Automate your event logs and integrate them with your control system.

Achieve Better Visibility and Improve Operations Performance

Imagine an ideal shift change where the incoming operator fully understands what happened in the previous shift. No looking for a hardcopy logbook, no digging through unrelated information, no tagging pages. A unique tool, Emerson Logbooks exists today with the convenience of a browser-based application that captures electronic records of operator activity.

Minimize Shift Handover Risk

Setting a consistent, compliant shift handover process leads to minimized risk and increased operator effectiveness. With Emerson Logbooks, incoming operators have insights into events and issues from the previous shift via a shift change dashboard, shift status reports, and summary reports. These tools streamline shift change meetings and assist in compliance with documented communication between shifts. With accurate documentation in place, everyone can be confident tasks are not lost in the shift transition.

Drive Operator Action through Improved Task Management

Supervisors can use Logbooks to set and manage priorities by assigning tasks to an individual user or to a group. At login each operator is presented with a list of tasks, or “pre-flight” checklist, for the shift. The operator has a simple graphical interface that clearly presents priorities, offering greater visibility to the tasks that need to be done. Tasks do not go unattended and are recorded in the electronic paper trail. Operators act with the confidence that they are completing the correct tasks.

In addition to pre-defined task lists, personnel can generate ad-hoc tasks based on production asset health. When the list is integrated with repair work and order generation, plant operation is smoother because there is a stronger link between operations and maintenance departments.

Accelerate Decision-Making with Collaboration and Shared Knowledge

Because Logbooks presents an electronic historical record, operators have a plant-wide knowledge base, searchable across multiple logbooks. With that capability, similar past issues can be reviewed and current issues are quickly resolved.

For ease of access, Emerson Logbooks consolidates information onto a single screen and offers easy-to-add meta-data so that operators have the context needed to resolve issues.

Searches are productive because the information has embedded data structure and time stamps. When integrated with a distributed control system (DCS), such as the DeltaV system, information from Logbooks is viewed within the context of current process events — delivering greater visibility to critical production alarms and events, including process deviations.

Operators can collaborate across shifts, plant areas, or facilities to solve problems faster. Armed with easily accessible key information and historical knowledge, operators and supervisors can react to issues more quickly and accurately.

Contact Emerson for Efficiencies that Come with Knowledge

When you implement Emerson Logbooks with your automation system, you realize how important accessible, consistent knowledge is to operational success. We look forward to working with you and your organization to equip personnel with focused information — current and historical — to develop and maintain highly efficient and safe operations.



Assuring a Successful Operator Response to Alarms

Good design is the key to avoiding stale alarms, alarm floods, inaction, and incorrect action.

Operators around the world want their shifts to go smoothly. They want to help avoid dangers to the process, equipment, and people around them. And in times of crisis they want answers. But guidance and successful operator intervention is sometimes difficult — especially when alarm management has not been well designed.

Today's control systems require little effort to set conditions that raise alarms. In addition, alarms are often set for conditions that are purely informational, where there is not a problem requiring operator intervention. As a result, more and more alarms are generated. In this environment, operators can be overloaded by, or even become complacent about, alarms. All too often poor alarm management design leads to alarm floods — many alarms occurring in just a few minutes — where operators can easily miss critical alarms, respond too late, or respond incorrectly during a plant upset, raising the prospect of an accident or unplanned shutdown.

Regulatory agencies (OSHA, USD Safety, UK Safety Executive, FDA, and others) increasingly have stepped in to review process plant alarm management practices, using checklists based on standards such as EEMUA-191, IEC 62682, and ISA-18.2. In addition, some insurance companies check alarm system performance against these standards to determine a facility's risk profile and qualification for coverage. They need documentation and assurances that all is well.

Severe and often overwhelming alarm floods continue to be a serious problem. In an Emerson study of actual system event records for 326 systems in 2014-2015, the peak number of alarms observed in a ten minute period averaged 270 alarms.

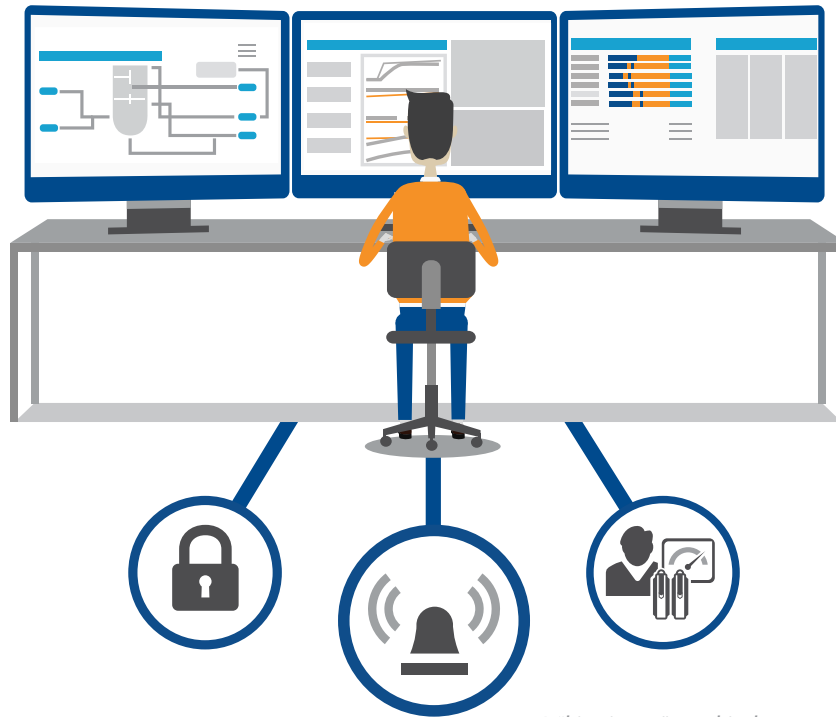
— Emerson Process Management survey

Many demands exist for well-designed alarm management, yet few facilities meet the needs adequately. Alarms will continue to be a source for operational pains if these conditions continue:

Operators cannot manage poorly designed alarms — If the automation system does not direct the operator's attention to key events, plant safety and operation are at risk. How can operator intervention be successful if the system presents too many alarms at once? Problems also can include stale alarms that go unresolved for days or weeks or false alarms that are considered normal. Usually, both are ignored and become background noise. And unfortunately, most facilities are familiar with alarm floods, making it difficult to know which actions to take.

Knowledge is not transferring — When alarms happen, knowledge is the operator's most important asset. But sharing knowledge among operators is often ineffective. For example, in an alarm situation, junior operators might not have the experience to quickly gain situational awareness. Difficulty also arises during shift handover when the incoming shift needs a complete picture of process disturbances that have recently occurred. Not knowing the alarm timeline and not possessing trustworthy information and guidance lead to continued errors and inefficient operations.

No accountability for alarm modifications — To mitigate operational risk, alarms must be functioning in an expected (controlled and documented) manner, which is often not the situation. Over time it is common to observe unmanaged — and even well-intentioned — changes being made to alarm limits, priorities and other settings, including the indefinite removal (suppression) of alarms from service. To ensure ongoing effectiveness of the alarm system, change management must be in place with transparency and accountability.



A “big picture” graphical pattern equips operators to manage alarm floods effectively and identify root causes accurately.

Human Understanding in Alarm Management

Dealing successfully with alarms comes through experience, analysis, and research. Building on these sources, Emerson has created alarm principles that bring operational success for its users.

System in place that fully supports the operator

With the Emerson solution, many options are available to support operators in alarm situations. For example, the DeltaV™ distributed control system (DCS) is designed to eliminate stale alarms through conditional enabling of alarms based on related conditions, such as preventing a low-pressure alarm on a pump until an upstream pump has been on for sufficient time to generate the expected pressure.

And through its dynamic alarming ability, the system can eliminate alarm floods by detecting equipment malfunctions or process abnormalities and then suppressing or combining the resulting redundant alarms. But even if dynamic alarming is not configured for use at a facility, the DeltaV Alarm Mosaic can (with no configuration required) present multiple alarms in a “big picture” graphical pattern, so the operator can manage alarm floods more effectively, with built-in aids to help in root cause identification.

Educate operators and support them as they educate each other

The DeltaV alarm help system provides documentation to understand the processes for resolving alarms. With one-click access, operators can ensure a prompt and consistent response by calling up the consequence of inaction, the recommended corrective action, and the remaining time available to respond. And privileges can be given to experienced operators so they, during quiet times, can help write alarm help system content, effectively

capturing their knowledge and passing it on to others.

The DeltaV system, through the Alarm Mosaic, automatically provides an alarm activation history recall that enables operators to review alarms from previous shifts, including presentation of related control actions that preceded or led to their resolution. This assists with future alarm maintenance.

Improve alarm management through accountability and increased transparency

Operational certainty requires heightened awareness whenever alarms are removed from service. The DeltaV system distinguishes temporary operator alarm suppression — called shelving — from long term manual removal from service or suppression by designed logic, for increased accountability whenever any alarms are suppressed. Suppression reasons are recorded in event histories and presented to operators in dedicated suppressed alarm lists for maximum awareness. In addition, the system can efficiently and automatically audit alarms to provide operator or management reports. These reports show deviations from configured settings, such as an alarm’s threshold limit or priority.

Contact Emerson to Improve Operational Excellence through Alarm Management

Alarms can require a great deal of operator attention and can impact operational excellence directly. Letting alarm issues wait leads to operator frustration and delayed profits. Emerson has the tools to assist in immediate improvements to operational excellence. Contact Emerson to assist operators in a key part of their jobs: alarm management success.

Learn more at www.emersonprocess.com/operationsperformance



Improve Bottom-Line Results with Better Batch Operations

Improve quality and increase operational performance by providing operators with better batch insights.

With growing global competition, you're challenged to get your batch products to market faster, and in many industries, you're pressed to meet regulatory requirements; yet you need manufacturing flexibility to quickly respond to changing customer demands. Batch operators are absolutely critical to facility safety and product quality. When the operator environment is streamlined and operators have the tools they need to perform well, operations improve as do the product quality, scheduling, and reporting.

“Across the industry, we have found yield variations up to 30% from batch to batch and campaign to campaign.”

— McKinsey&Company Outpacing Change in Pharma Operations

Avoid Common Problems

Today's economic conditions along with safety and quality concerns demand confidence that your batch system helps you prevent these difficult situations:

Poor product quality — Almost every facility at one time or other has had to scrap a finished product run. Meeting product quality specifications at minimum waste is not only difficult, but can be very costly. If the final product quality was poor, you have many questions to answer. Were the raw materials of poor quality? Did your process have unforeseen deviations, such as too much or too little energy going to machinery? Agitator spinning too fast? Pumps running too hot? Temperatures drifting?

Missed deadlines — Equipment scheduling problems can be difficult and can lead to product delays. Some systems do not alert batch operators to opportunities to run multiple products through the plant or alert them to equipment limitations. If operators would like to coordinate production with other downstream operations teams, they might not know if it is possible.

Inaccurate or out-of-date reporting — Without dependable record keeping and report creation, you cannot reliably ensure correct electronic signatures for governmental agencies or for your own company's auditing requirements. In addition, you are not able to track and review batch process anomalies — a significant problem if you are not meeting quality and scheduling requirements. Maybe the issue is that the batch and reporting systems are not integrated with other business systems, such as Laboratory Information Management Systems (LIMS).

Effective Batch Tools Improve Operations and Deliver Better Bottom-Line Profits

A batch solution must offer easy-to-use tools that work with operators to deliver consistently high-quality products on time. It also must show that your team has used best practices in the creation and finishing of the end product. If the batch system delivers on those qualities, your facility will experience more streamlined and uninterrupted operations. You don't need to look far. Tools and techniques in DeltaV™ Batch are available from Emerson today to assist you.

Confidently Make the High-Quality Products You Require

DeltaV Batch Analytics helps you quickly identify an abnormal condition and gives you an earlier opportunity to put the batch back on track. Batches are managed more efficiently because the easy-to-use engineering tools help operators predict end-of-batch quality parameters, detect process faults in real-time, and determine reasons for deviations.

You minimize batch-to-batch variation and improve yield. For ease of use, Batch Analytics is web-based for real-time process analysis and adjustments. Although simple to use, Batch Analytics uses multi-variant analysis and modeling to provide strong reliable answers.



Reduce cost of design, implementation, testing and maintenance with consistent implementation.

Improve Operator Productivity and Increase Right-First-Time Performance

Emerson's DeltaV Batch Executive engine coordinates all batch processing activity, creates detailed batch history records, and schedules recipes and resources. By using it, operators will easily perform equipment arbitration and determine equipment ownership. In this way, the batch runs will avoid equipment conflicts and product cross contamination. Through the DeltaV Batch Executive, monitoring and scheduling are more efficient because operators can select equipment at run-time based upon given parameters, such as availability and cleanliness.

Operations will experience fewer surprises in batches. Seeing the big picture is clearer because equipment trains can be created that enable operators to group equipment together defining useful equipment boundaries. And with electronic logbooks, communication between shifts is more accurate and efficient. These functions enable operators to more easily see opportunities and stumbling blocks and make appropriate choices.

Simplify Record Keeping and Be Confident in Reporting Accuracy

Configuration changes by unauthorized users can lead to costly mistakes to your product and regulatory non-compliance. DeltaV Batch embeds version control and audit trail capabilities to automatically capture changes as they occur in the system. Record keeping is streamlined for an operator because it is automated as events occur. For example, during the execution of a recipe, DeltaV Batch can automatically generate batch history and store events conveniently to files that can be read by the

Batch Historian or viewed from the Batch Operator Interface for further detailed analysis.

And for easy reporting access and data archiving, DeltaV Batch enables web-based access to batch event and continuous historian information for anyone, anywhere using DeltaV History Analysis.

Accuracy and completeness are part of the solution. To ensure that end-products are safe and effective, organizations put regulations into place and Emerson assists users in compliance. DeltaV Batch fully supports compliance with the challenging electronic records demands of regulated industries for recipe and campaign management, batch history, automatic version control and change management, and electronic signature support. For example, to facilitate meeting FDA 21 CFR Part 11, OSHA, and ISO requirements, DeltaV Batch incorporates action confirm/verify via electronic signatures, with an additional verifier name and password if required—thus making sure that electronic records and signatures are equivalent to paper records and signatures.

Contact Emerson for Batch-Powered Operational Excellence

Because the DeltaV system is built for batch, the same intuitive features and engineering tools simplify and streamline your batch tasks. Please contact Emerson to find out how DeltaV Batch will help you succeed in improving operational excellence.

Learn more at www.emersonprocess.com/operationsperformance



Informed Operational Decisions Based on Multi-Sourced Information

Save time and effort with standards-based data connections.

Data management directly affects plant operations and productivity. To be used most effectively, data must be shared among control systems, manufacturing execution systems, and enterprise business systems. Too often, data is blocked from those areas due to disparate data types, data security concerns, or the expense of data mapping and data maintenance. Costs of data silos can be invisible, and they can pile up.

“66% of system integration projects were on time. 47% were rated as moderately effective.”

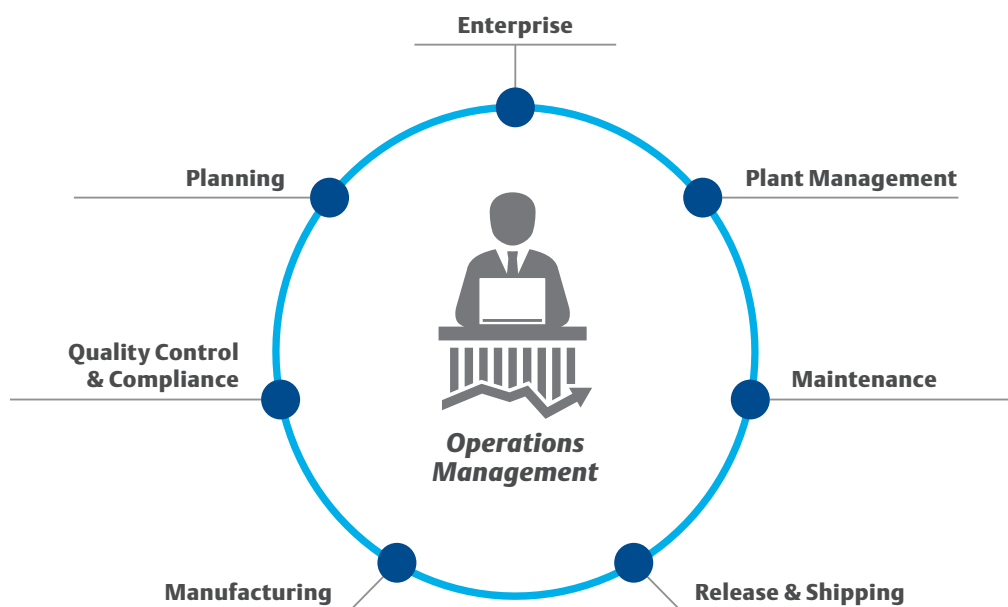
— Control Engineering, CFE Media, 2015 System Integration Study

Overall, operations and consequently plant profitability suffer from these issues:

Not Effectively Using Data because of Disparate Data Types — Field data is valuable when shared throughout the control system for control action, alarming, and operator decisions. Different formats, however, can make the data from various sources unusable to the control system. Engineers must determine the best way to bring the data into the system and present information to the operator. That takes time and research. If data management becomes a manual task, human error is introduced and can impact plant operations and production.

Cannot Easily Share Data between Management Systems and the Control System — Security and format issues sometimes block data between the control system and business systems, thus preventing important analysis. If data is lost or blocked at any step in the data-chain, your plant’s profitability will suffer. Engineers need to configure firewalls and manage different domains. After data is successfully brought into the control system, you still must manage user names, passwords, and data authentication and authorization.

Data is not Readily Used in Operations — After data has been successfully delivered to the control system, you must design the most effective visual methods such as user graphics, alarming strategy, and production reports to inform the operators and guide them to successful actions. You must understand how the data will be used in the process and consider how to present it in a meaningful way. This work can be time consuming filled with trial and error.



Operation Streamlined with Easy Data Sharing

When data flows among systems — from the field to the control system to the management systems and back — you understand the power of information influencing success. The DeltaV™ system was engineered to promote ease of connectivity. Once the data is in, the system treats it as native and streamlines the complete business process. All this is implemented within easy-to-use human-machine interfaces (HMIs).

Data Moving between the Field and the Control System

Using field device data in the DeltaV distributed control system (DCS) is easy. In fact, at the device level, the DeltaV system provides plug-and-play capability for runtime and diagnostics with minimal configuration in a variety of protocols. Connection configuration is accomplished through DeltaV's easy-to-use engineering tools. Data is physically connected using reliable hardware specifically designed and tested for this task: I/O cards, Ethernet I/O Card (EIOC), and the DeltaV Application Station.

From the start, Emerson's goal is to make data connections easy, minimizing the need for a customized engineering solution. With these tools, you can eliminate costly custom applications that are hard to maintain and remove errors during start-up and maintenance because data comes directly from the connected equipment.

Find Operational Improvements from a Fully Integrated Enterprise

With the kind of complete data integration and visibility offered in the Emerson solution, people have the information they need to make decisions — reliably, securely, and in real time. In fact, using the standard OPC protocol and robust

Web Services, the DeltaV system connects to any layer of the manufacturing environment. For example updates can be sent from the DeltaV system to enterprise business systems such as Emerson's Manufacturing Execution System (MES), Syncade™, and other systems on the network. Data integration provides complete visibility into the state of the plant for those who need to know.

No Special Treatment Needed for Shared Data

Once the data is in the DeltaV system, it is considered as native data and is used easily for control logic, alarming, batch logic, displays, monitoring, and histories. This ease minimizes the time required for configuration of screens and reports. It enables the team to make more effective decisions that ultimately improve operations.

Simplifying data integration enables the DeltaV system to treat all multi-sourced data as its own. Because all data is presented in a consistent fashion, operators can make intuitive decisions to run their plant better. Whether reporting alarms to shift supervisors or changing control-loop parameters on a graphic, the system just works regardless of the data connections behind the screen — the DeltaV system does that hard work to make the operator's job easier.

Contact Emerson for Streamlined Knowledge Sharing

Data Integration with the DeltaV system provides data between the field and business systems with minimal setup time. Decision makers at every plant level — engineering, operations, and production — can get the critical data they need, reliably, securely, and in real time.

Learn more at www.emersonprocess.com/operationsperformance



Maintaining Situational Awareness: Directing the Operator's Eyes

*High performance graphics
decrease operator errors.*

The universal demand for process safety and productivity puts a high value on a very small piece of real estate in your control room: the operator screen. Recently the Chemical Manufacturers' Association released a report that attributed 26% of incidents to operator error. That number is conservative by some accounts, and no doubt highlights the significant role operators serve in a plant's incident-free operation.

*\$85 million dollars -
the average loss of
major incidents caused
by operational error.*

— J & H Marsh & McLennan, Inc.

In creating an effective and efficient work environment for operators, graphics-design engineers must consider how to attract a person's attention, the impact of colors and shapes on perception, and the role patterns play in helping a person quickly scan and process information.

A high performance human-machine interface (HMI) inevitably leads to improved operator productivity and situational awareness. This in turn improves the control system effectiveness and leads to a safer, more efficient plant operation. But facilities and processes are becoming more and more complicated, so maintaining situational awareness is increasingly difficult.

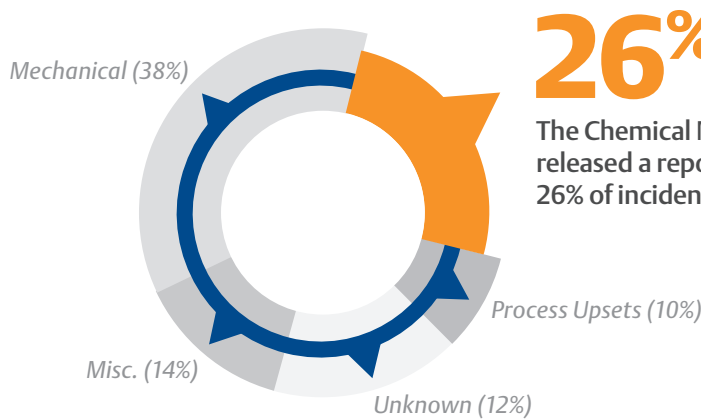
Many factors come to play, and facilities are seeing these painful situations become more common.

Finding information on the screen takes too much time — If your operators must scan through multiple graphics to check the state of the process, they are wasting valuable minutes that could be spent resolving issues. And when the process experiences an upset, an operator should be able to quickly identify where it started and how it ripples through the process. Ideally, when operators are optimizing the process, key performance indicators (KPIs) should be on the same graphic, rather than flipping among multiple screens.

Seeing the information is not easy — Small font size, ineffective colors, too many indicators on the screen. All of these characteristics on a graphic can hold back an operator from discerning relevant information among the flood of data. Because the operator workstation is the operator's window to the process, it must clearly help the operator pick out the important process conditions. Icons should not compete for attention with the process values and take up valuable screen space. If the operator cannot quickly recognize when the process is drifting, the opportunity to react is missed and safety can be jeopardized.

Graphics do not help operators determine actions — If the information presented on the screen does not make sense to an operator, or if they cannot quickly determine a set of actions based on what they see, even relatively small problems can grow quickly. Poorly organized data where grouped tasks aren't always performed from the same graphic impedes the operator from completing important tasks.

Causes of Plant Incidents



26% *Operator Error*

The Chemical Manufacturers' Association released a report that attributed 26% of incidents to operator error.

Create a Clear View to Assist with Operator Responsibilities

Graphics must help direct operators' actions by being seen and understood and must guide operators to easily find information. Emerson has been a key player in researching, developing, and implementing effective high performance operator graphics. Compliant to standards such as ISA-101, Emerson's DeltaV high performance dynamos fit into any graphic from Level 1 (for example, the dashboard view or overview display) to Level 4 (for example, diagnostic or special-use displays).

Human centered design (HCD) is central to Emerson's development and design of operator graphics. In fact, Emerson believes HCD is more than making products easier to use. HCD makes customers' jobs easier to do. Implementation of Emerson's research leads to enhanced operation performance—better productivity and profitability.

Establish and Maintain Situational Awareness via High Performance Dynamos

Finding information on an operator graphic becomes simple via graphical objects (or dynamos) that present a consistent visual representation, group information to provide appropriate context, and assist the operator to scan graphical elements quickly on a single display. Using high performance dynamos, Emerson's solution—in four seconds—provides operators a situational awareness of their entire area of responsibility.

The DeltaV Level 1 dynamos immediately guide the operator to the plant area that is in alarm and shows the changes to the process as the disruptions move through the plant. When the conditions have been assessed, the system guides the operator to a consolidated view of KPIs that can drive process efficiencies and optimization.

Graphics Visibility Promotes Understanding

Plainly, operators can only work with items they can see and interpret. Emerson's high performance graphics philosophy has been tested to magnify the operator's ability to see and process

information effectively and efficiently by employing visual representations that use space efficiently—even in information-dense graphics.

Dynamos support day-to-day operations for improved problem solving and investigation. Using high performance dynamos, the operator has access to complete module status information, yet the status doesn't compete for attention. If abnormal statuses are present, the operator can access information quickly by hovering, no need to click or switch screens to a faceplate.

Advances such as analog and qualitative indicators and pattern matching in graphical elements contribute to improving operator response from one minute to less than five seconds.

Seeing and Understanding Should Efficiently Lead to Appropriate Decisions

In the DeltaV system, high performance dynamos support task based graphics. Even if the operator's task is simply monitoring without immediate action, Emerson has developed best practices for assembling the graphics components that help lay out appropriate and safe responses. When graphics facilitate operator's situational awareness, the overall project and end-product outcome is more certain.

Emerson's High Performance Graphics Guide Operators to the Best Decisions

Situational awareness is key to operational excellence, but it's not the only capability that graphics should provide to operators. Contact Emerson to give operators the right information, when they need it, and in the right context for the actions required.

Learn more at www.emersonprocess.com/operationsperformance



Emerson incorporates best-of-class products, proven processes, and an understanding of human limitations and strengths for better operator success.

Learn more at www.emersonprocess.com/operationsperformance

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