**ARC WHITE PAPER**

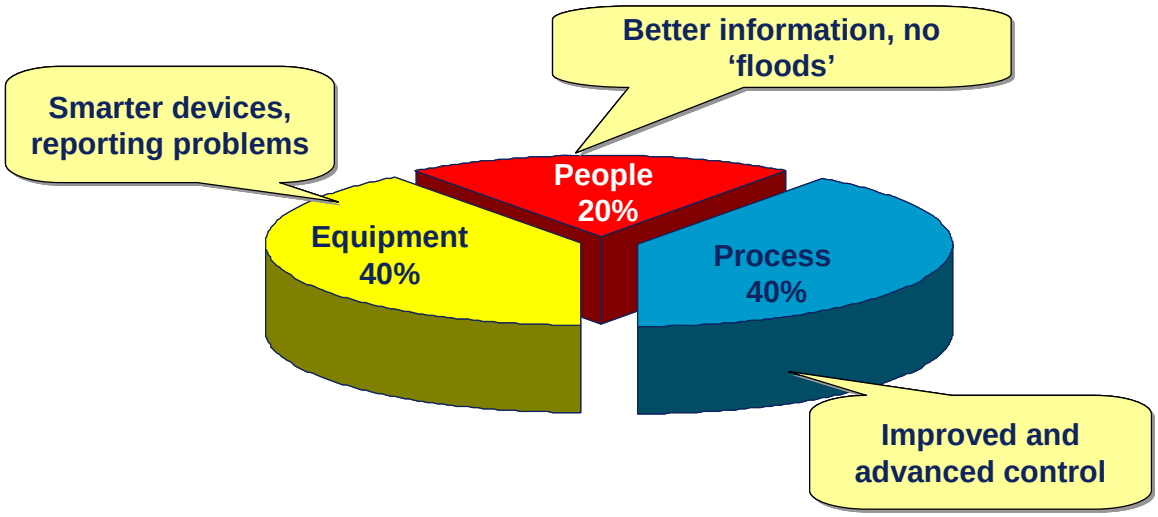
By ARC Advisory Group

JANUARY 2008

# Emerson Strategies for Abnormal Situation Avoidance & Alarm Management

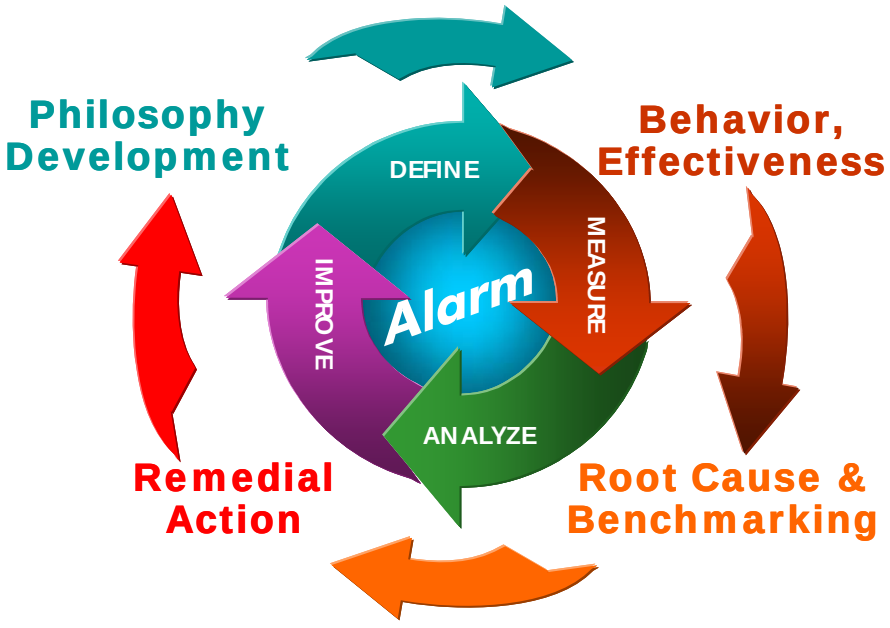


ARC Advisory Group




*Established in literature; confirmed by 7 plant studies - US, Canada, & Europe. Also from discussions with ExxonMobil, MAP, ChevronTexaco, Aramco*

**Sources of abnormal situations can be addressed by today's alarm management solutions.**




**Alarm management should be approached as a continuous improvement process with operational excellence as the goal.**

# Executive Overview

The state of alarm management schemes in today's process plants is in crisis. Proliferation of alarms is out of control, making it almost impossible for end users and operators to distinguish between critical impending abnormal events and nuisance alarms. Emerson realizes the issues that users are facing regarding alarms and abnormal situations and has recently unveiled a multi-tiered strategy to address the issue. The approach mirrors the Six-Sigma DMAIC process that is recommended by ARC, and includes data collection, statistical analysis, alarm evaluation, and system improvement – all within the context of ongoing evaluation and continuous improvement.

Emerson realizes the issues that users are facing regarding alarms and abnormal situations and has recently unveiled a multi-tiered strategy to address the issue.
This approach is based on a continuous improvement process that is facilitated by Emerson's own solutions and service capabilities.

Emerson's alarm management capabilities have evolved steadily over the past several years. This functionality starts at the core of the DeltaV process automation system (PAS) with the DeltaV Event Chronicle. Emerson then added DeltaV Analyze to provide alarm and event analysis. Consistent with Emerson's strategy of building its solutions business, the company has also introduced a full suite of alarm management related services. Most recently and most importantly, however, Emerson has released a web-based alarm analysis tool that combines Emerson's capabilities in alarm and event analysis with its services capabilities. Based on the DeltaV Analyze product, the new web-based service allows end users to send their alarm activity history to an Emerson team of experts that can quickly analyze and identify needless alarms and optimize the end user's alarm scheme.

ARC believes that a truly effective alarm management strategy must be approached in the context of a Six-Sigma DMAIC process, incorporating a definition of the alarm management scheme desired, measurement, and auditing of the existing alarm management philosophy. This is followed by an analysis of the findings and a path toward improvement that is augmented by a constant reevaluation and continuous improvement process. The combination of Emerson capabilities in data gathering, analysis, and improvement capabilities with DeltaV Analyze provides a path to continuous alarm improvement where the burden of the work is placed on the supplier and their own experts, which greatly eases and facilitates this process for end users.

The approach that Emerson takes to alarm management also rests on a solid business case. Project justification for end users in process automation is becoming increasingly difficult, and technology alone is not sufficient to justify automation projects. Even reduced total cost of ownership is not enough in most cases. There must be a solid business case for improved return on assets, asset utilization, reduction of unplanned downtime, and other aspects directly related to plant profitability and performance. Emerson realizes this and has built its offering on customer need regarding alarm management. This includes the potential costs and penalties associated with a lack of an effective alarm management strategy identified through its own research.

## Technology Has Created an Alarm Management Crisis

Alarm management is one of the most undervalued and underused aspects of process automation today. In most cases, alarm systems do not receive the attention and resources that are warranted. This is understandable, because alarming appears to be a deceptively simple activity. Many plants still use the alarm management philosophy developed by the engineering firm when the plant was built.

Current automation systems have essentially eliminated the cost of adding more alarms and, therefore, the incentive to limit or rationalize their number.

The age of digital process control transformed the role of the alarm. In the days of hardwired controls and alarms, engineers were very stingy with alarms, in part because each alarm point had a cost. The primary issue with alarm systems is there is too much information for an operator to assimilate and act on. Ten years ago, it cost about one thousand dollars to add an alarm.

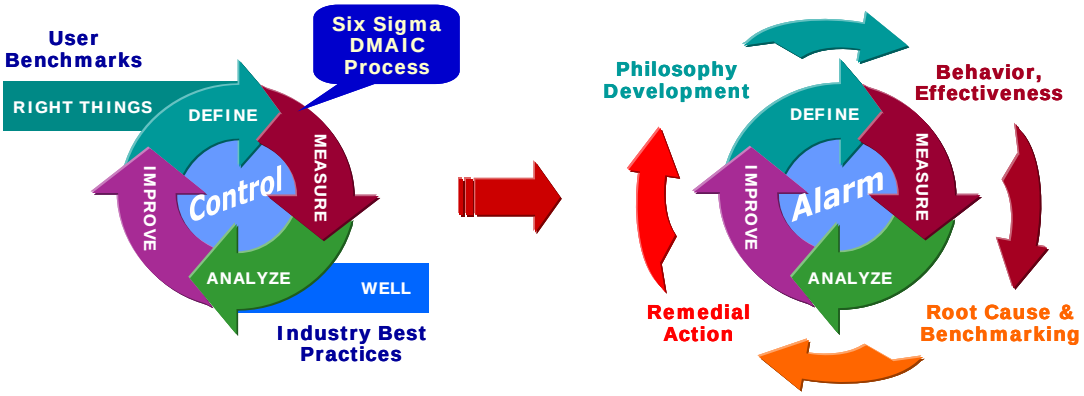
Current automation systems have essentially eliminated the cost of adding more alarms and, therefore, the incentive to limit or rationalize their number. With the potential for every measured point to have a high alarm, low alarm, and other variations, there are often more alarm points then there are measured variables in the process. In many cases, it is easier to add another alarm rather than rationalize existing alarms.

## Multiple Sources of Alarms and Alerts Compound the Issue

Alarms and alerts in today's plants come from many sources, not just the PAS. Quality systems, Plant Asset Management (PAM) systems, and condition monitoring systems are all examples of sources that provide their own unique set of alarms that must be managed in the context of the entire automation schema. Safety and regulatory requirements have also added to the alarm load.

Alarms are a signal to the operator that they should intervene in the process operation to correct a condition in the plant and return the process to a normal state or to prevent the process from going into an abnormal/unsafe condition. It is the first hard layer in a multilayered safety strategy. Operators should view alarms in the context of the overall plant operation. It makes no sense, for example, for an operator to have to respond to an alarm for low flow when the pump controlling the flow is shut down for maintenance. Alarms that function as they should alert the operator to a potential problem, inform the operator of the nature of the problem, and guide the operator toward a course of corrective action.

Best practices for alarm management require distinctions between alarms and alerts. Alerts provide a notification mechanism, but do not necessarily require immediate action. Alarms are used as a warning, and should always require operator action. In short, alarms are not alerts. Alarms are not alarms unless they require operator action.




The Correlation of Operational Excellence to Alarm Management

### Drive toward Alarm Management Operational Excellence Requires Continuous Improvement Approach

The push for operational excellence (OpX) in plants today is also driving the need for more effective alarm management. Plants are operating closer to their limits than ever before, and users are continuously looking for new ways to increase OpX by reducing downtime, increasing productivity, and implanting real time performance management (RPM) strategies for their plants. Effective alarm management strategies are a key component in achieving all of these goals. The need for effective alarming is increasing dramatically in spite of the fact that most alarm systems are not effectively used. As alarm systems become less effective, they diminish the effectiveness of all automation.

Manufacturing is moving from a demand-limited situation toward a capacity-limited situation. This forces manufacturing assets to run close to or at their design limits, which means there is not much time to respond when there is a problem. A growing void of experienced operators who understand the process well enough to know when there is a problem and how to react also exists. Even experienced operators are finding it difficult to track the condition of the process because of levels of abstraction introduced by increased levels of automation complexity and sophistication.

## Justification of Alarm Management Must Rest on a Solid Business Case

Justifying the cost of an alarm management program can be a challenging task. Operations and engineering realize that alarm management is a serious issue, but often have trouble convincing senior level plant management that they should invest in an advanced alarm management strategy. Justification should be approached from a business case standpoint, and alarm management should be looked at not as a technology, but as a business enabler and risk management investment. When implementing an alarm management strategy, the goals and objectives of that strategy must be clearly communicated to all the staff who are involved, including operations, engineering, and plant management. Commitment from plant management is especially crucial to a successful alarm strategy implementation.

| Area | Benefits |
|---|---|
| Safety | Reduced risk of human injury and incidents. |
| Unplanned downtime | Avoid plant shutdown, lost product, and associated costs. |
| Information management | Avoid nuisance alarms, improved fault tracing. |
| Role of the operator | Give operator more time to focus on the process, creating knowledge workforce. |

**Key Areas of Alarm Management Justification**

## Lack of an Alarm Management Strategy Can Cost You Plenty

According to research across the industry, lack of an effective alarm management strategy has a direct negative impact on plant operations, performance, profitability, and safety. For example, in the regulated industries a deviation alarm can represent a very significant accumulated cost of typically $2K to $6K per alarm or can serve as cause to destroy a batch. In the heavy process industries, an emergency alarm that escalates into an incident can ultimately result in a shutdown. Unscheduled shutdowns cost the industry between 2 percent and 5 percent of production annually.

Costs associated with poor alarm management strategies include quality, lost production time, damage to assets, and endangerment to human life. According to the Abnormal Situation Management Consortium (ASM), lack of an alarm management strategy costs the US petrochemical industry losses of $10 to $20 billion per year.

**The Cost of Ineffective Alarm Management**

| | |
|---|---|
| Deviation Alarms in Regulated Industries | $2 to $6K Per Alarm |
| US Petrochemical Industry Losses: | $10-$20 Billion |
| Annual Automation Industry Equipment Damage: | Over $2 Billion |
| Typical Cost of Unplanned Incident: | $100K to $1 Million |
| Major Incidents in Refining Industry Average Cost: | $80 Million |

According to insurance industry estimates, the automation industry is experiencing over $2 billion per year in equipment damage, which can be directly reduced by implementation of an effective alarm management strategy. According to the HSE 166 study, the typical cost of a plant incident can range from $100,000 to $1 million, with the refining industry averaging a major incident once every three years that costs an average of $80 mil-

lion. The Nexus Engineering study on refinery operations indicates that one week of unscheduled downtime can wipe out an entire year's worth of benefits generated by advanced process control (APC). These are all powerful metrics for developing a solid business case to justify the cost of alarm management strategy implementation.

### Transforming the Role of the Operator

Operators are underused, and the operator of the future will play a pivotal role in operations decision making. This requires information empowerment. Alarm management is a perfect example of this empowerment. An alarm management system has the potential to transform the role of the operator. A good alarm management system can free operators from doing tedious or repetitive tasks and give them more time to focus on the process and to make intelligent decisions that affect productivity and plant performance. A sound alarm management philosophy also allows users to capture critical events during process upsets without being overwhelmed with nuisance alarms.

## Strategies for Alarm Management Should be Based on EEMUA Guidance

The Engineering Equipment and Materials Users Association (EEMUA) has created what ARC believes is the definitive guide to best practices and guidelines for alarm management. Any alarm management philosophy should be based on these recommendations. EEMUA Publication 191 is well recognized and considered a "good industry practice" by OSHA. Based in the UK, the EEMUA is an organization comprised of "substantial purchasers and users of engineering products" from industries such as oil and gas, power, refining concerned with reducing costs through the sharing of knowledge and resources. EEMUA is not a standards-making body, but they do want to further the development of existing standards by sharing their knowledge with the rest of the world.

EEMUA states that if an operator has to respond to an alarm every 2 minutes and it takes one minute to adequately respond to that alarm, then 50 percent of the operator's overall time is spent responding to alarms. .

The four core principles EEMUA espouses throughout publication 191 include usability, safety, performance monitoring, and investment in

engineering. Usability ensures that the design of the alarm system can adapt to the needs of the user and operate within the constraints of the user. According to EEMUA, a usable alarm system must "be relevant to the user's role at the time, indicate clearly what response is required, and be presented at a rate the user can deal with, and be easy to understand.

EEMUA states that if an operator has to respond to an alarm every 2 minutes and it takes one minute to adequately respond to that alarm, then 50 percent of the operator's overall time is spent responding to alarms. The huge number of alarms added to today's control system also means that the operator cannot respond effectively to an abnormal situation when it does arise because they are overwhelmed with alarms.

| Long Term Average Alarm Rate in Steady Operation | Acceptability |
|---|---|
| More than 1 per minute | Very likely to be unacceptable |
| One per 2 minutes | Likely to be over-demanding |
| One per 5 minutes | Manageable |
| Less than one per 10 minutes | Very likely to be acceptable |

**EEMUA Guidance of Alarm Frequency Acceptability**

EEMUA's definition of safety means that the "contribution of the alarm system to protecting the safety of people, the environment, and plant equipment should be clearly identified." In performance monitoring, EEMUA states that the "performance of the alarm system should be assessed during the design and commissioning to ensure that it is usable and effective under all operating conditions". EEMUA advocates regular auditing throughout the lifecycle of the plant to ensure good performance. Investment in engineering is defined as the system following a "structured methodology in which every alarm is justified and properly engineered".

## Developing an Effective Alarm Management Strategy Rests on Culture of Improvement

EEMUA advocates a culture of improvement when it comes to implementing an alarm management strategy. Good alarm management practices are essential in operational excellence (OpX), and ARC has come up with a simple OpX alarm management process that correlates to a five-step DMAIC process. Specifically:

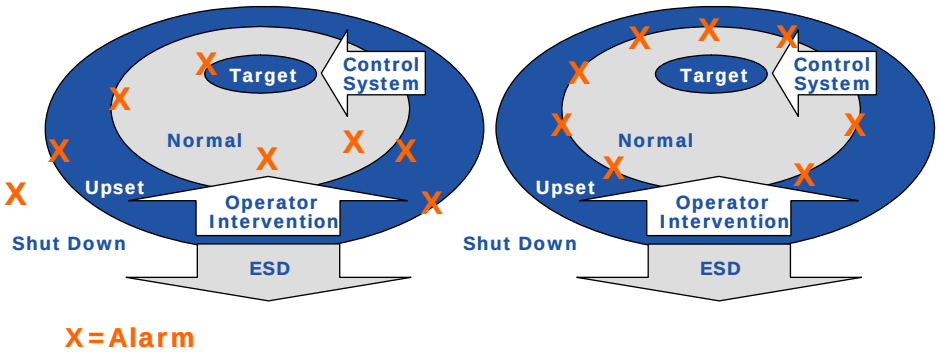
**D**efine relates to philosophy development, **M**easure relates to determining alarm behavior and alarm effectiveness, **A**nalyze relates to root cause analysis and performance benchmarking, and **I**mprove relates to the remedial action necessary to align the prevailing implementation with the alarm philosophy. Finally, **C**ontrol relates to alarm execution.

## Alarm Management Philosophy Development

There are two parts to developing a sound alarm management philosophy. The first is the development and maintenance of the alarm philosophy. This document needs to cover everything anyone needs to know about this alarm system implementation. It should be considered the design definition.

The second part is the alarm rationalization. This systematic process optimizes the alarm database for safe and effective operation. It usually results in a reduction of the number of alarms, alarm prioritization, validation of alarm parameters, evaluation of alarm organization, the number of alarms assigned to an operator, and finally alarm presentation.

Selection of alarm settings is one topic to which the EEMUA guidance devotes a significant amount of time. EEMUA's position is that alarms should be set at the point where the operator must take action. If alarms are set too conservatively, then they are triggered within normal operating parameters. Conversely, if alarms are set outside the normal operating range of the plant, it is too late for the operator to take action.




**An Effective Alarm Should Mark the Point Where the Operator Should Take Action**
***Source: EEMUA Publication 191***

## Determining Alarm Behavior & Effectiveness

This step measures what is working and what is not. Behavior is determined by auditing the current archive to determine “bad players”, relative duration of states to determine variability, standing alarms, and which alarms or events trigger floods. Effectiveness is measured to determine effectiveness of administration, whether management of change is working, operator readiness to process requests, and comprehensiveness of operator interventions.

There needs to be a recognized best practice for alarming, and a methodology that provides a framework to execute these best practices and facilitate continuous improvement. Many plants still use the alarm management philosophy developed by the engineering firm when the plant was built. Finally, there needs to be a suite of tools to help manage the alarm system. At a minimum, these tools should support alarms from disparate sources, provide the ability to measure, track, and archive performance, provide quality analysis such as Six-Sigma, and finally provide either ad-hoc or programmatic web-enabled access.

| | |
|---|---|
| Purpose of the Alarm System | Alarm Ownership |
| Alarm Design Principles | Assumptions |
| Key Performance Indicators | What Is Abnormal and Normal |
| Approved Alarming Techniques | Breadth of Solution (Single or Disparate Sources) |
| Priority Assignment | Organization and Presentation |
| Operator Roles | Associate Data with Events, Alarms, and Work Processes (Methods) |
| Documentation of Procedures after an Alarm Occurs | Meaningful and Intuitive Alarm Script that Relates to KPIs |
| Training | Unique Alarm Sets to Particular Asset States such as Start-up, Shut-down, Grade Changes, or Load Changes |
| Maintenance | Automatic Suppression of Alarms |
| Management of Change | Standardization and Enforcement of the Criteria to Determine Alarm Priority |
| Escalation Policy | |

**A Good Alarm Philosophy Document Should Include These Elements**

### Analyze Root Causes and Provide Benchmarking

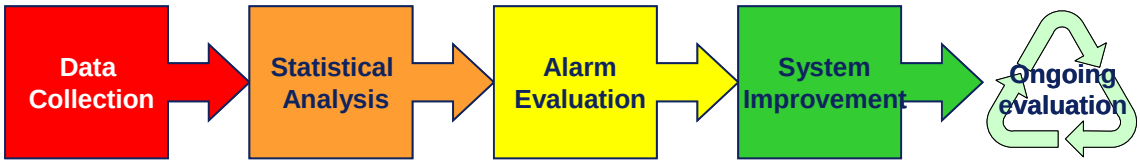
Once problems have been identified, causes need to be determined and remedial actions defined. In this step, quantitative root cause analysis identifies problematic areas. Benchmarking, tracking, and analysis provide a basis to determine the reasons for alarm and operational problems. The analysis also provides a perspective on how well the control system is operating, the effect the alarm system is having on the Operator, and the key causes of operational problems. This step can also be used for spot incident reviews.

### Improvement through Remedial Action

Some examples of remedial action include implementing conformance to the alarm philosophy, elimination of nuisance alarms, tune alarm priorities, elimination of alarms with the same root cause, and recalibration or elimination of standing alarms. This is the final step in the process, but is not the end. The loop needs to be closed with a continuous view toward improvement constant reevaluation.

## Emerson Holistic View of Alarm Management Starts at the System Core

Emerson has created an alarm management philosophy that fits nicely with ARC's DMAIC model and conforms to EEMUA guidelines. Emerson's approach to alarm management is a holistic one that incorporates technology and data availability with services and engineering expertise. The alarm management philosophy starts with the large amount of data in the system and transforms that data into usable and actionable information that end users can directly translate into strategy development and actions that have a direct impact on plant performance. The end user can then implement a




**Emerson's Approach to Alarm Management Facilitates a Continuous Improvement Approach**

continuous improvement process that is bolstered by expertise from Emerson's own services organization. Of course, the correct approach to alarm management is to take the best practices into account at the point of initial system configuration and installation.

## DeltaV Event Chronicle Captures Required Data for Effective Alarming

ARC recognizes that in most plants, the alarm strategy performs at a sub-optimal level. Ideally, the alarm management strategy should be employed when the automation system is initially configured. This is why Emerson's alarm management offering starts at the core functionality of the company's DeltaV process automation system (PAS).

The DeltaV system possesses an alarms and events subsystem that monitors the alarms and events within the system. The DeltaV system then incorporates an Event Chronicle function that electronically records alarms and events by plant area and stores them for retrieval and analysis. Configuration of Event Chronicle is done through DeltaV Explorer. Event Chronicle serves as a change management tool that captures the "who, what, why, when, and where" of all on-line system events, including operator changes, control module installations, alarms, and changes in device status. This allows the user to view and record relevant information for each event, such as the operator that made a change, when that change occurred, from what workstation and why.

Event Chronicle serves as a change management tool that captures the "who, what, why, when, and where" of all system events, including operator changes, control module downloads, alarms, and changes in device status.

## Event Chronicle Supports Redundancy & Common Time

The DeltaV Event Chronicle captures messages such as alarm state changes, user-defined events, operator logon/logoff, operator changing attributes, and configuration downloads. This is all done through the DeltaV system, which can capture data values and associated timestamps at the lowest possible level in the system to provide an accurate picture of events and alarms as they occur.

Event Chronicle receives these timestamps and events and makes them available to the Process History View application. Since events are time-stamped in DeltaV control modules, multiple Event Chronicles have consistent timestamps no matter where they come from in the system. Multiple

Event Chronicles can also reside on the same system for redundant event capturing. This supports ARC's definition of common time that is specified in the architecture of a collaborative process automation system (CPAS).

## Event Chronicle Supports a Common View

Event Chronicle provides a clear and common view for the end user into events and when they happened, and enables easy visualization of things like bursts of events. Other operational events that can be viewed include operator changes, tuning parameter changes, control module installations, alarms, and device status. The Process History View application displays the events in chronological order, and events are color-coded by event type. A single Event Chronicle report can give a single view for the end user into system events that span multiple control modules and workstations.

## Filtering of Alarm & Event Information

Events stored in the Event Chronicle can be filtered using tools provided in Process History View. Through embedded filters, users can isolate events, and standard filters can be set based on date/time, event type, category, area, node, or module. Additional settings such as **Parameter, State, Level,** or **Description** allow users to filter events in other columns of the Event Chronicle.

If an end user wants to view changes in performance in a control module, for example, they can select the History View button on the control module's faceplate, access the History View, and have it pre-filtered for events from the Event Chronicle relevant only to that control module. Event Chronicle can also automatically export daily. Records are available to any desktop application for further analysis. Users can set up daily exports or deletion of event records based on their age.

## Integration with Third Party Alarm Analysis Products

DeltaV alarms and events are available to a number of third-party alarm management applications from suppliers such as PAS, Matrikon, ProSys, and TiPS. The primary vehicle for this is the OPC Alarms and Events Server, which takes alarm and event data from the DeltaV system and distributes it in a format that is built upon OPC's specification for alarms and events.

# DeltaV Analyze Provides a Path to Operational Excellence in Alarms

Building on the core capabilities of DeltaV Alarms and Events and Event Chronicle, Emerson has developed a new, web-based application that makes it possible for users to not only view the history of alarms and their causes, but also to enhance the performance of the alarm management system. DeltaV Analyze provides a path to operational excellence in alarm strategy by providing an easy way to analyze the top underperforming alarms in the plant, eliminating unnecessary or nuisance alarms, and comparing plant alarm performance directly to EEMUA best practices.

## Ensuring Conformance to EEMUA Best Practices

With DeltaV Analyze, EEMUA recommended alarm averages are displayed on the Overview screen so the end user can compare actual performance to EEMUA guidelines. EEMUA 191 guidelines, for example, specify that no more than 5 percent of alarms that annunciate should be of the highest alarm priority, while safety related alarms should occur even less frequently.

| |
|---|
| Chattering alarms and events |
| Long standing alarms |
| Alarm suppression times |
| Alarm acknowledgement times |
| Operator actions, by user |
| Device versus Process versus SIS alarms |
| System problems |

**DeltaV Analyze Helps Identify Key Alarm System Attributes and Potential Problems**

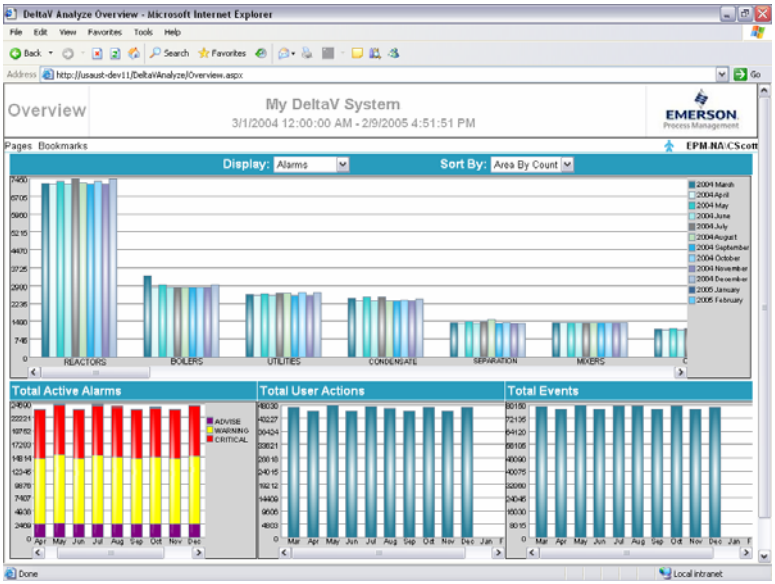
To see if they are meeting EEMUA criteria, end users can select the month and/or area of interest to view specific information. Several pages are provided to highlight high-frequency problems. These pages locate and order which modules and/or devices in the system are causing the most activity. A common approach in plants is to target the top 5 to 10 high-frequency tags for alarm review each month.

## DeltaV Analyze leverages Web-Based Environment

Like the DeltaV Event Chronicle, DeltaV Analyze can display monthly trends of alarms, events, and user actions, but it uses this data and places it in context so users can automatically view where their alarm management strategy needs improvement. Information can be viewed in a configuration-free Web-based environment that can be viewed throughout the plant. Re-

mote access to DeltaV Analyze web pages is also possible through implementation of a DNS server. Since DeltaV Analyze is a web-based application, users are able to bookmark favorite pages and filter combinations as you would in Microsoft Internet Explorer, allowing them to return to specific dates and times quickly. Users can also look at relative times for specific data points.

An overview page shows monthly accumulations of alarms for the past 12 months. An overview display allows users to determine quickly if the alarm, event, and user action rates are properly trending month over month, and if some areas need further investigation.




**DeltaV Analyze One Year Summary**

DeltaV Analyze also offers pie charts that can show alarms and events calculated by priority, category, and event type. Clicking on a section of the pie, such as critical alarms, causes the chart to filter the information for critical alarms only. Distribution of alarms over time can also be analyzed. Although the alarm average over a month may be considered manageable, there could be isolated incidents of alarm flooding where the frequency is well beyond acceptable limits. Up to 4 hours of alarm activity can be selected to be viewed in 10-minute increments to show more detailed alarm activity and isolate what events and time periods exceeded acceptable limits.

DeltaV Analyze periodically processes the event database and creates its own summary records, so it does not have to access the event database directly, and does not have a significant impact on event database performance. Summary records are also structured to minimize the time required to display Web pages. Event databases from other DeltaV systems can also be processed at the user's request with the information stored in a separate location.

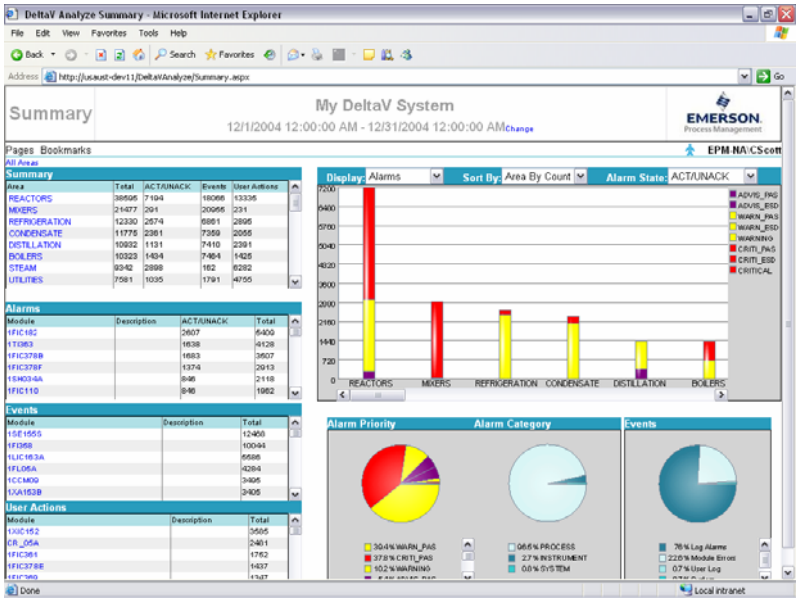
### Eliminating Very Long or Very Short Alarms

Alarm statistics can be viewed to determine alarms that were active for very long or short periods. The current industry approach to alarms is that each alarm should have an expected operator response and, once the proper response has been completed, the alarm should clear. Longstanding, per-

sistent alarms, for example, usually do not require action and clutter alarm summaries. Very short alarms also pose a nuisance, since they are activated just long enough to activate the warning system and typically do not require action.

## Measuring Operator Intervention

Quantity and type of operator intervention required on control modules can also be measured. Some control modules may require more manual intervention than is practical, while some may be left in manual, or may be candidates for more sophisticated control algorithms. The Operator Actions page summarizes all user changes and categorizes them by alarm acknowledgements, mode changes, and value changes. End users can view which modules had the most user actions, as well as which users made the most changes. Users can also view operator intervention information by plant shift.




**DeltaV Analyze One-Month Summary**

## Identifying Top Underperforming Control Modules Makes a Big Difference

In many cases, fewer than 10 of the control modules in a plant can cause over 40 percent of total plant-wide alarms. If a user can effectively address this small number of underperforming alarms, operator alarm loading can be significantly reduced. The summary page of DeltaV Analyze provides module and/or device activity for alarms, events and user actions for up to 31 days. The modules or devices with the most alarms, events, and user actions are displayed in scrollable tables, and can be viewed in the context of the entire plant or by plant area.

## DeltaV Analyze Installation & Configuration

DeltaV Analyze is installed on the same workstation as Event Chronicle or Plant-wide Event Historian. The workstation can use either the Windows XP

or Windows Server 2003 operating system. Microsoft's Internet Information Services (IIS) is enabled on the workstation. This workstation is also the source of DeltaV Analyze web pages. To set up DeltaV Analyze, users select the event database and decide how long to keep summary records and disk space usage. Users must then define any custom alarm priority colors and the online processing frequency.

## Emerson Alarm Management Services Bring Core Expertise & Capabilities

Service is the fastest growing segment of the automation market today, and with good reason. The vast pools of engineering expertise that used to exist at major user companies have shrunk to critically low levels. Many of the automation services that are required throughout the lifecycle of a plant or factory can no longer be performed in house. Users are looking to the next logical choice for these services -- the suppliers that provide them with the automation products, systems, and software that keep their plants running. Developing an effective alarm management program is typically a service intensive process, and Emerson has developed a comprehensive service offering both for alarm management implementation and a specific set of services around DeltaV Analyze that assist users in identifying key underperforming alarms and control modules.

| Key Services Provided by Emerson for Alarm Management Assessment |
|---|
| **Data Collection:** Retrieval of alarm logs for evaluation |
| **Statistical Analysis:** Using DeltaV Analyze to ID frequency per unit and relationships between alarms |
| **Alarm Evaluation:** Systematic justification of alarms by trained & certified specialists in accordance with EEMUA-191 |
| **Reporting:** Alarm assessment results delivered via Guardian |

### Alarm System Management Assessment Services

Emerson has service people that can assist end users in all aspects of alarm strategy development and continuous improvement. This starts with an Emerson Alarm System Specialist, who will examine all aspects of the end user's existing alarm management systems. The assessment begins with retrieval of alarm logs for evaluation and statistical analysis using DeltaV Analyze. The assessment evaluates exposure to risk because of poor alarm management by examining several key areas. Alarm performance during normal operation and upsets is examined, along with frequency

of nuisance alarms, alarm frequency, and susceptibility to alarm floods using performance targets based on EEMUA best practices.

Emerson experts can also evaluate procedures used to define and configure alarms, alarm settings, and priorities as well as the associated plant operating methods and change management practices used. Operator training and readiness to respond to alarms are also evaluated. In ARC's view, these are all necessary first steps in developing an effective alarm management strategy in accordance with a continuous improvement process.

| Alarm System Summary |
| --- |
| About This Report |
| About EEMUA 191 |
| Alarm Distribution |
| The Five Areas with the Most Alarm Activity |
| The Ten Modules with the Most Active Alarms (whole database) |
| Day with the Highest Alarm Activity |
| The Ten Modules with the Highest Alarm Activation Times |
| The Ten Modules with the Most Suppression Time |
| Summary of User Actions |
| Summary of System Alarms |
| Conclusion and Useful Information |

**Contents of Typical DeltaV Analyze Subscription Report**

Emerson takes one of two approaches based on the results of the alarm management assessment. Plants with an acceptable alarm performance are encouraged to adopt a continuous improvement program to maintain a high level of performance throughout the lifecycle of the plant. For plants where alarm performance is unacceptable and significant improvements are required, Emerson will assist in systematic development of an alarm philosophy, alarm rationalization process, and implementation of alarm system changes.

## Alarm Maintenance as Part of Change Management

Emerson offers solutions for ongoing alarm maintenance under its SureService umbrella. SureService Alarm System Maintenance provides periodic collection of alarm and event data for analysis and reporting. Alarm Management Specialists consult with the end user on the findings of these reports and work out an action plan to address any issues. This is all done within the context of the end user's Management of Change (MOC) process.

## DeltaV Analyze Subscription & Alarm Reporting Services

Essential to the DeltaV Analyze product offering is Emerson's associated service capabilities for analyzing DeltaV alarms, events and trends. End users that do not wish to install DeltaV Analyze directly on their system have the option of a subscription service that provides online access to DeltaV Analyze through Emerson's own secure Alarm Management Services website.

Through the subscription service, end users can upload Event Chronicle files onto the Emerson Alarm Management Services website for processing. Once the files are processed, the full analysis functionality of DeltaV Analyze via Emerson's secure website can be used. Multiple end users can access data simultaneously.

The Alarm Management Reporting services are available to users of the desktop version of DeltaV Analyze as well as the online subscription service. Emerson processes the uploaded files using DeltaV Analyze and then generates an Alarm Management Summary report, which is reviewed by Emerson's SureService specialists. A final version of the report is generated and posted on the secure website, where it is accessible to the end user. The end user is notified via email that the report is ready, and they can receive a PDF version of the report attached to the email.

| |
|---|
| Review of assessment results with the customer by a certified Emerson local service provider |
| Re-design of alarm settings, priorities & logic |
| Development or modification of operating procedures |
| Operator & Engineer training |

**Key Services Provided by Emerson for Alarm Management Improvement**

The Alarm Management Summary Report summarizes the analysis performed on Event Chronicle data, and can form the basis for an evaluation of current alarm system design and configuration. The report contains highlights of some of the most active areas and modules in your system for alarm activity, and other statistical information that allows end users to hone in on the worst trouble spots quickly. In accordance with Emerson's focus on EEMUA best practices in DeltaV Analyze, the KPIs presented in the reports compare the end user's alarm system performance with EEMUA best practices and guidelines.

## Emerson Offers Free Alarm Summary Report

As a way of introducing the company's new portfolio of Alarm Management Services, Emerson offers a free Alarm Summary Report for all DeltaV sys-

tems. The report contains a subset of the information presented in a full Alarm Management Overview Report, including KPIs per EEMUA best practices, alarm system summary, and alarm distribution. The report also presents the five areas with the most alarm activity, ten modules with the most active alarms, highest alarm activation times, and most suppression time.

## Emerson Alarm Management Strengths & Challenges

Any end user should make sure that alarm management functionality is on the checklist for their next process automation system purchase. End users need to explore the benefits of developing, implementing, and managing an alarm management philosophy. Alarm strategies should be viewed as a continuous improvement process with guidelines and procedures for periodic review and evaluation of alarms.

ARC advises users to employ EEMUA guidelines as a best practice and OpX as the methodology for continuous improvement. Emerson's decision to build its alarm management strategy on these guidelines provides an advantage for end users and is a key strength for Emerson. Another advantage for Emerson is its continued focus on ease of use, which is a guiding principle throughout the work processes associated with the DeltaV system and Emerson's suite of alarm management offerings.

By offering a web-based tool for alarm analysis and continuous improvement of alarm strategies, Emerson has given increased visibility of the importance of alarm management and has eased the process of developing a continuous improvement strategy.

By offering a web-based tool for alarm analysis and continuous improvement of alarm strategies, Emerson has given increased visibility of the importance of alarm management and has eased the process of developing a continuous improvement strategy. By bundling its services such as SureService DeltaV Analyze Alarm Management Summary reports, Emerson has taken a big step towards demystifying alarm management and providing a path to continuous improvement in alarm management that is accessible to all process manufacturers, not just those with a lot of core engineering expertise.

While Emerson has produced a strong alarm management offering, it does have some challenges to face. The market for alarm management products

and services has many players, from small software companies that provide best of breed solutions to independent systems integrators and many of the large process automation system suppliers. Emerson must continue to communicate its message of ease of use as well as an easier path to continuous improvement to rise above the established competition and develop a significant installed base.

**Analyst:** Larry O'Brien
**Editor:** Tom Fiske
**Distribution:** EAS and MAS Clients

**Acronym Reference:** For a complete list of industry acronyms, refer to our web page at **www.arcweb.com/Community/terms/terms.htm**

| | |
|---|---|
| **API** | Application Program Interface |
| **APS** | Advanced Planning & Scheduling |
| **B2B** | Business-to-Business |
| **BPM** | Business Process Management |
| **CAGR** | Compound Annual Growth Rate |
| **CAS** | Collaborative Automation System |
| **CMM** | Collaborative Manufacturing Management |
| **CNC** | Computer Numeric Control |
| **CPG** | Consumer Packaged Goods |
| **CPAS** | Collaborative Process Automation System |
| **CPM** | Collaborative Production Management |
| **CRM** | Customer Relationship Management |
| **DCS** | Distributed Control System |
| **EEMUA** | Engineering Equipment and Materials Users Association |
| **ERP** | Enterprise Resource Planning |
| **HMI** | Human Machine Interface |
| **IT** | Information Technology |
| **MIS** | Management Information System |
| **MRP** | Materials Resource Planning |
| **OpX** | Operational Excellence |
| **OEE** | Operational Equipment Effectiveness |
| **OLE** | Object Linking & Embedding |
| **OPC** | OLE for Process Control |
| **PAS** | Process Automation System |
| **PLC** | Programmable Logic Controller |
| **PLM** | Product Lifecycle Management |
| **RFID** | Radio Frequency Identification |
| **ROA** | Return on Assets |
| **RPM** | Real-time Performance Management |
| **SCM** | Supply Chain Management |
| **WMS** | Warehouse Management System |

Founded in 1986, ARC Advisory Group has grown to become the thought leader in manufacturing and supply chain solutions. For even your most complex business issues, our analysts have the expert industry knowledge and firsthand experience to help you find the best answer. We focus on simple, yet critical, goals: improving your return on assets, operational performance, total cost of ownership, project time-to-benefit, and shareholder value.



You can take advantage of ARC's extensive ongoing research plus experience of our staff members through our Advisory Services. ARC's Advisory Services are specifically designed for executives responsible for developing strategies and directions for their organizations. For membership information, please call, fax, or write to:

ARC Advisory Group, Three Allied Drive, Dedham, MA 02026 USA
Tel: 781-471-1000, Fax: 781-471-1100, Email: info@arcweb.com
Visit our web pages at www.arcweb.com