

Abnormal Situation Solutions

Features

- Comprehensive solutions for prevention, awareness, response and analysis of abnormal situations
- Early detection of potential process and equipment problems
- Predictive intelligence network to detect potential issues before they occur
- Enables proactive rather than reactive management
- Increases plant safety and availability
- Improves operator effectiveness
- Provides support for more accurate decision making



Emerson Solutions for Abnormal Situations

An abnormal situation is an event that triggers an operator to question the condition or operation of a plant. The situation can be either a perceived or an actual event, but in either case, causes uncertainty and delays in identifying and responding to the root cause.

Abnormal situations can be triggered by failures in equipment, people, processes or some combination of the three. Most occurrences can be prevented if the right technology and knowledge is applied to quickly provide the appropriate plant personnel with predictive diagnostic information, thus supplying early detection, guidance and avoidance of potentially costly problems.

Plant process activity, historical data, environmental information, intelligent device data are just a few sources that feed the control systems, simulators, optimization packages, remote notification systems and guidance programs. These tools present information to plant operating and safety personnel through reports, graphics or alarms to provide the appropriate information required for accurate decision making.

Emerson offers leading edge technologies that provide early detection of potential process and equipment problems, the tools to quickly respond to the situation at hand and the means to analyze the event in order to avoid future reoccurrence.

Emerson’s solutions for abnormal situations cover the life-cycle of the event, including:

Emerson Technology	Abnormal Situation Solution
Digital architecture	Prevention
AMS Suite for Asset Management	Prevention
Ovation controls	Awareness and response
Ovation alarm analysis tools	Post-event analysis
Ovation simulation	Prevention and post-event analysis

Emerson technologies can be implemented individually or combined to provide a powerful comprehensive solution to combat the occurrence and minimize the impact of abnormal situations. The following sections provide additional detail on each technology listed above and how it can be used to prevent, respond to, learn from and avoid abnormal situations.

Digital Architecture

Predictive Intelligence for Prevention

This control system network of predictive intelligence enables detection of process and equipment problems even before they occur, thus facilitating proactive and profitable management.

Powered by Ovation™, the control system is a proven strategy to build a digital architecture—a blue print to build solutions that optimize performance by:

- Leveraging digital intelligence
- Connecting the plant
- Controlling process
- Optimizing assets

Along with Ovation, AMS, and digital architecture, Emerson offers a wide range of products and services that will help customers optimize performance, increase reliability, as well as programs to track, generate, analyze data and integrate enterprise-wide systems. The complete package includes the most powerful and

flexible technology as a safe foundation for future control and information systems.

AMS Suite

Predictive Intelligence for Production Assets

Emerson’s AMS Suite uses predictive intelligence to improve availability and performance of production assets including mechanical equipment, electrical systems, process equipment, instruments and valves. AMS Suite does this through the AMS Asset Portal, AMS Device Manager, AMS Machinery Manager and AMS Performance Monitor.

AMS Suite applications monitor and configure intelligent devices like valves, transmitters, analyzers and other field devices, as well as rotating equipment such as pumps and motors. It continuously monitors and captures diagnostic data from intelligent field devices and makes it available for maintenance action.

AMS Suite: Intelligent Device Manager

The AMS Suite: Intelligent Device Manager provides a universal window into intelligent field devices with a comprehensive set of analysis and reporting tools delivering:

- Predictive diagnostics
- Documentation
- Calibration management
- Device Configuration

AMS Suite: Machinery Health Manager

The AMS Suite: Machinery Health Manager combines predictive maintenance techniques with comprehensive analysis tools. The Machinery Health Manager determines the condition of mechanical equipment including rotating machinery and static equipment. With the Machinery Health Manager, it becomes easy to document, trend and communicate all the details of the equipment to help gauge and measure accurate asset condition, advise appropriate actions and prioritize daily maintenance activities.



AMS Suite: Equipment Performance Monitor

Determining the optimal time to carry out maintenance requires accurate and ongoing measurement of equipment efficiency. AMS Suite: Equipment Performance Monitor provides details of equipment degradation using rigorous thermodynamic models. It also provides inefficiency calculations with financial impact information to help prioritize maintenance activities.

AMS Suite: Asset Portal

The AMS Suite: Asset Portal provides secure access to the information stored in mechanical equipment, process equipment, instruments and valves via standard internet connections. Assets, active alerts and event history information in a consolidated platform can also be viewed in a fast and consolidated format. Furthermore, it has the capability to view combined asset information from multiple plant locations and facilities around the world.

Ovation Controls

Event Awareness and Accurate Response

The Ovation control system delivers higher levels of plant availability, reliability and environmental compliance. Ovation embodies Emerson's unsurpassed knowhow in the control and management of complex operations.

From basic control and monitoring of a single plant to fleet or district-wide management, Ovation offers seamless communication with intelligent field devices and integrated AMS Suite: Intelligent Device Manager software to deliver the power of predictive intelligence. Embedded advanced control applications, tailored to meet the challenges of the power generation and water/wastewater treatment industries, ensure full optimization of mission critical processes.

Ovation maximizes the operators' ability to identify an abnormal situation and respond with a predetermined approach. Ovation's design focuses on human factors that have a proven track record of accurate performance during challenging conditions.

Emerson's vast knowledge and proven techniques in the areas of alarm management, graphics design and information access has been built into Ovation to provide an intuitive environment for guiding operators to properly handle irregular plant conditions.

Ovation Alarm Management

Alarm management is a key factor in early detection of unusual process events. Ovation's alarm management strategy combines a best-in-class philosophy with the implementation of hardware and software to clearly convey potential problems to operators.

Ovation's alarm management system focuses the operator on important plant activities that deviate from normal operation. The base alarm system detects and displays abnormal plant conditions on the Ovation operator workstation. These conditions include points out of range, digital state changes, drop time outs and much more. Alarms are displayed in the workstation alarm window and can be sent to the audio annunciator, the process historian and an alarm printer.

Alarming Actionable Events

Ovation's alarm philosophy is based on activating alarms only when an action is required. Alarms on expected events are normally not activated because they distract the operator away from actionable incidents.

Ovation's basic approach to alarming only actionable data helps to lessen an operator's workload, which promotes focused attention on events that require acknowledgement, especially during an abnormal situation. Allowing operators to concentrate on maintaining optimal plant operation emphasizes safety, which ultimately reduces unplanned outages, maximizes availability and increases productivity.

Intuitive Presentation of Alarms

The key to successful implementation of an alarm management strategy is to present the information in an intuitive form. Easy navigation of alarmed events maximizes the operators' ability to identify and quickly respond to the problem. Ovation displays alarms in a manner that instinctively indicates a

problem area and the priority of that problem in either a list or graphical (iconic) form.

Alarm lists provide a running display of all actionable alarms ordered by time of occurrence and filtered by priority or plant area. With a single click on an alarm list item, the operator can quickly access relevant information about the alarm such as action requirements, display interface, help files and trends. Additionally, the alarm list display provides straightforward functions to acknowledge, reset, acknowledge audible, view history and shelve alarmed events. The list also contains tabs which can sort the alarm information by state, such as unacknowledged, acknowledged, returned and reset.

Ovation alarm lists use various features that allow operators to quickly recognize various alarm types. These features include long description strings, alarm actual values, color changes based on priority, blink options and condition statuses. Alarm ancillary data provides quick access to additional important information in order to help the operator respond in a timely and efficient manner.

Iconic Alarms

Iconic, or graphic alarms, provide the operator with another level of alarm visualization by using dynamic graphical representations (icons).

Iconic alarms group alarms by priority and associated plant area. Alarm groups are represented by bitmap images displayed in the iconic alarm list window. The icon list contains up to 200 bitmaps, each with a user-defined border that changes color depending on the alarm status of individual points within groups and the acknowledgment status of the entire group. Each bitmap icon is linked to process graphics that relate to the points within the group, providing quick display of alarm information.

Iconic alarms are filtered by plant area and priority to direct the operators' attention to the proper plant subsystem where the abnormal situation is present. Options are available in the affected area to access specific graphics and alarm information relevant to the abnormality. The operator is then quickly guided to the source of the developing situation.

Alarm Rationalization

An effective alarm management strategy requires continuous improvement in order to achieve maximum results. Emerson strongly stresses the need to have a process that rationalizes alarms and continuously optimizes the control system to achieve higher operator response rates and proper plant operation, while ensuring the highest level of safety possible.

Each Ovation system provides a vast array of tools to help implement alarm rationalization initiatives and control the amount of data presented to the operator during abnormal situations. Examples of these tools include:

- Alarm suppression
- Risk enforcement with 8 prioritization levels
- First-up detection and indication
- Alarm grouping
- Dead-band management
- Variable limits
- Incremental alarming
- Escalating alarms with 5 levels
- Plant mode alarming
- Eclipsing alarms

Ovation Graphic Design

An alarm is normally an operator's first indicator that an event has developed that could potentially lead to an abnormal situation. Ovation graphic displays play an important role in visually conveying the development of an occurrence to an operator. Graphics incorporated into the control system will precisely pinpoint alarm areas and provide efficient control of plant equipment to help avoid costly process issues.

Operators of Ovation systems are well equipped with displays that accurately reflect the plant configuration with a familiar look and feel. Each Ovation system comes equipped with user-friendly, predefined graphics to help the plant operators understand the process. The use of predefined standards provides an easy-to-use baseline for creating quality process graphics. These standards, developed from years of graphic design experience by Emerson, act as a

guide for converting a plant configuration to a display monitor. Utilization of standards minimizes design and implementation time while creating a common presentation of system displays. This will minimize operator error as graphic uncertainty is greatly reduced.

Ovation graphics present information in a uniform format, using light backgrounds and standard color schemes that do not attract attention when plant conditions are normal. Objects are represented with short and long term information to provide fast visualization of data during abnormal conditions. Short-term graphs, such as bars, plots and trends, provide a quick view into the process while long-term information such as digital readouts with alarm colors and conditions description provide detailed information when time and conditions permit more analysis. Flashing and animation can be used in a responsible manner to attract the operator's attention to high priority abnormalities.

Successful Ovation graphic design ensures each operator is comfortable with and fully understands what they see on the system monitors. The design process actively involves the plant operators in the creation and review of the system graphics. Operators are encouraged to attend several review meetings to examine graphic displays to ensure that the data is presented in the proper place, while taking into consideration human factors such as color blindness, display types and preferences.

The Ovation system employs a natural hierarchical structure to display and access graphics. Through menus and hot areas in the graphics, the operator can quickly jump from one area to another with the click of a button. Additionally, Ovation supports multiple views of graphics in the same HMI, which permits simultaneous visualization of several plant processes or the entire plant.

Ovation's hierarchical structure normally includes functional displays in the following categories:

- Overview level
- Process level
- Subsystem level
- Equipment level
- Faceplates

Control and responses to abnormal conditions are normally interfaced through pop-up or faceplate displays, depending on operator preferences. Actions are recorded in event logs to facilitate review, analysis and optimization in future implementation.

Graphic displays are an integral component of abnormal situation handling and can only be effective if they convey the proper information at the right time. Design of Ovation graphics follows this guideline by placing great emphasis on providing the operator valuable information during normal and abnormal conditions.

Ovation Information Access

Ovation provides maximum flexibility for the operator to quickly access information at any point or group of points in the system by providing links to menus of display options. Information gained from these menu options include:

- Trends
- Graphics displays
- Control displays
- Detailed point information
- Help files
- Schematics
- P&ID drawings
- Asset Management System
- Calibration
- Custom applications

Additionally, context sensitive help is available to provide details about the entire Ovation system if required.

Ovation Alarm Analysis Tools

Analyze Alarmed Events

A successful abnormal situation strategy is never complete without a strong follow-up to improve response and effectiveness.

Obtaining accurate data of an incident after it has occurred and analyzing the actions that mitigated the

condition is the first step to improve effectiveness. Ovation's historian continuously stores point data, alarms and operator events for post-event retrieval and examination. Historical information is processed through an intuitive alarm analysis package that allows segregation of plant areas and provides summary information on:

- Total alarms
- Acknowledged alarms
- Unacknowledged alarms
- Standing alarms
- Control system alerts
- Ovation system alarms
- Alarms by priority
- Alarm rates
- Frequent alarms
- Operator response time
- Performance metrics

Additionally, the system provides facilities to save and review previous plant upsets and perform auto-correlation analysis to help identify the root cause of an abnormal situation and alarm conditions.

Ovation Simulation Solutions

Plant Operation and Process Analysis

Leveraging decades of experience in the power generation, water treatment and wastewater treatment industries, Emerson's Ovation Simulation solutions have helped to increase plant efficiency, enhance operator performance and improve plant safety. Whether used as a training tool or for engineering analysis, Ovation Simulation plays a major role in improving operator reaction to abnormal situations.

When used as a training tool, Ovation Simulation teaches operators to fully understand plant control. By using equipment that is identical to the actual control system, operators develop a thorough understanding of how their actions impact plant operations and overall plant efficiency. In cases where system changes or equipment upgrades are planned, operators use Ovation Simulators to fine tune their skills, observing system reactions in various conditions.

The result is a custom-trained operator who has in-depth knowledge of plant equipment and plant processes.

Ovation Simulators are a powerful tool for engineering analyses. By simulating a variety of plant operating conditions, engineers can use the Ovation Simulators with high-fidelity functionality to develop and re-engineer control system logic. Ovation Simulation permits engineers to observe the effect of the changes before they are implemented, allowing them to thoroughly analyze and measure modifications without affecting the normal day-to-day operations of the plant.

Emerson's Ovation Simulation can help customers' plants realize:

- Enhanced operator ability to identify and correct plant upsets or abnormal situations
- Fewer plant trips through improved operator performance
- Improved operator response time due to simulator training programs
- Improved efficiency during plant startup and shutdown
- Reduced cyclic stress, and fewer system and equipment failures due to operator error
- Efficient performance of engineering analyses

In addition, control logic can also be verified on the simulator in a controlled environment. Once the control logic has been demonstrated, it can easily be loaded back on the actual plant control system. Ovation Simulation can save millions of dollars in downtime, waste, and inefficiency through the reduction of unplanned trips whether it is used to train staff or to operate the plant more efficiently.

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