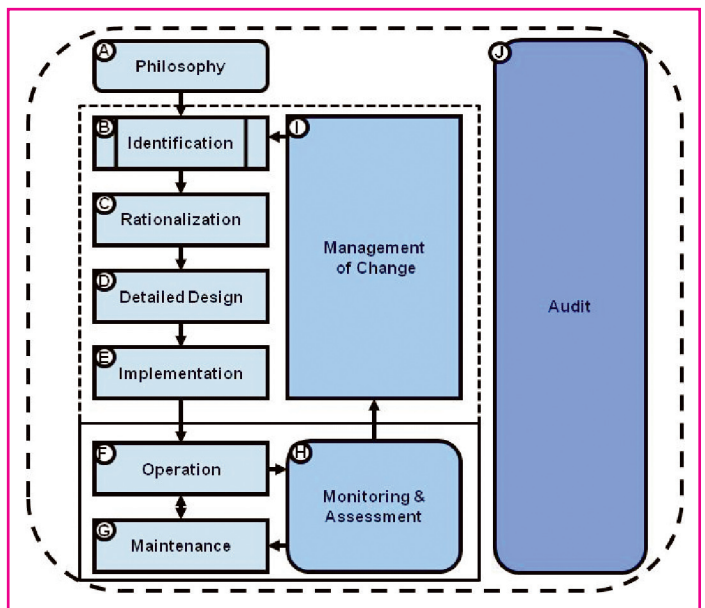
You Asked: Alarm Management

by: Todd Stauffer

Setting a new Standard for Performance, Safety, and Reliability with ISA-18.2

Alarm Management affects both the bottom line and plant safety. A well-functioning alarm system can help a process run closer to its ideal operating point – leading to higher yields, reduced production costs, increased throughput, and higher quality, all of which add up to higher profits. Poor alarm management, on the other hand, is one of the leading causes of unplanned downtime and has been a major contributor to some of the worst industrial safety accidents on record.

Changing the practices and procedures used in the plant has become easier and more important with the June 2009 release of a new ISA standard on alarm management. The ISA-18.2 standard, which provides a blueprint for creating a safer and more productive plant, is expected to be adopted by regulatory agencies (such as OSHA in the U.S. and the labour ministries in Canada) and insurance agencies as "good engineering practice". This article will provide an introduction to the new standard and discuss how it will affect the process industry.



Alarm Management Lifecycle per ANSI/ISA-18.2-2009

Good alarm management is a journey

Alarm management is not a one-time activity, rather it is a process that requires continuous attention. The new ISA-18.2 standard "Alarm Management for the Process Industries" provides a framework for effective alarm management following a lifecycle approach, which is similar in many respects to the process safety standard ANSI/ISA-84.00.01-2004 Part 1 (IEC 61511-1 Mod).

The key activities of alarm management are executed in the different stages of the lifecycle. The products of each stage are the inputs for the activities of the next stage.

Philosophy

The usual starting point in the alarm lifecycle is the development of an alarm philosophy document. It defines the standards for how your site or company will perform alarm management through all phases of the lifecycle. It should contain the rules for classifying and prioritizing alarms, for using colour to indicate an alarm in the HMI, and for managing changes to the configuration. It should also establish key performance benchmarks, such as the acceptable alarm load for the operator (average number of alarms / 10 min). For new plants, the alarm philosophy should be fully defined and approved before commissioning.

Identification and Rationalization

When it comes to alarms, more is not better. The purpose of Identification and Rationalization is to find the minimum set of alarms that are needed to keep the process safe and under control. Rationalization involves reviewing and justifying potential alarms to ensure that they meet the requirements and definition of an alarm.

Alarm: *An audible and/or visible means of indicating to the operator an equipment malfunction, process deviation, or abnormal condition requiring a response.*

Rationalization also involves documenting each alarm's priority, classification, limit, cause, consequence, and corrective action in a Master Alarm Database.

Detailed Design

Poor design and configuration practices are a leading cause of alarm management issues such as "nuisance" and "stale" alarms. Following the recommendations in the standard can go a long way to eliminating and preventing common alarm issues.

Alarm design includes basic alarm design, setting parameters like the alarm deadband or off-delay time, advanced alarm design, using process or equipment state to automatically suppress an alarm, and HMI design, displaying the alarm to the operator so that they can effectively detect, diagnose, and respond to it. During the design stage, the information contained in the Master Alarm Database (such as alarm limit and priority) is used to configure the system.

Implementation, Operation, and Maintenance

The standard describes the practices and procedures for putting an alarm into operation, working with it, and taking it out of service for repair, replacement, or testing. Requirements and recommendations for training and testing are defined, as well as the tools that should be made available to the operator for working with alarms (such as alarm shelving). The standard describes the procedures that must be followed to take an alarm out of service, including documenting why an alarm was removed from service, the details concerning interim alarms, special handling procedures, as well as what testing is required before it is put back into service.

Monitoring and Assessment

An unmonitored alarm system is a "broken" alarm system. Monitoring performance and comparing it to key metrics such as those in the standard is a key activity in the lifecycle. One of the key metrics is the rate at which alarms are presented to the operator. In order to provide adequate time to respond effectively, an operator should be presented with no more than one to two alarms every ten minutes. A related metric is the percentage of ten minute intervals in which the operator received more than ten alarms (which indicates the presence of an alarm flood). ISA-18.2 recommends using no more than three or four different alarm priorities in the system. To help operators know which alarms should be responded to first, it is recommended that no more than 5% of the alarms be configured as high priority.

Management of Change (MOC)

Even the most well-designed alarm system can run into problems if there is no control over who can make changes to it. Management of change entails the use of tools and procedures to ensure that modifications to the alarm system (such as changing an alarm's limit) get reviewed and approved prior to implementation. A recommended practice is to periodically review the actual running alarm system configuration vs. the Master Alarm Database to ensure that no unauthorized configuration changes have been made.

Audit

The audit stage of the alarm lifecycle is primarily focused on the periodic review of the work processes and performance of the alarm system. The goal is to maintain the integrity of the alarm system throughout its lifecycle and to identify areas of improvement.

Conclusion

The new ISA-18.2 standard provides a framework for the successful design, implementation, operation and management of alarm systems in a process plant. Following the standard can improve operations efficiency, reduce downtime, and improve plant safety. One may expect that this standard will set the bar on screening alarm systems so that credit can be taken for operator action as a layer of protection during SIL selection for SIFs. The cost saved by reducing the SIL of multiple SIFs can be substantial over the life of a plant.

For more information go the ISA website www.isa.org to get a copy of the standard (free to all ISA members).

Todd Stauffer, BSME, MSME, P.E. has over 15 years of experience in process control applications (including alarm management and HMI design) in various industries. He is an editor and voting member on the ISA-18.2 standard committee. Before joining exida, he worked for a DCS supplier in various engineering and product management roles.

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Alarm Performance Metrics
Based upon at least 30 days of data

Metric Target Value		
Annunciated Alarms per Time	Target Value: Very Likely to be Acceptable	Target Value: Maximum Manageable
Annunciated Alarms Per 10 Minutes per Operating Position	-1 (average)	-2 (average)

Metric	Target Value
Percentage of 10-minute periods containing more than 10 alarms	-<1%
Maximum number of alarms in a 10 minute period	10
Percentage of time the alarm system is in a flood condition	-<1%
Percentage contribution of the top 10 most frequent alarms to the overall alarm load	-<1% to 5% maximum, with action plans to address deficiencies
Quantity of chattering and fleeting alarms	Zero, action plans to correct any that occur
State Alarms	Less than 5 present on any day, with action plans to address
Annunicated Priority Distribution	3 priorities: ~80% Low, ~15% Medium, ~5% High or 4 priorities: ~80% Low, ~15% Medium, ~5% High, ~<1% "highest" Other special-purpose priorities excluded from the calculation

Alarm Performance Metrics from ISA-18.2

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