

ALARM RATIONALIZATION: FOCUSING ON ALARMS THAT MATTER

Executive Summary



Alarm Rationalization is a key phase in the Alarm Management lifecycle, but it is not an isolated or standalone process. There are inputs and outputs associated with rationalization and these steps are just as important as the rationalization decisions. A successful alarm rationalization effort requires careful planning, execution and implementation.

Even before this, plants must select an approach that will maximize the benefits achieved. Despite the potential benefits of focusing on bad actors or structuring the process by equipment, a full process – unit-by-unit or console-by-console will generally achieve the greatest consistency and returns. However, even so, a rigorous and structured approach is required. Alarm rationalization software tools can play a significant part in making the process more efficient.

The alarm rationalization process in fact includes five distinct elements:

- Planning, justification and funding
- Preparation
- Sessions
- Management of change (MOC)
- Implementation

Each of these is essential to the outcome. Appropriate planning will ensure senior management and operator buy-in, without which no alarm project can succeed; preparation will ensure the meetings and subsequent processes are supported with the correct information so they are as efficient as possible; the rationalization sessions, following the actual process flow, bring a structured, coherent approach to the project that minimizes the required work; the MOC procedures ensure changes to the alarm settings on the DCS are controlled and safe; and a structured implementation will minimize disruption and ensure the quickest possible return on investment.

Finally, the process must be supported both by the right technological tools, but also appropriate expertise to ensure the best outcome from the project. The potential benefits are significant; it is therefore important to ensure the opportunity alarm rationalization presents is not wasted.

This white paper examines the issues and suggests recommendations for achieving operational excellence.

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What is Alarm Rationalization?



At its simplest, alarm rationalization is a systematic review and documentation of all alarmable tags in the control system with the objective of optimizing the number and quality of alarms that the control room operator needs to respond properly during normal operations and process upsets.

Alarm rationalization (AR) encompasses several significant activities: alarm justification, in which existing or potential alarms are systematically compared to the criteria for alarms detailed in the alarm philosophy; documentation of the proposed alarms meeting the criteria, recording the alarm type, set point, cause, consequence, and operator action; and alarm prioritization, again according to the philosophy.

Alarm rationalization is the second step undertaken in an overall strategy for reducing the number of alarms received by control room operators. The first is to reduce the number of nuisance alarms by performing a bad actor cleanup, which typically reduces the number of alarms received during normal steady state plant operation. Alarm rationalization does the same and also reduces the number of alarms during upset conditions. Finally, to fully achieve industry best practices and targets, a further reduction in the number of alarms during upset conditions can be achieved by implementing advanced alarming techniques such as dynamic alarming.

These three steps can be seen in Figure 1.

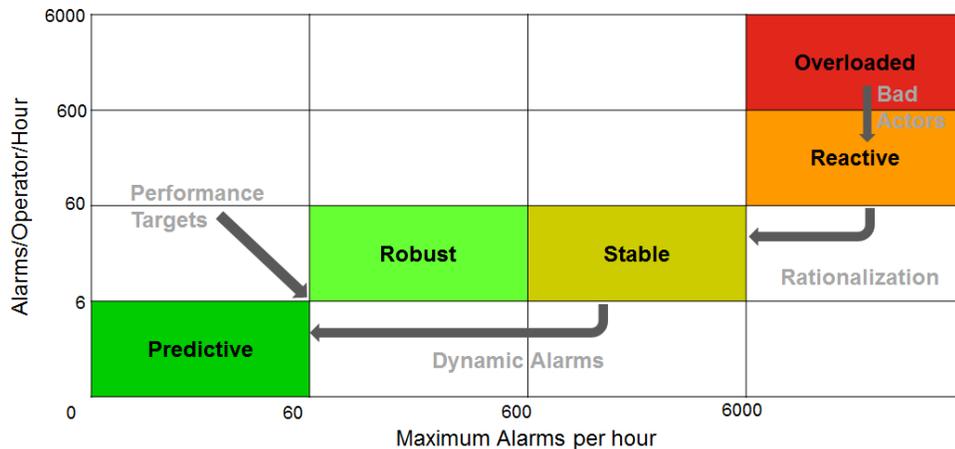


Figure 1. The three-step approach to achieving alarm performance targets

Benefits and Challenges

Alarm rationalization not only reduces the number of alarms, but improves the quality of the alarm system, delivering a range of benefits:

- Consistent criteria for setting and prioritizing alarms
- Improved control room operator decisions about which alarms to address first in cases of high alarm loading
- Elimination of alarms requiring no operator response
- Creation of an alarm response manual accessible to control room operators directly from the control room
- Creation of a master alarm database (MAD), which can be used to define and follow proper controls and procedures for all changes to alarm settings through periodic comparison of the design and DCS.

There are also a number of hidden benefits of a complete rationalization exercise:

- Increased understanding of the process and control system
- Review of P&IDs
- Training for personnel who may not have many years' experience running the unit.

The biggest challenges in completing an alarm rationalization exercise, meanwhile, are time and resources. However, these should not be prohibitive as there are ways to make the process more efficient. Nevertheless, it is important to avoid sacrificing quality to save time or money.



Approaches

There is really no right or wrong when it comes to an alarm rationalization effort. Any improvement to an alarm system is beneficial. However, some approaches deliver a more consistent end result.

The approach may be focused around bad actors, equipment or the process.

- **Bad Actors:** This is often the first step in improving an alarm system. The alarms addressed are determined by performing an analysis of the alarm system that, for example, identifies the most frequent alarms received during a span of time (e.g. Top 20 Alarms for the week). The solution to these nuisance alarms is often simply to remove the alarm altogether if it is not needed or to make simple changes to the alarm settings such as the alarm limit or deadband.
- **By Equipment:** Another option is to rationalize all tags associated with a particular piece of equipment such as a column, pump or compressor. This can be particularly useful where many pieces of equipment on the facility share the same control strategy.
- **Complete Process:** This can be done unit-by-unit or console-by-console and involves a complete review of all alarmable tags using a methodical approach.

There are advantages and disadvantages to each of these approaches. However, methods that do not attempt to rationalize all tags result in a system that may be inconsistently configured: the alarm rationalization effort will never address all alarms configured in the control system; the operator will continue to receive new nuisance alarms and alarms that have not been rationalized, without knowing which alarms have been rationalized and which have not; alarm floods are still likely to occur during upset conditions; and alarm priorities will not be consistently configured so cannot be used to prioritize alarms first when faced with high alarm loads.

Therefore, this document focuses on the complete process of rationalizing all alarmable tags as the one giving the best results.

Tools

The use of an alarm rationalization tool can make the alarm rationalization process more efficient. It should incorporate the following basic features:

- A simple user interface
- Connectivity to the MAD
- The ability to update current parameter values from the control system
- The ability to capture data and send the data back to the MAD
- Addition and/or deletion of tags in the MAD
- Progress tracking
- Statistical analysis of the alarm design parameters (e.g. alarm distribution by priority)
- Reporting functionality to summarize proposed changes resulting from alarm rationalization
- The ability to export proposed changes in a format that can easily be attached to management of change (MOC) procedures.

The alarm rationalization tools included with Honeywell's DynAMo Documentation & Enforcement software provides all this required functionality.

Methodology

There are 5 key phases in the alarm rationalization process:

- Planning, justification and funding
- Preparation
- Sessions
- Management Of Change
- Implementation

Planning, Justification and Funding

An alarm rationalization project can only succeed if it has the support of both operations and management.

There are various means to justify an alarm rationalization project, whether using KPIs to compare the alarm performance to industry best practices, an audit of the overall alarm system, or incidents in which alarms played a role. Compliance with current industry standards,

guidelines and best practices may also suggest the need for a rationalization project.

Obtaining funding for an alarm rationalization can often be difficult due to the time and resources required. However, the return on investment can be illustrated through reference to the long-term benefits:

- Operation within boundaries – With the right alarm at the right time, operators can take action to ensure the operation remains within the desired operating window
- Fewer unplanned outages and incidents – With the right advanced warning, operators can make decisions to prevent outages and incidents
- Lower insurance costs – Many insurance companies require companies to adhere to industry standards and best practices to qualify for reduced insurance rates.

Preparation

The preparation steps should be completed prior to the rationalization meetings.

- Select an area or unit: The selection of the area or unit to be rationalized can be based on alarm performance, personnel availability, unit size and complexity or time available
- The alarm philosophy document: The APD should be reviewed by all members of the AR team, with specific emphasis on the chapters relevant to alarm rationalization.
- The master alarm database: The MAD should be populated to include all alarmable tags and appropriate documentation fields as required by the APD.
- Documentation: Documentation used to support the AR discussions should be gathered and made available (e.g. P&IDs, HMI graphics, SOPs, LOPAs, HAZOPs, etc.)
- Team identification: Personnel required during the AR sessions should be identified and informed of the commitment required of them (e.g. facilitator, operator, process engineer, etc.)
- Schedule: The schedule of the AR sessions should be set such that team members can still achieve their day-to-day job requirements.

Rationalization Process

Alarm rationalization works best following the actual process flow through the P&IDs, starting at the point product enters the unit.

Disturbances typically have downstream consequences. Following the material flow through the process therefore provides a validation method to ensure causes and consequences are matched, alarms are not duplicated and the best indication of a problem is the one that is alarmed.

Using the P&IDs, start at the beginning of the process and for each tag denoted as available on the DCS, the available alarms need to be rationalized:

- Locate the tag in the MAD (or AR tool)
- Complete the tag level documentation
- Determine if alarms are required
- Complete the alarm documentation
- Apply guidelines for alarm settings, if applicable
- Prioritize the alarm according to the method specified in the APD
- Determine the alarm limit
- Determine whether other alarm related settings are required (e.g. dead-bands)
- Discuss any dynamic alarm strategies that may be applicable
- Track and regularly report on the progress of the AR sessions.

Management of Change (MOC)

Changes to alarm settings on the DCS are typically controlled through the site's MOC procedures. However, it may not be practical to complete a separate MOC for every change from an AR exercise, where there may be hundreds or thousands.

A number of solutions are possible: A single MOC can be used to cover all changes; MOCs can be grouped by types of change; or MOCs can be grouped based on classification.

Implementation

A procedure for the implementation should be discussed and determined before the rationalization meetings start to ensure that the rationalization team records the results of the meetings in a suitable format for the implementation team.



Implementing Changes

The biggest challenge when implementing the results of an AR exercise is to determine when to make the changes:

- Ongoing, regularly while AR efforts continue, bringing immediate benefits in terms of alarm loading, but risking operator confusion from an inconsistently configured system
- Unit-by-unit, after rationalization is complete for each unit
- Console-by-console, with changes implemented after all alarms under a single operator's control have been rationalized so the operator will only receive alarms that have been rationalized.
- When choosing the method, consider potential dependent activities such as changes to the operating philosophy, changes to the standard operating procedures, changes to and delivery of operator training, updates to HMI graphics, and addition of new types of alarms.
- The method of implementation should also be considered:
 - One-by-one, with changes implemented on a tag-by-tag basis, which may be time-consuming and pose a greater risk of error
 - In bulk, with all changes uploaded in a single operation if the control system allows it (probably the most efficient method for applying many changes)
 - Through enforcement, if the MAD allows.

Verifying Changes

Once the changes have been made to the tags on the DCS, the data should be verified by comparing the DCS alarm parameter values to the rationalized values in the MAD.

Conclusion

Any alarm rationalization project will bring benefits, but the structured approach to planning, preparation, rationalization, MOC and implementation outlined in this paper is designed to make the best use of the opportunity and investment.

While this outline provides a brief overview of the process, it is – as stated at the beginning – a labor-intensive and time-consuming process. Partly as a result, software solutions can have a significant impact on increasing the efficiency and improving the outcomes from the exercise. It is also a process that requires significant expertise to get the best results.

As with any significant project, the strength of the personnel and tools involved will determine the success seen.

Honeywell's approach to rationalization follows the process described in this paper, and uses DynAMo Documentation & Enforcement master alarm database to capture and maintain a complete set of rationalization data. This is supported by alarm management experts with detailed domain knowledge and comprehensive services proven to improve alarm performance.

For More Information

Learn more about how Honeywell's Alarm Management solutions can improve your plant safety and profitability, visit our website www.hwill.co/dynamo or contact your Honeywell Account Manager or Distributor.

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