TiPS TechDoc: White Paper:
Alarm Rationalization Quality Assurance Guide

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Rationalization Benefits

When discussing the benefits of an alarm rationalization, it's usually on a basis of performance gains such as reducing alarms, improving operations, reducing waste, or increasing safety. These are indeed potential alarm rationalization payoffs, but they are highly variable and need to be measured in order to confirm improvement. For example, if you expect alarm rationalization to result in reduced alarms, you must measure alarm activity before and after rationalization.

The performance benefits of alarm rationalization should be a focal point, since improving your operation is the reason for the investment in rationalization in the first place. If there was no anticipation of improvement, the investment would not be warranted. However, it is crucial to remember that any performance gains will be relative to the quality of the rationalization output. Because rationalization is essentially an alarm system design exercise, its output is a carefully reviewed alarm design augmented with operator advisory and training information such as cause and effect details with recommended responses.

Unfortunately, there is no standardized format or guideline for the content of a rationalization, and the quality varies widely. Unless you establish a standard design, your rationalization results will typically be inconsistent, particularly if you bring in outside resources to help things along or if you farm out the entire effort. This document and the reference spreadsheet downloadable at http://www.tipsweb.com/rationalization, will help you define expectations for the quality of a rationalization and will provide a framework from which to measure that quality.

Please note that this document provides guidance and a framework for a good rationalization document. Add or remove fields as you see fit to reflect your operation's needs. Keep in mind that the alarm activity data produced by your systems will be affected by the design of the rationalization template. Establishing a standard for rationalization output ensures consistency in alarm performance analysis and comparison across units or across an organization.

What Qualifies Us to Deliver this Guide?

Over the past years, TiPS clients have asked us to import their rationalization data into our LogMate alarm management software product. Inconsistencies in the data have required that we design a myriad of import scripts. The lack of a common output format and incompleteness of data has revealed to both us and our clients that they have invested in poorly executed projects with inconsistent results. This guide attempts to arm industry with knowledge of what makes a good rationalization data standard. TiPS LogMate adheres to this design recommendation, and allows for modifications to accomodate client needs or future changes in the recommendation.

Downloadable Reference Spreadsheet

Throughout the guide are references to a spreadsheet that provides a framework for the data entry and project management of a rationalization. A copy of the spreadsheet in Excel® format is available for free download at http://www.tipsweb.com/rationalization/. Entered data can be used to reconfigure a DCS, imported into an alarm management product, or used to develop an operations reference.

Why Do I Need a Spreadsheet?

A spreadsheet is provided because it can serve as a generally universal reference. More important is that you have a standardized rationalization output design, whether in a spreadsheet, a database, or otherwise. A design standard provides a benchmark from which to measure the quality and consistency of a rationalization, a crucial step, especially if you are hiring a third-party and want to be clear about expectations.

One of the major flaws in rationalization output is inconsistency. Results from one unit or site formatted differently from another can become a major issue with cross-unit and cross-site reporting, using scripts to parse the results into a control system configuration, and with utilization of an alarm management software package. Variances in data structure require all interaction with the data to accommodate the differences, which increases the labor and time required. Protect yourself from this ballooning overhead by requiring all data output to fit a specified format.

Completely Complete

A rationalization is finished when the entire spreadsheet is complete. By complete we mean filled in with substantive information. "Equipment failure" is not substantive because it doesn't state the specifics about the piece of equipment or the failure mode. Partial spreadsheet = partial rationalization. This is not meant to construe that you must complete the entire spreadsheet to reap any benefit, only that the rationalization is partial until the spreadsheet is complete.

To explain why, recall that at the conclusion of a rationalization the nature of the alarm system will be radically changed. You will effectively be able to say that the settings are "right", that alarm problems are not a result of bad settings. As such you will also be radically altering the way operators perceive and use the alarm system. If the system is only partially rationalized, how do the operators know which alarms are good and which are bad? How will they be able to rely on advisory information if it's only provided for some of the alarms?

A rationalization will improve the quality of the alarm system. An alarm's purpose is to prompt action and guide response. A partial rationalization has benefits, but there is a considerable difference in the utility of the system once the entire system has been rationalized.

A Dynamic Conundrum

The intent of most rationalizations is to achieve a correct basic alarm system design. Alarm dynamics such as state-based trip point changes or logical grouping introduces a completely new hierarchies to rationalization and documentation. Properly documenting dynamics requires the ability to show parent-child relationships and groupings. While this is entirely possible, it is not within the scope of this document or reference spreadsheet.

Understanding the Reference Spreadsheet

If you decide to download the reference spreadsheet, here are a few notes to keep in mind:

There are four categories of data contained in the spreadsheet, which correspond to sections in this document:

- **Base Alarm Identities:** The list of Tags or Points and their associated alarms
- **Project/Process Management:** Status tracking and time stamp data
- **Design Details:** Explicit design details of each alarm
- **Operator Advisory:** Information about the situation being alerted and recommended actions

Each field is commented with a short explanation. The field names and comments also appear in this document, listed at the end of each section. Field names are suggestions and may be freely changed in the interest of clarity or understanding.

The field names used in the reference spreadsheet are specific to the TiPS LogMate product, but they may be changed to accommodate other systems.

Base Alarm Identities

The basic structure of a working rationalization document will mimic a list of control system tags (or points) and their associated alarms. The document should allow for repetitive tag entries as a result of multiple alarms per tag.

Spreadsheet Fields

Tag: Contains the unique Tag or Point identifier
Tag Description: A plain language or less cryptic description for the Tag. This may be an actual configuration item or simply a reference field in the design document.
Alarm: Contains the identifier for each alarm associated with a Tag

Project/Process Management

To facilitate progress and ensure the most efficient use of time, a rationalization team should use some kind of project management mechanism. At a minimum there should be a way to track the status of alarms as they are shuttled through the rationalization process, including identification of the person responsible for signing off on the final design.

The project (or process) management section manages the status and movement of each alarm as it travels through the rationalization process. This section identifies how much of the rationalization has been completed and identifies who has approved any changes and when they were approved.

Laying this information out in a spreadsheet or project management tool is especially useful for filtering by categories such as unit or priority and for reporting on statistics such as percent complete or number of alarms with changes pending approval.

This type of reporting establishes visibility of progress, which is useful for maintaining momentum and enthusiasm and for management awareness. It also allows you to correlate other metrics to the rationalization effort, such as the alarm rate compared to the amount of the rationalization completed.

Spreadsheet Fields

Current Status: The current status of the alarm within the context of the overall alarm configuration. This can include Incomplete, Pending Approval, Configured, Deconfigured, Rejected. This field ensures that alarms considered and rejected or removed in the past are not reconsidered unnecessarily.

Finalize Date: The date on which the alarm was reviewed and either accepted or rejected by a senior team member.

Finalize User: The user who reviewed and either rejected or accepted the alarm.

Finalize Comment: Any comments regarding the review or outcome of the review.

Design Details

Design Details include the specific configuration items that are mirrored between the control system settings and the rationalization data. Typically, the current system settings are shown as well as the newly selected settings to make it easier to identify differences.

Severity Grid

Typically, two alarm design parameters are reworked in a rationalization, the alarm priority and the alarm trip point. Because the selection of alarm priority can become subjective and political, a technique called a "severity grid" can be used. A severity grid mathematically recommends priorities based on the consequences of missing an alarm and the time available to respond. The severity grid mechanism is covered in detail in the EEMUA 191 document, Alarm Systems - A Guide to Design, Management and Procurement, available at www.eemua.org.

Essentially, a severity grid is a matrix bounded by consequence categories on one axis and impact levels on the other. Examples of consequence categories might be Safety, Regulatory, or Equipment. During the process of rationalization, the level of impact an alarm might have within each category is established. A calculation can then be run against the impact levels and a priority assigned based on a threshold.

This document and the reference spreadsheet accommodate the use of a severity grid through the inclusion of fields for consequence category impact levels, time to respond, and a "Calculated Priority" field, where the priority suggested by the severity grid calculation can be presented. The impact categories shown are suggestions. These fields should be modified to mirror your priority selection methodology if a severity grid is being used.

A severity grid calculation can be done in a spreadsheet or in an alarm management software package that supports severity grid calculations.

Design Details (continued)

Spreadsheet Fields

Alarm Rationale: The reason or "rationale" for the alarm, whether the alarm was actually used or not.
Alarm Message: The text that is displayed by the control system when the alarm is active.
Current Priority: The priority of the currently configured alarm.
Calculated Priority: The priority calculated by the "severity grid" algorithm (if used).
Selected Priority: The priority that was actually selected for this alarm. Can be different than "calculated".
Priority Selection Rationale: The reason or rationale for the priority that was selected.
Current Trip Point: The trip point of the currently configured alarm.
Selected Trip Point: The trip point that was selected for this alarm through the rationalization process.
Trip Point Selection Rationale: The reason or rationale for the trip point that was selected.
Tag Type: The tag type as specified in the control design.
Operating Group: The operating group the Tag is included within.
Process Area: The process area the Tag is included within.
Setpoint: The setpoint of the Tag as specified in the control design.
Tag Comments: Any comment needed to be associated with the Tag.
EU: The engineering units associated with the Tag.
EU Low: The low limit in the engineering unit range for this Tag.
EU High: The high limit in the Engineering Unit range for this Tag.
Safety Impact: The degree of impact the alarm has in regards to safety.
Regulatory Impact: The degree of impact the alarm has in regards to regulations such as environmental restrictions.
Equipment Impact: The degree of impact the alarm has in regards to equipment.
Economic Impact: The degree of impact the alarm has in regards to economics or finance.
Quality Impact: The degree of impact the alarm has in regards to product quality.

Operator Advisory

The Operator Advisory fields contain the operating, process, diagnostic, and engineering insight cultivated during the rationalization process. This information is invaluable to understanding the dynamics of the alarm system and its relationship with the operation of the unit. Operator Advisory data will be used to drive the design of the alarms and to support operators in the successful resolution of upset conditions.

Spreadsheet Fields

Time to Respond: The amount of time an operator has to respond in order for the action to trend the situation back towards normal prior to a safety system interaction.

Cause: The potential cause(s) of the alarm.

Upstream Tag: The upstream or parent Tag(s) relevant to this alarm.

Downstream Tag: The downstream or child Tag(s) relevant to this alarm.

Confirmation: Recommendations for confirming that the alarm is "real" and the situation it is alerting is "real".

Consequence: Potential consequences if the alarm is not addressed or action is not taken in a timely manner.

Corrective Action: Recommended actions for reversing the abnormal trend.

Testing Requirements: The testing methodology for the alarm.