

# Why Alarm Management?

## ■ Environmental changes in the process industry

Recently, a scrap-and-build approach for older control rooms is being considered in many plants in order to increase plant operation efficiency with limited human resources, and to win global competitions and recover from the drawn-out economic stagnation. Thus, the number of control and monitoring loops per operator is rapidly increasing, and with it the load on the operators.

A DCS process alarm (hereinafter “alarm”) is a basic monitoring function for maintaining the plant in a safe and stable condition, and it should be set closely to the limits of the plant’s state (“normal”, “upset”, “shutdown”) as shown in Fig.1.

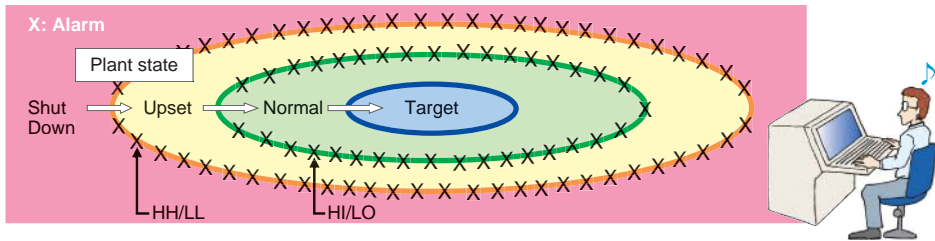


Fig. 1. Effective alarm settings

However, in older control rooms which had many operators, including veteran operators, alarms were generally set without proper consideration, as shown in Fig.2. If these older control rooms are integrated without reviewing the existing alarms, alarm flooding occurs which might result in the oversight of important alarms and no action or incorrect action by the operators, which may result in various losses that could far exceed the profit generated by the integration of control rooms.

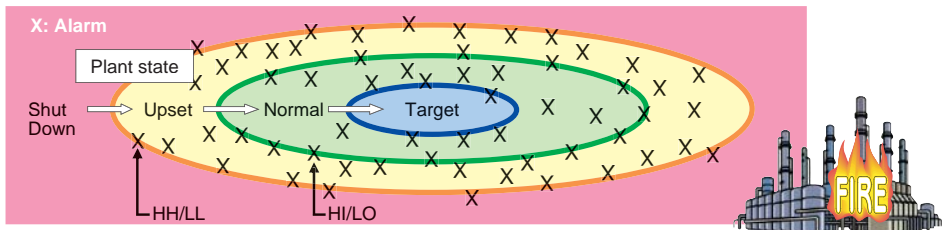


Fig. 2. Typical existing alarm settings

Therefore, the number of customers who works on an Alarm Management is increasing.

# Standard Tactics of Six Sigma DMAIC

Against such a background, Yokogawa devised an original alarm management methodology based on the established Six Sigma DMAIC cycle, which steadily provides various effective solutions to customers throughout the cycle.

## ■ Measure and Analyze Phases

In these phases, data acquisition and analysis are required to quantitatively identify current alarm situations and related problems. The Exaplog™ Event Analysis Package can periodically gather DCS event messages including alarms, and display or print out the results of statistic analysis, such as frequency of alarm occurrence per tag, station, alarm type, priority, etc., and determine whether they are chattering alarms, longstanding alarms, chained alarms and so on. Exaplog, by using various filter functions, also supports customers in identifying whether an alarm is valid, the root cause of its occurrence and essential improvement tactics.

## ■ Improve phase

In the “improve” phase, an essential improvement is required. Yokogawa can provide various solutions based on the root causes of the problems.

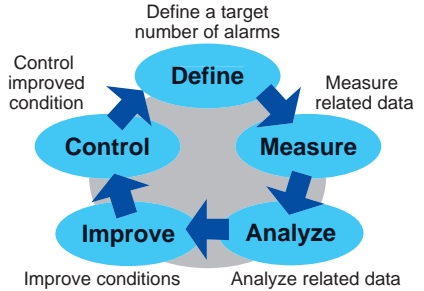


Fig. 3. Six Sigma DMAIC cycle



Fig. 4. Exaplog Event Analysis Package

Table 1. Various Yokogawa solutions

Root cause of alarm occurrence	Essential improvement	Yokogawa's solutions
Field related problems	Replacement of field instrumentation, retuning of tag range, modification of process, etc.	Field instrumentations Consultation, engineering
Control related problems	Retuning of PID, modification of DCS sequence, introduction of APC, etc.	APC package (Exasmoc™, Exarqe™) Consultation, engineering
Alarm related problems	Retuning of alarm setting, modification of DCS sequence, addition of advanced alarm, etc.	AOA package (Exaplog, AAASuite™) Consultation, engineering
Operator related problems	Automation and standardization of operational procedure, introduction of training system	AOA package (Exapilot™) Training system (OmegaLand™) Consultation, engineering

# AAASuite, a More Practical Solution

In cases where the number of veteran engineers are diminished due to restructuring or to budget, and the manpower to proceed with essential improvement tactics is therefore unavailable, it's almost impossible to ameliorate alarm flooding using only the mentioned standard procedures. That's where Yokogawa's new solution, AAASuite comes in.

## ■ AAASuite, Advanced Alarm Administrator

AAASuite is an innovative package which automatically analyzes alarms based on the embedded diagnostic logic accumulated from Yokogawa's longstanding experience, and optimizes and manages the alarms by using existing DCS functions in lieu of making the essential improvements. By such optimization and management of alarms, only the most essential alarms are announced with optimum timing to the operators, thereby facilitating safer, more stable and efficient operation with limited human resources.

**Table 2. Key functions and introduction procedure**

Introduction procedure	Key functions	Purpose	Number of alarm occurrence*1
1	Suppression of repeating nuisance alarms	Suppression of nuisance alarms	Drastically decreased
2	Optimization of alarm setting	Reduction of nuisance alarms	Drastically decreased
3	Re-notification of longstanding true alarms	Addition of value-added alerts	Slightly increased
4	Prediction of important alarms	Addition of value-added alerts	Slightly increased
5	Addition of more advanced alarms	Addition of value-added alerts	Slightly increased

\*1 The number varies depending on specific plant conditions.

## ■ Easy connectivity

AAASuite can be run on Windows® 2000 Server/Professional or Windows XP Professional, and can be added easily to an existing control system by using an industry standard OPC™ (OLE for Process Control) interface.

## ■ Easy engineering

All diagnostic logic based on Yokogawa's longstanding experience has already been embedded in AAASuite, and intended tag names and alarm types also can be automatically set in this diagnostic logic via the A&E (Alarm and Events) server of the OPC interface. AAASuite thereby frees the engineers from troublesome engineering work.

# Automatic Alarm Suppression

## ■ Automatic suppression of repeating nuisance alarms

AAASuite automatically identifies typical nuisance alarms by analyzing the frequency of the occurrence of alarms and related process data. AAASuite then automatically suppresses the repetition of these nuisance alarms by changing the alarm set point to a stricter setting, or by setting the alarm to “off” at the DCS. After such suppression, AAASuite continues to monitor the relevant tag, and if the situation changes, AAASuite automatically reverts to the original alarm set point or to the alarm “on” condition.

**Table 3. Type of nuisance alarms and suppression methods**

Type of nuisance alarms	Root causes of occurrence	Suppression methods	Essential improvements
Repeating HI (LO) alarms	Incorrect alarm settings	Changing of alarm set point to a stricter level	Retuning of alarm setting
Longstanding false HI (LO) alarms	Incorrect alarm hysteresis settings	Secure instantaneous changing of alarm set point	Retuning of alarm hysteresis
Oscillating HI-LO alarms	Incorrect PID parameters settings	Setting the alarm to “off” for relevant alarm type	Retuning of PID parameters
Repeating annunciators	Inadequate DCS applications	Setting the alarm to “off” for relevant annunciator	Modification of DCS application
Repeating IOP (IOP-) alarms	Over range	Setting the alarm to “off” for relevant alarm type	Retuning of tag range Replacement of field instrumentation
Repeating IOP (IOP-) alarms	Minor field transmitter problems	Setting the alarm to “off” for relevant alarm type	Replacement of field transmitter

## ■ Audit trail

An archive of suppressed alarms, root causes of alarm occurrence, and essential improvement tactics can automatically be stored in the report as an audit trail. Through this function and by analyzing the audit trail, future essential improvements can be determined.

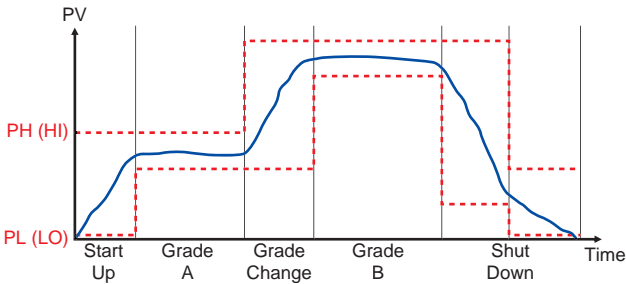
## ■ Added safety (Optional)

In case an AAASuite master PC is shutdown for some reason, an AAASuite recovery PC reverts the suppressed alarms to their original set points or restores the alarms to “on” automatically.

# Dynamic Alarm Optimization

## ■ Dynamic alarm setting based on changes in operational state (Optional)

HI/LO alarm set points should be adjusted (as in Fig. 5) when operating conditions have changed (i.e. grade change, load change, etc.). AAASuite can dynamically change these alarm set points according to changes in operational states. A database of alarm set points can be stored in a CSV (comma separated value) format file, and AAASuite downloads the appropriate alarm data settings to the DCS automatically when an operational state is changed. If the customer allows operators to change the alarm set points manually during operation, AAASuite uploads the current alarm data sets to a CSV format file automatically when the operational state is changed again.



**Fig. 5. Effective alarm settings based on an operation change**

With the above two functions, AAASuite supports customers' amelioration of alarm flooding. Moreover, AAASuite support adds high-value added alarms which enhance an individual operator's performance (including supporting the operator in performing concurrent multi-tasking).

## ■ Re-notification of longstanding true alarms

AAASuite automatically re-notifies operators of longstanding true alarms in order to prevent possible oversights.

**Table 4. Type of longstanding true alarms**

Type of alarms	Root causes of occurrence	Re-notification methods	Essential improvements
HI (LO) alarm	Unstable process	Message, sound	Setting of Still function*1
IOP (IOP-) alarm	Transmitter failure Broken wire	Message, sound	Setting of Still function*1

\*1 Still function can be used for high priority tag in CENTUM CS / CS 1000 / CS 3000.

# High-Value Added Alerts for Facilitating Enhancement of an Individual Operator's Performance

## ■ Predictive alert for critical alarms

HH/LL alarms are often used to trigger an interlock sequence (i.e. emergency shut down). The operator needs to detect these alarms before the process reaches HH/LL and before the interlock is executed. AAASuite causes predictive HH/LL alerts before the process reaches interlock HH/LL alarm limits. (Also available for HI/LO alarms)

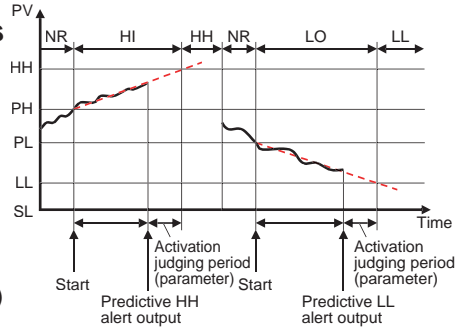


Fig. 6. Predictive alert

## ■ Advanced alert (Optional)

An advanced alert is a more meaningful alarm function for keeping the plant in an optimal safe, stable and efficient condition and should be set closely to the limits of the plant state ("Target", "Normal") as shown in Fig.8. AAASuite provides various kinds of advanced alerts as a template.

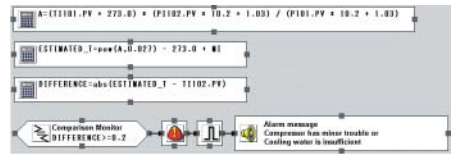


Fig. 7. Advanced alert (Compressor load monitor)

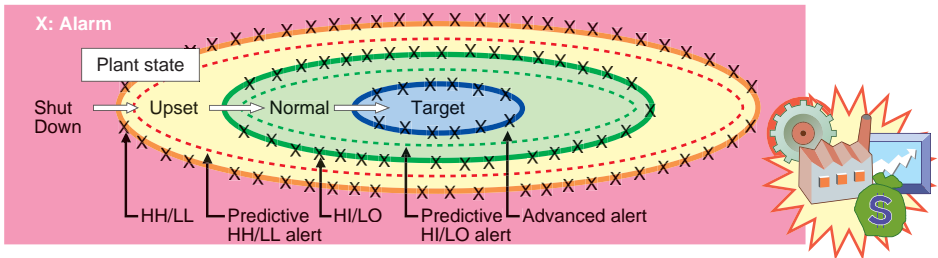


Fig. 8. Effective alarm setting by AAASuite

AAASuite, which has been designed to reduce the need for additional labor and to enhance individual operators' performance, was discussed herein. Although it is essential that alarm management should be initiated with a detailed review of all alarms, engineering manpower is limited and therefore the alternatives presented in this document should be strongly considered.