SUHAS KULKARNI, SYSTEM 800XA OPERATIONS

ABB Ability™ System 800xA

Effective Alarm Management in Industries Webinar Presentation

April 2020

 Document ID.: Rev.:

Presenter introduction: Suhas Kulkarni

25 years serving industrial customers

Title:
Global Service Manager – Food & Beverage, Datacenters & Smart Manufacturing

Background:
I have been working with ABB for past 20 years. During these years I have held various roles in Engineering, Project Management, R&D Program Management and Marketing Functions. I have worked for various Industries like Sugar Plants, Dairies, Iron & Steel, Cement, Mining, Specialty Chemicals, Petrochemicals etc

Agenda

Alarm Management Background

- Definition
- Why Do we need to control Alarms?
- What are the issues?
- What is Guidance?

Solutions in ABB Ability System 800xA

- Base offering in System 800xA
- Extended Operations
- AlarmInsight

Questions

Alarms

Definitions and Purpose

Definition of an Alarm

Namur NA 102:

Indication requiring immediate response by the operator. The response may be, for example, manual intervention, increased watchfulness or initiation of further investigation.

ISA–RP 77.60.02-2000:

An audible or visible means of indicating to the plant operator an equipment or process malfunction or abnormal condition.

Purpose of an Alarm System

EEMUA 191:

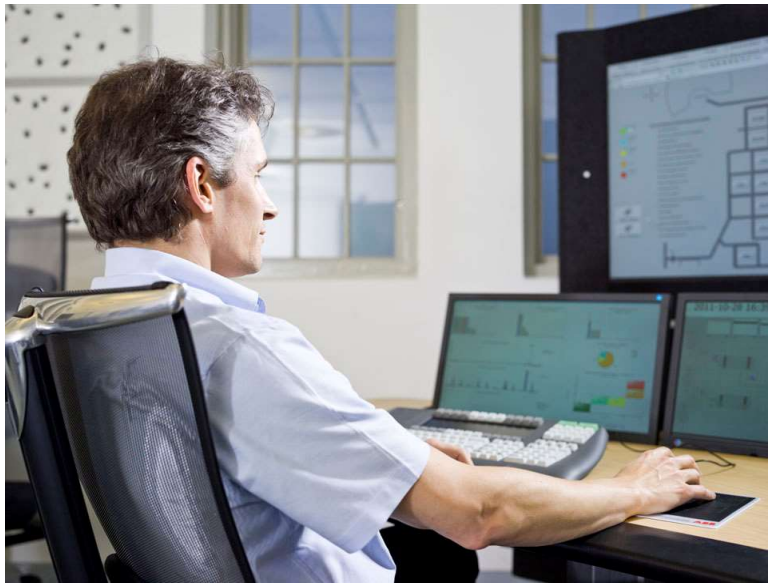
- The purpose of an alarm system is to direct the operator's attention towards plant conditions requiring timely assessment or action
- Each alarm should alert, inform and guide
- Every alarm presented to the operator should be useful and relevant to the operator
- Every alarm should have a defined response
- Adequate time should be allowed for the operator to carry out his defined response

When an alarm sounds

Operators need to know instantly what it means and have both the time and the information to deal with it correctly

EEMUA 191 states:

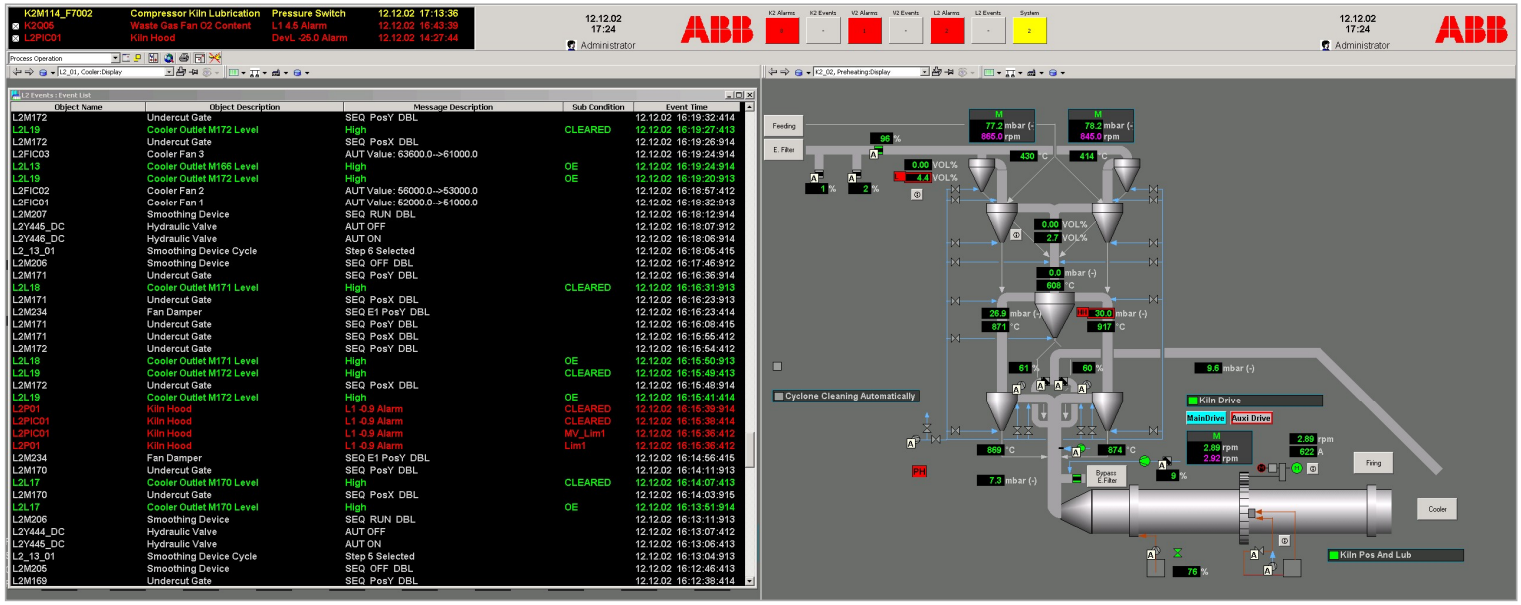
- Each alarm should alert, inform and guide
- Every alarm presented should be useful and relevant to the operator
- Every alarm should have a defined response



Acknowledging or silencing an alarm without investigating it is not an option!

Unfortunately, that’s not always the case

Value-added Engineering



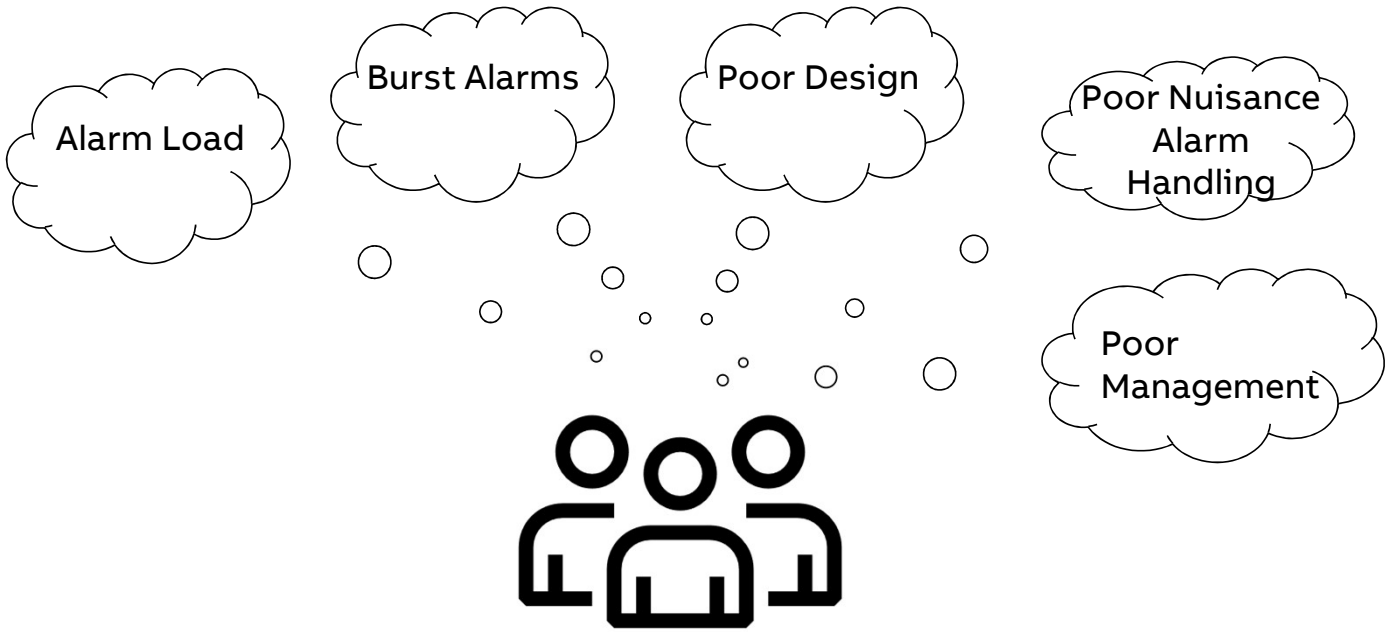
With fewer operators controlling ever-larger process areas, effective alarm management is essential!

Today, many operators face too many alarms

Without a properly configured alarm system, even the most skillful operator may run into difficulties

- Often turn off acoustic alarms
- Acknowledge alarms without acting
- Missed alarms can cause incidents or near-incidents
- Suppress alarms for long periods
- May not even know what a particular alarm means

What are issues ?



What are issues ?

Alarm Load

Symptoms

- High number of alarms per operator per minute
  - 1 per minute is unacceptable
  - Highest seen 40 per minute
- Operators accept alarms without review

Effects

- Devaluing of the Alarm System
- Decision making impaired
  - Poor operator responses
- Adds to operator stress
- Masks high priority alarms
  - More outages
  - Loss of protective layer

What are the issues?

Alarm Bursts

Symptoms

- High number of alarms from a single cause e.g
  - Compressor trip
  - Shutdown/Startup
- Often see 100+
- Occasionally see 500+

Effects

- Incorrect/delayed diagnosis of causal event
  - Incorrect response to incident
  - Delayed response to incident

What are the issues?

Nuisance Alarm Handling

Symptoms

- High number of alarms per operator per minute
  - Repeating alarms
  - Instrument Fault alarms
  - System alarms

Effects

- Alarms defeated
  - Safety alarms
  - ‘Unofficial’ defeats
- Ignoring the alarm system
- Poor control room environment
- High operator stress
- Devaluing of work request system

What are the issues?

Poor Design

Symptoms

- High numbers of high priority alarms
- Safety alarms not differentiated
- No defined operator response
- Standing Alarms
  - Out of use or standby equipment

Effects

- Operators respond to inappropriate alarms
  - Delayed or no response to important alarms
- Inconsistent or incorrect operator response

What are the issues?

Poor Management

Symptoms

- Alarms disabled inappropriately
  - Without risk assessment
  - Without regular review
- Alarms ignored
- Faulty alarms not addressed

Effects

- Removal of a layer of protection
  - Safety
  - Environmental
  - Economic
- Regulator attention!

What Guidance is available?

ASM (Abnormal Situation Management) Consortium

ISA 18.2: “Alarm Management for the Process Industries”

HSE: “Better Alarm Handling”

EEMUA 191: “Alarm Systems - A Guide to Design, Management & Procurement.”

What Guidance is Available

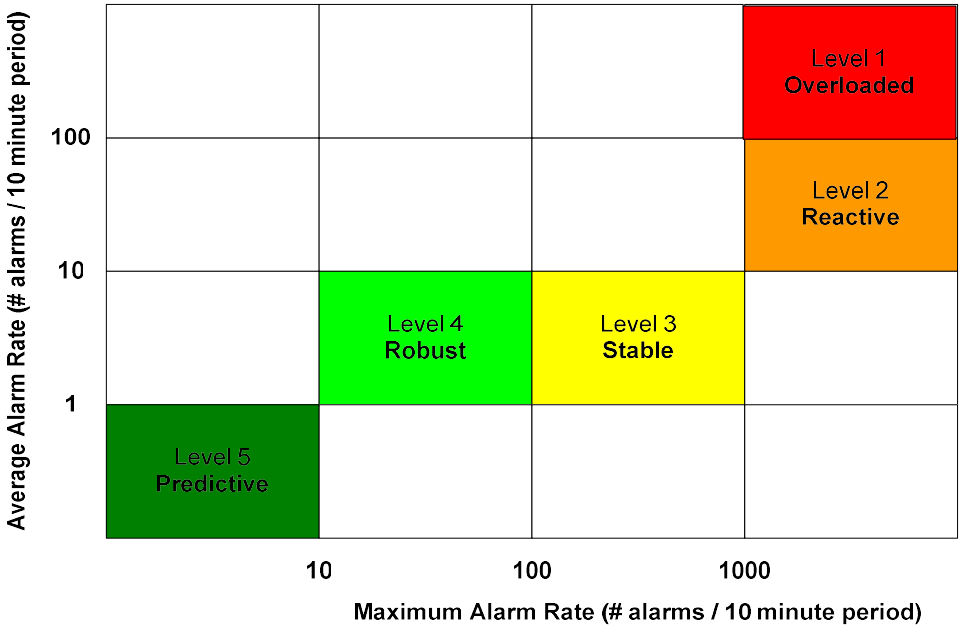
Design Principles – Primary KPIs

Metric	Benchmark value[#1]
Average alarm rate	less than 1 per 10 minutes
Maximum alarm rate	less than 10 per 10 minutes

#1 as suggested in EEMUA Guide 191 Second Edition

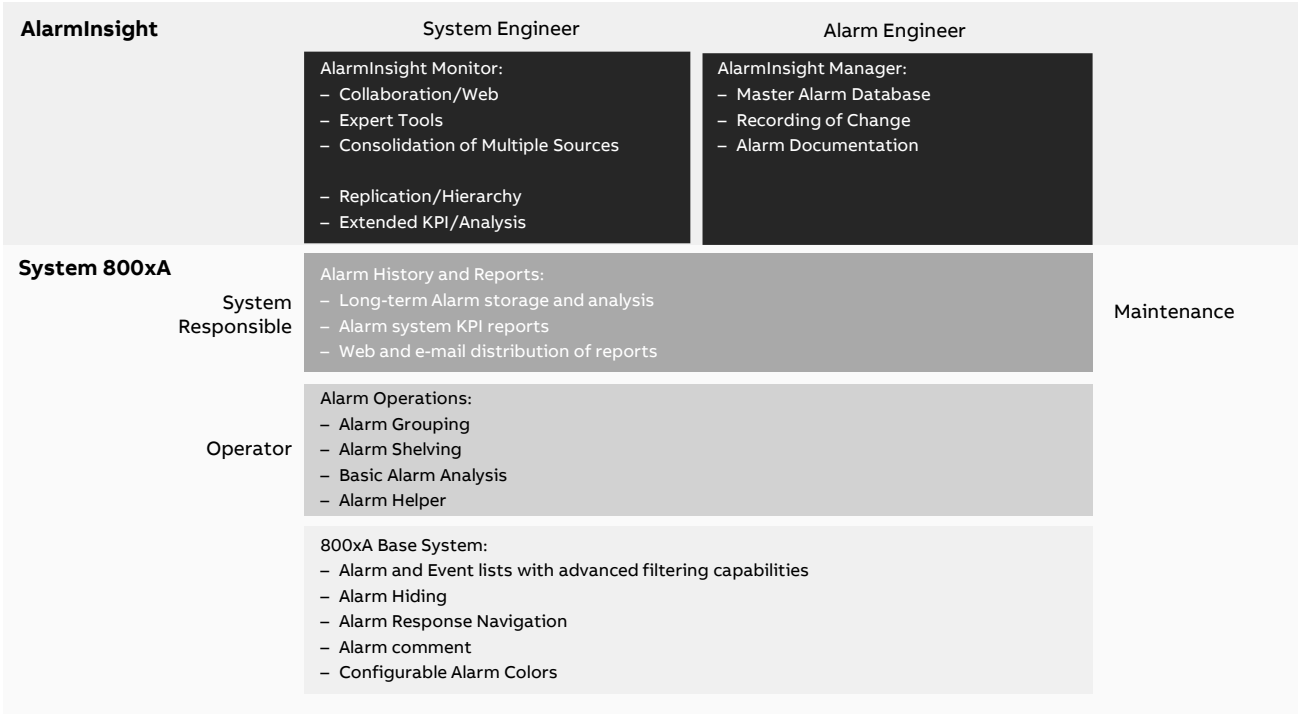
What Guidance is available

Performance Levels

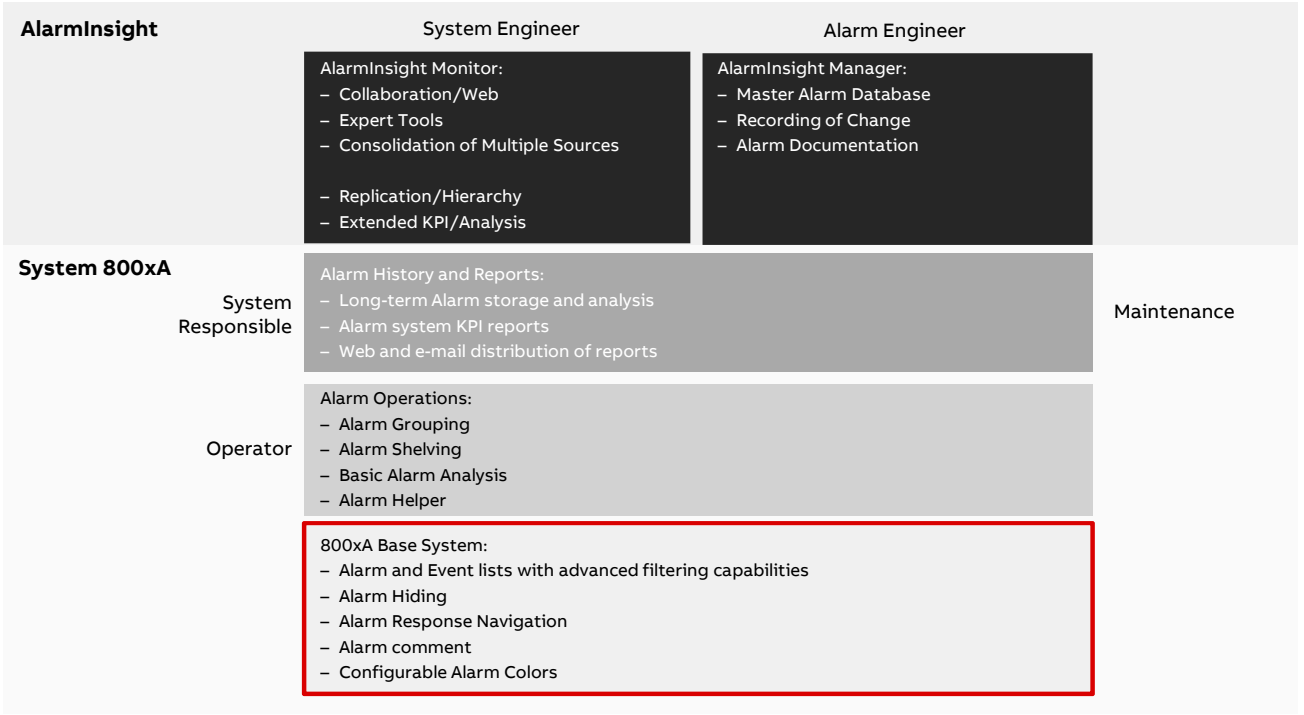


See: EEMUA 191:2007 section 4.1.2 and Appendix 13

System 800xA Alarm Management overview



System 800xA Alarm Management overview



Proactive, operator-friendly alarm-list presentation

The better the alarm list, the quicker the problem gets resolved

- Operators more proactive
- Can acknowledge all visible alarms
- Enter and record comments in the events list
- Navigate directly to the relevant events list
- View live status presentation
- Make comments to alarms and events directly in the Alarm Lists

Proactive, operator-friendly alarm-list presentation

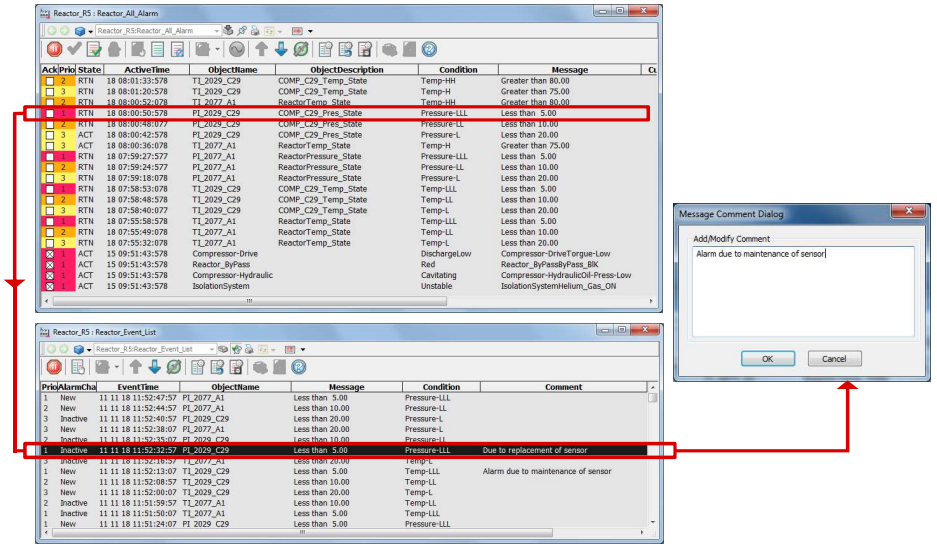
View live values in the alarm list

Reactor_R5 : Reactor_All_Alarm

Reactor_R5:Reactor_All_Alarm

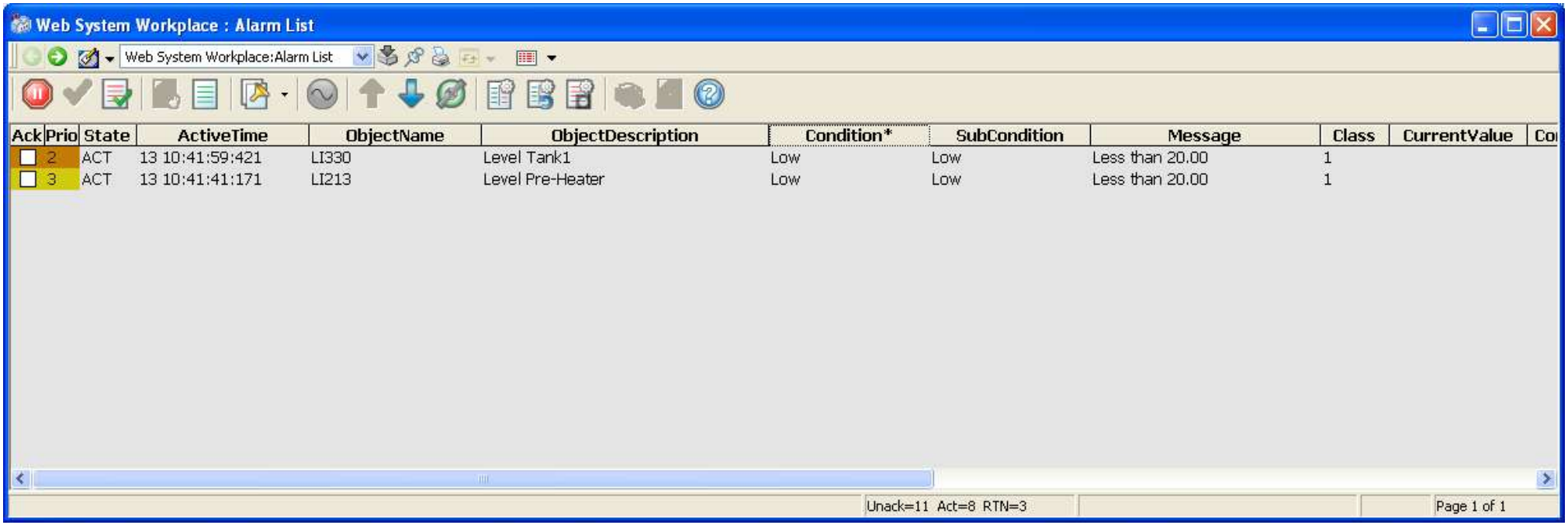
Ack	Prio	State	ActiveTime	ObjectName	ObjectDescription	Condition	Message	CurrentValue
	2	ACT	18 08:00:52:078	TI_2077_A1	ReactorTemp_State	Temp-HH	Greater than 80.00	95.89
	1	ACT	18 08:00:50:578	PI_2029_C29	COMP_C29_Pres_State	Pressure-LLL	Less than 5.00	33.96
	2	ACT	18 08:00:48:077	PI_2029_C29	COMP_C29_Pres_State	Pressure-LL	Less than 10.00	33.96
	3	ACT	18 08:00:42:578	PI_2029_C29	COMP_C29_Pres_State	Pressure-L	Less than 20.00	33.96
	3	ACT	18 08:00:36:078	TI_2077_A1	ReactorTemp_State	Temp-H	Greater than 75.00	95.89
	1	RTN	18 07:59:27:577	PI_2077_A1	ReactorPressure_State	Pressure-LLL	Less than 5.00	38.33
	2	ACT	18 07:59:24:577	PI_2077_A1	ReactorPressure_State	Pressure-LL	Less than 10.00	38.33
	3	ACT	18 07:59:18:078	PI_2077_A1	ReactorPressure_State	Pressure-L	Less than 20.00	38.33
	1	RTN	18 07:58:53:078	TI_2029_C29	COMP_C29_Temp_State	Temp-LLL	Less than 5.00	68.41
	2	RTN	18 07:58:48:578	TI_2029_C29	COMP_C29_Temp_State	Temp-LL	Less than 10.00	68.41
	3	RTN	18 07:58:40:077	TI_2029_C29	COMP_C29_Temp_State	Temp-L	Less than 20.00	68.41
	2	RTN	18 07:57:23:578	TI_2029_C29	COMP_C29_Temp_State	Temp-HH	Greater than 80.00	68.41
	3	RTN	18 07:57:10:578	TI_2029_C29	COMP_C29_Temp_State	Temp-H	Greater than 75.00	68.41
	1	RTN	18 07:55:58:578	TI_2077_A1	ReactorTemp_State	Temp-LLL	Less than 5.00	95.89
	2	RTN	18 07:55:49:078	TI_2077_A1	ReactorTemp_State	Temp-LL	Less than 10.00	95.89
	3	RTN	18 07:55:32:078	TI_2077_A1	ReactorTemp_State	Temp-L	Less than 20.00	95.89
	1	ACT	15 09:51:43:578	Compressor-Drive		DischargeLow	Compressor-DriveTorgue-Low	
	1	ACT	15 09:51:43:578	Reactor_ByPass		Red	Reactor_ByPassByPass_Blk	
	1	ACT	15 09:51:43:578	Compressor-Hydraulic		Cavitating	Compressor-HydraulicOil-Press-Low	
	1	ACT	15 09:51:43:578	IsolationSystem		Unstable	IsolationSystemHelium_Gas_ON	

Alarm comments

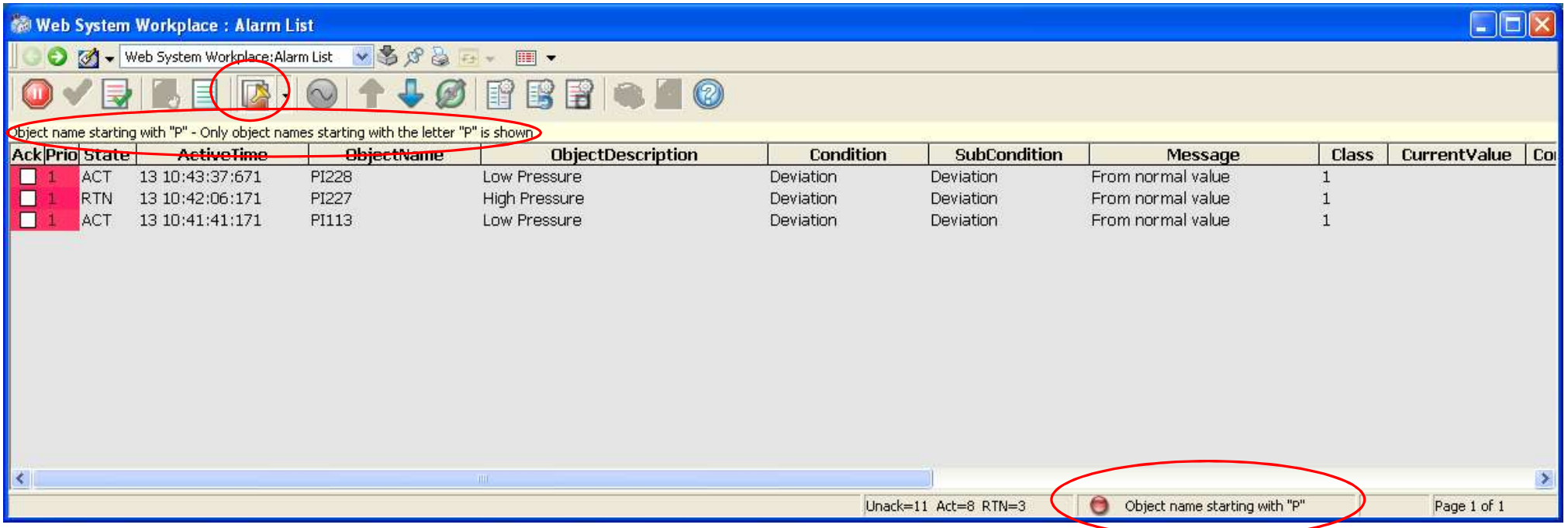


Easy-to-use System 800xA alarm lists encourage operators to take a proactive approach to recording and dealing with unexpected events.

Operator Filters



Predefined Filters

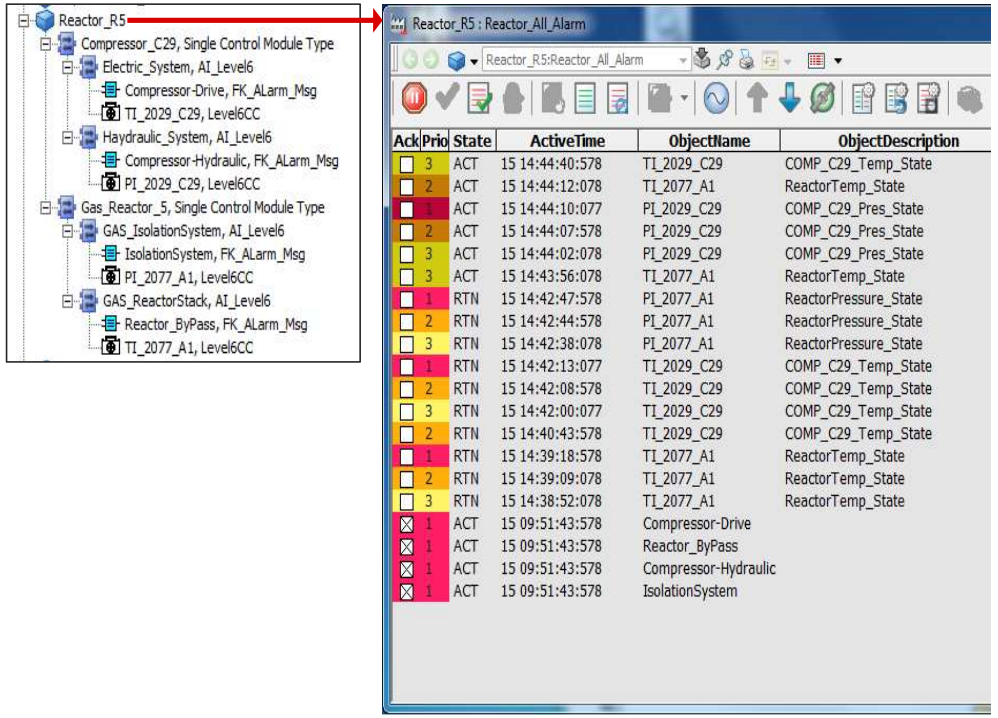


Automatic alarm structuring

Enables simple and safe alarm delegation

Take advantage of the Functional Structure

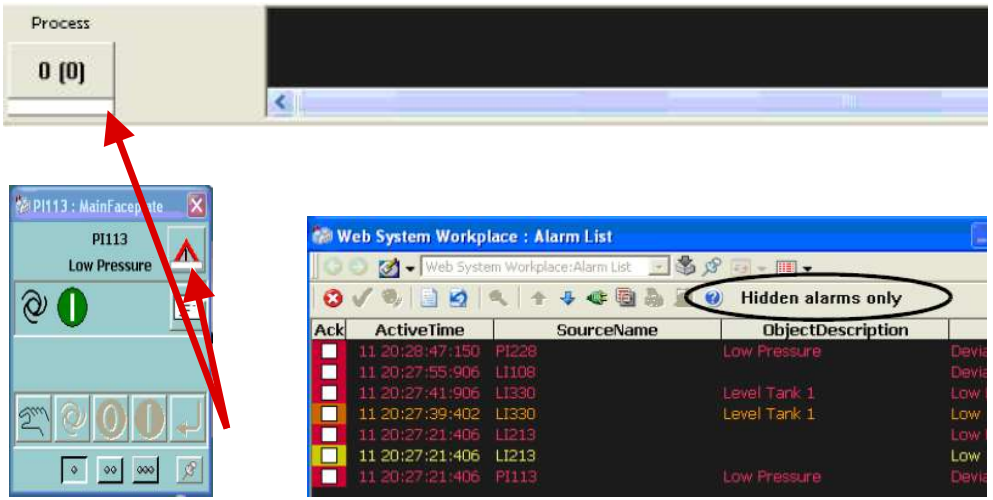
- Make usage of the Functional Structure:
  - Simplifies alarm list engineering – just add on top of already-engineered structures
- Fast and cost-effective (engineering is already done)
- Operators only need monitor alarms for their ‘own’ objects
- Adding a new object alarm automatically updates the alarm list



Alarm hiding

Reduce distractions from nuisance alarms

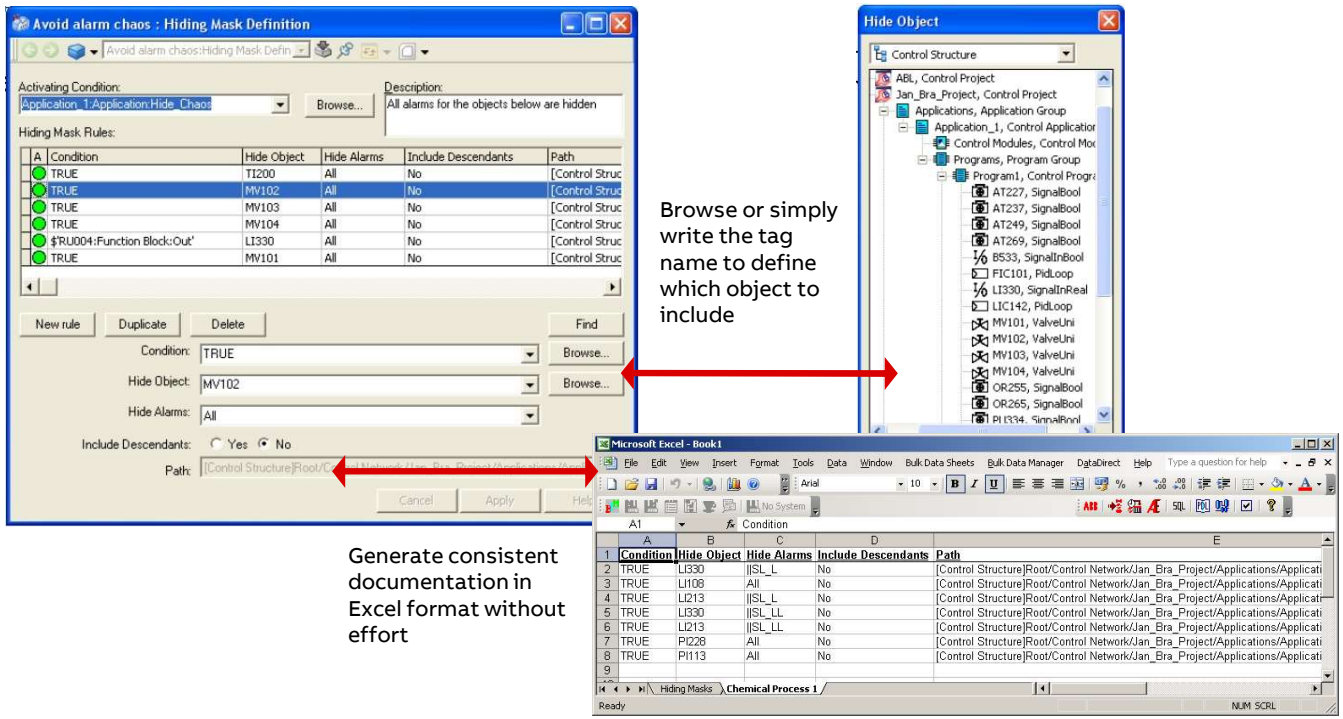
- Set up during the engineering phase
- Suppresses alarms that are not relevant
  - Expected or based on a known process state e.g. low flow during controlled shutdown
- Never visible to operators, only an indication in the faceplate



Operators only see alarms that require attention or action on their part

Alarm hiding

Configuration

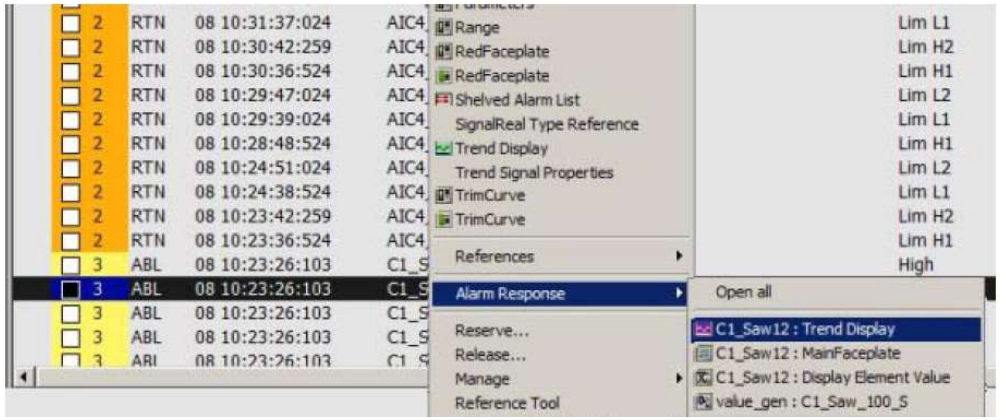


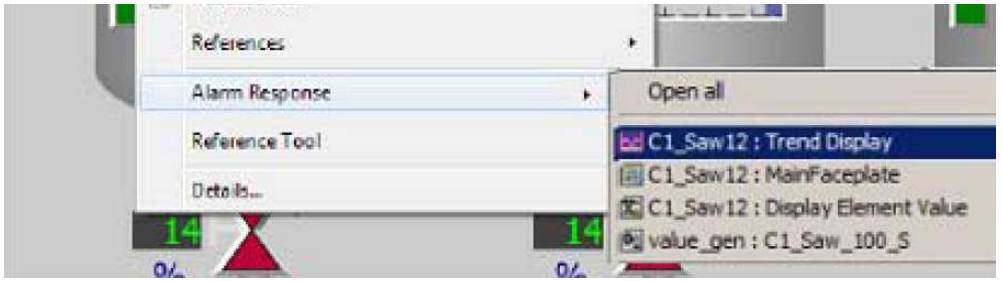
Alarm Response navigation

Gives fast access to essential information

Fast, direct access to alarm-related information

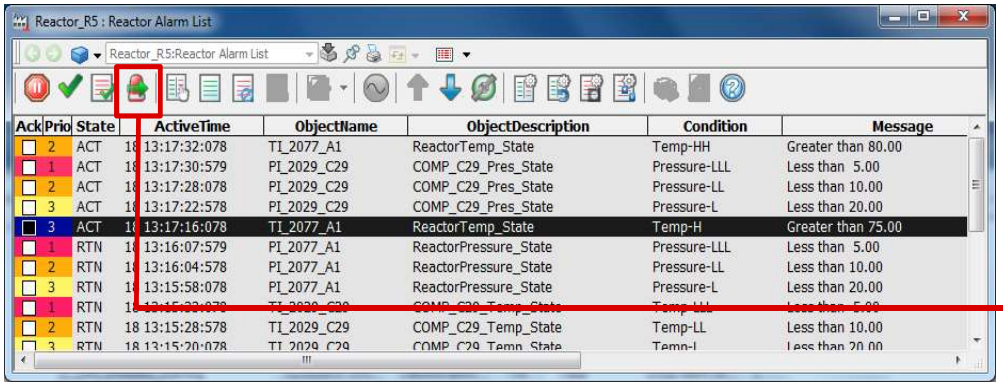
- Operators activate Alarm Response navigation via the Alarm and Event list or the object context menu
- Right-click to specific information on what the object is and does, and to react correctly
- One click access to the object's faceplate, graphic display, operating manual or live video image
- System Configuration Console offers users the option of simple configuration of default behavior
- Rules can be configured in the Workplace Structure, or in an object basis

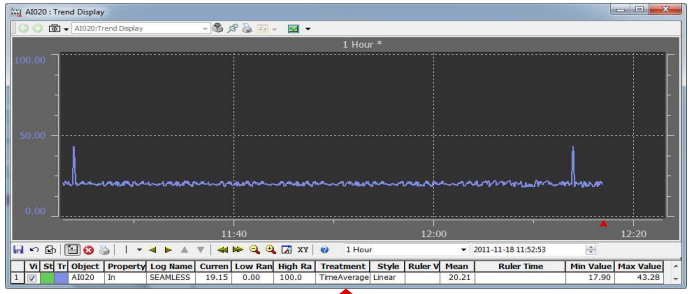


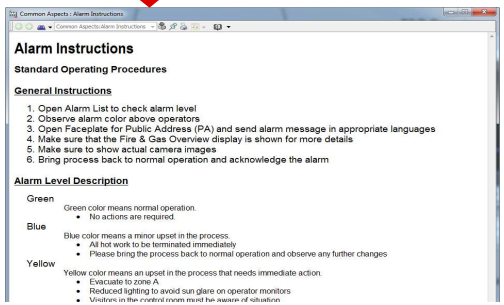


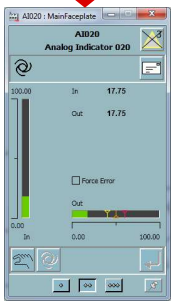
Alarm Response navigation

Fast navigation from an alarm





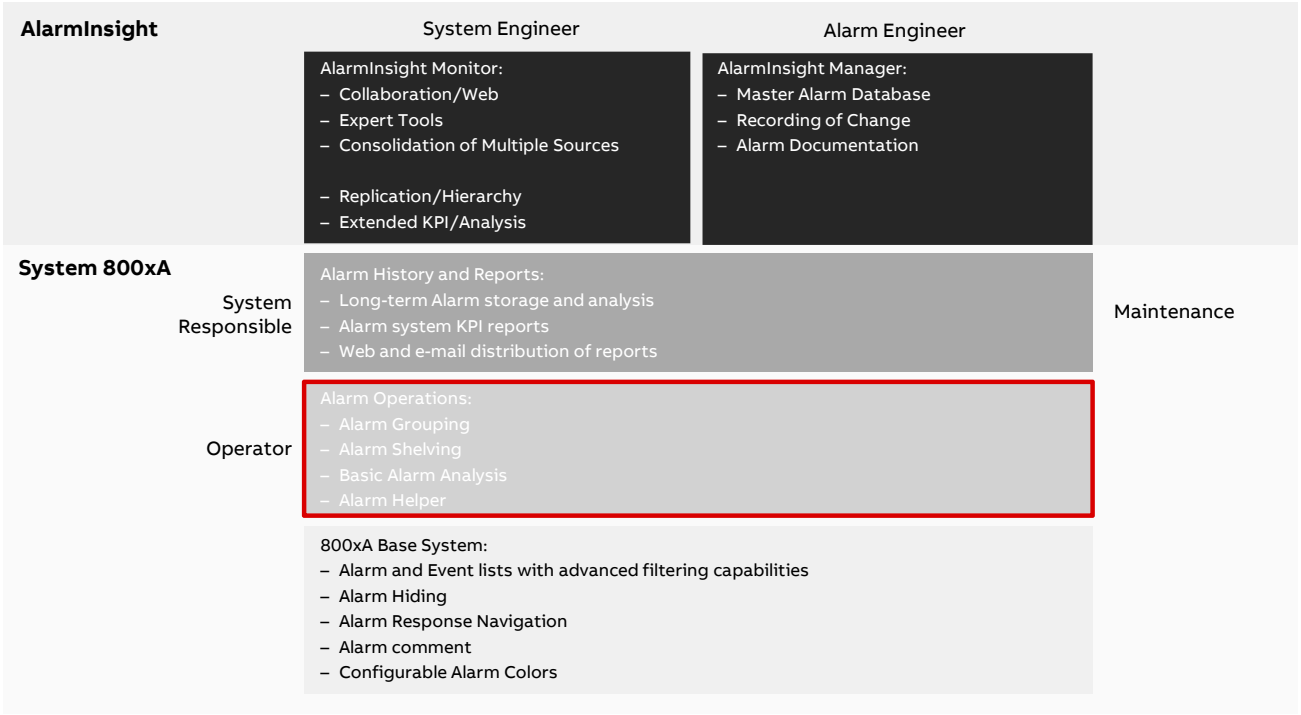




Operators have detailed information needed to correctly handle the alarming situation

System 800xA Alarm Management overview

Highlight Alarm Operations

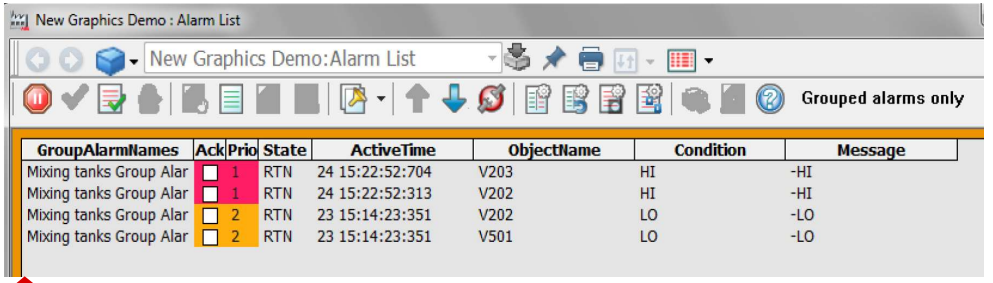


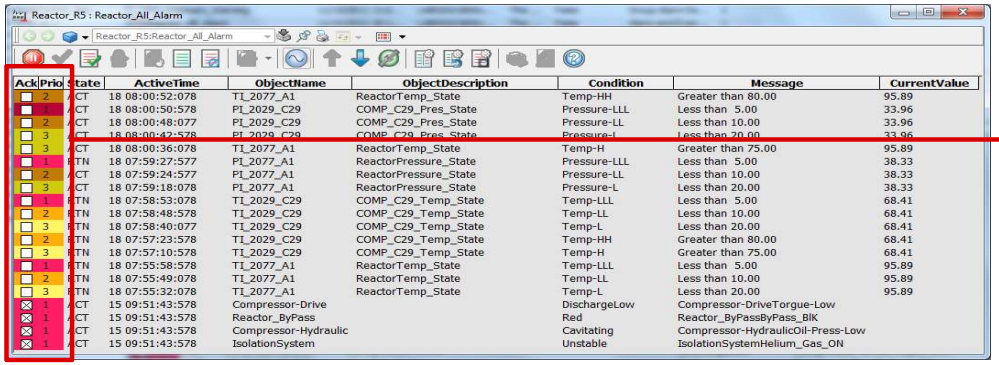
Alarm grouping

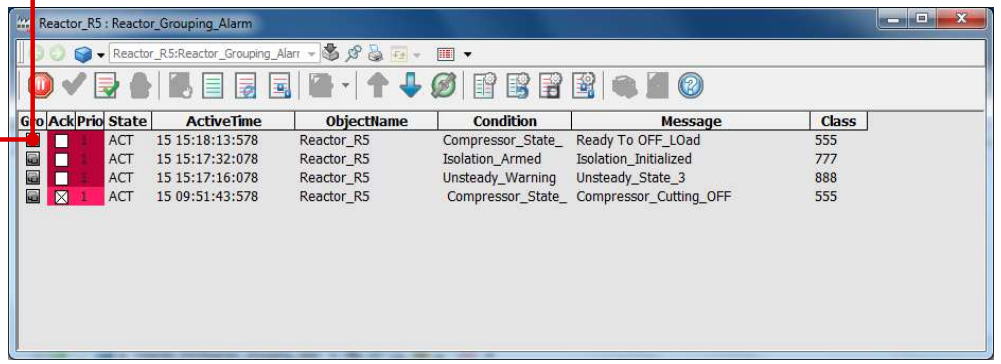
Replacing long lists

Helps operators handle tasks with undistracted attention

- One single alarm is presented instead of several individual
- Generally related to a common process unit or a similar operator response
- Helps operators understand the implications of a particular alarm
- Easy to define, configure and manage via context menus

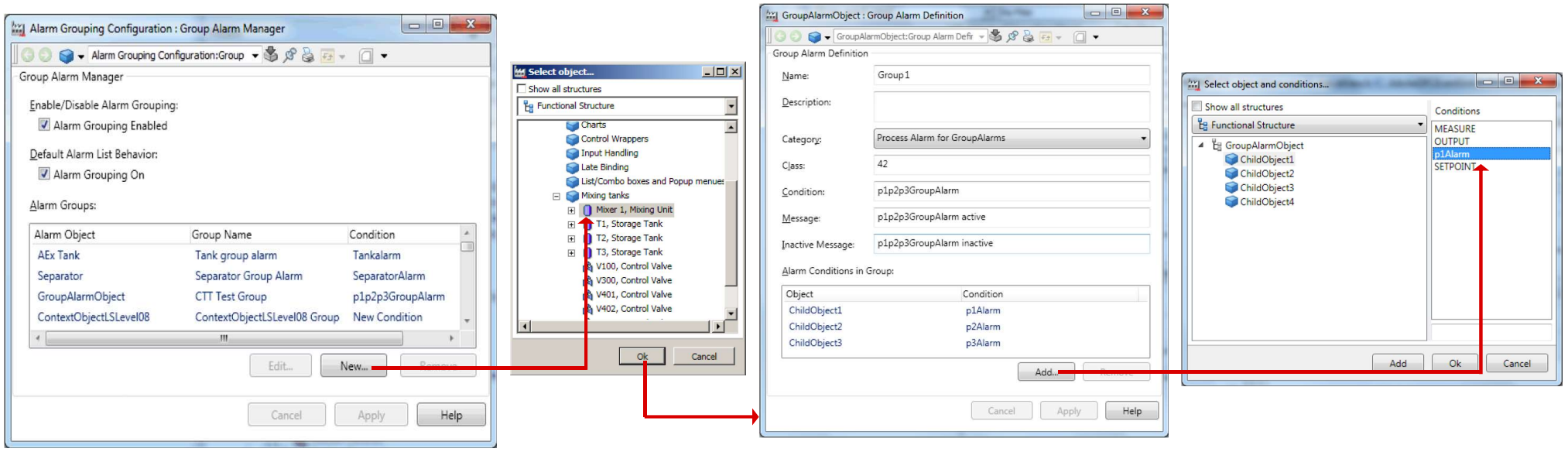






Alarm grouping

Configuration

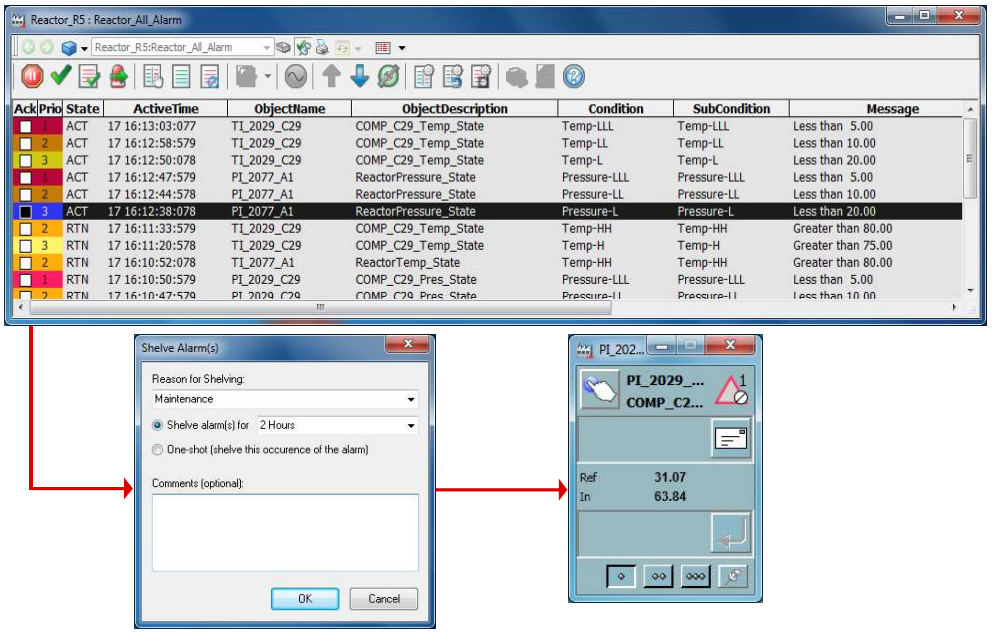


Alarm shelving

Removing distractions in temporary situations

Helps operators handle stressful situations calmly and effectively

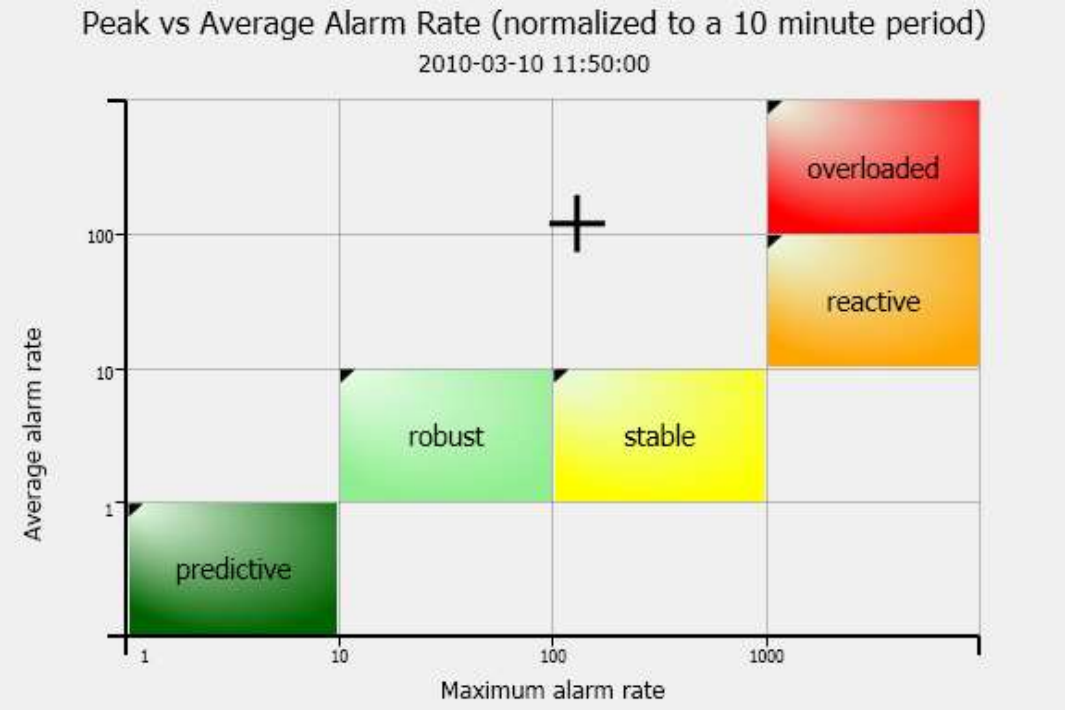
- Temporarily removes an alarm from the main list to a ‘shelf’ list
- Operator decides whether or not to shelve an alarm
- They can concentrate on tasks judged to require their immediate focus
- Alarm itself is not affected – it still requires attention from the operator



A valuable tool that helps operators work with maximum efficiency

Basic Alarm Analysis

- A tool that assists in analyzing and optimizing the alarm system
- Analysis according to EEMUA 191 of the performance of the alarm system
- An alarm analysis service performs continuous calculations of metrics according to ISA 18.2 and EEMUA 191
- Very simple configuration, just add an alarm analysis object to an object with an alarm list
- Use pre-made graphic elements to visualize the metrics.

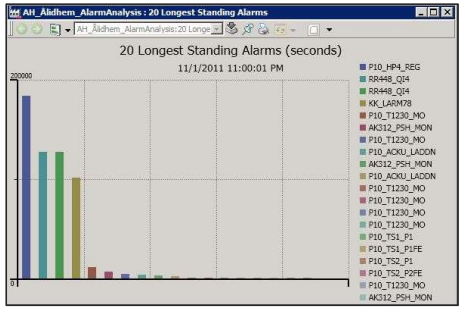


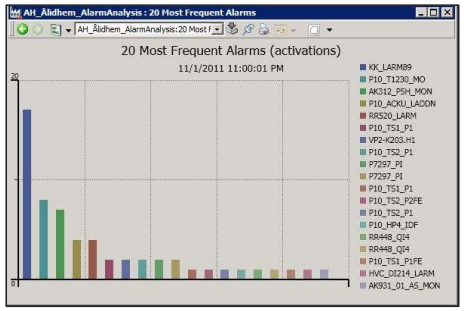
Basic Alarm Analysis

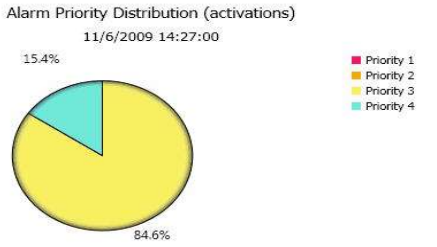
Key Performance Indicators

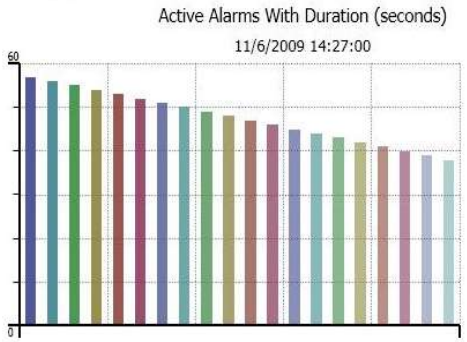
Pre-made, easy to use graphics simplify understanding

- Top 20 alarms
- Number of alarms over time
- Top 20 Longest in alarm
- Alarm priority distribution
- Number of standing alarms over time
- Disabled / Inhibited / Shelved / Hidden alarms
- Alarm Performance Benchmark







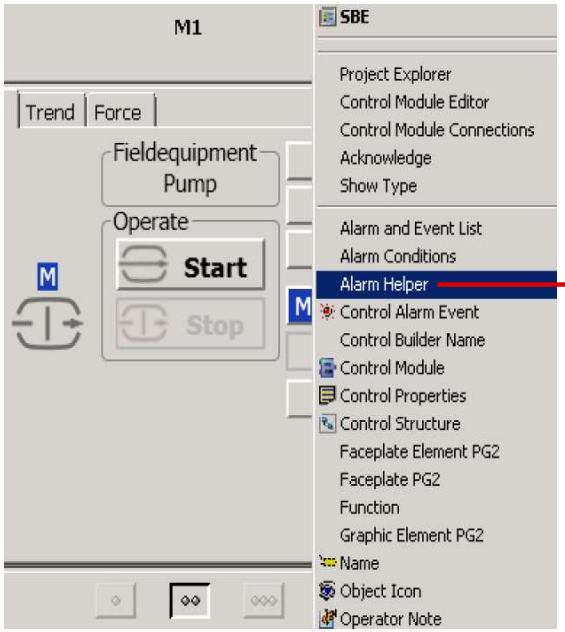


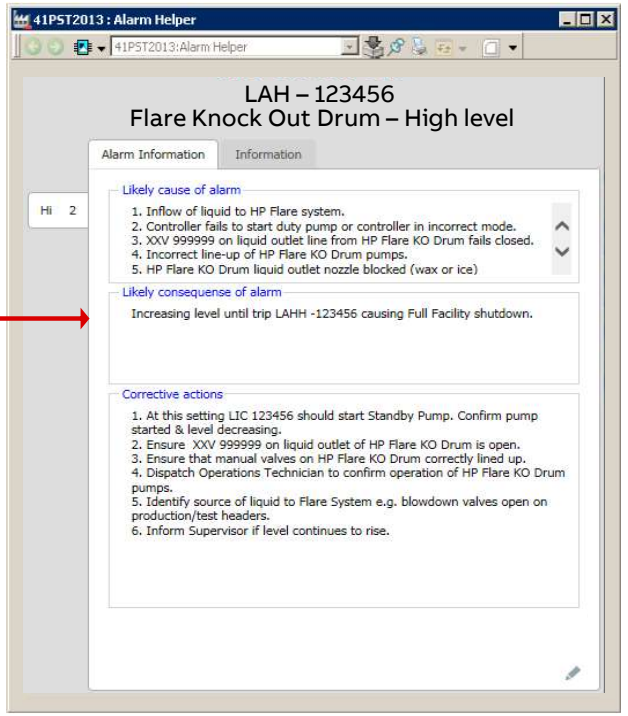
Helps users optimize functions for maximum safety and efficiency

Alarm Helper

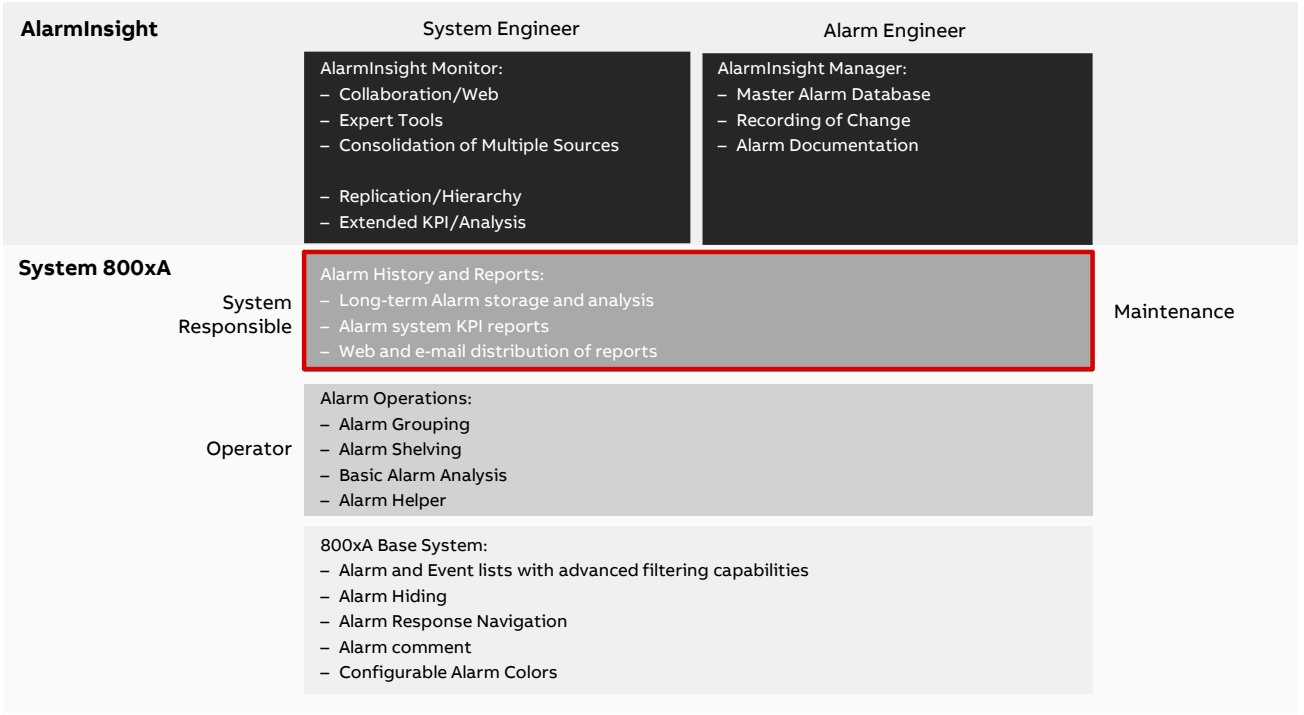
Help operators to make the right decision

- Guides and describes appropriate responses to the alarms at hand
- Makes it easier for operator to take the right actions – thereby acting safely and ensuring robust operation
- Available directly from the operators user interface, right click from alarm lists or process graphics.
- Configuration made easy by support for import from Excel.





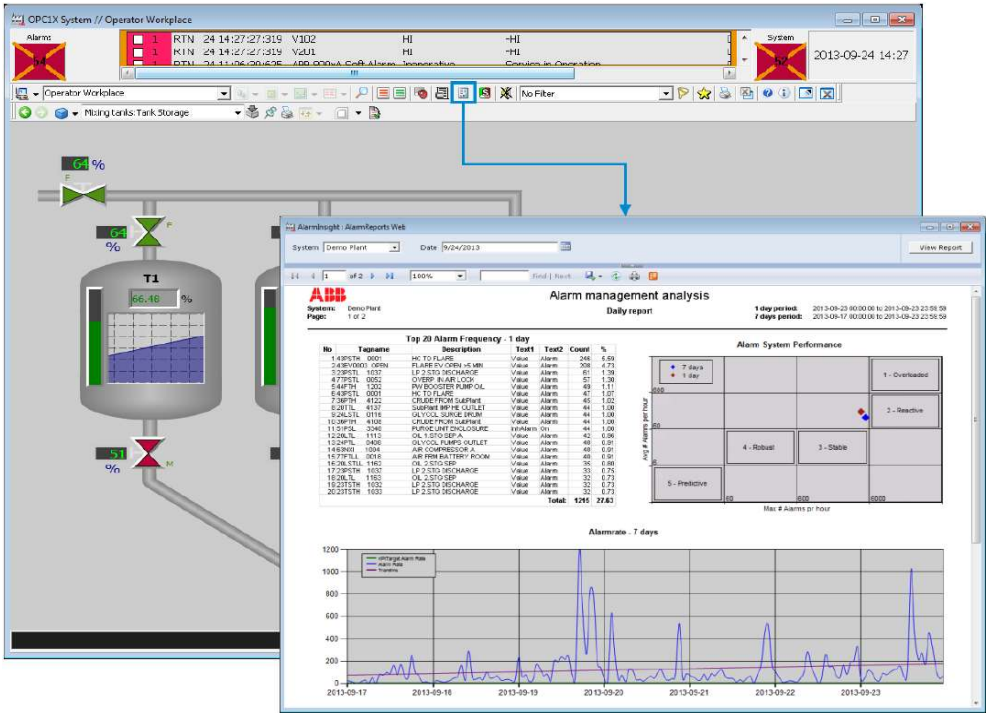
System 800xA Alarm Management overview



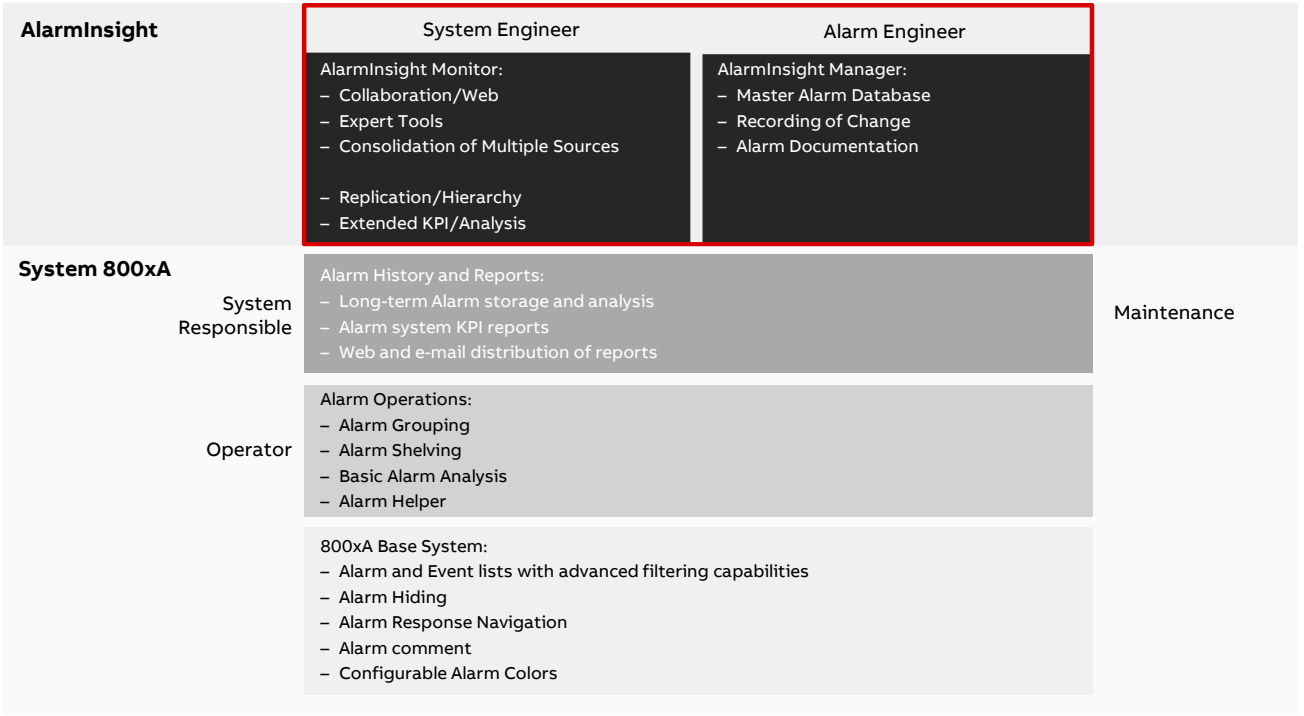
Alarm History and Reports

Long-term storage of alarms and events for analysis

- Alarm Performance KPI reports for Alarm Historian database according to EEMUA 191 and ISA 18.2
- Available on web or distributed via email
- Easy access from Operator Workplace
- Ideal for system management to communicate alarm system health in the organization



System 800xA Alarm Management overview



AlarmInsight

Full-scale alarm management

Extensive analysis functions and visualization tools

- Based on 800xA Alarm Operations and 800xA Alarm History and Reports
- For enterprise solutions, consolidates data from multiple control systems, different vendors and assets
- Common tool for alarm management benchmark reports
- Operations experts wanting specific alarm information and managers needing to see overviews find that AlarmInsight meets both their demands.

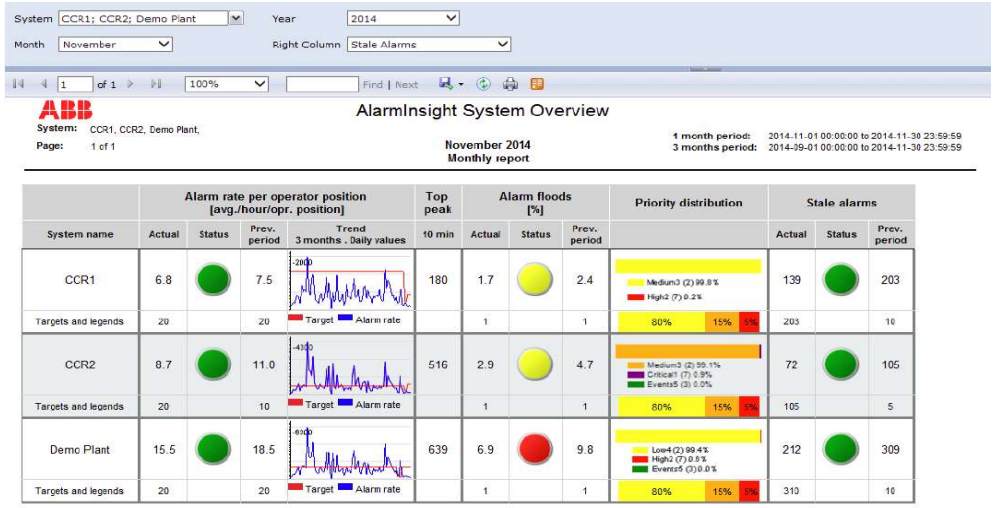
Solutions for System Engineers and Alarm Engineers

- AlarmInsight Monitor:
  - KPI-Report: automatic KPI reports (daily, weekly, monthly)
  - Alarm Analysis: set filters, analyze and generate reports
  - Event Log Viewer: set filters, find root cause and sequence of events
  - Expert Tool: service tool for ad-hoc ,deep-dive analysis supporting improvement work: used in all phases (client)
- AlarmInsight Manager:
  - Alarm Rationalization Tool: Alarm Rationalization and Continuous Alarm reviews; Management of change; Master Alarm Database (SQL)
  - Alarm Change Recorder: Monitor changes to alarms values and attributes; track changes during operation and modifications

AlarmInsight

Full-scale alarm management

Alarm Reporting



System CCR1; CCR2; Demo Plant Year 2014
Month November Right Column Stale Alarms

AlarmInsight System Overview

System: CCR1, CCR2, Demo Plant,
Page: 1 of 1

November 2014
Monthly report

1 month period: 2014-11-01 00:00:00 to 2014-11-30 23:59:59
3 months period: 2014-09-01 00:00:00 to 2014-11-30 23:59:59

	Alarm rate per operator position [avg./hour/opr. position]				Top peak	Alarm floods [%]			Priority distribution	Stale alarms		
System name	Actual	Status	Prev. period	Trend 3 months . Daily values	10 min	Actual	Status	Prev. period		Actual	Status	Prev. period
CCR1	6.8		7.5		180	1.7		2.4	Medium3 (2) 99.8% High2 (7) 0.2%	139		203
Targets and legends	20		20	Target Alarm rate		1		1	80% 15% 5%	203		10
CCR2	8.7		11.0		516	2.9		4.7	Medium3 (2) 99.1% Critical1 (7) 0.9% Events5 (3) 0.0%	72		105
Targets and legends	20		10	Target Alarm rate		1		1	80% 15% 5%	105		5
Demo Plant	15.5		18.5		639	6.9		9.8	Low4 (2) 99.4% High2 (7) 0.5% Events5 (3) 0.0%	212		309
Targets and legends	20		20	Target Alarm rate		1		1	80% 15% 5%	310		10

Alarm Rationalization Tool

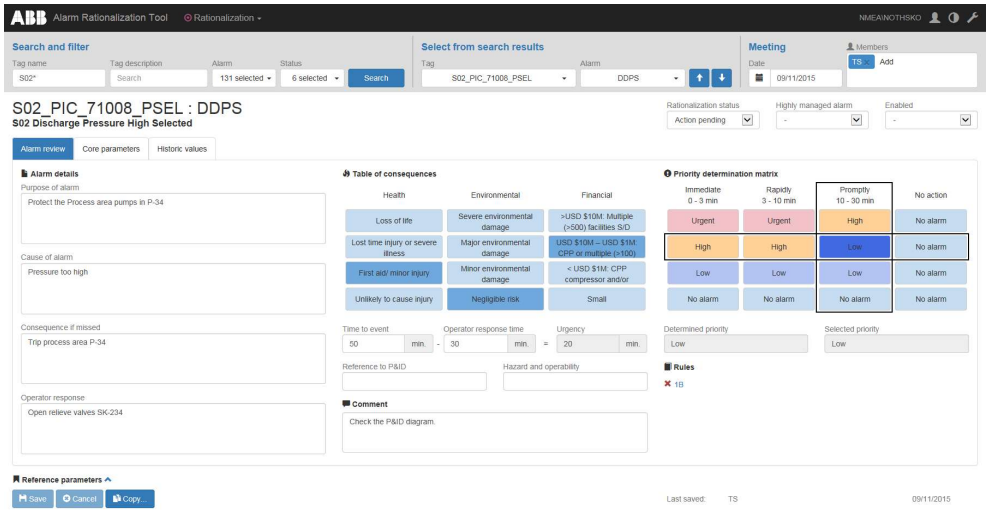


ABB Alarm Rationalization Tool Rationalization

Search and filter Select from search results Meeting

S02_PIC_71008_PSEL : DDPS
S02 Discharge Pressure High Selected

Alarm review | Core parameters | Historic values

Alarm details
Purpose of alarm: Protect the Process area pumps in P-34
Cause of alarm: Pressure too high
Consequence if missed: Trip process area P-34
Operator response: Open relieve valves SK-234

Table of consequences

	Health	Environmental	Financial
	Loss of life	Severe environmental damage	>USD $10M: Multiple (>500) facilities S/D
	Lost time injury or severe illness	Major environmental damage	USD $10M – USD $1M: CPP or multiple (>100)
	First aid/ minor injury	Minor environmental damage	< USD $1M: CPP compressor and/or
	Unlikely to cause injury	Negligible risk	Small

Priority determination matrix

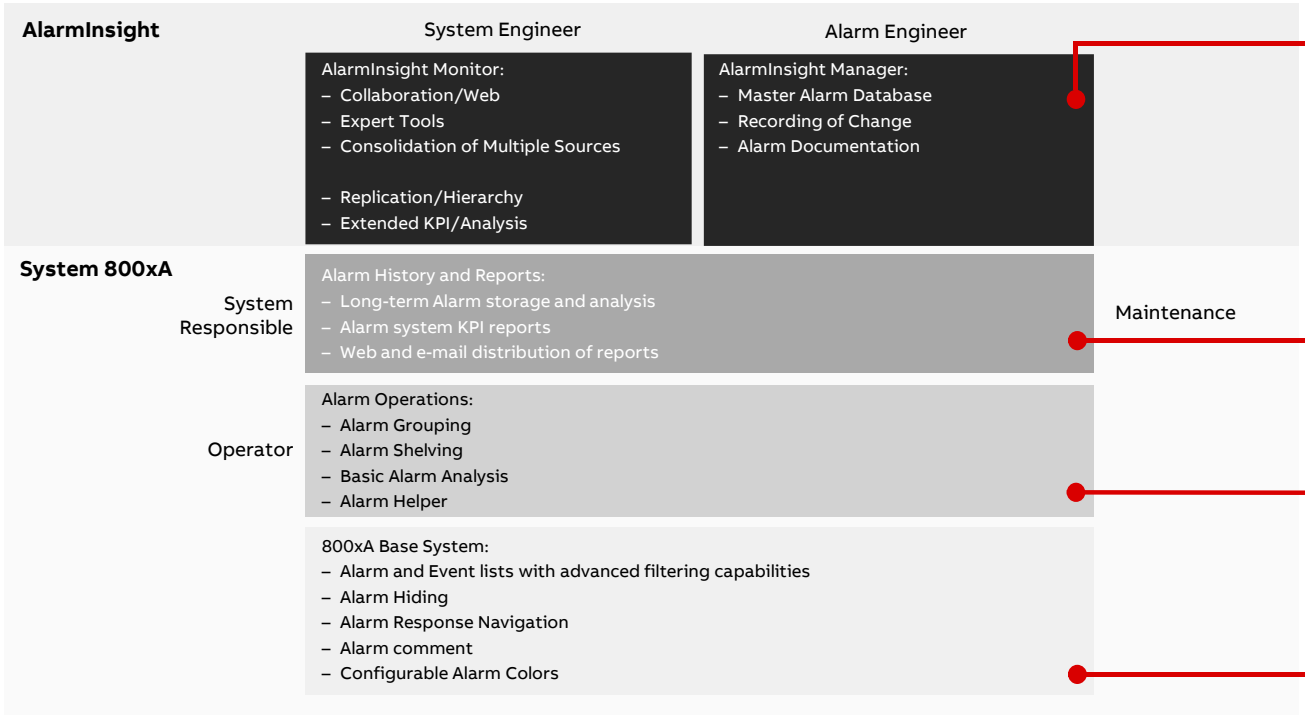
	Immediate 0 - 3 min	Rapidly 3 - 10 min	Promptly 10 - 30 min	No action
	Urgent	Urgent	High	No alarm
	High	High	Low	No alarm
	Low	Low	Low	No alarm
	No alarm	No alarm	No alarm	No alarm

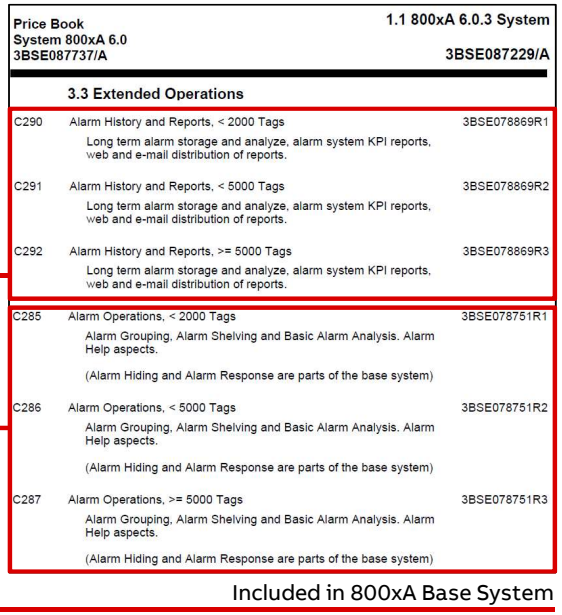
Time to event 50 min. - Operator response time 30 min. = Urgency 20 min.
Determined priority: Low Selected priority: Low
Reference to P&ID Hazard and operability
Rules: 18
Comment: Check the P&ID diagram.
Reference parameters
Save | Cancel | Copy...
Last saved: TS 09/11/2015

Meets the demands of experienced operators and managers needing to see alarm overview and advanced KPI's

System 800xA Alarm Management overview

Features detailed by License item





Price Book
System 800xA 6.0
3BSE087737/A

1.1 800xA 6.0.3 System
3BSE087229/A

3.3 Extended Operations

C290	Alarm History and Reports, < 2000 Tags Long term alarm storage and analyze, alarm system KPI reports, web and e-mail distribution of reports.	3BSE078869R1
C291	Alarm History and Reports, < 5000 Tags Long term alarm storage and analyze, alarm system KPI reports, web and e-mail distribution of reports.	3BSE078869R2
C292	Alarm History and Reports, >= 5000 Tags Long term alarm storage and analyze, alarm system KPI reports, web and e-mail distribution of reports.	3BSE078869R3
C285	Alarm Operations, < 2000 Tags Alarm Grouping, Alarm Shelving and Basic Alarm Analysis. Alarm Help aspects. (Alarm Hiding and Alarm Response are parts of the base system)	3BSE078751R1
C286	Alarm Operations, < 5000 Tags Alarm Grouping, Alarm Shelving and Basic Alarm Analysis. Alarm Help aspects. (Alarm Hiding and Alarm Response are parts of the base system)	3BSE078751R2
C287	Alarm Operations, >= 5000 Tags Alarm Grouping, Alarm Shelving and Basic Alarm Analysis. Alarm Help aspects. (Alarm Hiding and Alarm Response are parts of the base system)	3BSE078751R3

Included in 800xA Base System

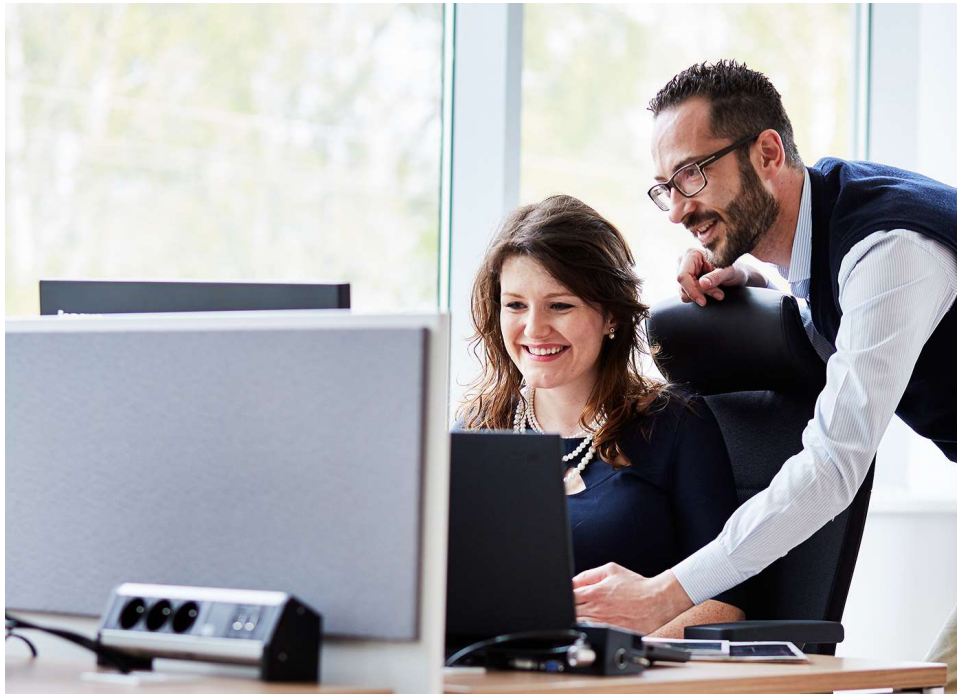
System 800xA Alarm Management – summary

Greater availability and improved safety

Dramatically improves operator response to alarms

- Know at once what an alarm means and how to best deal with it
- Optimizes their ability to monitor processes
- Can be entrusted with larger sections of the plant without compromising safety
- Protects the plant, the individuals, and the environment
- Lowers costs and allows control-room consolidation for greater efficiency
- More info:

  new.abb.com/control-systems/system-800xa/800xa-dcs/operator-interfaces-hmi/alarm-management



Questions?


ABB