Preventing Unplanned Downtime through Alarm Management:

The Five Most Important Alarm Management Techniques for Preventing Unplanned Downtime

The Cost of Bad Alarm Management

Alarm management within process automation systems has never been more important. A recent study found that more than $20 billion is lost annually due to unplanned downtime. Approximately 40 percent of these losses are linked to preventable human error. Important factors causing human errors include the proliferation of alarms and the operator's ability to respond quickly, efficiently, and correctly during upset conditions.

The results of poor alarm management can influence your company's bottom line in multiple ways such as loss of product, damage to equipment, loss of life, and damage to company reputation. Just in the past year, one widely publicized incident cost 15 lives, and caused 100 injuries and significant property damage. The total OSHA fines exceeded $20 million for this incident. The fine for the alarm system alone was more than $2 million. In addition, company management is under scrutiny for criminal negligence. The U.S. federal investigative report found that "managers authorized the start-up of a key unit despite knowing that key alarms weren't working."[4]

White Paper

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An Alarming Trend in DCS Alarming

More is not necessarily better when it comes to alarms in automated process control systems. Not long ago, when controls were hardwired to annunciator panels, engineers were selective about the number of alarms in a system. In a hardwired system, a single alarm could cost $1,000 to implement, so there were typically no more than 30 to 50 alarms per unit. Today, alarms are often viewed as "free." A single I/O point may be configured to activate multiple alarms. These modern Distributed Control Systems (DCS) may include more configured alarms in the system than there are measured process values.

As a result, managing these alarms is becoming an increasingly important role of the process plant operator who must interact seamlessly with the DCS. The job of the control system is to maintain the process within the target range of performance. The job of the operator is to intervene to keep the process within its normal performance range. When processes go outside the normal range, upset conditions prevail. The ability to respond quickly, efficiently, and correctly during upset conditions can mean the difference between high profits, unplanned downtime, or catastrophic failure.

To help ensure operators are prepared to handle any alarm situation, companies worldwide are taking advantage of new alarm management capabilities in modern control systems. By utilizing recognized industry best practices, systems like Siemens PCS 7 DCS helps manufacturers minimize unplanned downtime, increase production, and more confidently protect workers.

Industry Trends Elevate Alarm Management

There are several significant trends in manufacturing facilities putting pressure on plant operators and elevating the alarm management issue.

- Operators are being asked to do more than ever before
- Significant variations exist in the operators' education level, skill sets, and abilities
- Inadequate time is allowed for operator training, particularly in responding to alarm/upset conditions
- A "brain drain" is occuring whereby many of the plant's most experienced operators, technicians, maintenance people, and control engineers are transitioning out of the workforce

Industry leaders have acknowledged the growing importance of alarm management. In 2003, the User Association of Process Control Technology in Chemical and Pharmaceutical Industries (NAMUR) issued recommendation NA 102 *Alarm Management*. Most recently the ISA working committee SP 18 has issued a draft version of S18.02, a new standard that will serve as the recommended practice for US industry for design, deployment, and management of alarm systems.

Alarm Management Best Practices

To understand how to improve alarm management, it is important to first review industry best practices. There are numerous excellent references that document alarm management best practices. One of the most important is the EEMUA Publication 191, *ALARM SYSTEMS – A Guide to Design, Management and Procurement.* It provides practical recommendations on alarm management based on experiences from many end users and human factor studies. According to the EEMUA, alarms and alarm systems should be configured with the following basic principles in mind.

Characteristic	Reasoning
Relevant	Not spurious or of low operational vaue
Unique	Not duplicating another alarm
Timely	Not long before a response is needed or too late to do anything
Prioritized	Indicating the importance that the operator deal with the problem
Understandable	Having a message which is clear and understandable
Diagnostic	Identifies the problem that has occurred
Advisory	Indicates the action that should be taken (corrective response)
Focusing	Draws attention to the most important issues

Table 1
Characteristics of Good Alarms/Alarm System [Ref 3]

The single most important characteristic of a good alarm system design is that each alarm requires an operator response. If an alarm condition doesn't really require the operator to take action, then the condition should not be alarmed.

A good alarm subsystem contains many capabilities that help end users implement alarm management best practices and follow the recommendations of the EEMUA. Typically this includes the capability to:

- Focus operator attention on the most important alarms
- Provide clear and understandable alarm messages
- Provide information on the recommended corrective action and allow comments to be recorded regarding the actions taken or the future actions required
- Suppress alarms from a field device or from a process area when they are not meaningful
- Analyze alarm system performance metrics to identify nuisance alarms or scenarios requiring additional training

Indicators of Poor Alarm Management
There are several tell-tale signs or "symptoms" of poor alarm management. Many manufacturing operations exhibit one or more of these symptoms. Some of the most common include:

- ***Nuisance alarms*** – alarm conditions that come and go on a regular basis or intermittently
- ***Alarm floods*** – when too many alarms are presented to the operator during abnormal situations
- ***Cascading alarms*** – when specific alarms always occur together
- ***Alarm messages are not useful*** – when alarm messages do not provide meaningful information to the operator concerning the cause of the problem or the corrective action
- ***Excessive number of high priority alarms*** – too many high priority alarms are present in the system causing the operator to treat some as lower priority
- ***Standing alarms*** – too many alarms are present continuously in the system even during steady-state conditions (and operators ignore them)

Five Ways to Improve Alarm Management and Prevent Unplanned Downtime
While there are many features and benefits delivered by the alarm management capabilities of the DCS, there are five categories aligned with the EEMUA's best practices that deliver immediate benefits to any process manufacturer who wants to avoid unplanned downtime. These features allow plant personnel to:

I. Focus on the most important alarms
II. Suppress meaningless alarms as needed
III. Quickly comprehend the situation based on clear, consistent, concise, and informative messages
IV. Obtain useful information regarding probable cause and recommended corrective action
V. Evaluate system / operator performance

I. Focus on the Most Important Alarms
As shown in Table 2, operators are confronted with many alarms per day (by a factor of 10X) than they can reasonably process (based on the recommendations of the EEMUA).

With the potential for an overabundance of alarms, one of the most important features of a DCS is its ability to focus the operator's attention on the most critical alarms. When a new alarm occurs, multiple visual and audible methods are typically provided to attract the operator's attention and indicate the importance of a particular alarm condition.

Each individual alarm message within the system can be assigned an alarm priority. EEMUA studies have shown that to maximize operator effectiveness, no more than three different sets of alarm priorities should be configured in an entire system. This alarm priority attribute can be used to ensure that the highest priority unacknowledged alarm is displayed at all times. It also provides one means of filtering alarm display lists so that operators can home in on specific critical alarms.

	EEMUA	Oil & Gas	PetroChem	Power	Other
Average Alarms per Day	144	1200	1500	2000	900
Average Standing Alarms	9	50	100	65	35
Peak Alarms per 10 Minutes	10	220	180	350	180
Average Alarms/10 Minute Interval	1	6	9		8 5
Distribution % (Low/Med/High)	80/15/5	25/40/35	25/40/35	25/40/35	25/40/35

Recommended   Actual   Source: Matrikon

Table 2
Alarming Benchmark Performance by Industry

Preconfigured displays listing incoming alarms are typically one of the operator's main ways for monitoring alarms. From this display (Figure 1), an operator can filter and/or sort based on any column to fine-tune the display so that it shows only the most important alarms.

The default HMI symbols (block icons) should be designed to effectively focus the operator's attention in the event of an alarm. For example, when a new alarm occurs, an alarm status grid within the HMI symbol may change color (typically yellow or red) and display text indicating that an alarm is present. This dual indication of alarm status change (color and text) follows HMI design best practices to ensure that even color-blind operators, who make up a significant minority of the male population, can detect the alarm state change within a graphic display.

A built-in alarm horn capability makes it easy for the user to trigger an action when a new alarm condition occurs, such as the playing of a unique .wav file via the PC's sound card. For example, the horn could be configured to create a unique sound based on the occurence of an alarm with any combination of specific alarm attributes, including message class, priority, tag name, source, or process area (Figure 2).

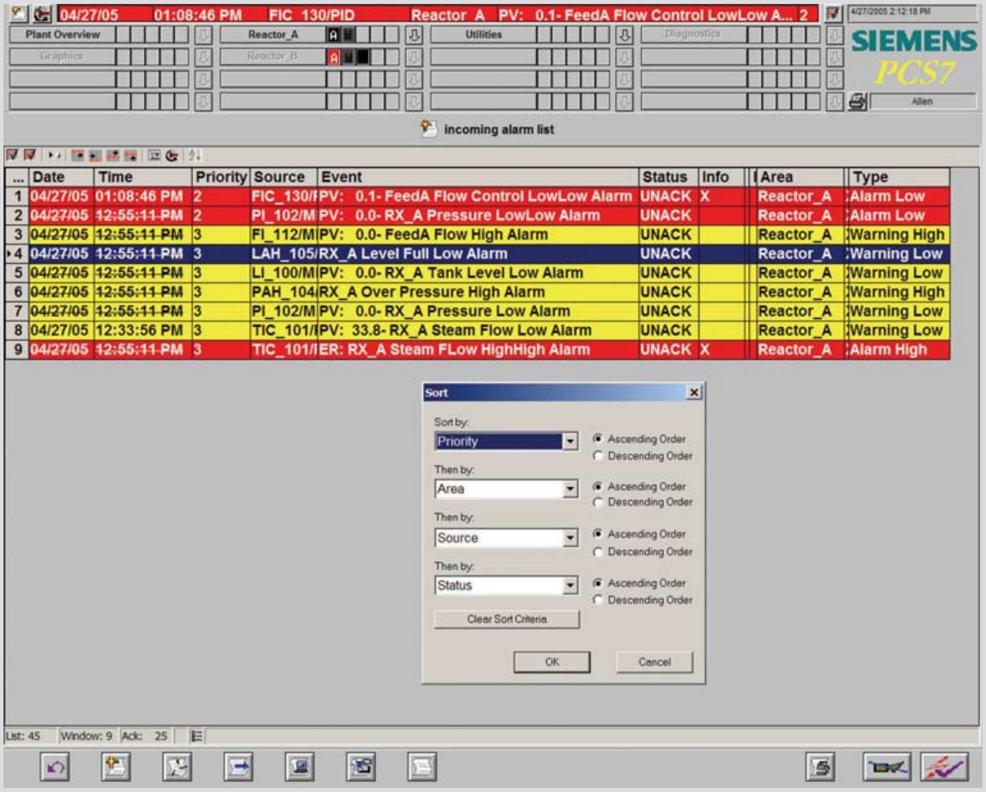


Figure 1 Filtering and Sorting of Alarms in the Incoming Alarm List

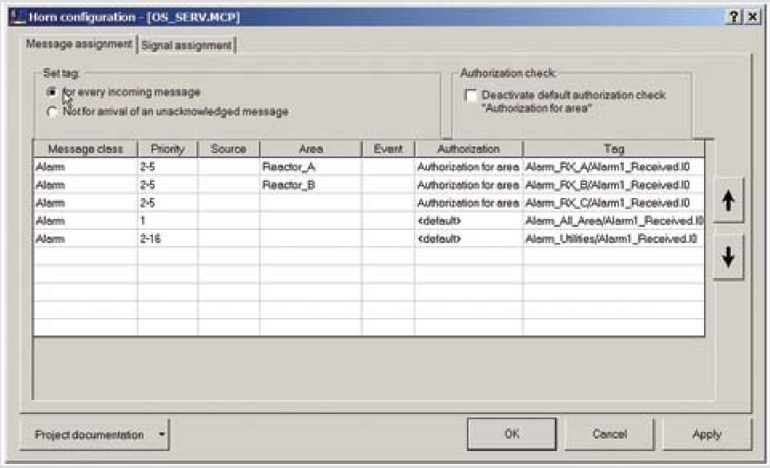


Figure 2 Alarm Horn Configuration Tool

II. Alarm Suppression

Another way to reduce the number of meaningless alarms is by using an alarm "locking" or suppression capability. Ideally, all alarms from an individual device, or from an entire process area, should be able to be suppressed at the touch of a button (the lock button). As a result, alarms from deactivated equipment, or from process areas that are non-operational, can be removed from the view of the operator. The lock button is typically protected by standard access security and requires the appropriate privileges for it to be enabled.

When a device has been locked or taken out-of-service, its corresponding symbol (block icon) on the process graphic should reflect this. For example, an “X” is placed in the alarm status grids on Figure 3.

In addition, an "X" is placed in the plant overview button bar to indicate that at least one point in a particular area has been taken out-of-service (locked) (Figure 4).

Alarm "locking" is a powerful capability for eliminating meaningless alarms that can impede operator effectiveness. However, if left unmonitored, important alarms could remain out-of-service after they become meaningful. To prevent this situation, a list of all devices that are currently suppressed (called the "Lock" list) should be provided. Operations personnel can get an up-to-date list of all the locked alarms in their system, no matter how old, to determine whether it is acceptable to startup or begin using the equipment (Figure 5).

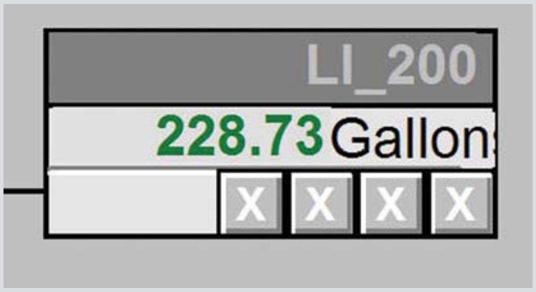


Figure 3 Standard HMI Symbol with Alarms Suppressed

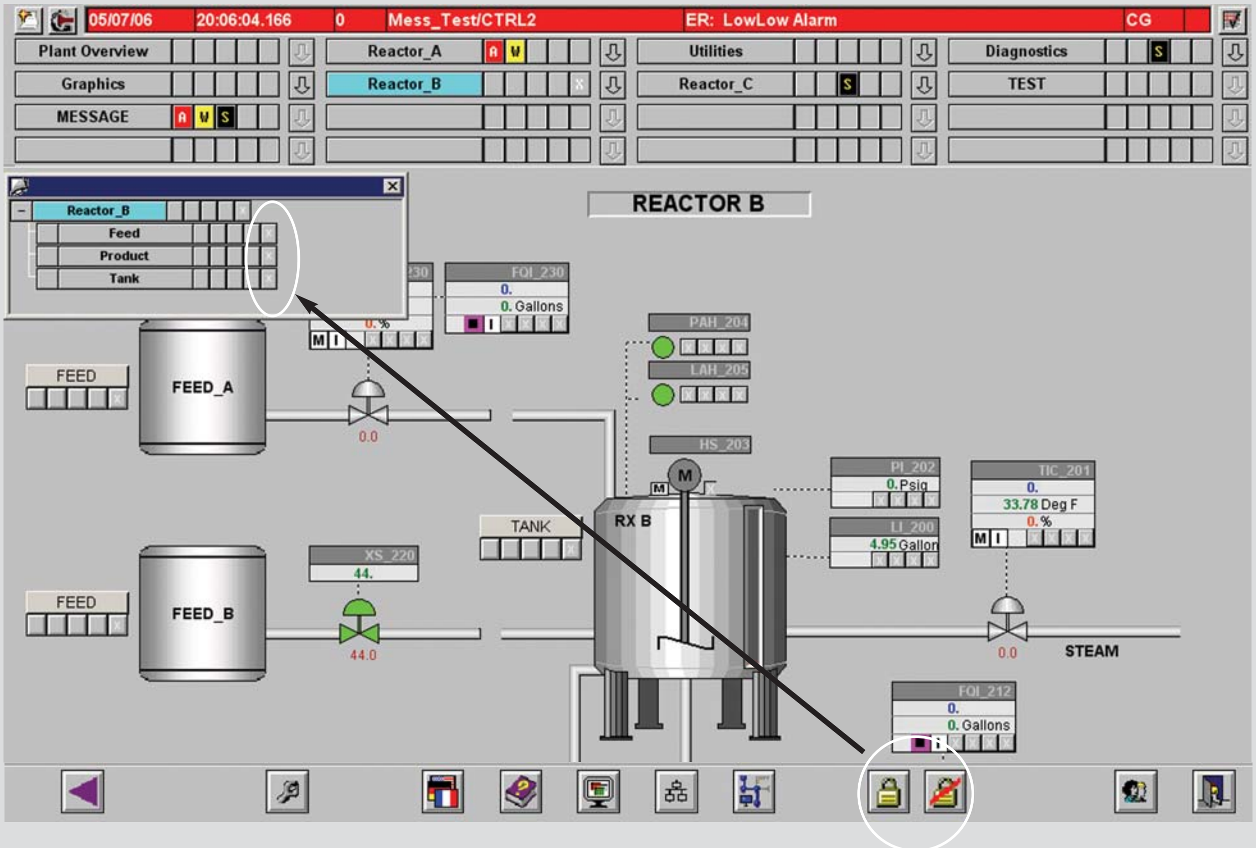
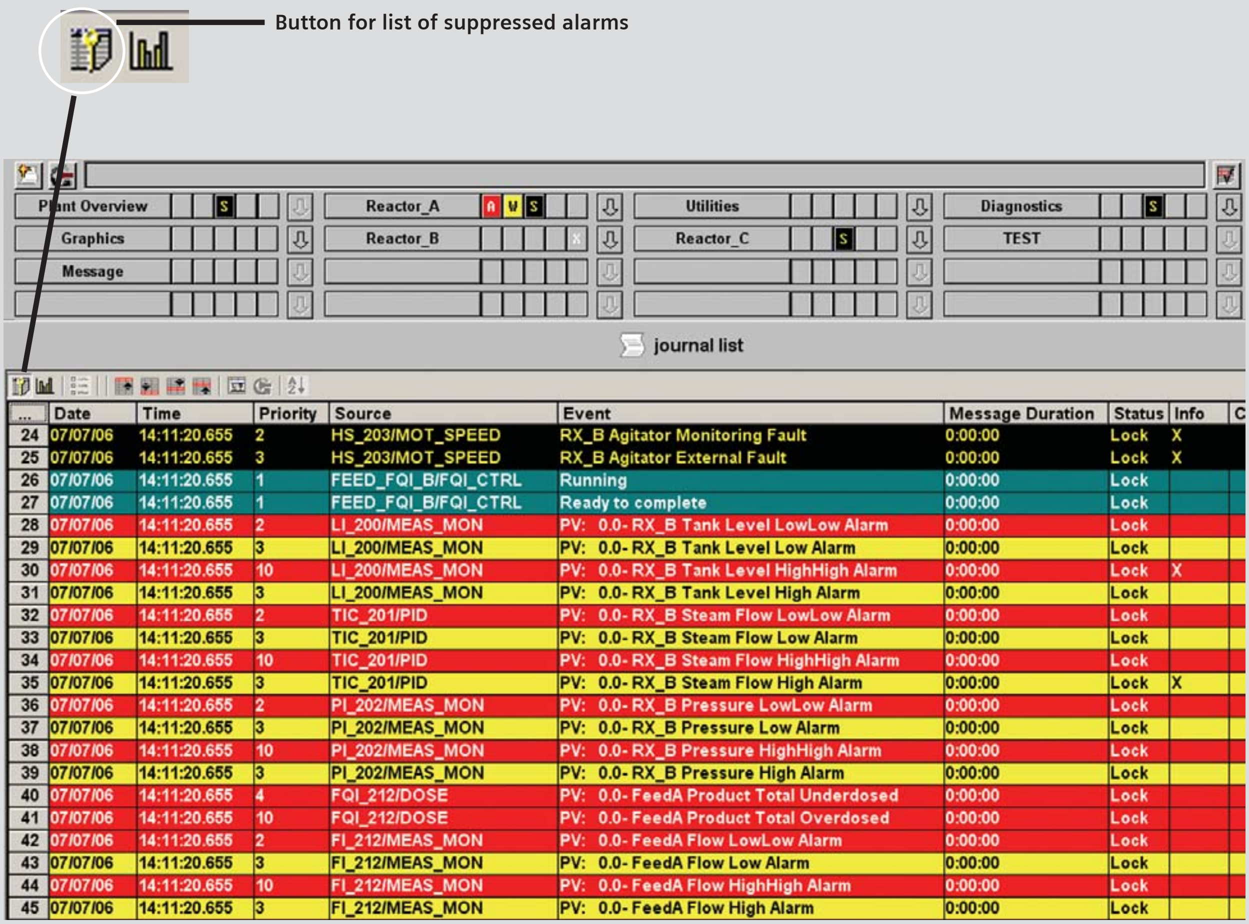


Figure 4 Operator Interface Showing Alarms Suppressed in a Process Area



...	Date	Time	Priority	Source	Event	Message Duration	Status	Info	C
24	07/07/06	14:11:20.655	2	HS_203/MOT_SPEED	RX_B Agitator Monitoring Fault	0:00:00	Lock	X	
25	07/07/06	14:11:20.655	3	HS_203/MOT_SPEED	RX_B Agitator External Fault	0:00:00	Lock	X	
26	07/07/06	14:11:20.655	1	FEED_FQI_B/FQI_CTRL	Running	0:00:00	Lock		
27	07/07/06	14:11:20.655	1	FEED_FQI_B/FQI_CTRL	Ready to complete	0:00:00	Lock		
28	07/07/06	14:11:20.655	2	LI_200/MEAS_MON	PV: 0.0- RX_B Tank Level LowLow Alarm	0:00:00	Lock		
29	07/07/06	14:11:20.655	3	LI_200/MEAS_MON	PV: 0.0- RX_B Tank Level Low Alarm	0:00:00	Lock		
30	07/07/06	14:11:20.655	10	LI_200/MEAS_MON	PV: 0.0- RX_B Tank Level HighHigh Alarm	0:00:00	Lock	X	
31	07/07/06	14:11:20.655	3	LI_200/MEAS_MON	PV: 0.0- RX_B Tank Level High Alarm	0:00:00	Lock		
32	07/07/06	14:11:20.655	2	TIC_201/PID	PV: 0.0- RX_B Steam Flow LowLow Alarm	0:00:00	Lock		
33	07/07/06	14:11:20.655	3	TIC_201/PID	PV: 0.0- RX_B Steam Flow Low Alarm	0:00:00	Lock		
34	07/07/06	14:11:20.655	10	TIC_201/PID	PV: 0.0- RX_B Steam Flow HighHigh Alarm	0:00:00	Lock		
35	07/07/06	14:11:20.655	3	TIC_201/PID	PV: 0.0- RX_B Steam Flow High Alarm	0:00:00	Lock	X	
36	07/07/06	14:11:20.655	2	PI_202/MEAS_MON	PV: 0.0- RX_B Pressure LowLow Alarm	0:00:00	Lock		
37	07/07/06	14:11:20.655	3	PI_202/MEAS_MON	PV: 0.0- RX_B Pressure Low Alarm	0:00:00	Lock		
38	07/07/06	14:11:20.655	10	PI_202/MEAS_MON	PV: 0.0- RX_B Pressure HighHigh Alarm	0:00:00	Lock		
39	07/07/06	14:11:20.655	3	PI_202/MEAS_MON	PV: 0.0- RX_B Pressure High Alarm	0:00:00	Lock		
40	07/07/06	14:11:20.655	4	FQI_212/DOSE	PV: 0.0- FeedA Product Total Underdosed	0:00:00	Lock		
41	07/07/06	14:11:20.655	10	FQI_212/DOSE	PV: 0.0- FeedA Product Total Overdosed	0:00:00	Lock		
42	07/07/06	14:11:20.655	2	FI_212/MEAS_MON	PV: 0.0- FeedA Flow LowLow Alarm	0:00:00	Lock		
43	07/07/06	14:11:20.655	3	FI_212/MEAS_MON	PV: 0.0- FeedA Flow Low Alarm	0:00:00	Lock		
44	07/07/06	14:11:20.655	10	FI_212/MEAS_MON	PV: 0.0- FeedA Flow HighHigh Alarm	0:00:00	Lock		
45	07/07/06	14:11:20.655	3	FI_212/MEAS_MON	PV: 0.0- FeedA Flow High Alarm	0:00:00	Lock		

Figure 5 List of Suppressed Alarms (Locked)

III. Provide Clear and Understandable Alarm Messages

Control systems like PCS 7 help users conform to alarming best practices by making it easy to define clear and understandable information in alarm messages. As shown in Figure 6, a typical alarm message display should contain clear, easy-to-understand information, such as tag name, tag description, the process area in which the alarm occurred, message type, alarm state, alarm priority, and corrective action information if it exists.

In particular, the "Event" field is designed to be easily configured to provide information in a format that makes sense to a plant operator. In the example shown below, the "Event" field delivers information based on the equipment description or physical device name (RX_A Tank). The field provides a clear description of the problem (Level LowLow Alarm), and also includes a snapshot of the value of the process variable (5.0) when the alarm was triggered (dynamic messaging) (Figure 6).

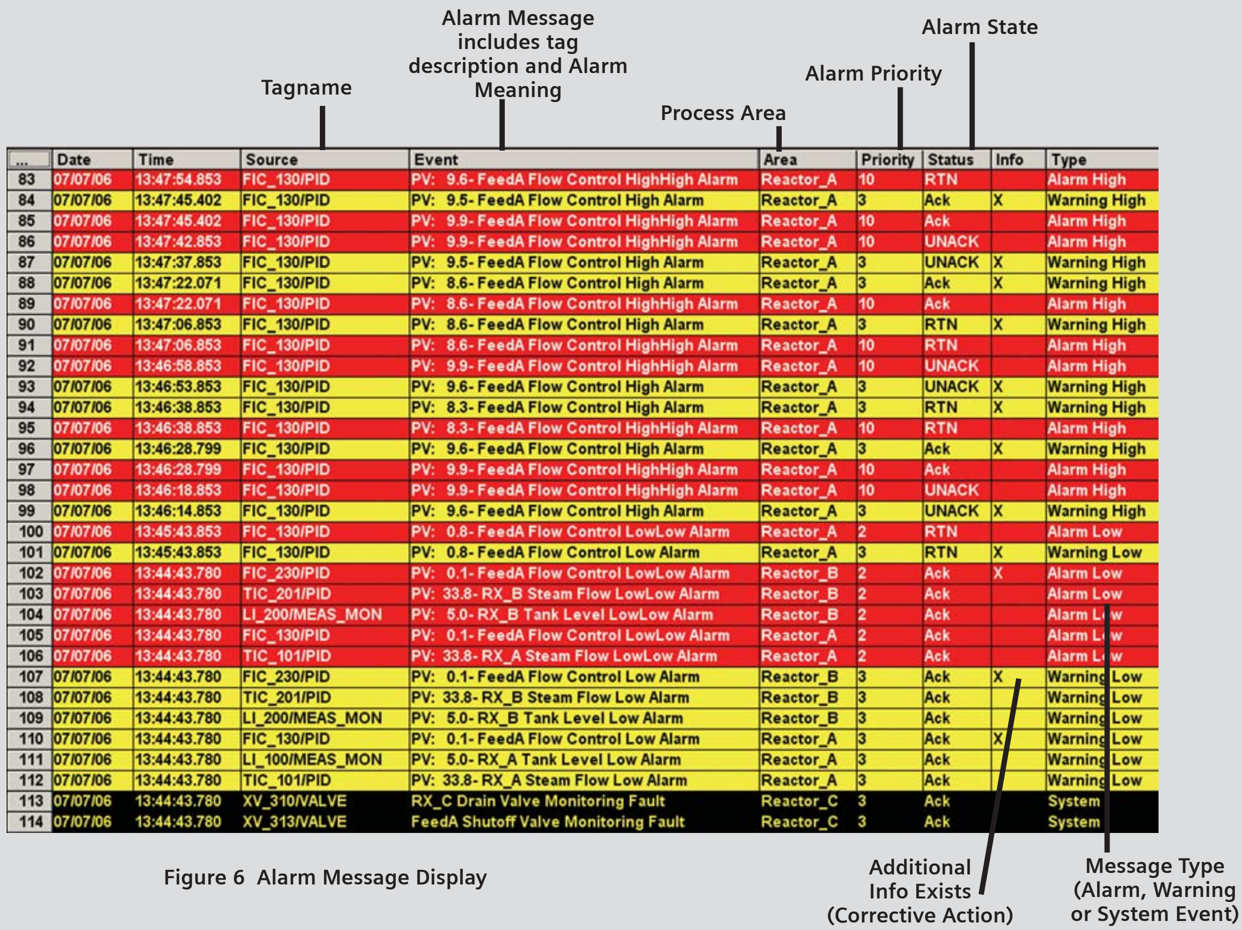
If the system could talk, it would say "A Reactor A Tank LowLow Level alarm has occurred in the Reactor A process area. The tag name for this device is LI_100. The alarm is currently Unacknowledged and has a priority of 2 (High). The process variable hit a value of 5.0 feet when the alarm was triggered. No corrective action information is available for this alarm."

IV. Recommended Corrective Action

One of the most significant trends effecting manufacturing facilities is the attrition of experienced and knowledgeable plant personnel (including operators). The DCS was first introduced in 1975 and widely adopted in manufacturing facilities throughout the late 1970s and early 1980s. In many plants, the best and most experienced operators have run the plant for the past 25 to 35 years. Consequently, when these people leave the workforce, significant process knowledge may be lost.

One way to address this operator attrition is by allowing operational best practices to be captured and documented directly within the system. For each alarm, it is desirable that a separate message displaying corrective action information is made available to the operator via the "Info Text" field. Many end users take their Standard Operating Procedures (SOPs), and copy/paste this information directly into DCS via an "Info Text" field. Other facilities configure these fields based on the recommended procedures of their most valued operators, ensuring that everone in the plant can benefit from his/her experiences, and that this process knowledge is not lost (Figure 7).

In addition, operators should be able to add comments to individual alarms after they have been acknowledged. As a result, they can document actions taken to correct a situation, the root cause of the problem, or to flag it for follow-up attention (by maintenance personnel). This "Comment" field can then be sorted so maintenance can create an on-demand "report" of all the annotated alarms.



...	Date	Time	Source	Event	Area	Priority	Status	Info	Type
83	07/07/06	13:47:54.853	FIC_130/PID	PV: 9.6- FeedA Flow Control HighHigh Alarm	Reactor_A	10	RTN		Alarm High
84	07/07/06	13:47:45.402	FIC_130/PID	PV: 9.5- FeedA Flow Control High Alarm	Reactor_A	3	Ack	X	Warning High
85	07/07/06	13:47:45.402	FIC_130/PID	PV: 9.9- FeedA Flow Control HighHigh Alarm	Reactor_A	10	Ack		Alarm High
86	07/07/06	13:47:42.853	FIC_130/PID	PV: 9.9- FeedA Flow Control HighHigh Alarm	Reactor_A	10	UNACK		Alarm High
87	07/07/06	13:47:37.853	FIC_130/PID	PV: 9.5- FeedA Flow Control High Alarm	Reactor_A	3	UNACK	X	Warning High
88	07/07/06	13:47:22.071	FIC_130/PID	PV: 8.6- FeedA Flow Control High Alarm	Reactor_A	3	Ack	X	Warning High
89	07/07/06	13:47:22.071	FIC_130/PID	PV: 8.6- FeedA Flow Control HighHigh Alarm	Reactor_A	10	Ack		Alarm High
90	07/07/06	13:47:06.853	FIC_130/PID	PV: 8.6- FeedA Flow Control High Alarm	Reactor_A	3	RTN	X	Warning High
91	07/07/06	13:47:06.853	FIC_130/PID	PV: 8.6- FeedA Flow Control HighHigh Alarm	Reactor_A	10	RTN		Alarm High
92	07/07/06	13:46:58.853	FIC_130/PID	PV: 9.9- FeedA Flow Control HighHigh Alarm	Reactor_A	10	UNACK		Alarm High
93	07/07/06	13:46:53.853	FIC_130/PID	PV: 9.6- FeedA Flow Control High Alarm	Reactor_A	3	UNACK	X	Warning High
94	07/07/06	13:46:38.853	FIC_130/PID	PV: 8.3- FeedA Flow Control High Alarm	Reactor_A	3	RTN	X	Warning High
95	07/07/06	13:46:38.853	FIC_130/PID	PV: 8.3- FeedA Flow Control HighHigh Alarm	Reactor_A	10	RTN		Alarm High
96	07/07/06	13:46:28.799	FIC_130/PID	PV: 9.6- FeedA Flow Control High Alarm	Reactor_A	3	Ack	X	Warning High
97	07/07/06	13:46:28.799	FIC_130/PID	PV: 9.9- FeedA Flow Control HighHigh Alarm	Reactor_A	10	Ack		Alarm High
98	07/07/06	13:46:18.853	FIC_130/PID	PV: 9.9- FeedA Flow Control HighHigh Alarm	Reactor_A	10	UNACK		Alarm High
99	07/07/06	13:46:14.853	FIC_130/PID	PV: 9.6- FeedA Flow Control High Alarm	Reactor_A	3	UNACK	X	Warning High
100	07/07/06	13:45:43.853	FIC_130/PID	PV: 0.8- FeedA Flow Control LowLow Alarm	Reactor_A	2	RTN		Alarm Low
101	07/07/06	13:45:43.853	FIC_130/PID	PV: 0.8- FeedA Flow Control Low Alarm	Reactor_A	3	RTN	X	Warning Low
102	07/07/06	13:44:43.780	FIC_230/PID	PV: 0.1- FeedA Flow Control LowLow Alarm	Reactor_B	2	Ack	X	Alarm Low
103	07/07/06	13:44:43.780	TIC_201/PID	PV: 33.8- RX_B Steam Flow LowLow Alarm	Reactor_B	2	Ack		Alarm Low
104	07/07/06	13:44:43.780	LI_200/MEAS_MON	PV: 5.0- RX_B Tank Level LowLow Alarm	Reactor_B	2	Ack		Alarm Low
105	07/07/06	13:44:43.780	FIC_130/PID	PV: 0.1- FeedA Flow Control LowLow Alarm	Reactor_A	2	Ack		Alarm Low
106	07/07/06	13:44:43.780	TIC_101/PID	PV: 33.8- RX_A Steam Flow LowLow Alarm	Reactor_A	2	Ack		Alarm Low
107	07/07/06	13:44:43.780	FIC_230/PID	PV: 0.1- FeedA Flow Control Low Alarm	Reactor_B	3	Ack	X	Warning Low
108	07/07/06	13:44:43.780	TIC_201/PID	PV: 33.8- RX_B Steam Flow Low Alarm	Reactor_B	3	Ack		Warning Low
109	07/07/06	13:44:43.780	LI_200/MEAS_MON	PV: 5.0- RX_B Tank Level Low Alarm	Reactor_B	3	Ack		Warning Low
110	07/07/06	13:44:43.780	FIC_130/PID	PV: 0.1- FeedA Flow Control Low Alarm	Reactor_A	3	Ack	X	Warning Low
111	07/07/06	13:44:43.780	LI_100/MEAS_MON	PV: 5.0- RX_A Tank Level Low Alarm	Reactor_A	3	Ack		Warning Low
112	07/07/06	13:44:43.780	TIC_101/PID	PV: 33.8- RX_A Steam Flow Low Alarm	Reactor_A	3	Ack		Warning Low
113	07/07/06	13:44:43.780	XV_310/VALVE	RX_C Drain Valve Monitoring Fault	Reactor_C	3	Ack		System
114	07/07/06	13:44:43.780	XV_313/VALVE	FeedA Shutoff Valve Monitoring Fault	Reactor_C	3	Ack		System

Figure 6 Alarm Message Display

...	Date	Time	Priori	Source	Event	Message Durati	Status	Info
165	05/07/06	20:05:51.968	2	TIC_101/PID	PV: 0.0- RX_A Steam Flow LowLow Alarm	0:02:17	QS	
166	05/07/06	20:05:51.213	2	FIC_130/PID	PV: 0.0- FeedA Flow Control LowLow Alarm	0:02:16	QS	
167	05/07/06	20:05:22.774	3	TIC_101/PID	RX_A Steam Flow External Fault	0:01:48	QS	X
168	05/07/06	20:05:16.901	3	TIC_101/PID	PV: 0.0- RX_A Steam Flow Low Alarm	0:01:42	QS	
169	05/07/06	20:04:59.745	3	LI_100/MEAS_MON	PV: 0.0- RX_A Tank Level Low Alarm	0:01:25	QS	
170	05/07/06	20:04:58.688	3	FIC_130/PID	PV: 0.0- FeedA Flow Control Low Alarm	0:01:24	QS	X
171	05/07/06	20:04:58.089	3	TankLVL/CLS_MON	External Fault	0:01:23	QS	
172	05/07/06	20:04:57.485	10	FIC_130/PID	ER: FeedA Flow Control HighHigh Alarm	0:01:22	QS	
173	05/07/06	20:03:34.515	3	TankLVL/CLS_MON		0:00:00	C	
174	05/07/06	20:03:34.515	10	FIC_130/PID	hHigh Alarm	0:00:00	C	
175	05/07/06	20:03:34.515	3	TIC_101/PID	ault	0:00:00	G	X
176	05/07/06	20:03:34.515	2	FIC_130/PID	l LowLow Alarm	0:00:00	C	
177	05/07/06	20:03:34.515	2	TIC_101/PID	owLow Alarm	0:00:00	C	
178	05/07/06	20:03:34.515	3	FIC_130/PID	l Low Alarm	0:00:00	C	X
179	05/07/06	20:03:34.515	3	LI_100/MEAS_MON	ow Alarm	0:00:00	C	
180	05/07/06	20:03:34.515	3	TIC_101/PID	ow Alarm	0:00:00	C	
181	05/07/06	20:03:34.515	1	TK_AGITATE_A/TANK_AGIT		0:00:00	C	
182	05/07/06	20:03:34.515	1	PROD_FQI_A/FQI_CTRL		0:00:00	C	
183	05/07/06	20:03:34.515	1	FEED_FQI_A/FQI_CTRL		0:00:00	C	
184	05/07/06	20:03:34.515	1	TK_TEMP_A/TEMP_CTRL		0:00:00	C	
185	05/07/06	20:03:34.515	1	TK_LVL_A/TANK	MANUAL	0:00:00	C	
186	05/07/06	20:03:34.415	3	TIC_101/PID	RX_A Steam Flow External Fault	0:00:00	C	X
187	07/06/06	16:24:35.203	2	FIC_130/PID	PV: 0.0- FeedA Flow Control LowLow Alarm	0:00:00	Lock	
188	07/06/06	16:24:35.203	3	FIC_130/PID	PV: 0.0- FeedA Flow Control Low Alarm	0:00:00	Lock	X
189	07/06/06	16:21:38.790	2	FIC_130/PID	PV: 0.1- FeedA Flow Control LowLow Alarm	0:00:00	C	
190	07/06/06	16:21:20.792	3	FIC_130/PID	PV: 0.4- FeedA Flow Control Low Alarm	0:00:00	C	X
191	07/06/06	16:20:34.380	1	TK_LVL_A/TANK	Step execution time exceeded	0:00:00	C	
192	07/06/06	16:20:29.280	1	TK_LVL_A/TANK	Is the phase ready to start?	0:00:00	C	X
193	07/06/06	15:10:35.833	3	FIC_130/PID	PV: 0.6- FeedA Flow Control Low Alarm	0:26:05	G	X
194	07/06/06	15:10:34.832	2	FIC_130/PID	PV: 0.4- FeedA Flow Control LowLow Alarm	0:26:04	G	
195	07/06/06	15:10:22.831	3	LI_100/MEAS_MON	PV: 5.0- RX_A Tank Level Low Alarm	0:25:52	G	
196	07/06/06	15:09:51.831	3	PI_102/MEAS_MON	PV: 0.0- RX_A Pressure Low Alarm	0:05:25	G	
197	07/06/06	15:09:43.831	2	PI_102/MEAS_MON	PV: 0.0- RX_A Pressure LowLow Alarm	0:05:17	G	
198	07/06/06	15:06:54.840	2	TIC_101/PID	PV: 59.7- RX_A Steam Flow LowLow Alarm	0:00:34	G	

Figure 7 Capturing Operational Best Practices Within the System

V. Analyzing Alarm System/Operator Performance

Effective alarm management is a dynamic process that requires continuous attention. Look for a DCS that includes out-of-the-box tools to provide alarm Key Performance Indicators (KPI) that engineers and operations personnel can use to continuously evaluate and improve the performance of the system – as well as responsible personnel.

The Alarm History (Journal) list should contain useful information such as including how long a particular point was in alarm before it was acknowledged. In the screen below, the highlighted alarm was active for more than two hours and it was never acknowledged. This might indicate an area where additional operator training is necessary, or where a "nuisance" alarm is being ignored by the operations personnel (Figure 8).

An alarm "hit list" provides a frequency analysis of the alarming activity in the system. This display could be used, for instance, to determine which devices went in and out of alarm most frequently over the past 48 hours. The presence of alarm state changes at an unusual frequency might indicate an intermittent hardware problem in the field, or a "nuisance" alarm which can be corrected by adjusting its limit and/or dead band (Figure 9).

Conclusion

Alarm management is one of the most undervalued and underutilized facets of process automation today. As alarm systems become less effective, they diminish the effectiveness of the entire automation system thus effecting your company's bottom line. By taking advantage of the alarm management functions of systems like PCS 7, manufacturers place an investment in risk management. As a result, plants may operate closer to the limits than ever before while reducing downtime, increasing productivity, and protecting workers.

References

1. "Collaborative Process Automation Drives Return on Assets", Dave Woll, ARC, June 2002
2. "Alarm Management Strategies", Larry O'Brien, ARC, November 2004
3. EEMUA Alarm systems, a guide to design, management and procurement, Publication 191
4. "Investigators Fault BP for More Lapses in Refinery Safety", Wall Street Journal, August 18, 2005
5. "Expertise Lost: How Do You Keep the Plant Running if Nobody Remembers How", CONTROL Magazine, April 2005

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Figure 8 Alarm History Display Provides Useful KPIs

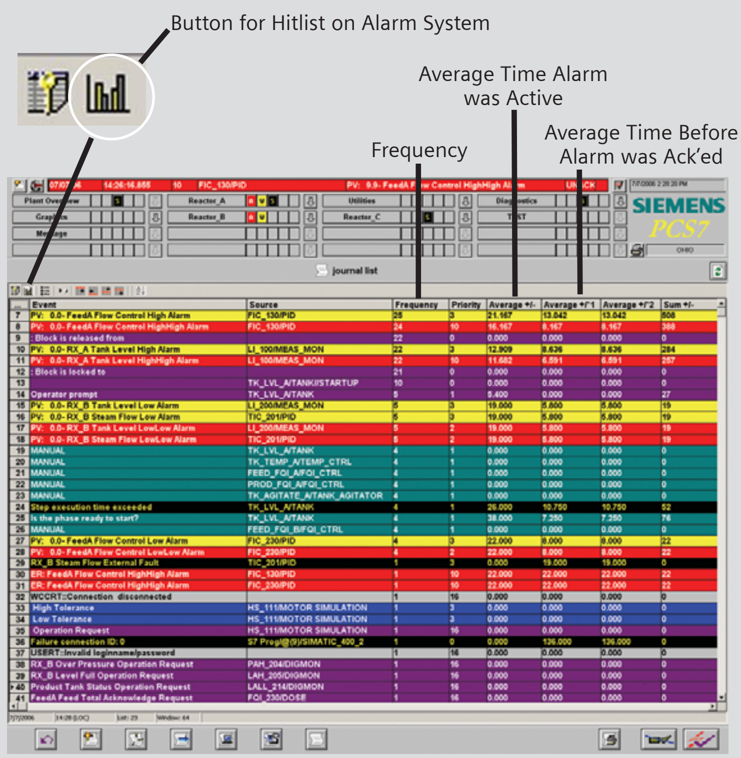

Figure 9 Alarm Frequency Analysis Helps Identify "Nuisance" Alarms

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