New Concept For Alarm Structure And Management In Dcs Systems

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ABSTRACT: The objective of this paper is to set new standard for good design and best practice to applied when any DCS Manufactures/Suppliers configure process alarm system in any oil refining, oil and gas production, gas-handling facilities, gasification plant or any chemical processing plant and thereby to optimize/minimize unnecessary alarms from reporting to operator workstations CAD (Control Alarm Display). These views based on the experience acquired and implemented during involvement with the commissioning and startup of two DCS projects in Mina Al-Ahmadi Refinery, Kuwait.

Keywords: DCS, CAD, Shell DEP, IMAC

1. BACKGROUND

All DCSs have a sophisticated alarm and HMI system for operators to monitor and control plant status. These are powerful platforms for users to design and configure effective alarm systems. The DCS alarm system can be a vital, productive tool for managing industrial process control plants, and can configured to identify and notify personnel of a wide variety of abnormal conditions in a manufacturing process.

2. INTRODUCTION

Operator continuously monitors and control the process back to operating targets to prevent the occurrence of abnormal situations. All modern process control systems provide alarm systems to assist process operators in managing abnormal situations, defined critical standard, target limits or the condition when the process is not behaving as expected or when other threats have impact operations. These notifications / alarms based on plant operating limits obtained from equipment and process constraints, commonly referred to as the plant-operating window. Console operators are empowered to use the alarm system as an essential tool to monitor and manage abnormal situations through actions that stabilize, control, slow down or shutdown the process.

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3. PRECISE DEFINITIONS

- Alarm – Type of notification generated by alarm system to notify operators of the exceedance of any defined critical, standard or target limit.
- Management of Change – A method of reviewing proposed changes and includes a review process by appropriate personnel and obtaining concurrence before the change implemented.
- Abnormal situation – The exceedance of any defined critical, standard or target limit
- Configuration – The setting of parameters of defined application to implement the alarm system functionality.
- Dead band – The difference between the limit and the value of the process parameter at which the notification is de-activated. The notification de-activated when the process parameter has moved into the safe direction further than the value of the dead band.
- Display – What is seen on visual display console
- Notification state –The state of an alarm e.g. enabled /disabled or inhibited.
- CAD – Control Alarm Display
- Workstation – User's workplace with an HMI within the control room. A console typically consists of several workstations.
- IMAC – Alarm Management Solution.

4. OPERATING LIMIT DEFINITION

Within the engineering constraints of the equipment, the following limits defined:

- Critical limits – immediate action required.
- Standard limits – action required to mitigate slow, cumulative degradation.
- Target limits – related to optimization

It is imperative that all aspects of limits and constraints identified.

Limits may be from mechanical, process, quality or operation constraints. This requires a multidisciplinary approach.

5. CURRENT ALARM DISPLAY (CAD) WINDOW

DCS operator, can pick the "PROCESS" button on the HMI screen to call process Current Alarm Displays (CAD) as per the following graphic displays (Figure-1).

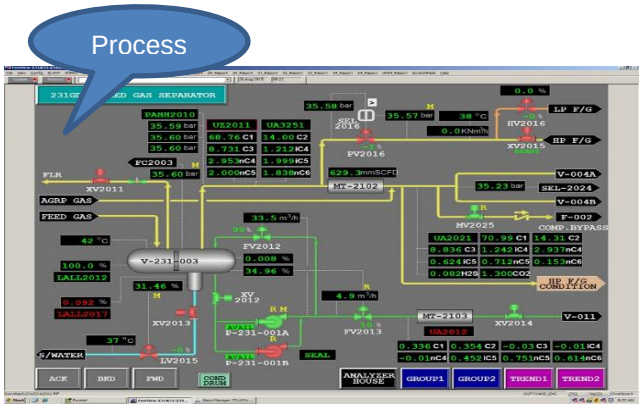


Figure-1

This display is a dynamic, multi-page listing the following:

- Active process alarms.
- Active but acknowledged process alarms
- Inactive and unacknowledged process alarms.

For the inactive alarms that acknowledged will not displayed. All active and acknowledged alarms, as well as inactive and unacknowledged alarms will remain in CAD (Figure-2), however values and statuses are dynamically updated in Graphic Display.

6. GOALS OF NEW CONCEPT STUDY

The main goal of this pilot study is:

- Minimize the alarms in CAD.
- Barring unnecessary blocks from reporting to CAD workstations.
- Grouping alarms based on priority.
- Directing unnecessary alarms to IMAC and historian.

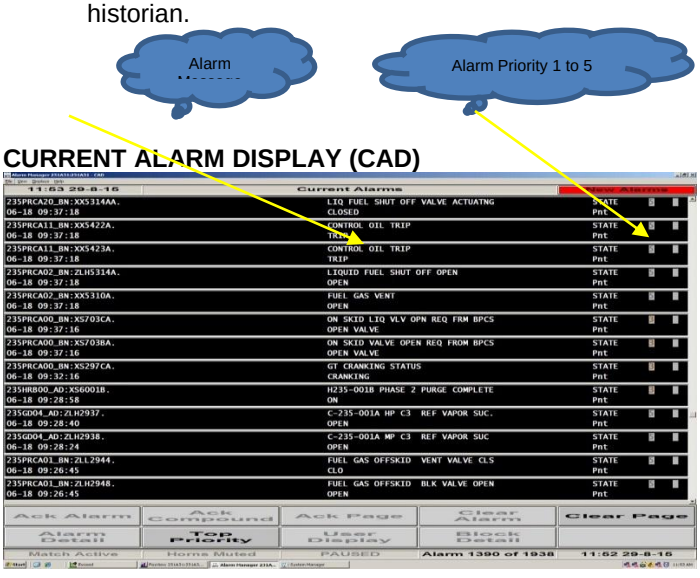


Figure-2

7. BLOCKS BANDED TO REPORT TO CAD DISPLAY

The following blocks banded to report to CAD display because of its visible changes in graphics displays:

- MOV Limit Switches Feedback.
- XV Limit switches Feedback.
- Motors State Alarms.
- Pumps State Alarms.
- Third Party Alarms (Metering Skids).

8. EXEMPTIONS

Some exceptions for third party alarms, XV, MOV Limit switches Motors and pumps state upgraded to priority 1 and 2 based on criticality of the third party alarm and state alarm.

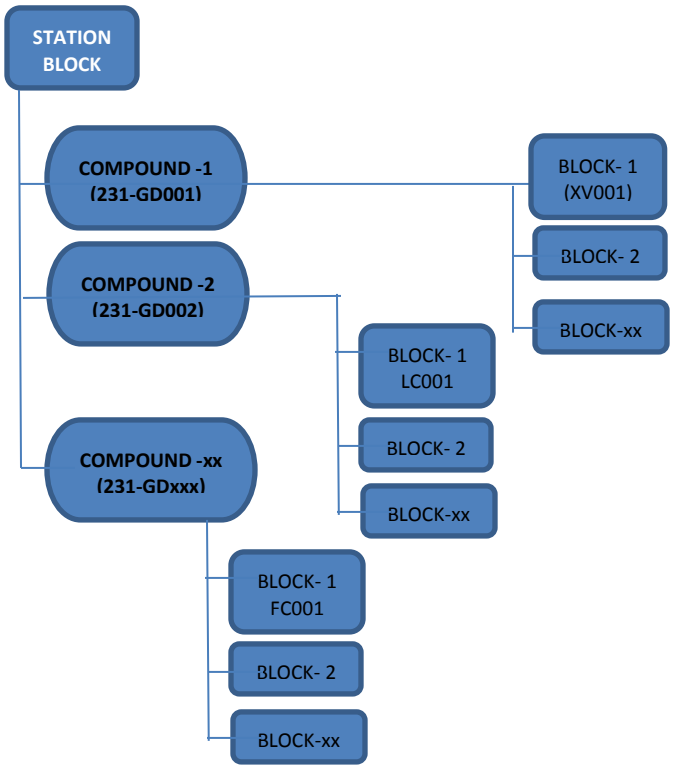
9. SORTING ALARMS

The Current Alarm Display (CAD) sort alarms as per the following order:

- Unacknowledged alarms.
- Acknowledged alarms.

These two groups are both display on the CAD and sorted by alarm priority and then by time of occurrence, i.e. the most recent, unacknowledged, and highest priority alarm will show on top of the CAD display.

10. DATABASE STRUCTURE IN LPG-4 DCS SY



11. ALARM PRIORITIES, GROUPS & DEVICES

- Each block has the following parameters:
  - Alarm Priority number (Block Parameter).
  - Alarm Group number (Block Parameter).

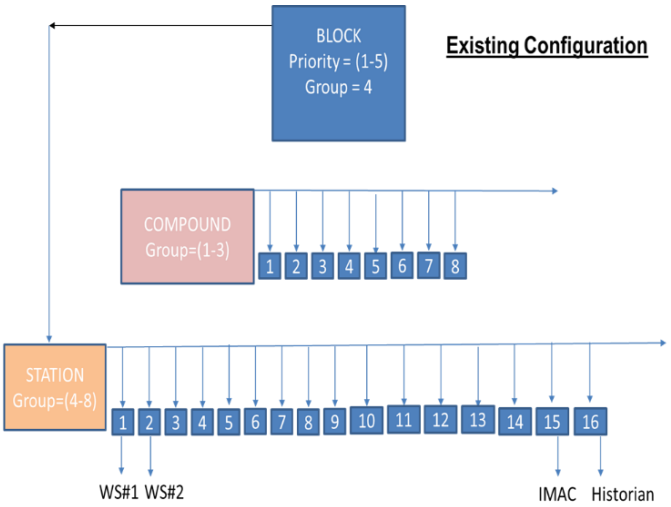
- Each “Alarm Group” can have a number of devices assigned to it.
- When an alarm occurs, the alarm message is sent to the assigned alarm group, then according to group number, it will routed to all devices assigned to this group.
- Groups 1-3 are part of parameters in compound Block.
- Groups 4-8 are part of Station block.
- Alarm Assigned Devices (Station and Compound
- Blocks Parameter).

12. PREVIOUS ALARMS SETTING FOR LPG-4 DCS SYSTEM

Different priority numbers assigned as per following table:

Priority	Alarm Type	Alarm Priority Classification	Group Number	Assigned Devices
1	HH, LL, ESD Trips, I/O Bad, Fault	Critical	4	ALL Workstations, IMAC, Historian
2	H, L , Mismatch, Deviation	High	4	ALL Workstations, IMAC, Historian
3	Third Party (Metering)	Low	4	ALL Workstations, IMAC, Historian
5	MOV & XV Limit switches Feedback, Motors and Pumps State	Very Low	4	ALL Workstations, IMAC, Historian

13. PREVIOUS CONFIGURATION



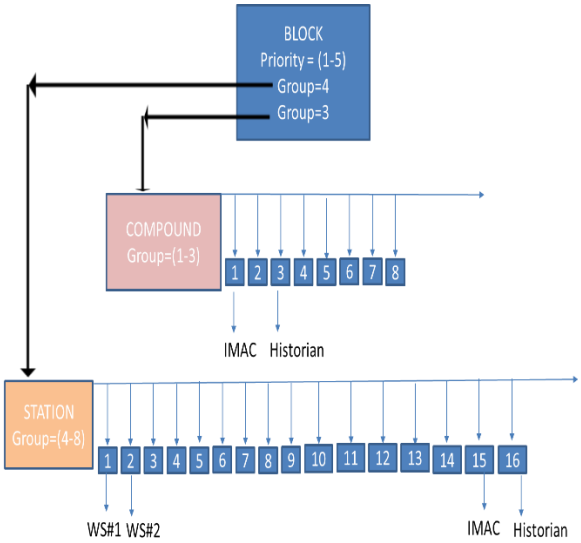
14. PROPOSED ALARMS SETTING FOR DCS SYS.

Priority	Alarm Type	Alarm Priority Classification	Group Number	Assigned Devices
1	HH, LL, ESD Trips, I/O Bad, Fault	Critical	4	ALL Workstations, IMAC, Historian
2	H, L , Mismatch, Deviation	High	4	ALL Workstations, IMAC, Historian
3	Third Party (Metering)	Low	3	ALL Workstations, IMAC, Historian
5	MOV & XV Limit switches Feedback, Motors and Pumps State	Very Low	3	ALL Workstations, IMAC, Historian

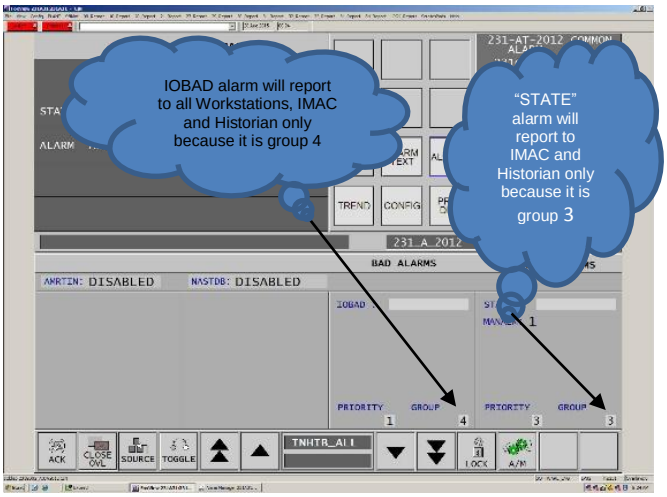
Different priority numbers assigned as per following table:

- Alarms with priority 1 & 2 assigned to Group 4.
- STATION Block technic used for Devices assignment for Group 4.
- Alarms with priority 3 & 5 assigned to Group 3.
- COMPOUND Block technic used for Devices assignment for Group 3.

15. PROPOSED CONFIGURATION



16. BLOCK ALARM SUMMARY PAGE



What does this save for us?

It eliminates 14638 Blocks from reporting to CAD in workstations

17. ALARMS' RATE BEFORE IMPLEMENTING THE NEW CONCEPT

Date	Period	No. of Alarms/Day	No. of Alarms/Hour
21/5/2015	24 hours from 00:00	48350	2015
19/6/2015	24 hours from 00:00	57780	2408
20/6/2015	24 hours from 00:00	44612	1859

18. ALARMS' RATE AFTER IMPLEMENTING THE NEW CONCEPT

Date	Period	No. of Alarms/Day	No. of Alarms/Hour
13/7/2015	24 hours from 00:00	123	5
147/2015	24 hours from 00:00	75	3
16/7/2015	24 hours from 00:00	75	3

19. SHELL DEP (Design and Engineering Practice) STANDARD (32.80.10.14-Gen. February 2011)

Blocks with alarm priority 1 & 2 reconfigured to follow Shell DEP as Following:

PROCESS TYPE	DEAD BAND % OF SPAN
FLOW	5 %
LEVEL	5 %
LIQUID PRESSURE	5 %
GAS PRESSURE	2 %
TEMPERATURE	1 % OR 2°C whichever is less

- STATION Block technic used for Devices assignment for Group 4.
- Alarms with priority 3 & 5 assigned to Group 3.
- COMPOUND Block technic used for Devices assignment for Group 3.
- As per Shell Dep, alarms per console operator:

Number of alarms that can effectively handle per hour.
Unacceptable: > 6
Current: 4-6
Target: < 2
The following CAD display (Figure-3) shows the number of alarms per console after implementing the new concept in LPG-4 plant as per SHELL DEP standard:

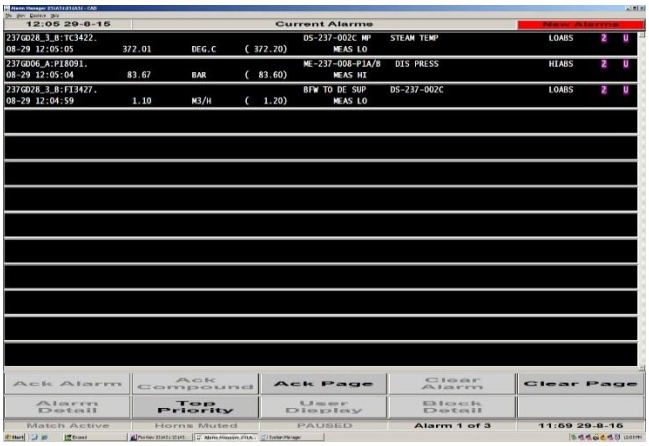


Figure-3

Current Alarm Display (CAD) After Implementing New Concept.

References

[1] "Why is Alarm Management Required in Modern Plants" Stan DeVries

[2] "Setting a new standard in alarm management" Siemens.

[3] "Alarm Management" Emerson

[4] "A Path Forward for DCS Alarm Management" Pierre Grosdidier; Patrik Connor.