DeltaV SIS™ for Burner Management Systems

RESULTS

- Inhibit startup when unsafe conditions exist
- Protect against unsafe operating conditions, including improper fuel quantities
- Provide operators with status information
- Initiate safe operating condition or shutdown interlock if unsafe condition exists
- Operate reliably and eliminate spurious trips

APPLICATION

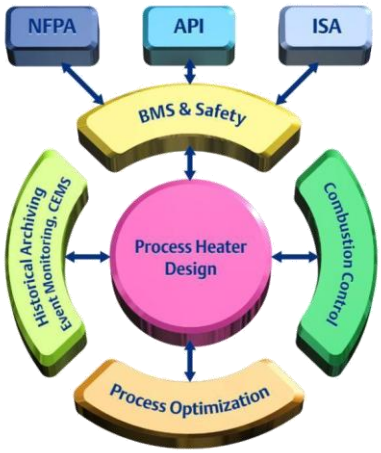
Burner Management Systems (BMS) are installed to prevent the catastrophic combustion of fuel used in industrial burners, such as fired heaters, boilers, and incinerators, and to prevent overheating process equipment. An explosion due to the combustion of fuel can result in equipment failure, significant unscheduled downtime, and/or harm to personnel. Overheating the process stream can result in a harmful environmental release. Safety systems, including burner management systems, have two basic tools to ensure safety: permissives and interlocks. A BMS goes through a series of states for startup, operation and shutdown. The transitions between the states are the permissives that ensure safe conditions are met before the next state is entered. Interlocks are functions that, upon detecting an unsafe condition, cause specific actions to occur that take the equipment to a safe state.

CHALLENGES

Accidents and disasters are very seldom because of the extensive industry experience. However, there are various codes and standards that one may reference with regards to burner management systems, including:

- NFPA 85 & 86 – prescriptive standards that are specific about what must be implemented for burner management systems
- IEC 61511 – concerned with all safety instrumented systems in the process industry
- TR.84.00.05 – ISA's technical report specifically for the application of ANSI/ISA 84 (IEC 61511) to Burner Management Systems
- FM Approval Standard 7605 – requires that PLC based BMS must comply with IEC 61508
- Industry-specific organizations (such as API) having their own codes and standards
- Governmental agency standards, guidelines or references that relate to safety and/or burner management systems in particular

The particular standard, code or guidance followed will vary depending on user's experience and familiarity with fire-heated equipment, industry, insurance requirements, etc. Additionally, consideration should be given to if, and how, the safety interlocks will be integrated with the burner control. The IEC 61511 standard requires independence between process control and safety logic and hardware. However, there are benefits to having integration at the operator interface.



Other challenges in defining a BMS are the correct implementation of on/off sequences and state dependant interlocks, accurate split between control and safety functions, clearly conveying states and interlocks to operators, and ensuring availability of the system. A burner management system must be able to determine when to move to the next state, what the outputs are for each state and which interlocks are active in each state. Specifications are not always written in a manner that is easy to convert to custom ladder logic in conventional PLCs.

SOLUTION

DeltaV SIS was built from the ground up for IEC61511 compliance and was designed to make the implementation and management of the safety logic as efficient as possible.

Optimized Process Reliability

DeltaV SIS is the only process safety system that is able to directly use HART information from devices to increase overall reliability of the safety loops. HART diagnostics and variables from input devices can be used to:

- Understand faults to avoid tripping, where permitted
- Provide warning when abnormal situations, such as a plugged impulse line, occur
- Alert non-critical faults for preventive maintenance

Final elements with HART also provide benefits, such as:

- Using valve health from partial stroke test to advise of potential problems
- Detecting earth leakage current from final element

All of these ways of using Smart SIS functionality result in higher availability and/or lower operational expenses.

Flexibility to Meet Project Needs

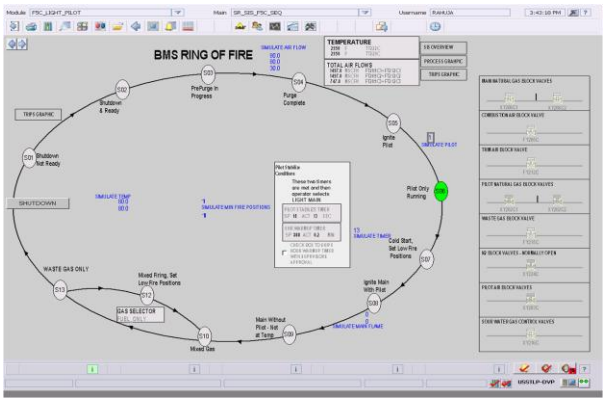
Because of its modular architecture, DeltaV SIS easily scales to all BMS requirements. Fault isolation and easy maintenance with large systems are unique to DeltaV SIS. For example, a multi-burner plant may have each burner running on its own logic solver.

However, much smaller systems are also easily implemented with a single logic solver and flexible I/O. Each logic solver has an interface for 16 I/O channels that can be configured as Discrete Input, Discrete Output, Analog Input (HART) and/or HART two-state output channels.

DeltaV SIS logic solvers are SIL-3 rated, whether they are simplex or redundant. Redundancy can be specified where high availability is critical. DeltaV SIS allows for flexible redundancy within the system – add redundant logic solvers only where needed and intermixed with simplex logic solvers.

Increased Visibility to BMS Information

Easy access to safety-related information is readily available at the DeltaV Operate station or to other BPCS operator interfaces. For DeltaV Operate, standard operator faceplates automatically provide detailed safety information. Proper authority and verification is required based on the desired action.



A BMS "ring of fire" clearly shows the DeltaV SIS State Transition Diagram active state, conditions to be met for the next state and active interlocks

Reduced Engineering and Complexity

No custom code is required to implement complex SIS tasks for burner management, such as state transitions and step sequencing. The DeltaV SIS IEC 61508-certified safety function blocks provide faster configuration, testing, and troubleshooting of SIS logic. They make safety logic development both intuitive and easy.

These powerful, smart safety function blocks are certified by TÜV for use in SIL 3 applications without exception and reduce what formerly took pages of ladder logic and custom programming to engineer into a simple drag-and-drop configuration activity.

Function Blocks for BMS Applications

The three main parts for BMS logic are:

1. States & Transitions: define when to move to next activity and what interlocks allow logic to move
2. Outputs: define valve positions for each state
3. Trips: including which is active in each state

The function blocks that are provided with DeltaV SIS have been developed around these three types of logic. The following IEC 61511-certified function blocks are key components in defining a BMS.

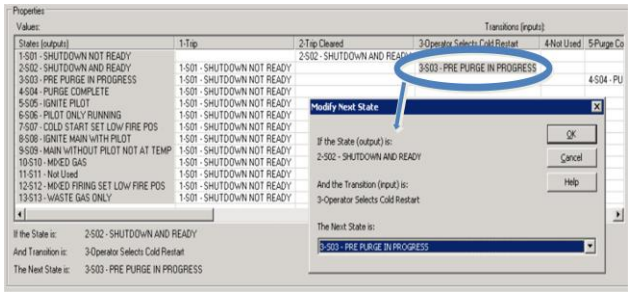
Function	Description
	**State Transition Diagram (LSSTD)** Implements a state machine. The block changes state based on the values of its transition inputs.
	**Step Sequencer (LSSEQ)** Drives a number of discrete block outputs based on the input sequence number.
	**Cause And Effect Matrix (LSCEM)** Executes interlock and permissive logic to associate as many as 16 inputs (causes) with as many as 16 outputs (effects) to control one or more final elements.

State Transition Diagram

The entire burner operation is in one of a number of defined states. The transitions advise when the operation can move to the next state. This approach is a very clear and systematic development process:

- Define the states and transitions.
- Define the outputs in each state.
- Define the required trip signals.
- Define per state if a trip is active or masked.

For example, a state of "Shutdown and Ready" requires that an operator select "Cold Restart" in order to continue to "Pre-Purge in Progress". The picture below shows how this is implemented in a straight-forward table format in the State Transition Diagram.



This method is very good for developing functional requirements in an interdisciplinary team. Having the requirements in a table format makes the DeltaV SIS State Transition Diagram configuration even easier.

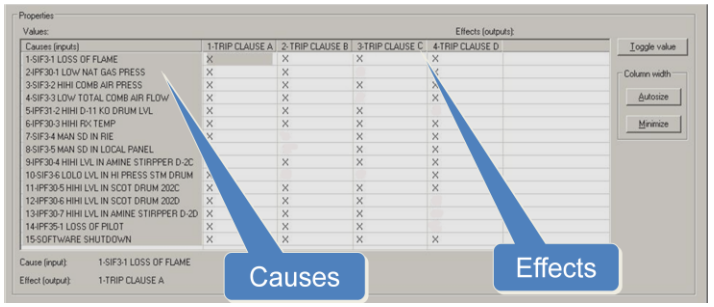
Step Sequencer

The Step Sequencer function block associates system states with the action of driving outputs.

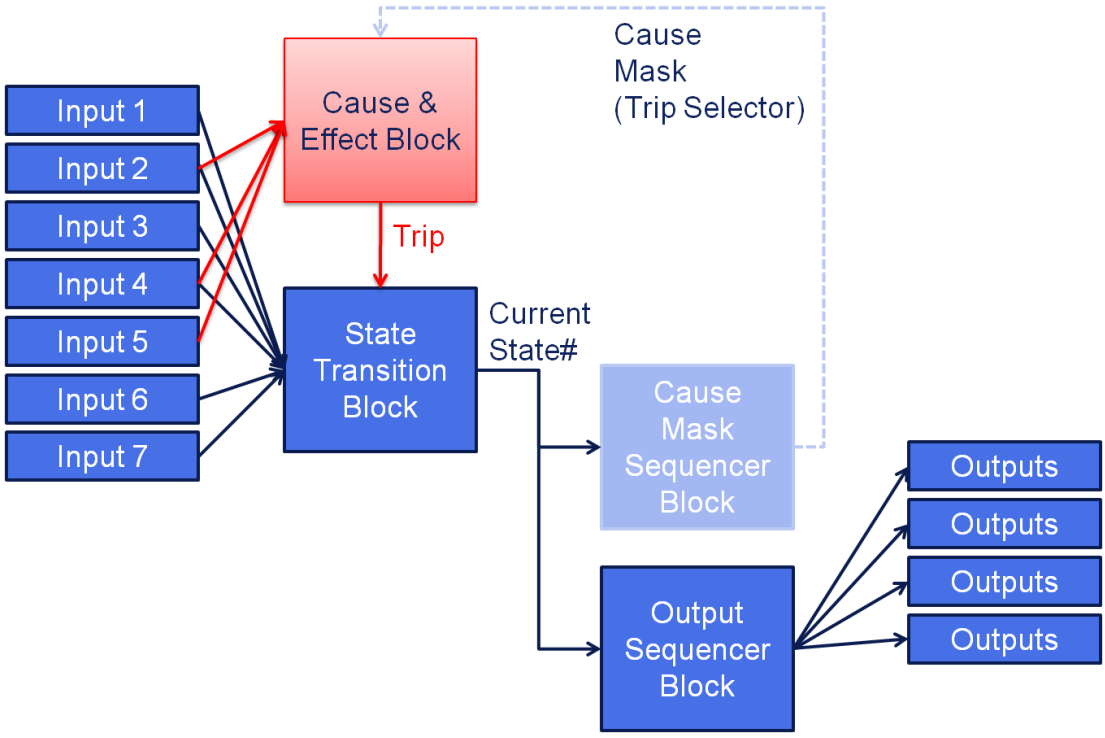
In other words, it defines the outputs such as valve position or igniter position for each of the states defined in the State Transition Diagram. The table format clearly shows the value for each output in any of the identified states.

Cause Effect Matrix (CEM)

The Cause Effect Matrix function block is used to define interlock and permissive logic that associates causes (inputs) and effects (outputs). A matrix is used to identify one or more causes that make each effect trip. When a cause becomes active, all effects associated with that cause also trip.



Of course, all of these function blocks are also well suited for other safety applications. Additional function blocks are available in the DeltaV SIS system. Please refer to the DeltaV SIS Engineering Tools product data sheet for a complete listing of DeltaV SIS function blocks.



DeltaV SIS function blocks reduce complexity for burner management applications

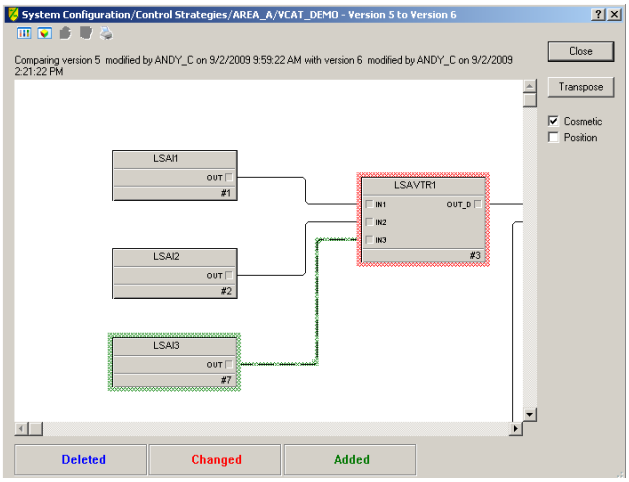
Simplified Safety Lifecycle Management

No matter what standard you follow – whether prescriptive or performance-based, DeltaV SIS is able to help you comply. The BMS standards that are now in general use are all valuable, first and foremost, in identifying the hazards of combustion. DeltaV SIS is TÜV certified for meeting the requirements of IEC 61511, NFPA 85, EN 50156-1 and EN 298.

For those least familiar with hazards of combustion, using firm, more rigorous prescriptive standards, such as NFPA, may be most comfortable. For some, corporate policies will dictate the use of these more traditional standards. This does not eliminate the possibility of using performance-based standards as well.

Many will find that integrating these design philosophies will not necessarily be more expensive, and in fact, will provide benefits by balancing the availability, safety and lifecycle aspects of the system. The benefit of the newer standards is that they clarify the role of risk in the decision-making and highlight the requirements for the entire safety lifecycle of fired units.

DeltaV SIS change management supports regulatory requirements and automates your IEC 61511 compliance. With the version control feature enabled, all changes in the DeltaV SIS logic are captured with graphic and textual details of the change, who made it, and when it was made.



DeltaV SIS system also documents the changes to existing SIS logic, showing the nature of the change in addition to the identity of the person changing it. Where required by the standard, editing and verification are required to be by appropriately qualified personnel. These qualifications, including peer groupings and authorities to ensure that reviews have been made by the right people, are built-in from the start of the project.

ADDITIONAL INFORMATION

- DeltaV SIS System Overview Brochure
- DeltaV SIS Function Blocks Product Data Sheet

To locate a sales office near you, visit our website at:
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