# DeltaV SIS™ for Burner Management Systems

## Reduce Engineering and Complexity, Simplify Control, Safeguard Fuel Burning Equipment

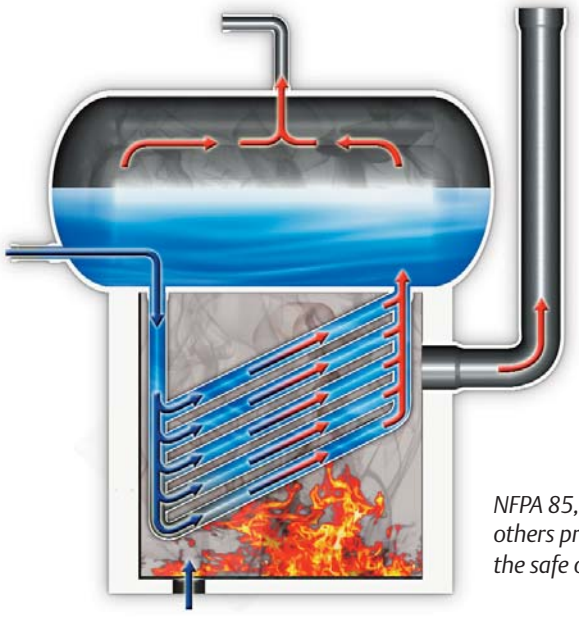
### The Challenge: Understanding standards, reducing costs, increasing reliability—safely

Companies in the process industry face a challenging business environment with increased pressure to provide improved safety while at the same time reducing costs and increasing operational efficiency. To achieve their goals, successful companies plan and manage their operational risks. They do more with less; they avoid regulatory fines, production shutdowns, equipment damage, and injury to personnel.

The focus of a burner management system (BMS) is to ensure safe operation of furnaces, boilers, ovens and other fired equipment. While fired equipment is common in the process industries, many find burner management systems complex due to permissive-based sequencing and management of multiple-state scenarios. Since boilers and other types of fired heaters are often crucial to process operations, BMS reliability and availability are very important issues to the control engineering team.

Modern burner management systems must consider:

- Inhibiting startup when unsafe conditions exist
- Protecting against unsafe operating conditions, including improper fuel quantities
- Providing operators with status information
- Initiating a safe operating condition or shutdown interlock if unsafe condition exists
- Operating reliably and eliminating spurious trips



*NFPA 85, EN 50156, IEC 61511 and others provide guidelines to ensure the safe operations of fired heaters.*

Over time, BMS standards have evolved to help companies implement safer operations; however, these standards affect capital project costs and require competent resources to ensure compliance.

In addition to general safety standards, a number of guidance documents have been produced specifically for BMS applications. Many end-users are concerned that these guidelines complicate compliance and add to hard line issues with government agencies or other local jurisdictional authorities. Determining which of the standards and/or guidelines to follow can be an intimidating task.

DeltaV SIS

EMERSON™
Process Management

Other key challenges in defining a BMS include the correct implementation of:

- On/off sequences
- State-dependent interlocks
- Link to setpoint control functions
- Safety and control functions splits.

A BMS must be able to determine when to move from one state to another, what the valve positions are for each state, and which interlocks are active for each state. The sequential nature of the BMS logic requirements and the condition-based safety interlocks are often specified by engineers in a variety of formats. Traditionally, start-up, operational states, and trip conditions are indicated in a cause & effect diagram. Another approach is to use narrative write-ups. Both of these methods may leave out some key items and leave room for assumptions. This results in specifications which may be complex to interpret, making it difficult and time-consuming to create custom ladder logic in conventional PLCs.

In many industries and applications, risk analysis is applied to the BMS in order to determine if additional risk reduction is required to protect against property loss, environmental impact and injury to personnel. If it is determined that a safety integrity level (SIL) of 1 or greater is required by specific interlocks or functions, a portion of the BMS functions will require a safety instrumented system (SIS).

Several of the BMS standards, recommended practices, and guidelines (for example, API 556 and ISA-TR 84.00.05) have been developed, which strongly suggest that portions of the BMS be considered safety instrumented functions (SIFs) unless proven otherwise. The SIFs must have risks properly identified and ranked, safety integrity calculations performed and levels selected. The BMS should be functionality tested, and users must ensure that the system is designed, maintained, inspected and tested per the applicable standards and guidelines.
The benefits of a BMS being implemented in a safety logic solver include:

- Increasing safety integrity
- Simplifying regulatory compliance
- Potentially lowering insurance costs
- Providing compliance to many industry guidelines.

When some BMS functions are in an SIS, it is important to balance safety with availability. Sometimes there is a focus on safety requirements without considering the effect on availability. If a process is designed well, the SIS will rarely be used. The logic solver should run continuously day-in and day-out without any process demands. When this is the case, the role of the SIS is to provide availability to keep your plant running and generating profit.


*The different states and transitions for a burner are represented by a state transition diagram in the DeltaV SIS system.*

## DeltaV SIS™ solution

The DeltaV SIS process safety system can be used for BMS applications, a safety solution for control and monitoring of burner units. The DeltaV SIS system was built from the ground up for IEC 61511 compliance and was designed to make the implementation and management of the safety logic as efficient as possible.

## Modular architecture

Whether it's a small, isolated boiler with a single burner or a large fuel burning application with multiple burners and/or fuels—the DeltaV SIS system scales to fit the BMS requirements. Each modular logic solver has 16 channels of configurable I/O. The smallest

*Efficient implementation and management of safety logic*

system could have a single logic solver with only 16 I/O, but logic solvers can be added as needed—up to 30,000 I/O. The modular architecture is particularly suited to multi-burner plants, allowing each burner to run on its own logic solver for enhanced fault isolation and easier maintenance.
For increased BMS availability, the DeltaV SIS architecture has flexible redundancy. DeltaV SIS logic solvers are designated as redundant when availability is critical. Both simplex and redundant logic solvers are SIL 3 rated and TÜV certified. In addition to protecting against random hardware failures that might cause spurious trips, redundancy also provides the ability for online replacement, proof testing, and firmware upgrades.

The DeltaV SIS system can be implemented as a standalone process safety system, connected to an existing basic process control system (BPCS) or integrated with the DeltaV system for a state-of-the-art integrated control and safety system (ICSS).

## Easy access to BMS safety information

Because some BMS systems run for months at a time and are only started up once or twice a year, an operator may not be very familiar with the BMS logic. So the BMS information must be clearly conveyed to operators—showing what step the logic is in, what must happen before proceeding to the next step, what interlocks are active, etc. Easy access to BMS-related information from the DeltaV SIS system is readily available at the DeltaV Operate station or to other BPCS operator interfaces. In DeltaV Operate, graphics make it clear what interlocks are active and what step in the sequence is active; standard operator faceplates automatically provide detailed safety information with no configuration. The DeltaV SIS function blocks provide first-out information and are simply displayed for operators. Proper authority and verification is required based on the desired action. Historical data collection saves all of the first-outs, authorizations, and other needed documentation.

When the DeltaV SIS process safety system is implemented as an ICSS with the DeltaV system, the burner sequencing can be seen from the same operator screen as the process control loops that are providing regulatory control for the equipment.

## Reduced engineering

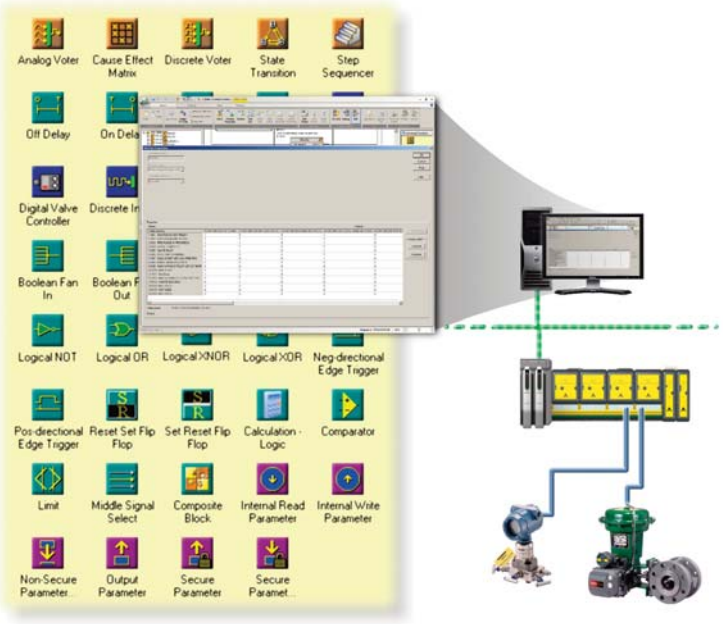
The DeltaV SIS IEC 61508-certified function blocks were specifically designed for the sequential nature of burner management systems. Emerson has developed a unique methodology for specifying different burner states and required conditions in a simple matrix format. One page shows the states, active trip conditions, valve positions, and how to move from state to state. This format translates readily into the parameters required for the DeltaV SIS function blocks. There is no question on the design; it is locked down and clear. Configuration is greatly simplified, without the need for complex or customized programming.

## Function blocks for BMS applications

The following function blocks are key components in defining a BMS application:

- **State Transition Diagram**

Implements a state machine, where each burner and the overall burner process is considered to be in one of a number of defined states, with transitions between the states based on identified plant conditions. The function block changes state based on the values of its transition inputs. For example, “Purging,” “Ignition,”




*No need for complex, customized programming—configuration is easy.*

"Running" might all be defined states, with specific operator inputs such as "Start," or plant inputs such as an accumulated air flow signifying a change in state.

■ **Step Sequencer**
Drives a number of discrete outputs based on the current burner state derived from the state transition block.

■ **Cause and Effect Matrix**
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. The function block includes state-based cause masking, and allows different trip conditions for each of the defined burner states. The first out trap feature quickly identifies the root cause of any trip condition, minimizing down-time.

Templates can be saved and used elsewhere.

## Comprehensive change management

The DeltaV SIS system's change management supports regulatory requirements and simplifies your IEC 61511 compliance. All changes in the DeltaV SIS system logic may be captured based on the change, who made it, and when it was made.

In addition to the identity of the person making a change, the DeltaV SIS system also documents what changes were made to existing SIS logic. The precise details of the change can be seen in both graphical and text formats —color coded for changes, additions and deletions. Where required by the standard, editing and verification will only be accepted when performed by appropriately qualified personnel. To ensure that reviews have been made by the right people, these qualifications, including peer groupings and authorities, are built in from the start of the project.

## Delivering results

With proper sequencing and interlocks, BMS applications in the DeltaV SIS system reliably facilitates the burner unit(s) going safely through all relevant states, from start-up to operation and shutdown when needed.


*Flexibility to meet BMS needs* —whether large or small

*Increased visibility to your process* —see BMS sequencing and controls from the same application / screen / display

*Reduced engineering and complexity*—built-in function blocks simplify design, configuration and testing, resulting in time savings.

**Emerson Process Management**
12301 Research Blvd.
Research Park Plaza, Building III
Austin, Texas 78759 USA
T +1 512.835.2190
F +1 512.832.3443

**www.DeltaVSIS.com**



DeltaV SIS

Form F-00056 /Printed in USA/2K/ 01/11

EMERSON
Process Management