BURNER MANAGEMENT SYSTEM SOLUTIONS
Increase the Safety and Availability of your Combustion Process
BURNER MANAGEMENT SYSTEM SOLUTIONS

Triconex® is the leading supplier of safety and critical control systems for burner management, critical control, fire and gas detection, safety/emergency shutdown, and turbomachinery application. Our expertise and leadership comes from the installation of more than 8,000 safety systems in a wide range of industries and applications in over 50 countries. Today, Triconex meets client needs by delivering packaged system solutions that provide safety, increased availability, conformance to local codes, and reduced life cycle costs. Triconex Burner Management Systems provides customers with a dedicated resource for cost effective, turnkey solutions that incorporate the highest quality design and implementation.

Total Solutions for Safety and Critical Control

Triconex® Burner Management Systems offers clients a full range of products and services including up-front analysis and consultation, system and mechanical equipment design, fabrication and integration, programming, Factory Acceptance Testing (FAT), installation and commissioning, training, and on-going service.

The Triconex Burner Management Systems combine proven Triple Modular Redundant (TMR) hardware with over 100 years of BMS industry expertise to provide solutions for large utility, pulp and paper, and hydrocarbon processing applications involving industrial boiler, furnace, kiln, oven, or process heaters. Active participation with the National Fire Protection Agency (NFPA), Canadian Standards Association (CSA), Industrial Risk Insurers (IRI), Factory Mutual (FM), Instrument Society of America (ISA), and International Electrotechnical Commission (IEC) ensures that system designs conform to the latest international codes and standards.
Advanced Burner Management Systems Improve Plant Safety and Availability

Triconex-based burner management systems improve plant operations by providing safe and reliable startup, operation and shutdown of the burners, and associated fuel equipment for combustion processes. The system prevents burner startup if the proper conditions are not met and initiates burner shutdown if unsafe conditions occur. The BMS logic is implemented in a fault tolerant TMR control architecture, which ensures that “no single point of failure” will cause an inadvertent shutdown of burner equipment, prevent the boiler from being tripped automatically by the BMS logic, or manually by an operator. All system failure modes are designed so that a loss of any component (such as CPU, I/O module, power supply, and communications) is not only alarmed but allows the system to isolate the failure and continue providing safe operation.

Depending on your application requirements, Triconex Burner Management Systems can be supplied as complete standalone solutions with an operator interface or tightly integrated into a plant-wide Distributed Control Systems (DCS). Triconex has developed standard communications modules that make connection of the BMS system to third-party devices simple, eliminating the need for custom programming or additional third-party hardware.

TRICONEX BURNER MANAGEMENT SYSTEMS

What are the benefits?

Installing a Triconex Burner Management System in your facility can significantly improve your company’s bottom line.

- Increase process availability by minimizing downtime caused by erroneous trips or difficulties with obsolete burner management equipment
- Significantly reduce hazards to personnel and the environment due to explosion or other undesirable events
- Protect against damage to combustion process equipment
- Improve system status monitoring and fault determination through immediate diagnostic failure identification
- Reduce insurance premiums through strict compliance with applicable local and international standards

A WIDE RANGE OF EXPERIENCE

Boiler and Fuel Types

Triconex Burner Management Systems, drawing on its extensive expertise, has designed and implemented systems involving a wide range of boiler and fuel types. These include but are not limited:

Boiler Types

- Front-fired
- Cyclone-fired
- Opposed-fired
- Circulating fluidized bed
- Down-fired turbo furnace
- Heat recovery steam generators
- Recovery boilers

Fuel Types

- Natural gas
- Process gas
- Coke oven gas
- Light oils
- Heavy oils
- Petroleum coke
- Coal
- Wood bark
- Low BTU gas
- Refuse derived fuel
ADDRESSING YOUR SAFETY, AVAILABILITY, RELIABILITY AND MAINTAINABILITY NEEDS

Triconex Safety Systems

Responding to national and International demands for a control system to provide safer protection of processes and equipment while meeting the customer’s need for increased process uptime, Triconex developed the Triple Modular Redundant (TMR) system. By using three completely isolated control legs, a two-out-of-three voting strategy, and embedded diagnostics, the Triconex system can quickly determine unsafe conditions and ensure that no single point of failure will cause a process upset or shutdown. This design has become the standard for critical applications worldwide where the risk of a failure within the control system cannot affect the safety of employees, the environment, and capital assets. No other burner management system can help you attain the same levels:

- Increased safety
- Elimination of unnecessary trips
- Safety
- Improved system reliability

Triconex Burner Management Systems provide the highest level of safety available today. While most safety systems have been designed for fail-safe operation, requiring a system shutdown after detection of a fault, the Triconex TMR architecture allows the system to operate safely after detection of a system fault and permits online repair. The completely triplicated architecture uses a two-out-of-three voting strategy at each major system level (input, processor, and output) to quickly determine system problems and isolate them from correctly operating areas. In addition to voting, embedded diagnostics are executed at the lowest system levels, allowing problems to be quickly pinpointed to an individual I/O point or system component. By distributing diagnostics throughout the system, application resident diagnostic routines are not required at the processor level, allowing the TMR logic solver to achieve some of the fastest scan times in the safety industry.
The Triconex controller performs diagnostic routines automatically upon power-up and during operation, ranging from internal circuit fault detection to field wiring problem identification. Some of the diagnostics used to quickly identify faults include:

- **Input diagnostics**, which verify that individual circuits can transition to a safe state and are not fused in a “stuck on” or “stuck off” condition
- **Output diagnostics**, which guarantee that individual circuits are not fused in a “stuck on” or “stuck off” condition and can transition to a safe state. By using a quad circuit design, output circuits can be tested individually and isolated if a fused condition occurs
- **Supervised outputs** that can determine an “open” or “short” condition in field wiring between the field device and I/O module
- **Program watchdog timers**, which guarantee that the logic program executes in a certain time period and does not get stuck in an infinite loop
- **Cyclical redundancy checks (CRC)**, which ensure communications are secure from transmission errors
- **Processor memory checks**, which identify memory bit errors
- **Program emulation and CPU instruction tests**, which verify that instructions are properly configured and addressed before downloading the applications logic program into the Triconex system

**Availability**

A major goal for every boiler operator is to safely maximize unit availability since downtime results in lost revenue and increased operating costs. The unsurpassed availability of TMR systems reduces unscheduled downtime due to control system failure.

Availability is determined by the number of system shutdowns and the amount of time it takes to correct the problems and get the system operating again. Shutdowns, and therefore lower availability, are most often attributed to human error and system faults. Human errors occur when the system is difficult to operate, diagnose, and maintain. A complete set of built-in automatic diagnostics identify system problems down to a point or component level and help maintenance personnel determine exactly what actions to take. These functions make the system easier to operate and diagnose, reducing the probability of human errors.

The Triconex TMR architecture, diagnostics, and online repair capability eliminate costly spurious shutdowns and downtime. The TMR system can continue to operate in the presence of multiple failures, transgressing through a 3-2-1-0 operations mode, if necessary. Faulted modules can be replaced while the system is operational, providing continuous uninterrupted control. The many features of the Triconex system allow it to have the highest Mean-Time-To-Failure Spurious Trip (MTTF spurious), calculated at more than 128 years using the Markov Models as certified by TÜV. High MTTF along with low Mean-Time-To-Repair (MTTR) give the Triconex system the best availability of any system design.
Reliability

The reliability of any system is a function of the design and quality of its components. The Triconex® system is designed to operate in the harsh conditions of extreme temperatures, humidity, corrosive atmospheres, shock, vibration, and electrical interference. Before the manufacturing process begins, our quality assurance program pre-screens system components to make sure they are up to Invensys quality standards. Upon final assembly, each system is cycle tested prior to shipment to the customer site, reducing module infant mortality rates upon field startup. Using actual field failure rates based on Triconex repair records, the MTTF spurious of a typical TMR system is shown to exceed 1,000 years. In testament to the overall quality of Triconex design philosophy, components, and system engineering, field MTTF data ranks Triconex product reliability at the top of the list of control system suppliers.

Maintainability

Embedded diagnostics in the Triconex system are executed automatically, allowing the system to quickly detect a wide range of system failures. Once identified, the system diagnostics are easily displayed on engineering or operator stations through standard displays and messages, reducing the time to troubleshoot problems. Special hardware applications programming are not required.

Other key maintenance features of the Triconex system are completely isolated triplicated circuits on each system board and hot-spare capability. The single board design reduces system cost and makes the system easier to troubleshoot and repair. When a component failure occurs, maintenance personnel can insert a replacement board in a dedicated slot next to the failed board. After executing a diagnostic checkout of the replacement board, the system automatically, “bumplessly” transfers operations to the board. The Triconex system does not require maintenance personnel to disconnect any field wiring before replacing boards, which may be required in other systems.
COMPLETE TURNKEY SOLUTIONS CAPABILITY

Implementing a successful burner management system project involves more than just reliable components. It requires a team of engineers with technical expertise and project management knowledge to bring these components together into a property functioning system. Triconex Burner Management Systems provide complete turnkey solutions that function as stand-alone or tightly integrated system as part of an overall plant control strategy. The Triconex Burner Management System is comprised of knowledgeable and experienced personnel who keep pace with technology changes and industry requirements allowing them to handle diverse project scopes and sizes, and new or retrofit upgrades.

Up-Front Analysis and Consulting

Invensys Safety Consulting Engineers will perform on-site surveys of existing BMS equipment and make recommendations for improved safety, reliability, and standards compliance. If required, Invensys Safety Consulting Engineers can perform a complete hazard analysis to ensure that an objective critique of the process is incorporated into the project.

Burner Management Systems Design

Invensys Safety Consulting Engineers’ extensive experience with all types of combustion processes and fuels, coupled with their repeated use of a standard Triconex TMR architecture, has enabled the development of modular packaged control systems. The control system is configured using a library of proven application logic modules that can be customized to meet the unique requirements of each project. Human machine interface (HMI) stations can then be selected from a wide range of hardware and software options. As a final step, burner front components and auxiliary equipment are specified to meet stringent requirements and are completely integrated to complete the burner management system. This modular design approach successfully eliminates significant time and costs required in the design, configuration, and check-out of the system.

Applications Logic Module

Triconex has developed standard field-proven logic modules using TriStation 1131™ programming software to implement burner management systems in the TMR programmable logic controllers. This IEC-61131-compliant, PC-based software takes advantage of the Windows® operating system to provide an intuitive, graphical configuration environment. Users can choose from several programming editors (such as function block diagram, ladder diagram, structured text, or CEMPLE) and can combine programs as desired to develop their BMS system logic.

These logic modules are building blocks consisting of logic drawings, applications programs, and HMI graphics for various BMS functions. Using logic modules standardizes the logic design and eliminates repetitive design and programming tasks in BMS projects, reducing design cycle time, engineering, and overall system costs.

The logic modules are carefully designed and tested, and comply with applicable codes and standards such as the National Fire Protection Agency (NFPA), Factory Mutual (FM), and Industrial Risk Insurers (IRI). Using logic modules improves system quality and reliability by minimizing opportunities to create design errors. The time to test logic for a particular BMS project is reduced because the logic contained inside the modules does not require additional testing for a specific application.
Human Machine Interface (HMI)

Several types of HMI devices can be supplied, ranging from local operator stations with conventional push buttons and lights or simple graphic terminals, to personal computers or DCS workstations with advanced color graphics.

Based on years of experience, Triconex Burner Management engineers have developed standard HMI graphic displays that can be modified as required to meet individual customer application requirements. These standard displays allow the operator to monitor startup and shutdown procedures, burner operational status, diagnostics including system faults, and first-out alarms. In addition, control functions such as purge, fuel selection, main fuel trip, and remote start/stop of burners are provided.

Burner Front and System Cabinets

The end user can choose from standard packaged solutions using NEMA-Type 12 cabinets or custom designs that meet individual requirements. These cabinets house the safety system, I/O terminations, and flame amplifiers.

Engineering Workstation

In addition to the development of application logic modules, online changes and system configuration can be accomplished with TriStation 1131 software. Running under the Windows operating system, this “developer’s workbench” can be combined with the HMI software on a single PC, eliminating additional hardware, or supplied on a separate PC workstation.

Flame Detection

The ability to distinguish between the presence or absence of a burner flame under all circumstances is critical to the proper operation of a burner management system. Ultraviolet (UV) flame scanners for gas and light oil
applications or infrared (IR) flame scanners for coal, oil, and other heavy fuel applications can be provided as part of the system to detect the presence of both igniter and main flame. “Flame on”, “flame out”, and “marginal flame” conditions can be detected and sent to the Triconex controller. The self-checking flame scanners verify that the scanner will detect a “flame out” condition and are provided complete with swivel mount and connections for cabling and cooling air piping. Various flame scanner options are available to provide redundant flame scanning, or to accommodate applications where two separate burners are fed from one common fuel valve train.

**Ignition Equipment**

Proper selection and application of ignition equipment as part of the burner management system is necessary to successfully sequence burners into service under all conditions. Invensys Safety Consultant Engineers design, specify, and apply igniters to meet NFPA class I, II, or III requirements. Careful attention is given to all conditions of service for the ignition equipment assuring safe, stable, and environmentally compliant igniter performance.

**Valve Packages**

Fuel trip, burner shut-off, vent, and pressure regulating valves must be carefully selected and integrated into the burner management system to assure safe reliable boiler and furnace operation. Triconex Burner Management System solutions use field-proven valve equipment designed into highly reliable assemblies.

**Auxiliary Equipment**

Invensys will provide all equipment necessary for the complete implementation of a burner management system including auxiliary equipment such as blower assemblies and other piping specialties.

**Interface To Third-Party Systems**

The Triconex Safety System interfaces with third-party devices easy by providing communications modules, which implement industry standard networks (IEEE 802.3, RS-232/422), and protocols (MODBUS Serial, DDE, MODBUS TCP/IP, OPC). In addition, advanced modules, jointly developed with major DCS companies allow direct connections to plant-wide communication networks such as the Foxboro I/A Series System and the Honeywell TDC 3000 UCN. These modules allow communications from the TRICON™ to other process control and HMI nodes at network speeds, eliminating bottlenecks created by gateway devices and custom programming, helping you attain a fully integrated plant-wide solution.
Today’s boiler operator/owner faces an ever-expanding set of demands to protect the safety of employees, the catastrophe of explosion and fire. Triconex products and systems are submitted to leading independent testing agencies to certify that they can meet not only everyday operating conditions, but also extreme circumstances that can arise because of changing process conditions. Triconex products and systems can help you comply with important certification levels and assure that you have a system that provides the highest level of safety, availability, and reliability:

**PRODUCT CERTIFICATIONS**

**TÜV Rheinland**
TÜV certification ensures, per IEC61508 standards, the functionality of Triconex systems for critical process applications requiring maximum safety and uninterrupted operation in the event of a system failure. Triconex Safety Systems are designed to meet requirements up to SIL 3.

**CSA/NTL/C Standard C22.2 - No. 0-M91, No. 0.4-M1982 and No. 142-M1987**
CSA certifies that the Triconex controllers, when connected to a primary distribution line and operating under specified temperature ranges, does not constitute a fire hazard, and will not cause an electric shock to personnel when touching or replacing modules. It also guarantees that the Triconex system has been tested and complies with CSA’s general electrical and process control equipment standards and UL’s 508 standard for industrial controls.

**Factory Mutual Research Corporation (FMRC) Standard 3600, 3611, and 3810**
Triconex Safety Systems are qualified for use in Class I, Division 2, Temperature T4, Groups A, B, C, and D in hazardous indoor (or outdoor in a NEMA 4 cabinet) locations.
ATEX
TÜV Certification of Triconex Systems according to the ATEX directives ensures that Triconex systems and their field terminations can be used in European Class 1 zone 2 hazardous locations. When the Safety System is installed following the Planning and Installation Guide, Triconex systems comply with the requirements of the European Union ATEX directive 94/9/EC.

European Union CE Mark
CE Mark ensures the Electro-Magnetic Compatibility (EMC) of the Triconex system with other pieces of electrical/electronic equipment. When the Safety System is installed following the Planning and Installation Guide for CE Mark restrictions, the system fulfills the requirements of the European Union EMC Directive No. 89/336/EEC.

INDUSTRY / GOVERNMENT REGULATIONS, CODES AND STANDARDS

Instrument Society of America (ISA) S-84.01
Enforceable as “good engineering practice,” S-84.01 provides guidelines for the application of safety-instrumented systems for the process industries towards a goal of uniformity in the field of instrumentation. Triconex Safety Systems can help you meet the highest levels specified in both standards.

National Fire Protection Agency (NFPA) 85C - 8501, 8502, 8504, 8506
The NFPA produces voluntary standards for safe firing practices for boilers, other combustion equipment, fuel handling systems, and is recognized throughout the world as an authority on safe combustion practices. Triconex Burner Management Systems comply with NFPA standards and Triconex engineers actively participate in NFPA and with the rule making committees of NFPA to track important developments and changes in these standards.

Occupational Safety Health Administration (OSHA) 1910
OSHA mandates that safety practices be incorporated into safety systems inside the work place. Triconex Burner Management Systems using the TMR architecture and its high diagnostic coverage is able to achieve SIL 3 as defined in ISA S84.01 and SIL 3 as defined in the IEC61508 Standard on Functional Safety.

INSURANCE CODES

Factory Mutual Research Corporation (FMRC) Programmable Controllers 5-27/14-27
Factory Mutual Research Corporation tests and certifies safety related equipment and produces “Loss Prevention Data” describing and recommending safe practices to be adopted by boiler owners/operators who are insured through Factory Mutual. Triconex Burner Management Systems comply with FM recommended practices.

Industrial Risk Insurers (IRI) IM.4.0.1
Industrial Risk Insurers produces guidelines for loss prevention and control. Triconex Burner Management Systems comply with IRI recommended practice IM.4.0.1, which describes proper use of programmable controllers in burner management systems.

Application System Certification
CSA/NRTL/C Standard C22.2 No. 199-M89 Triconex BMS systems are designed to comply with Canadian Standards Association C22.2 No. 199-M89, which governs the application of combustion safety controls and solid-state igniters for gas and oil burning equipment.

TÜV Rheinland
Triconex Windows programming and configuration software, TriStation 1131, has been certified by TÜV for applications programming and emulation of Triconex safety and critical control systems.