

invenSYS
Foxboro PAC System

Powerful. Reliable. Affordable.





➤ The Foxboro PAC System

Powerful Yet Simple Technology

The [Foxboro® Programmable Automation Controller \(PAC\) System](#) is a high-performance automation controller and I/O subsystem integrated with easy-to-use Wonderware® software. Foxboro PAC hardware marries high performance, reliability and high I/O density with cost-effective redundancy options. The process modules and I/O system form the basis of a complete distributed control and recording environment capable of continuous analog, logic and sequential control combined with secure data recording at point of measurement; all designed to maximize return on investment (ROI). Because it is engineered with some of the most advanced, yet proven technologies available, the Foxboro PAC system is very powerful, yet so simple to use.

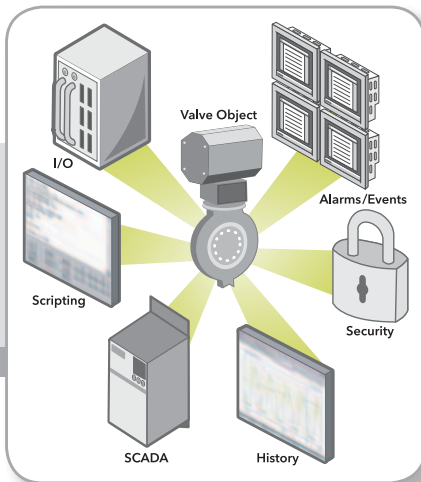
Among its many capabilities, it offers stunning visualization and seamless integration between the hardware and software, alongside Eycon intelligent local display and control. In a nutshell, the Foxboro PAC System fully encapsulates the vast control, recording expertise and reputation that Invensys has built over the last 100 years. In addition, the Foxboro PAC System is an integral component of the InFusion™ Enterprise Control System. This allows for new possibilities of open integration and efficiency that spans production operations and business.

The Foxboro PAC System is comprised of four primary components:

1. [Foxboro PAC Hardware](#) (T2750/T2550 Controllers and 2500 I/O, Eycon Intelligent Local Display and Control)
2. [ArchestrA System Platform](#) (Historian, Information Server, Application Server and Device Integration)
3. [Wonderware InTouch HMI Software](#)
4. [Foxboro PAC Software](#) (Integration software for Foxboro PAC Hardware, ArchestrA System Platform and Wonderware InTouch HMI Software)

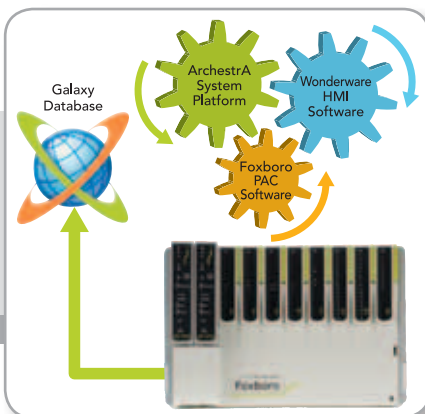
➤ Foxboro PAC System Components

- 1. Foxboro PAC Hardware**
T2750/T2550 Controllers and 2500 I/O, Eycon Intelligent Local Display and Control.



- 2. ArchestrA System Platform**
Historian, Information Server, Application Server and Device Integration.

- 3. Wonderware InTouch HMI Software**

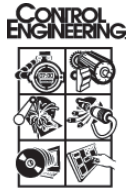


- 4. Foxboro PAC Software**
Integration software for Foxboro PAC hardware, Wonderware InTouch HMI Software and ArchestrA System Platform.

Engineer's Choice Award

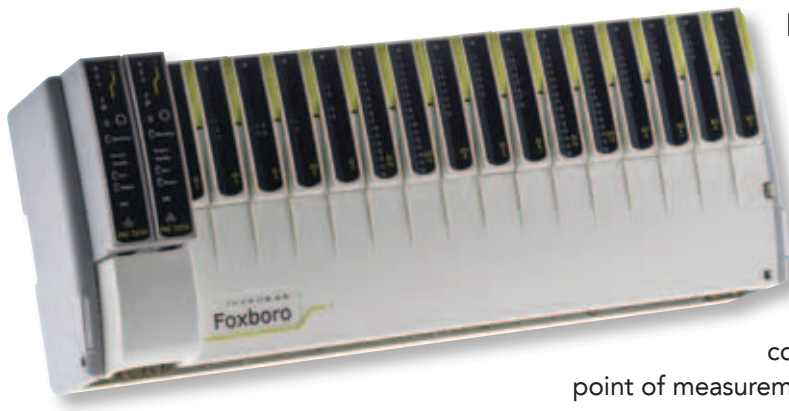
The Foxboro PAC System received an Honorable Mention in Control Engineering magazine's 2011 Engineers' Choice Awards.

"Innovative solutions such as the Foxboro PAC System make manufacturing and other control engineering applications more efficient through smart applications of new technologies. Investments in the best products and software can help solve the most pressing challenges in automation, control, and instrumentation," according to Mark T. Hoske, Control Engineering content manager.



2011
ENGINEERS'
CHOICE
AWARDS
HONORABLE
MENTION

Foxboro PAC Hardware – T2750/T2550 Controllers and 2500 I/O, Eycon Intelligent Local Display and Control



Powerful Performance. Powerful Control. Simple to Configure and Use.

Foxboro PAC hardware provides high performance control with cost-effective redundancy options in a versatile, modular system. Powerful instruments, such as the control units and the I/O system, form the basis of a complete distributed control and recording environment. This environment is capable of continuous analog, logic, sequential control, batch management, secure data recording at point of measurement and setpoint programming.

Combined with its powerful array of specialized features, it is designed to maximize your ROI, and ensure the maximum availability of your process. In addition to this, the Foxboro PAC is fitted with E-Sync technology (Invensys' easy synchronization functionality), offering both redundant processors and networking at the touch of a button – it couldn't be simpler.

Redundant Processing

Using the PAC in a redundant controller configuration automatically protects your process against controller or communications failure; their combined high availability maximizes process uptime. Commissioning a redundant capable processor is simple: Plug the second processor into a redundant base unit and press "Synchronize." All of the rest is automatic. Further capabilities include on-line reconfiguration and high mean time between failure of the system's I/O and passive backplanes to provide a highly available and extremely reliable system.

Redundant Data Recording

Foxboro PAC processors provide secure data recording at the point of measurement. This powerful feature is offered with redundancy; the data is held in non-volatile memory and is in a secure format to inhibit tampering. If your data has value to you, this simplest of capabilities is the most powerful feature of its kind in the market place.

Foxboro PAC Hardware Offers:

- High Performance
- High Availability
- Simplicity of Use
- Scalability
- Affordability

Continuous Logic and Sequence Control

Foxboro PAC supports the level of control block structuring and sequencing normally only found in advanced Distributed Control Systems, all at an affordable, competitive price.

Remote I/O

Foxboro T2750 PAC processors can be mounted in a base plate that is not connected to direct I/O, turning the powerful and configurable strategy engine into a capable process supervisor. The T2750 gives great flexibility in large applications where separating the processing from the I/O allows for physical distribution of the strategy and I/O modules, with savings on wiring costs. This assembly provides several capabilities:

- Full Data Access (DA) server for high-speed communications to the rest of the system
- Additional processing power for running distributed strategies where the application requires coordination of several distributed T2750/T2550 control units, each controlling their own I/O. Communications with those distributed units are over the PAC peer-to-peer high-speed network.
- Redundant I/O communications gateway where intrinsically safe or other third-party I/O can be brought into the system with support for:
 - Modbus-TCP; master and slave
 - Modbus-RTU; master or slave
 - Raw serial communications. Simple ASCII protocols can be integrated from such devices as analyzers, barcode readers and weigh scales



Foxboro PAC Hardware Features:

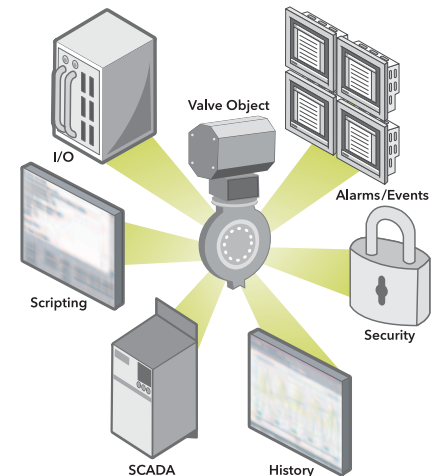
- Redundant operation with E-Sync technology
- “Store & Forward” data recording at I/O level integrated with Historian
- Supports IEC61131 Part 3 compliant software tools with rich function block library



ArchestrA System Platform

ArchestrA System Platform provides an industrialized application server, a powerful historian server, and an easy-to-use information server, with unparalleled connectivity; all specifically built for real-time industrial environments.

ArchestrA System Platform is an open industrial software application platform that is built for supervisory control, SCADA, and performance and information management solutions. Designed to suit the needs of industrial automation and information personnel, it is the backbone and manager of all functional capabilities required for industrial software solutions.



Galaxy Database

Galaxy is the term used to describe the complete ArchestrA system database – consisting of a single logical name space (defined by the Galaxy database) and a collection of Platform objects, Engine objects, and other Application objects. The Galaxy database is a relational database containing all persistent configuration information like object templates, instances, security, etc.

- The Galaxy Repository is a software sub-system consisting of one or more Galaxy databases
- The Galaxy Database Manager is a utility to manage your Galaxy. It can back up and restore Galaxies and reproduce a Galaxy on another computer.
- The Galaxy Database Server is the storage machine for Galaxy databases which support the Foxboro PAC System

Foxboro PAC Software

Foxboro PAC software provides the integration needed to link Foxboro PAC controller applications into the ArchestrA System Platform and Wonderware InTouch HMI software. This software enables your Foxboro PAC controllers and tools to seamlessly integrate with the ArchestrA Integrated Development Environment (IDE).

It includes several industry-leading components designed to ensure easy, maintainable and scalable implementation of one or more PAC applications.



- Full Data Access (DA) Server for high speed systems communications
 - DA Server deployment and browser extensions
 - Device Integration objects with diagnostic symbols
- PAC tools complete integration to IDE
- PAC application repository in the Galaxy
- Application objects
- I/O reference binding tool
- “Store and Forward” extension service

➤ Advanced Engineering and Development Environment

A Wide Range of Standard and Advanced Function Blocks

Along with the wide range of standard function blocks such as system blocks, I/O blocks, timers, counters, application specific, and maths blocks, others are provided, such as advanced auto-tune PID control and a powerful suite of diagnostic blocks that can be used to commission and diagnose the Foxboro PAC and analyze network performance.

Standard blocks such as the PID control block (with advanced control algorithm capable of heat/cool, direct/reverse, and valve positioning control) and application blocks such as 'Pump Duty/Standby', make engineering of complex control systems simple to configure, yet powerful, robust and reliable.

Function Block Libraries

- Analog and Digital I/O
- Manual Override
- Dynamic Signal Conditioning and Processing
- Analog, Simulation, and Communications Control
- Timing, Sequencing, Totalization, and Events
- PV Selection, Switching, and Alarm Collection
- Logic Latching, Counting, and Comparison
- Mathematical Functions and Free-format Expressions
- Diagnostic Blocks

A choice of IEC61131 part 3 languages gives the user the ability to select the most appropriate method of programming for the I/O type or application required. These include:

- Function Block Diagrams
- Sequence Function Charts
- Structured Text
- Ladder Logic Control

Integrated Development Environment

The IDE is a single programming and engineering development tool that securely stores and manages application information into a common database known as the Galaxy.

- One common toolset to configure the Foxboro PAC controller, Eycon intelligent local display and Wonderware Intouch HMI and Historian
- PAC control strategy files, I/O integration, alarm, historical collection, supervisory scripting, and security configuration are stored within the ArchestrA application Galaxy Repository
- Easy and Secure I/O referencing with an off-line tag binding tool
- PAC Application Objects Toolset including Alarm Management at source
- Audit trail logging and revision history

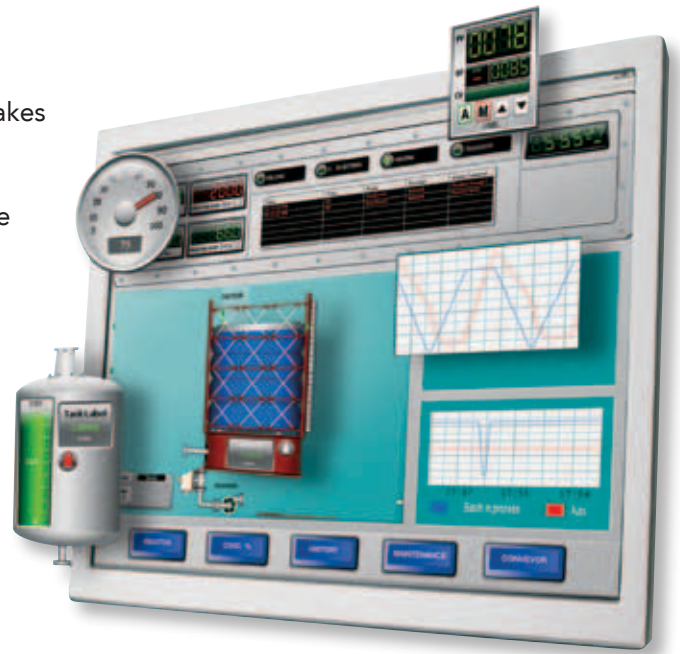


HMI Visualization

Wonderware InTouch HMI

InTouch HMI software provides graphic visualization which takes your operations management, control and optimization to a whole new level. The InTouch HMI reputation stands above all the rest. What the industry now knows as Human Machine Interface (HMI) all began with InTouch software over twenty years ago. No other HMI can match InTouch software for:

- Industry-leading innovation
- Architectural integrity
- Device integration and connectivity
- Uninterrupted software version migration path
- Truly legendary ease of use
- Lower maintenance
- Lower operational costs



Key Capabilities

- Resolution-independent graphics and intelligent symbols that visually bring your facility to life
- Sophisticated scripting to extend and customize applications for your specific needs
- Real-time distributed alarming with historical views for analysis
- Built-in, real-time and historical trending
- Microsoft ActiveX controls and .NET controls integration
- Extensible library of over 500 pre-designed, intelligent and customizable graphic and object symbols



Key Benefits

- Legendary ease of use enables developers and operators to increase productivity quickly and easily
- Unequaled device integration and connectivity to virtually every device and system
- Stunning graphic visual representation and interaction with your operation brings the right information to the right people at the right time
- History of an uninterrupted software version migration path that means your HMI applications investment is protected

➤ Eycon Intelligent Local Display and Control

The [Eycon Series of Visual Supervisors](#) provide innovative, multi-function control, recording and visualization; bringing expertise in control, data acquisition and process automation into a single, intelligent process management unit.

Process Management Key Benefits and Capabilities

The advanced array of features effectively makes the Eycon Visual Supervisor a distributed and local HMI with the efficiency and economy of integration into a single unit and the flexibility to be a powerful component of a wider system.

- Batch control/continuous and sequential control
- Recipe/Alarm/Event management
- Setpoint programming
- Audit trail and secure logins
- Master comms
- Data logging
- Printer support
- Bar code reader support

Utilized as a building block within a larger Foxboro PAC System, the Eycon Visual Supervisor provides peer-to-peer communications over Ethernet; thus reducing engineering costs for configuration, integration, installation and wiring, whilst improving efficiency and quality with accurate control. The versatility of the Eycon Visual Supervisor makes it ideal for a wide range of applications such as:

- Pharmaceutical/Chemical Reactors (21CFR Part11 compliant)
- Glass processing: float, bottling, fiber, solar
- Multi-zone heat treatment furnaces
- Injection moulding and extrusion
- Environmental monitoring
- Building management systems
- Induction furnaces
- Speciality chemicals processing
- Oil & Gas: wellhead chokevalve, gas dehydration control
- Water & Wastewater: raw water pump station, pump lift station, solids collection and disposal, water treatment
- Boiler: burner combustion control, demand load management, drum level control, steam distribution

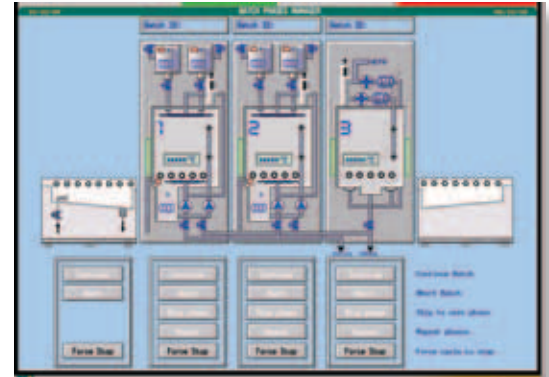


➤ Eycon Visual Supervisor Advanced Features

Batch Control

[Batch Manager](#) enables an operator to control a batch and monitor its progress from standard displays. Each batch is identified by either a unique number or a batch ID entered by the operator.

- Configure a batch from the Set-up page
 - Unique custom/automatic Batch Identity
 - Recipe selection
 - Six operator entry fields (such as customer name)
- Comprehensive batch control including
 - Start, Hold, Abort, Restart, Reset
- Automatic recipe download
- Automatic batch log and report generation



Recipe Management

The Eycon Visual Supervisor provides advanced and flexible recipe management. This powerful feature is easy and efficient for the operator to use. Automatic version control adds peace of mind that the correct recipe is being downloaded. Recipes can be created, maintained and downloaded from the front panel. The order of execution of a recipe is the order of the values in the file in a top-down manner.

- On-line and off-line recipe editor
- Up to 500 parameters per recipe
- Automatic version control
- Ability to store multiple recipes, with download and capture facilities
- Advanced recipe monitor with diagnostic information
- Optional multiple recipes in a single file



Setpoint Programmer

Many applications have a need to vary the process value over time; one in particular temperature control, often needs to ramp the process from one level to another and perhaps maintain that value for a set period using a setpoint program.

The Foxboro PAC controller has the ability to run multiple setpoint programs, up to 32 segments in each, following pre-programmed values for up to 8 analogue values and 128 digital values.



➤ Store & Forward – Secure Acquisition for Business Critical Data

- “Store” with redundant data recording at the point of measurement
- “Forward” over Ethernet communications to the Historian
- Electronic logging of process values, alarm events and custom text messages relating to events, batches and recipes
- Designed for 21CFR Part11 electronic recording compliance
- File Transfer Protocol (FTP) push to up to three servers
- Time synchronization across the network

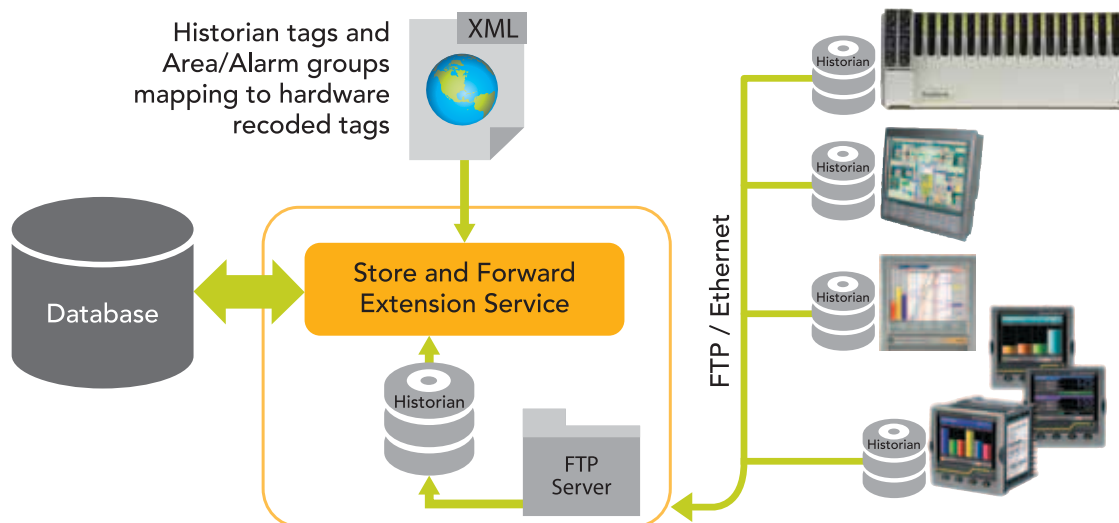
A unique feature of the Foxboro PAC controller is its secure redundant data recording. This allows data, alarm information, and messages to be recorded at the point of measurement, with all data being UTC time stamped as it is recorded, satisfying regulations such as FDA 21CFR Part11.

Secure data recording is always important and in many processes it is vital to the end product. Using the redundant processor and power supply capabilities of the Foxboro PAC controller not only records data but can also mirror it into a secondary processor. This ensures that as long as the process is running, secure data is maintained and is available over the communications network.

If communication is lost for any reason, the data is still available for forwarding when communication is restored, ensuring that any holes in the historical record are closed, thus providing a complete picture of the process. With up to several months of data stored in the internal flash memory, data can be pushed over FTP to primary, secondary or tertiary servers, effectively providing secure, long-term archiving capacity.

Data can also be pulled into multiple sources where it is needed for batch, process analysis, or reporting. This forms the primary source of archive for regulatory compliance. When the Foxboro PAC controller forms part of a distributed application solution, any loss in communication causing gaps in data at the top-end system will automatically be filled in from the secure files at the instrument when communications are restored.

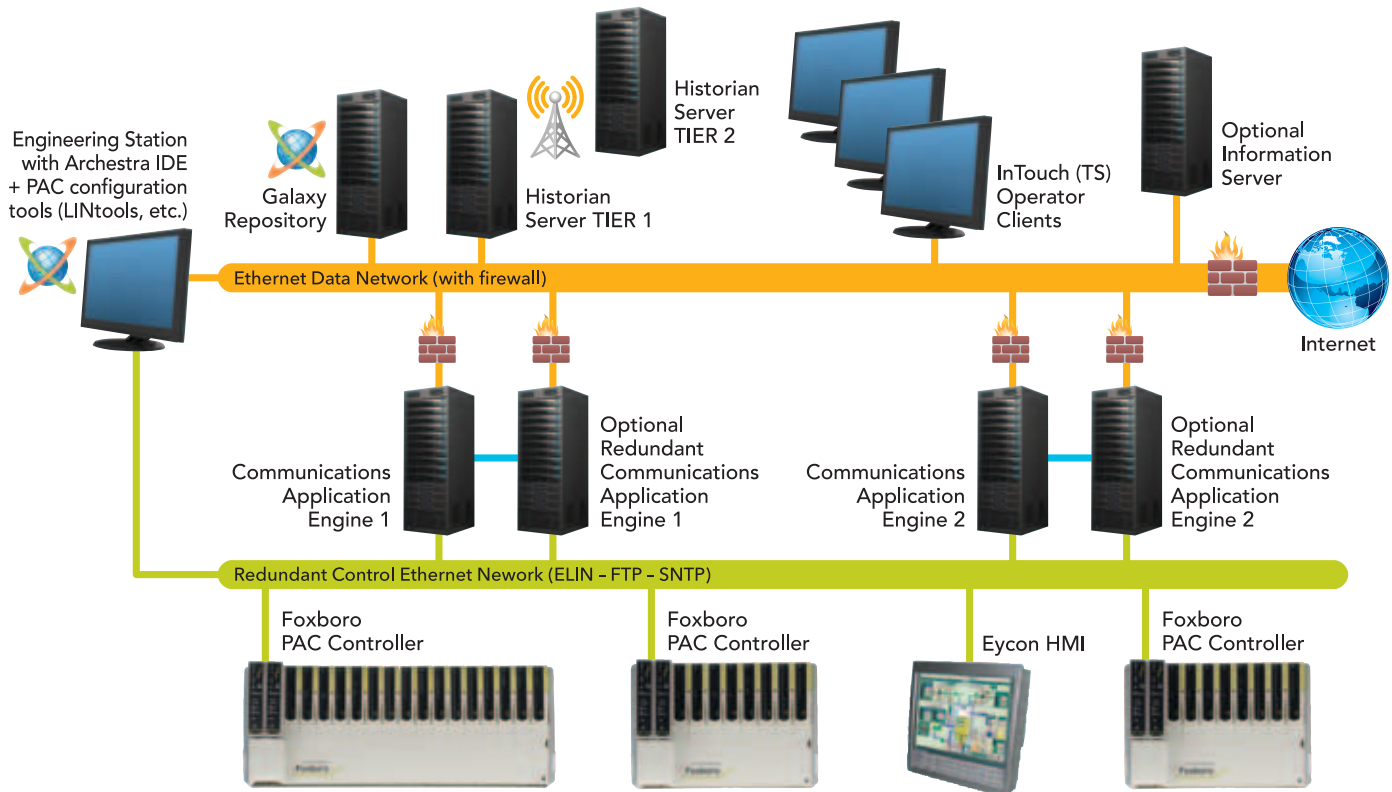
Software such as 'HMI Reports' or 'Review' can acquire the data for back up and inclusion in a database for viewing, printing, or report preparation and publication.



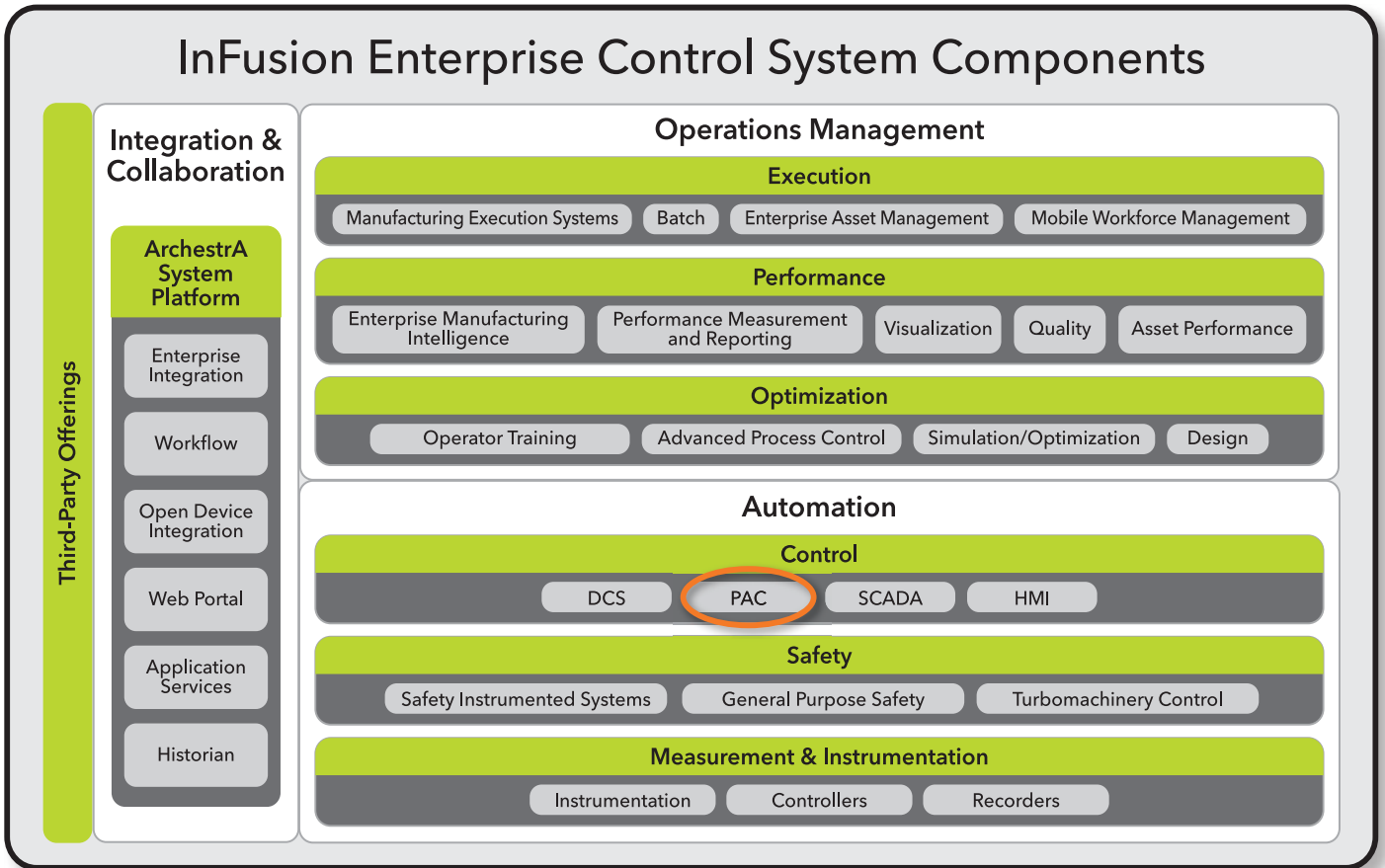
Why the Foxboro PAC System?

| Feature | Benefit |
|--|---|
| High Performance Controller | Precision isolated analog inputs and outputs, deterministic and precision loop control, high-speed peer-to-peer controller communication. Handles up to 4000 blocks per second. |
| Historian Store & Forward | Provides point-of-measurement data recording, adding an additional level of security to your process data. The key benefit is an automated process of forwarding the data to the configured historian, thus removing the requirement for any human intervention. |
| High Integrity Data Recording | Archive files can be saved both as simple CSV files or in Invensys' proprietary UHH format, which is suitable for use in the pharmaceutical industry. These files comply with FDA regulation 21 CFR Part 11. This provides significant benefits by reducing the time required to validate the file system. |
| Redundancy | Initially specifying or retrofitting a redundant I/O controller is as simple as plugging in the module and initiating an E-Sync by pressing the "Sync" button. Redundancy is achieved in under one minute. This exercise provides significant savings in material and labor over any competitive product. |
| ArchestrA System Platform Integration | The system is fully integrated within the ArchestrA Integrated Development Environment. PAC configurations are saved within the Galaxy and automatically retrieved and downloaded as part of any system restore. By simplifying the PAC programming and tag mapping, labor savings are achieved from tight integration of the IEC 61131 Part 3 tools. Additional security of your system is guaranteed through close coupling with the Galaxy configuration database. |
| Multi-Setpoint Programmer | Through simple parameterization, the PAC system can simultaneously run multiple Setpoint programs and plot both the Setpoint and PV trends on the trend screen. Application programming greatly benefits from a significant reduction in configuration. |
| InFusion Enterprise Control System | The InFusion Enterprise Control System utilizes proven open-industry standards-based, ArchestrA software technology to easily and affordably integrate your Foxboro PAC System with all of the Enterprise Control System components into one comprehensive enterprise-wide operation. |
| Industry-Leading HMI | Wonderware InTouch HMI software offers stunning graphics and superb connectivity to virtually every device and system. |

Foxboro PAC System Architecture



As components of the holistic InFusion Enterprise Control System family of offerings, these products are designed to provide specific functionality, while being easily combined, integrated and managed along with other InFusion Components. All InFusion Enterprise Control System components communicate with the open, industry standards-based Archestra System Platform software, which easily and affordably unites process and production control with business operations control. InFusion can help save significant time, effort and money by improving the ability to view and synchronize information from multiple systems and applications; improving collaboration, workflow execution and operations management.



Where does the Foxboro PAC System Fit with the InFusion Enterprise Control System?

The Foxboro PAC System is a key component of the InFusion Enterprise Control System and easily integrates with hundreds of applications – thanks to the unified HMI and unified business/IT network already built in as part of ArchestrA System Platform. You can start small with a single Foxboro PAC controller knowing that you have the option to grow into a full Enterprise Control System. Refer to the above diagram for examples of other integrated InFusion Enterprise Control System products and applications.

➤ Foxboro PAC System Integration – Triconex SIL 2 Safety Systems

When used in combination with the Triconex General Purpose System, the Foxboro PAC System integrates a TÜV certified Safety Integrity Level (SIL) 2 Safety Instrumented System that delivers superior availability and safety performance.

A powerful, scalable design with the assurance of continuous operation, the proven Triconex General Purpose Controller complies with International standards such as IEC61508 and fulfils the requirements for applications such as Emergency Shutdown (ESD), Fire and Gas Protection (F&G), Burner Management System (BMS) and Turbomachinery Control (TMC).

The redundant, high-availability architecture provides a flexible, robust, reliable and powerful solution that is ideal for clients looking to optimize the choice of platform for their specific critical control and safety requirements.

➤ Foxboro PAC System Integration – Foxboro SCADA Hardware

Invensys provides world-class SCADA solutions that combine the Foxboro PAC System along with Foxboro Remote Terminal Units (RTUs). Invensys supports SCADA systems worldwide, with 24/7 support.

[Foxboro Power RTU-SCD5200](#)

This model RTU provides a distributed, fast time resolution RTU used for data gathering and IEC 61850 client applications. This RTU is used in Electric Power and high-end Oil & Gas applications.

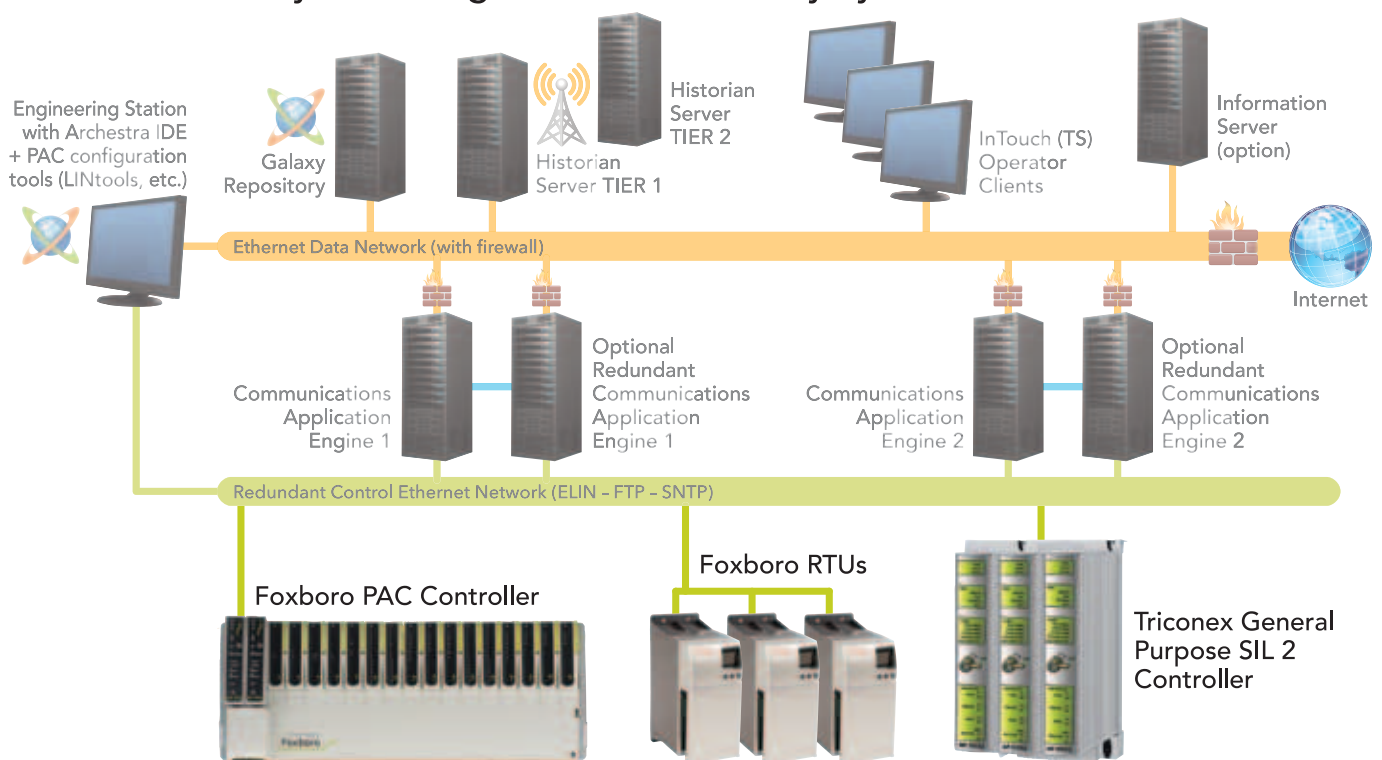
[Foxboro Production RTU-SCD2200](#)

This model RTU provides a modular, low-cost redundant RTU solution for Oil & Gas applications and is also commonly used in the Water & Wastewater industry.

[Foxboro Wellhead RTU-SCD2100](#)

This model provides a singular low cost, ultra low power class 1 div 2 solution for collection of a limited quantity of I/O from very remote sites in both the Oil & Gas and Water & Wastewater industries.

Foxboro PAC System Integration – SIL 2 Safety Systems and SCADA Hardware

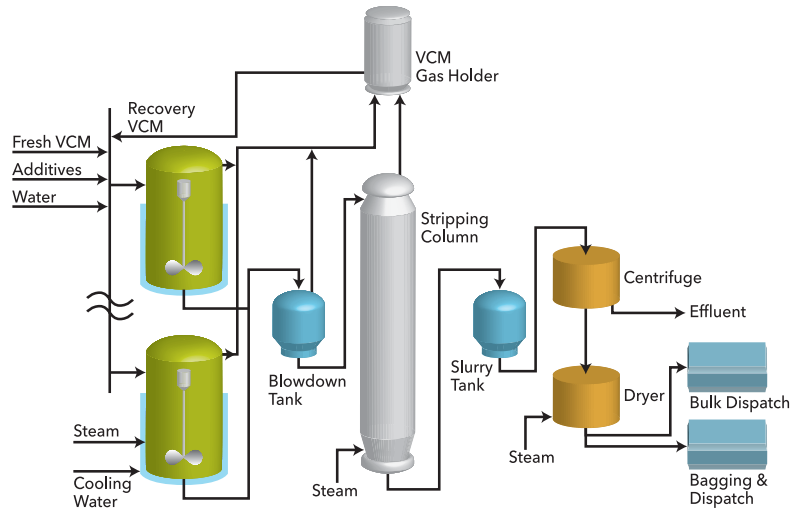


Examples of Real-World Foxboro PAC System Applications

PVC Plant with VCM Production Process

The PVC/Polymer production process is an exothermic process that is potentially volatile and dangerous. It is also a unique production process consists of continuous, batch and mechanical processes, all within a single plant. Foxboro PAC System provides the power, reliability, and flexibility to control this critical process accurately and safely.

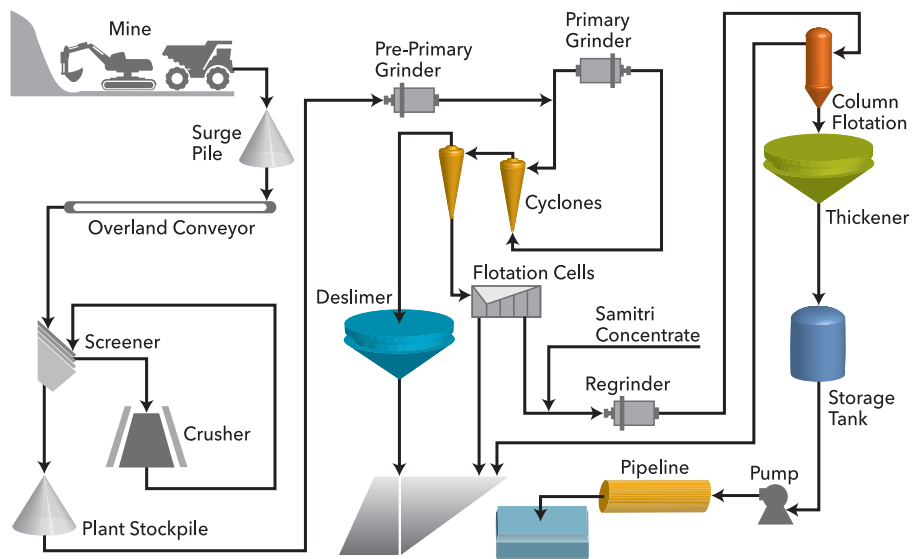
- Accurate control loops
- Sequential control of reactor charging and blow down cycles
- Energy-efficient stripping column control
- Parameterized recipe management
- Batch control and reporting
- 'Golden batch' setpoint trajectory reference control
- Centrifuge and spray drier efficiency
- Integrated packing, wrapping & palletizing line mgmt.
- High-speed pneumatic conveyor controls
- Fire, safety & critical shutdown system integrated
- Upstream chlorine cell power rectification control



Metals, Minerals and Mining: Induration Furnaces – Smelters

The mining industry continuously strives to find better ways to increase output, improve quality, and uphold the highest safety standards, while decreasing costs and protecting the environment. Because of their high energy consumption, iron making control processes are expensive as well as highly interactive and complex to control. Reliable process models are necessary for process optimization.

- Optimization of each system
- Accuracy and reliability
- Optimal productivity and efficiency
- Lower total cost of ownership
- Continuous improvement in efficiency
- Easier change management
- Control multiple input and output arrangements
- Immune to electrical noise
- Vibration resistant
- Continuous monitoring

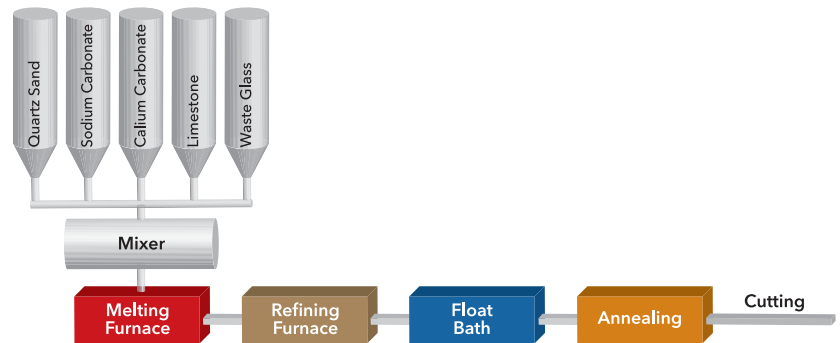


➤ More Examples of Real-World Foxboro PAC System Applications

Glass: Float, Bottling, Fiber, Solar

Glass manufacturing requires a high level of accuracy and reliability in the control of the furnace to achieve consistent glass quality, avoid energy losses, and keep emissions within legislated boundaries. Reliability is particularly important at critical stages in the process such as the furnace reversal.

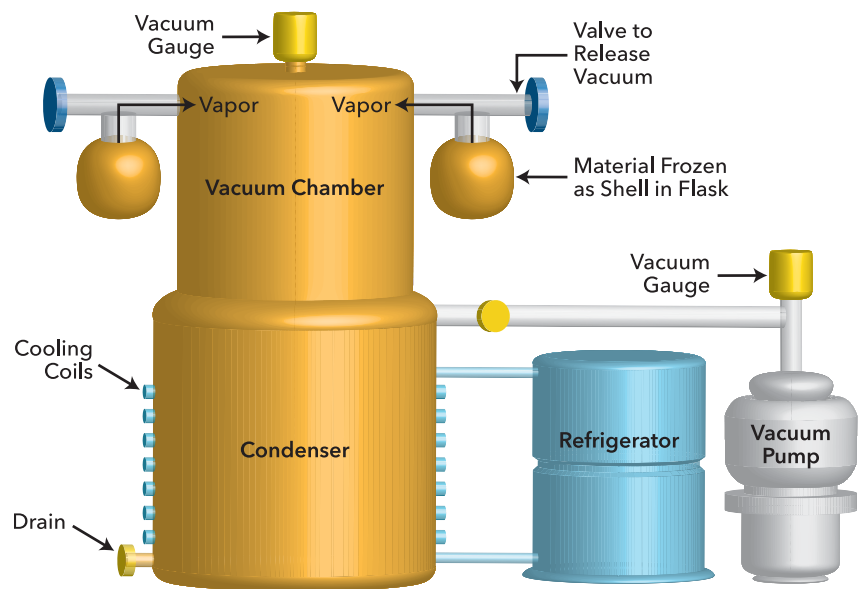
- High availability with dual redundant processors
- World-renowned accuracy of control
- Continuous, precise glass level control
- Cross-limiting lead/lag combustion control
- Fuel flow/ratio control
- Oxygen trim
- Fuel switch over control



Freeze Drying Process

Freeze drying is a relatively expensive process. The equipment is high cost and the high energy demands lead to high energy costs. Also in the pharmaceutical and biochemical industries the value of the product is generally high.

- Highly accurate and reliable control
- Minimizing wastage
- Increasing efficiency and production
- Keeping energy costs to a minimum
- Precise temperature control with setpoint ramping - important for preserving texture and nutritive content and for temperature sensitive product cooling and drying
- Customized user screens that are simple and intuitive - minimal training required
- Sequential control of the temperature, vacuum and refrigeration plant - critical for product quality
- 21 CFR Part 11 compliance for electronic records and electronic signatures - vital for audit compliance
- Safety strategies to ensure that the product is not damaged as a result of plant failure





Foxboro Helps RK Powergen Pvt. Ltd. Provide Clean, Reliable Electricity in India

Goals:

- Support a biomass power plant that would generate clean power in an area that previously had limited and unreliable electricity
- Automate plant operations to maximize efficiency and productivity while reducing downtime
- Facilitate accurate control and monitoring of plant equipment to ensure consistent output and safety and security
- Provide a solution that can be easily expanded as energy demands increase

Challenges:

- The plant had to meet strict requirements for sustainability, environmental monitoring and safety while conserving operating costs
- The solution had to integrate various processes into one control solution that would encompass the entire plant
- Operators needed real-time data to accurately control power generation, steam production and chilled water distribution

Foxboro Solution:

- Foxboro PAC System

Results:

- The plant provides electricity to local area residents and has improved local agricultural and industrial opportunities
- Sustainability goals such as decreased air pollution, water conservation and optimized fuel consumption are being met through the solution's monitoring and control capabilities
- Operators can now view plant-wide processes in real time, so they can react immediately and make changes to maintain power output and plan for maintenance



© Norsk Hydro

Foxboro Helps Hydro Increase Aluminium Cold Melting Capacity and Reduce Waste & Emissions

Goals:

- The company required a solution that would enable it to achieve increased melting capacity and reduce waste
- The technology needed to not only increase production efficiency but also reduce production costs and increase energy savings

Challenges:

- The aluminium manufacturer needed to accurately control combustion operations and enable the smooth transition of various metallurgical processes
- Optimizing energy output during the aluminium melting cycle was vital to achieving overall production efficiency
- To maintain profitability, the technology needed to provide both cost savings in production as well as assist in minimizing the company's environmental impact

Foxboro Solution:

- Foxboro PAC System

Results:

- By utilizing the key features of the Foxboro PAC system, Linde Gas has enabled Hydro to increase its aluminium cold metal melting capacity by more than 50 percent
- The company was able to reduce dross to less than 2% and fuel consumption by 50%
- A significant reduction in carbon dioxide and nitrogen oxide emissions was also achieved to maintain the company's commitment to reducing its impact on the environment
- The Linde Gas Low Temperature Oxyfuel technology, using the Foxboro PAC System, now enables the continuous production of 125,000 tons of foundry alloys annually

"By using the low temperature Oxyfuel method, we can melt 50% more coldaluminium in the same amount of time we did previously, and propane consumption and carbon dioxide emissions have been cut in half."

Wenche Eldegard
Cast House Manager
Hydro



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