

Life Is On

Schneider
Electric

Controlling your most critical assets

Schneider Electric turbomachinery
solutions and services

schneider-electric.com/processautomation



Integration is critical in the world of turbomachinery

Turbomachinery controls (TMC) and Schneider Electric

Why upgrade TMC?

Improve production availability, energy efficiency, and machine safety by integrating turbomachinery control with adjacent processes

For power generation, upstream oil and gas, and process facilities, turbomachinery equipment is often a plant's most critical capital investment. Overall production and plant safety are directly tied to TMC performance. Because unplanned outages or failures incur significant cost in terms of lost production and repair, enhancing turbomachinery controls is a smart undertaking: it improves production capability and overall profitability.

To protect and upgrade turbomachinery assets, Schneider Electric offers a comprehensive suite of solutions and services that can be tailored to every plant configuration or installation. Refined over three decades of experience, our solutions consistently drive TMC productivity, performance, safety, and effective life. Through our Triconex™,

Modicon™, Wonderware®, SimSci™, and Foxboro® brands, we offer the following industry-leading application solutions and services: critical compressor, power turbomachinery, nuclear turbomachinery, mechanical retrofit, engineering services, lifecycle, control platforms, and retrofit services (brownfield), training, and support for daily operation.

From small to large-scale operations, we serve a large range of clients. Our global experts deliver the industry-leading Triconex platforms, along with general purpose redundant and simplex Modicon platforms. We provide upgrades, retrofits, and repair. With more than 5,000 customers worldwide, we prioritize sustainable performance over the full life of these critical assets.

Historically, TMC has been managed separately from adjacent processes and automation strategies. Equipment pieces from various suppliers utilize undisclosed automation strategies, which are, in essence, unable to 'speak' to each other. Integration solves the hassle of managing multiple 'black boxes' by enabling TMC elements to communicate with each other and with adjacent processes.

Integrating turbomachinery control systems simplifies day-to-day operation and significantly increases efficiency. Integration combines many



The integrated turbomachinery advantage

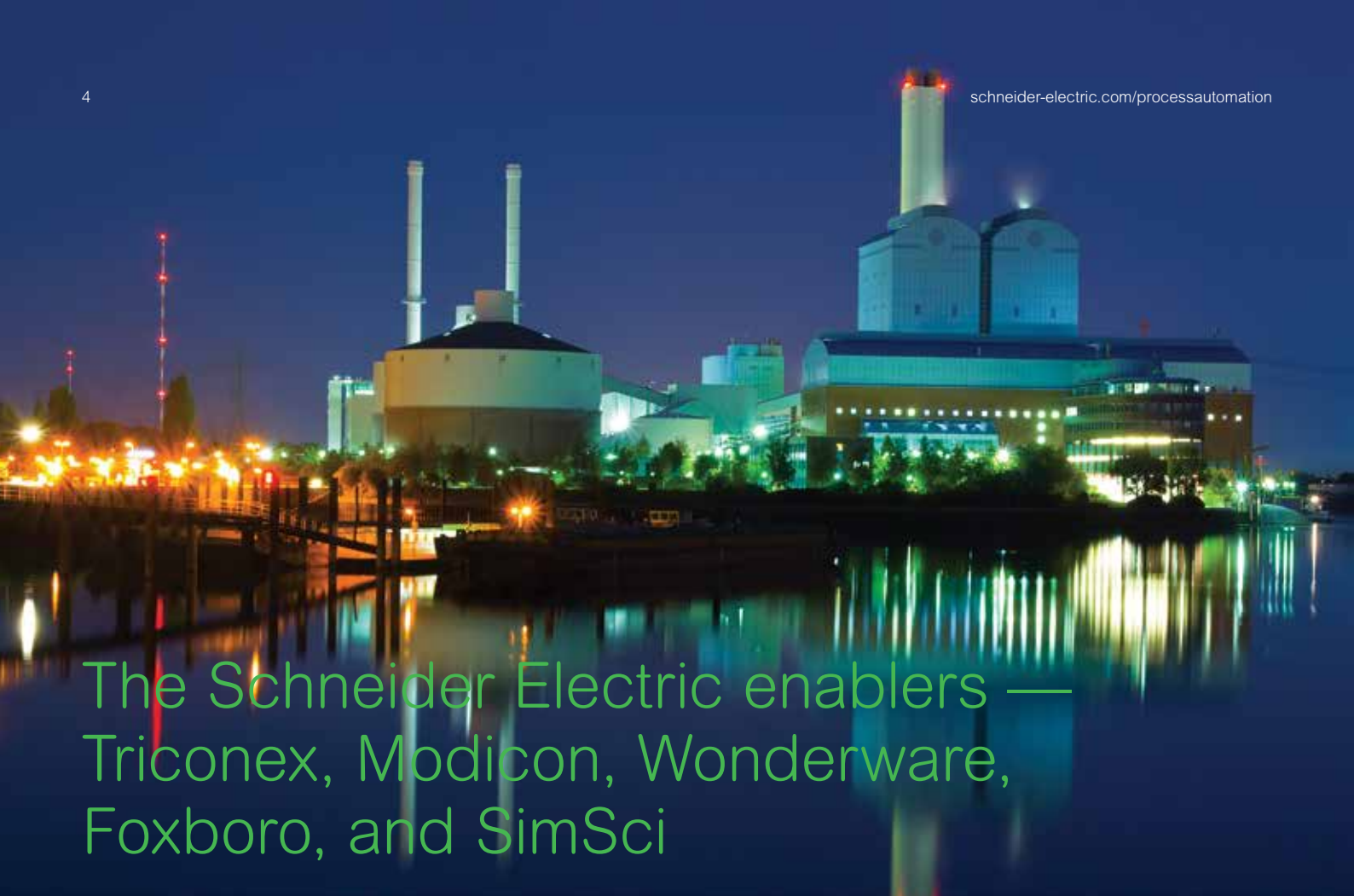
functions — such as machinery protection, turbine start-up sequencing, turbine load/speed control, drive load control (compressor surge control or generator excitation control), auxiliary control (lube oil pumps, seal gas control, motor control centers interface), steam system management and electrical system management — into a single control system.

Our team of experts at Schneider Electric has created a common language to facilitate communication across integrated systems. We have years of experience — in fact, we were one of the first companies to execute integrated turbine-compressor controls and turbine-generator controls. We are also the company that invented the PLC, then PAC, and now the ePAC:

- PLC = Programmable Logic Controller
- PAC = Programmable Automation Controller
- ePAC = Schneider Electric introduces the world's first ePAC, the Modicon M580, with Ethernet built right into its core

Our controls platforms — from triple modular redundant to simplex controllers — and suite of TMC integration solutions intelligently link various automation strategies into one integrated control system. Our mechanical retrofit packages are designed to update sensors, valve actuators and obsolete technology. Over the years, we have implemented successful solutions in projects across varied industries — power, upstream oil and gas production, pipeline compression, downstream refining, chemical processing, pulp and paper processing, and steel production, mining, and food and beverage.

What does this mean for you? Integrating turbomachinery maximizes your return on investment by reducing capital outlay, maintenance, engineering, procurement, installation, and training costs. Our Triconex and Modicon control platforms share turbine control strategies and algorithms that come with years of proven performance.



The Schneider Electric enablers — Triconex, Modicon, Wonderware, Foxboro, and SimSci

Triconex

To integrate and retrofit critical turbomachinery equipment, we use the Triple Modular Redundant (TMR) Triconex control platforms, in conjunction with application libraries and proven templates for turbomachinery sequencing and control.

Modicon

For general purpose TMC, our Modicon PAC is a complete range programmable automation controller — from simplex to redundant. Modicon platforms are designed based on the Triconex application libraries and proven templates for maximum performance in the general purpose market.

Wonderware


We proudly offer Wonderware, the market-leading industrial supervisory system. It utilizes plots, visualization techniques, and superior templates for real-time control and monitoring. Every HMI can benefit from Wonderware's user friendliness

Magelis®

As an upgrade option for the human machine interface (HMI), we offer the Magelis system.

Schneider Electric Magelis is among the world's most popular family of human machine interface machines because Magelis machines consistently meet the unique needs of a global customer base. Our customers rely on Magelis to present a clear picture of business, application and machine performance on a daily basis. From the smallest text display to the most sophisticated industrial PC, our Magelis HMI interfaces offer a clear window into plant operations.

Easy to install, set up, and operate, Magelis HMIs provide a simple and effective means of connecting systems, collecting data, and presenting information in a meaningful format.



Why is Schneider Electric the best choice for your TMC needs?
Along with our commitment to integration and our field experience,
we deliver best-in-industry service.

Foxboro

Enjoy even greater asset flexibility and asset optimization by integrating turbine controls with our Foxboro Evo control system. We also offer a full range of sensing and analytical instruments.

SimSci

Because simulation plays such an important role in the TMC industry, we use SimSci's DYNsIM and TRISIM:

- DYNsIM is the leading dynamic simulator for design, assessment, and training.
- TRISIM is a virtual simulator for the Tricon, Trident and Tri-GP controllers. It handles the base modeling capability from DYNsIM. TRISIM allows simulator access via the emulator available in TriStation 1131 series software.



Schneider Electric's turbomachinery solution and services suite

Our TMC solutions consistently improve industry and installation performance. We specialize in the following standard and customizable services:

Basic control offerings

- Controls for gas turbines, steam turbines, hydro turbines, compressors, and generators
- Integrated compressor-turbine control (ITCC)
- Generators and automatic voltage regulator (AVR)
- End-to-end control solution and service packages encompassing generation, compression and pumping
- Human machine interface (HMI)
- Station control for storage and transport
- Management systems for fleet, power (PMS), and assets
- Dynamic simulation modeling and operator training systems (OTS)
- Lifecycle maintenance and service support

Application and consulting engineering services

We have the most proficient experts in the field. To meet your goals, we offer the following application and consulting engineering services:

- **Site Surveys** — We analyze turbomachinery and existing control systems, and recommend the solution that will best fit your specific requirements.
- **Assessments and Studies** — We provide assessments and studies for the following: protection systems, instrumentation, steam balance, HMI, rotating machinery performance, surge control performance, capacity performance, governor valves/control, and TMC simulation. Also, we offer recommendations for upgrading obsolete TMC systems.
- **Dynamic Simulation** — We provide simulation for design, assessment, and base modeling. We also use simulation to train engineers in managing processes successfully under both normal and upset conditions. Training via high- and medium-fidelity dynamic simulation can provide operators with experience handling adverse conditions that would not be safe to test/train in the field.



- **Consulting and Integrated Solutions** — We offer design and justification assistance to help our clients' control and protective systems achieve the desired reliability, stability and performance.
- **Turbine Performance Optimization** — We can redesign and optimize sequences and controls to improve TMC system operation efficiency. Advanced Process Control is also available.
- **Upgrades** — We offer hardware, firmware, and software upgrades for SE TMC systems.
- **Support and Service Agreements** — We have created the Customer FIRST program as a global escalated and expedited portfolio of support elements. These include on-site managed inventory, training, scheduled maintenance, and other site services.
- **Control Algorithms** — We have validated our standard hardware and control algorithms over more than three decades. Used in a wide variety of applications all over the world, our algorithms include specialized solutions such as:
 - Steam and gas turbine startup sequencing
 - Steam turbine two-valve and three-valve extraction, admission, inlet or discharge pressure control
 - Gas turbine control (industrial frame and aeroderivative)
 - Compressor control (including surge control, performance control, decoupling control and load sharing)
 - Generator control (including isochronous, droop and parallel isochronous)
 - AVR (automatic voltage regulation)
 - Generator automatic synchronization
 - Generator power management (including load sharing and load shedding)
- **HMI Interfaces** — We offer both local and remote interfaces using existing DCS platforms or the Wonderware and Magelis platforms.

Schneider Electric TMC application solutions

Our top TMC application solutions include the following: critical compressor, power turbomachinery, nuclear turbomachinery, mechanical retrofit, engineering services, lifecycle and retrofit services (brownfield capabilities), training, and support for daily operation.

Critical compressor

To protect assets and enhance productivity, safety and lifecycle, we provide comprehensive critical compressor control. We can tailor the following solutions to suit a variety of plant configurations and installations:

- **Compressor performance control** — To meet process demands while maintaining the operational limits of the compressor and driver, we provide compressor loading control. Drivers include steam turbines, gas turbines and motors.
- **Anti-surge control** — To protect compressors from entering a surge condition, we can integrate our algorithms with adjacent process automation strategies, thereby boosting compressor performance and anti-surge mechanisms.
- **Steam turbine, gas turbine, and motor drivers** — Our integrated sequences and controls are designed to match OEM requirements, and to optimize compressor operation and machinery protection.

1. Power turbomachinery

Our solutions for the fossil power industry offer both excellence and sustainability. We can tailor the following solutions to suit a variety of plant configurations and installations:

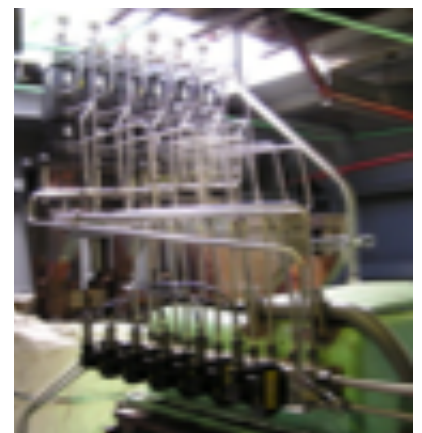
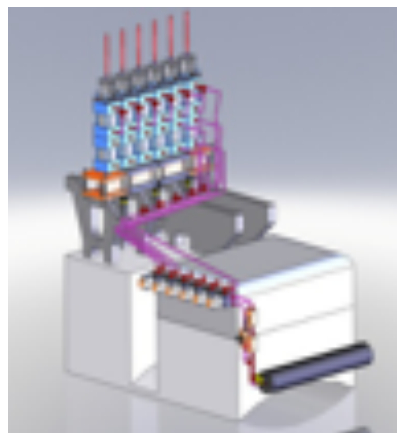
- **Generator controls** — We provide megawatt control, speed droop control, isochronous control, voltage, power factor and MegaVar control, generator mapping with selectable control priorities, over-temperature limiting, excitation limiting, load sharing, load shedding and machinery protection.
- **Automatic voltage regulation (AVR)** — Our AVR solutions include voltage and current control, voltage matching with “soft start,” and bus voltage matching for synchronizing.
- **Steam, gas, and hydro turbine controls** — Our integrated sequences and controls are designed to operate with generators, providing seamless steam header control and machinery protection. We also provide control strategies for reheat steam turbines independent of their configuration.



2. Nuclear turbomachinery

Our comprehensive TMC technologies and expertise measurably improve facilities operations in the nuclear power industry. We can tailor the following solutions to suit a variety of plant configurations and installations:

- **Steam and gas turbine controls** — Providing seamless control and machinery protection, our sequences and controls are designed for integrated operation with main turbines, feed water pumps and generators. We also have developed and implemented control strategies for pressurized water reactors (PWR) and boiling water reactors (BWR) on many nuclear sites.
- **Nuclear generator controls** — We deliver megawatt control, speed droop control, isochronous control, voltage, power factor and MegaVar control, generator mapping with selectable control priorities, over-temperature limiting, excitation limiting, load sharing, load shedding, and machinery protection.
- **Industry standards and documentation** — We offer 1E NRC qualified safety-related products, 10 CFR 50 Appendix B & Part 21 compliant services, quality control, documentation control, personnel certification, and compliance management.



3. Mechanical retrofit

Our mechanical retrofit upgrades extend the life of critical turbomachinery equipment and improve overall capacity. We can tailor the following solutions to suit a variety of plant configurations and installations:

- High- and low-pressure hydraulic actuator retrofits
- Pneumatic actuator retrofits
- LVDT brackets — redundant and triple redundant — for valve position feedback and control
- Speed gears, speed probes and brackets
- Thrust probes and brackets
- Hydraulic power units for high- or low-pressure applications
- Quadvoter trip block assemblies, which are fault tolerant, serviceable online, and SIL rated

We offer installation services for all the above solutions. We also provide design, testing, documentation, detailed demolition plans, and management of contractors on site.

4. Control platforms

Schneider Electric is a one-stop-shopping solution supplier: we provide a complete set of turbomachinery control platforms and solutions for any kind of machinery.

For critical machinery, our TMR solutions offer the robustness, reliability, and availability required. For general purpose machinery, our Modicon platforms provide standard base architecture, robustness, cost competitiveness, efficiency, and reliability.



5. Engineering services

Schneider Electric is pleased to act as an independent consultant or specialist owner engineer for all TMC projects and equipment. We collaborate with equipment suppliers and end-user customers, sharing our TMC expertise. In addition, we provide a full spectrum of engineering services — from specification development, hardware/software design and procurement, to installation, testing, commissioning and training. Other services include:

- FEED engineering
- Design specification
- HAZOP study support
- TÜV functional safety study
- Independent engineering opinion
- Factory acceptance testing attendance on behalf of end user commissioning and start-up support
- Field instrument design
- Reliability improvement assessments
- Customized training

6. Lifecycle and retrofit services (Brown Field capabilities)

Obsolete equipment often reduces the reliability and availability of turbomachinery, and increases downtime and repair costs. However, we can extend the life of old turbomachinery by installing new electronic control systems and instrumentation. Utilizing the best TMC technology, we help reduce operation costs and optimize performance.

Because we specialize in mid-life retrofit, upgrade and support of existing TMC instrumentation, our solutions provide cost-effective alternatives to more expensive upgrade paths. We have successfully extended the working life of over 5,000 machines worldwide by replacing obsolete controls. Although many general purpose industrial controls require replacement after 10 years, Schneider Electric's control systems have the longest lifecycles in the industry.

Schneider Electric experts will customize a complete installation package to your specific application. Our upgrade solutions include the initial budgetary cost estimate, functional specification, detailed specification in compliance with local legislation and regulatory requirements, implementation, commissioning, and start-up.

We provide control solutions for many types of OEM equipment, including:

- Alison
- Alstom
- Atlas Copco
- Borsig
- Dresser
- Ebara
- Elliott
- GE/Nuovo Pignone
- Mitsubishi Heavy Industries
- Pratt & Whitney
- Rolls-Royce
- Skoda
- Siemens/EGT/Ruston
- Solar
- Stal Laval
- SunDyne
- Westinghouse
- Worthington

7. Training

We are committed to helping you improve performance by acquiring the best technical knowledge and skills. Therefore, we've designed more than 300 Learning Service Solutions to accelerate business results, maximize plant availability, and manage risks by establishing consistent methods and applications.

Schneider Electric's Learning Services cover two areas of technology:

- **Plant systems** — Our non-vendor-specific training for plant systems covers instrumentation, field devices, process control, advanced process control strategies, and plant optimization. Product training encompasses Foxboro control systems and instrumentation, Eurotherm® instrumentation, Triconex safety systems, Wonderware manufacturing execution systems (MES) HMI and SCADA,, Modicon PAC, and SimSci advanced control and optimization software.
- **Engineering systems** — Our training for engineering systems covers optimization, offline and integrated simulation, optimization,

process control software for industries such as upstream oil and gas, hydrocarbon, chemical, power, and emerging energy.

These TMC learning solutions are geared toward operators, maintenance, and production personnel. Our training is broadly applicable in multiple environments, or can be tailored to the control system at your specific facility.

8. Support for daily operation

To maximize efficiency and uptime, our team of experts delivers swift on-site response. From optimizing performance to resolving technical issues, our team of experts can deliver on-site responses swiftly. Our team is highly qualified in both local and international standards to support various installations and machinery types.

Schneider Electric's technical support services include, but are not limited to:

- Telephone or email support (24/7) via support agreement
- On-site call out
- Commissioning support after major overhaul/rebuild
- Verification of surge line
- Verification of load rejection and other transient performance capabilities
- Determination of or verification of coefficients for dynamic models
- Proof testing of safety instruments and protective functions

Our clients are our top priority. We would be glad to customize a TMC support services package to your unique requirements.



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09-26-2016

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998-19870411_GMA-US_A4