GE is proud to provide controls you can trust from experts you can trust. GE’s steam turbine controls combine today’s technology with more than 40 years of experience designing, installing, and servicing steam turbines and controls. The product family offers a wide range of solutions for controlling, protecting, and monitoring the turbine along with related systems. Most importantly, it provides a reliable, high performance control system and the support to reduce plant lifecycle cost.

The Mark VIe steam turbine control is available for reheat, non-reheat, and boiler feed pump turbines in utility steam plants. Controls are available for retrofits of mechanical-hydraulic and electro-hydraulic control systems along with custom mechanical solutions for valves, hydraulic power units, and other vital systems.

GE’s family of e-technology platforms include the Mark VIe for turbine control, the EX2100e for excitation control, and the LS2100e for static starters. They provide significant performance enhancements in a modular structure, lengthening the lifecycle of your control systems and streamlining support for years to come.

Benefits of e-technology

The Mark VIe provides performance, operability and reliability for today’s connected plant.

• **Increased computational power** – advanced technology Mark VIe processors provide access to sophisticated software enhancement modules to improve turbine performance, reliability, and operability.

• **Intuitive features** – GE’s powerful ToolboxST* software, with modern drag-and-drop type editors, industry leading trender with video type forward-reverse-freeze capability, and code-compare tools.

• **Increased operational productivity** – user-friendly HMI graphics, alarm/event management, and trending leading to improved operator recognition and resolution of system faults.

• **Maintenance efficiency improvements** – reduced engineering time due to a single integrated software tool for configuring networks, processors, and I/O boards, along with editing application software, managing block libraries, and displaying system diagnostics.

• **Latest GE software libraries** – draws upon GE OEM experience to ensure safety-related software updates are delivered while also retaining the majority of the existing control system customization.

• **Improved reliability** – TMR controller redundancy provides 2-out-of-3 voting to improve reliability and eliminate single-point communication failures within the control.

• **I/O expandability** – flexible and modular architecture allows for future growth of capabilities and applications.

• **Built with cyber security best practices** – Achilles™ Communications Certification Level 1 Mark VIe Controllers feature hardened network switches and HMI s within a segmented network.

Steam Turbine Control

The steam turbine control is a complete control, protection, and monitoring system. Its flexible design provides a dual or triple redundant configuration for the basic control; triple redundancy for critical control and protective functions; and simplex for non-essential monitoring systems. All parameters are available to operator and maintenance stations on modern Ethernet networks and to related control systems via peer-to-peer communications on the control networks.

The control comes with a core of basic control functions for speed, load, and pressure control along with important systems such as steam bypass control. In addition, some common options include:

• Rotor Stress Control

• Automatic Turbine Start

• Turbine Supervisory Instrumentation

Benefits of these options include faster starting and loading and less cyclic life expenditure resulting in reduced rotor repair work for both surface and deep rotor cracking.

Feed Pump Turbine and Feedwater Control Systems

Feed pump turbine controls use the same set of tools as the main unit, including key features such as 1 ms time stamps for Sequence of Events monitoring. The feed pump turbine controls can be embedded in the main unit control or supplied separately and configured as redundant or non-redundant systems. For simplicity, the feedwater level control system can be implemented in the same control as the feed pump turbines, with the addition of required I/O.

Feed pump turbine controls have manual and automatic control modes with bumpless transfer and can be supplied with an automatic start sequence. Like the main unit, they have a basic core of control
and protective features and a wide range of options such as turbine supervisory instrumentation. This typically includes vibration monitoring for the turbine HP and LP journal bearings, pump inboard and outboard bearings, thrust wear protection, and eccentricity.

Distributed I/O
Since no two systems are alike, distributed I/O is available on 100 MB Ethernet to integrate auxiliaries, turbine supervisory instrumentation, motor operated drain valves, and other related systems. Its flexible architecture allows distribution of individual I/O modules or concentrated I/O clusters, local or remote, with category 5 Ethernet or fiber. This significantly reduces field wiring and the resultant installation and maintenance costs. Digitizing signals at the sensor also reduces noise susceptibility for more reliable operation. For additional flexibility, drivers can be provided for Modbus®, PROFIBUS, and HART® I/O devices.

Operator and Maintenance Software
The Mark VIe runs off a Windows® 7 HMI. With this HMI, your existing operator and maintenance stations will have the latest HMI/SCADA CIMPLICITY graphics system featuring easy screen navigation, alarm/event management, and trending tools. Your Windows 7 HMIs are able to run GE’s cyber security applications to help provide security and compliance with current and emerging cyber security standards.

In addition, Windows 7 HMIs use the latest versions of ControlST® and ToolboxST®, which will augment your existing Modbus® and TCP-IP GSM links to plant controls. This modern 32-bit software suite includes drag-and-drop type editors, math blocks, macros, and trending tools. Changes can be downloaded online without rebooting the new controllers. Your existing site-specific software is converted using GE’s Tree File Importer into the latest ControlST turbine control application, using an ISO 9001 certified process.

Configuration and Diagnostic Tools
A common software suite (ToolboxST*) is provided for configuration of the main unit and feed pump turbine controls, along with the feedwater control system, and even generator excitation controls, if included. The tools enable configuration of nodes on the plant networks such as operator and engineering workstations, controllers on the control networks, and devices on the I/O networks. Editors are included for screen graphics, the adjustment of tuning constants, and application software with on-line download capability.

Advanced diagnostics isolate faults to the board level to reduce mean-time-to-repair, and redundant I/O modules can be hotswapped on-line to enhance turbine availability. For integrated systems, the diagnostics clearly identify a specific unit and I/O is arranged to enable repair of one unit without affecting others.

Cyber Security
Upgrading to the Mark VIe control system allows you to take advantage of GE’s cyber security solutions, helping reduce your risk. Our cyber security solution provides defense-in-depth protection. The SecurityST® Mark VIe Solution and Commissioning Services is Achilles™ Practice Certified – Bronze, indicating the solution has undergone strict cyber security best practices demonstrating to customers that systems are developed and implemented securely. The Security ST appliance and Cyber Asset Protection Subscription are designed to support the plant operation’s compliance to cyber security standards and guidelines including NERC CIP, NEI 08-09 and ISA99/IEC 62443.

Controls LifeCare* Partnership
This comprehensive subscription helps to maintain the health of turbine and plant control, generator control and static starter systems. Subscribers benefit from GE expertise and a true partnership in the maintenance and servicing of control systems with a simple, packaged approach. Controls LifeCare is available in one-, five- and ten-year agreements and is applicable for both new and existing units.

Mechanical Solutions Options
GE’s electromechanical solutions are a critical piece of a control system migration or full panel retrofit. Integration considerations need to be made based on the age of the control system and the interface with the software and electromechanical components.

GE has the expertise and OEM knowledge to evaluate these needs to ensure assets remain reliable. Our solutions have the potential to improve performance, online capability, provide redundancy and fit within the current operations envelope.

Critical components that need to be evaluated include transducers and transmitters, fuel valves and fuel skids, and speed sensing. GE also provides solutions for Trip Manifold Assemblies (TMAs), Hydraulic Power Units (HPUs), and other assets that are important to operations. Our experience includes steam, hydro, and gas turbines as well as balance of plant. We have the application knowledge to make sure that your assets are upgraded correctly.

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